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Message from Associate Editor In Chief

Let me first of all take this opportunity to wish all our readers a very happy, peaceful and prosperous year ahead.

This is the first Issue of the Forth Volume of International Journal of Engineering Research and General Science. A total of 77 research articles are published and I sincerely hope that each one of these provides some significant stimulation to a reasonable segment of our community of readers.

In this issue, we have focused mainly on the Disaster Management and its innovative solutions. We also welcome more research oriented ideas in our upcoming Issues.

Author's response for this issue was really inspiring for us. We received many papers from many countries in this issue but our technical team and editor members accepted very less number of research papers for the publication. We have provided editors feedback for every rejected as well as accepted paper so that authors can work out in the weakness more and we shall accept the paper in near future. We apologize for the inconvenient caused for rejected Authors but I hope our editor's feedback helps you discover more horizons for your research work.

I would like to take this opportunity to thank each and every writer for their contribution and would like to thank entire International Journal of Engineering Research and General Science (IJERGS) technical team and editor member for their hard work for the development of research in the world through IJERGS.

Last, but not the least my special thanks and gratitude needs to go to all our fellow friends and supporters. Your help is greatly appreciated. I hope our reader will find our papers educational and entertaining as well. Our team have done good job however, this issue may possibly have some drawbacks, and therefore, constructive suggestions for further improvement shall be warmly welcomed.

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A Study to Compare the Level of Walkability in Two Urban Neighborhoods of Sri Lanka

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Abstract— Walkability was an essential consideration in city planning before the industrialization. But with the development of traffic and transportation planning, automobile priority cities neglect pedestrians and walkways. The quality of the neighboring environment plays a major role in encouraging people to walk when attending their daily needs and thereby people can have enough daily exercises which cause to improve good health. Although past studies have identified a relationship between neighborhood design factors and the level of walkability, this interdependence is poorly understood in urban planning in Sri Lanka. The purpose of this study is to determine factors and conditions that influence walkability in selected two urban neighborhoods in Sri Lanka and to develop two models to compare what design factors enhance walkability for the towns of Panadura and Maharagama. Ninety two (92) factors that affect the walkability in urban neighborhood were identified as the findings of the literature review of this study. Seventy six (76) walkability factors identified through perception surveys were examined within a 100m radius of 70 buffered circles representing 140 participants' residences in Panadura through a questionnaire survey and field observations. The same factors were examined and questionnaire surveys were carried out within a 100m radius of 50 buffered circles representing 100 participants' residences in Maharagama. Chi-square and Bivariate correlation analysis were carried out to identify the most decisive factors for walkability. Multiple Regression analysis was applied to develop models to assess the level of walkability of residents in above selected two urban neighborhoods based on the most significant factors. The findings of Panadura area reveals that people's level of walkability depends not only on built environment factors but also on some factors which are directly linked to "safety" namely feeling of personal safety, availability of unattended dogs on road , reported road accidents, people present on road and houses with opened windows facing either side of the road. Second priority was given to the factors related to the "convenience and comfort", such as paving treatment of sidewalk, width of sidewalk, quality of the maintenance of road, less foul air and clearance of the route. In Maharagama area, people's level of walkability mainly depends on the factors relevant to "convenience and comfort" such as availability of variety of activities either side of road (vendors, playing children on streets ect), width of sidewalk and availability of shade & cover from harsh climate. The methodology and the findings of this study will be helpful to urban designers and town planners to identify the factors that affect to enhance the level of walkability in different urban neighborhoods and to create healthy and livable cities in the context of Sri Lanka.

Keywords—Compare, Factors of built environment, Neighborhood, Walkability

1. INTRODUCTION

Regular engagement of physical activities such as walking and bicycling will improve public health. Therefore in modern world, people tend to have daily physical exercise through jogging and doing machinery exercises at gymnasiums by allocating more time of their busy life. The quality of the neighboring environment plays a major role in encouraging people to walk when attending their daily needs and thereby people can have enough daily exercises which cause to improve good health. Pedestrianization has become an integral part of the sustainable modern urban design, where pollution-free, convenient, safe, and comfortable pedestrian facilities are ensured (Cervero and Duncan, 2003). Though the influence of factors of the built environment on habitual behavioral patterns such as walking are not yet well understood by behavioral scientists (Sallis and Owen, 1999), but transportation and urban planning researchers have identified some strong patterns of association between walking and the factors of built environment (Frank et al., 2003, Owen et al., 2004, Frank and Pivo, 1995). However, a limited number of studies have done so far to investigate the relationship between factors and conditions of the built environment that affect to enhance the walkability in Sri Lankan urban neighborhoods. This paper discusses definitions and concepts of walkability, built environment and neighborhood. As an outcome of literature review, it elaborates 93 factors of built environment that affect the level of walkability. Chi-square and bivariate correlation analysis is applied

to identify the most significant factors which are contributed to enhance the walkability in two different contexts of urban neighborhoods. The main objective of this research study is to compare the level of walkability which can be utilized in planning policy frameworks that guide new development and changes in two selected urban neighborhoods in Sri Lanka.

2. LITERATURE REVIEW

Many individuals define walkability using different terms such as proximity, accessibility, and suitability. Walkability is a measure of how friendly an area is for walking. It takes into account the quality of pedestrian facilities, roadway conditions, land use patterns, community support, security and comfort for walking (Ariffin and Zahari, 2013). Walkability is the measure of the overall walking and living conditions in an area and is defined as the extent to which the built environment is friendly to the presence of people walking, living, shopping, visiting, enjoying, or spending time in an area (Abley, 2005). The built environment refers to the physical form of communities (Brownson et al., 2009), which has been operationalized according to six dimensions: residential density, street connectivity, accessibility to services and destinations, walking and cycling (Leslie,2005) defines neighborhood as a physical environment in which all basic community facilities such as school, playground and local shop is provided within walking distance; it is an environment in which community may have an easy walk to a shopping center where they could get their daily household goods, employed people may find convenient transportation to and from work. Foesyth et al. (2007) show that neighborhoods can create and use network, interaction and connection to improve the quality of life as well as help in getting information, ideas, influences and resources. Accordingly, built environment of a neighborhood plays a major role to enhance the walkability by creating networks among the physical forms of communities.

Researchers in planning and transportation have identified diversity of land uses, access to facilities and street connectivity as key aspects for promoting walkability in urban neighborhood (Krizek et al. 2010). Similarly, the proximity of destinations, good weather conditions, safety and well-designed pedestrian facilities can significantly contribute to better perceptions of the walking environment (Ariffin and Zachary, 2013). Frank and Pivo (1995) demonstrate that population density and to a lesser extent, pedestrian infrastructure can affect the rate of walking. As Leslie (2005) mentions more varied and interesting environments creating neighborhoods are conducive to walking. Grid networks, sidewalks, setbacks and parking can be played a role in creating a pedestrian friendly area (Park and Schofer,2006). Furthermore, they show that large setbacks increase the effort required to reach buildings from the street; small building setbacks make commercial establishment and residences easily accessible to pedestrians. Nankervis (1999) shows that weather variables such as temperature and total precipitation impact on walking. According to the study done by Campos et al. (2003), street lighting, width of walk ways, gradient of walk ways, weather conditions, proximity to main transport facilities and signage show a higher degree of importance in encouraging people to walk. At the same time, safety is also a point of concern for pedestrian's walkability. Individuals who live in areas that are more walkable and have lower crime rates get more encouragement to walk more (Doyle et al., 2007). In a similarly vein, Schofer (2006) illustrates that pedestrian activity is associated with the level of personal safety within a neighborhood. Table 1 summarizes identified ninety three (93) factors of the built environment that affect the walkability in urban neighborhood as the findings of the literature review of this study.

Table 1: Factors that affect Walkability in Urban Neighborhood

Factors	Source	Factors	Source
1. Socio demographic factors	Lawrence et al (2007), Ester et al (2006), Lilah et (2005), Ayşe & John (2012)46.	**8.Convenience & Comfort**	Lawrence et al (2007), Kevin (2010), Southworth (2005), Krambeck & Shah (2006), Ester et al (2006), Saelens & Handy (2008), Ayşe & John (2012), Steven (2005),Litman (2005),
1.Age		44. Cleanliness of the roads	
2.Gender		45.Variety of activities within buffer	
3.Ethnicity		46. Number of houses with opened windows facing either side of the road	
4.Education level of the respondent		47.Way finding signage	
5.Employment		48.Walking path modal conflict	
6.Per capita income		49. Ambient sound	
7.Household size		50.Foul air	
8.Number of employees		51.Continuity of sidewalks	
9.Physical Ability to walk		52.Sidewalk width	
10.Auto ownership		53.Paving treatment of sidewalk	
2.Mixed land use diversity	Cervero & Kockelman (1997), Sallis et al. (2005), Steven (2005), Lawrence et al. (2007), Forsyth et al. (2007), Saelens & Handy (2008), Ewing & Cervero (2010), Ayşe& John (2012)	54.Width of Home access road	
11.Residential Commercial Educational & recreation Administrative Agricultural		55. Maintenance of walking path	
		56.Shade & cover from harsh climate	
		57.Clear route	
		58.Vehicle parking facilities	
		59.Price of parking	
		60.24hour convenience stores	

3.Accessibility	Lawrence et al (2007), Ester et al (2006), Lilah et al (2005), Steven (2005), Sapawi & Said (2012), Krizek et al (2010)	61.Walking trail length	
12.Number of foot paths		62.Covered walkways	
13.Condition of foot paths		63.Places for casual contacts	
14.Covered access from fences		**9.Safety**	Krambeck& Shah (2006), Saelens & Handy (2008), Ayşe & John (2012), Steven (2005), Sapawi & Said (2012) Ariffin & Zahari,(2013), Southworth,(2005), Foster & Giles, (2008), Leslie et al.,(2005), Troy & Grove, (2008),
15.Number of significant barriers		64.Personal safety	
16.Development patterns		65.Number of crime watch signs	
17.Regional accessibility		66.Reported crimes	
4. Connectivity	Lawrence et al (2007), Kevin (2010), Southworth (2005), Krambeck (2006), Ester et al (2006), Saelens & Handy (2008), Ayşe & John (2012)	67.Road accidents	
18.Street connectivity (number of intersections within buffer)		68.Undesirable land use & activities	
19.Street pattern		69.Abandoned buildings & lands	
20.Connectivity between uses		70.People present in roads	
21.Number of bus services per day		71.Vehicle speed	
22.Linkage of transport modes		72.Noise mitigation signals	
23.Efficiency of transport service		73.Unattended dogs within buffer	
24.Block size		74.Enough street lighting	
25.Block length		75.Level of entrapment	
5.Density	Lawrence et al (2007), Ayşe & John (2012), Steven (2005), Southworth (2005)	76.Level of visibility	
26.Residential density		77.Canopies which block the view	
27.Employment density		78.Presence of back lanes	
28.Road density		79.Volume/ noise safety	
29.Population density		**10.Aesthetic**	Lawrence et al (2007), Kevin (2010), Southworth (2005), Saelens & Handy (2008), Steven (2005), Sapawi & Said (2012)
30.Retail Floor Area ratio		80.Attractive architectural design	
6.Company	Troy & Grove, (2008),	81.Presence of street trees	
31.Walking with another person		82.Number of places to exercise	
32.Walking with pets		83.Variety in routes	
33. Number of relatives within the buffer		84.Narrow & crowded streets	
11.Pedestrian facilities	Lawrence et al (2007), Ayşe & John (2012), Steven (2005), Schlossberg et al.,(2007), Ariffin & Zahari, (2013), Senevirathna & Morrall, (2013)	85.Landscaping treatments either side of road	
34.Presence of sidewalks		86.Naturally attractive places	
35.Disability infrastructure		87.Availability of plazas	
36.Availability of crossings		88.Park intensity	
37.Feed bus service		89.Visual complexity	
38.Public park within neighborhood		90.Transparency of fronting structures	
39.Street lighting		91.Coherence of built form	
40.Number of bus halts		**7.Weather**	Lawrence et al (2007), Saelens & Handy (2008)
41.Open sewers along walking path		92.Preferred walking time	
42.Street furniture		93.Rainy	
43.Quality amenities in public parks			

Many researchers have developed models to measure level of walkability using different variables. Lwin and Murayama (2011) developed urban green space walkability model to identify how people use the shortest or greenest walking route for different activities by specifying their start and end points. They show that the shortest route is ideal for shopping activities while the greenest route is ideal for walking as a recreational activity. Mitra and Buliung (2014) have used Multinomial (conditional) logistic model to explore correlates of walkability with four travel modes (walk, transit, school bus, and car).Socio-demographics, travel distance, household travel interactions, connectivity and built environment are the criteria used for this model. Manaugh and El-Geneidy (2011) have used Binomial logistic model to examine walkability scores with household travel behavior. It shows that walkability indices are highly correlated with most non-work trip purposes. Additionally, households with more mobility choices are more sensitive to their surroundings. Moreover, Bahrainy and Khosravi (2013), using Iranian new town (Hashtgerd) as case study, have applied multivariate regression analysis to study how under construction environment and urban design qualities (formal–spatial) affect to the walkability and residents' health considering. Maleki and Zain (2011), through partial least square regression model, have identified density, employment, non-residential land use and land diversity as the factors that influence to the distance to facilities in a sustainable efficient residential site design. Furthermore, Cervero (2003) has developed a Walking-choice model to explore the association between walkability and the factors related to street and urban design such as trip purpose, trip distance, slope, rainfall, neighborhood quality and built environment factors. In this manner past studies inform how various factors influence walkability. It appears that past studies have used social, demographic, and environmental factors separately in their models. To our knowledge, past research has not informed us how to different conditions and factors together influence and predict walkability. In the study, we use a combination of social, demographic, design, and other possible environmental factors to predict walkability in a selected neighborhood in the town area of Panadura, Sri Lanka.

3.0 METHODOLOGY

The validity and the consistency of ninety three (93) factors that affect the walkability in urban neighborhoods identified above through literature review were ascertained by applying the Delphi technique. Randomly selected town planner, architect, engineer, urban planner, transport engineer, urban designer, project manager & a doctor were the experts who were interviewed to refine the factors. In addition, randomly selected ten members of the general public were interviewed to get their perception regarding the factors that affect walkability. As a result of the perception survey, seventeen (17) factors were ignored since they were not affecting much the walkability in the context of Sri Lankan urban neighborhood. Those factors were regional accessibility, price of parking, 24 hour convenience stores, walking trail length, covered walkways, places for casual contacts, street furniture, quality amenities in public parks, presence of back lanes, volume/noise safety, availability of plazas, park intensity, visual complexity, transparency of fronting structures, coherence of built form and presence of sidewalks.

The data concerning the selected seventy six (76) factors were collected by conducting questionnaire survey, direct interviews and field observation survey. For this study, Panadura and Maharagama urban neighborhoods in the Western Province of Sri Lanka were selected as the case study areas. The residential land uses dominate in activity pattern in Panadura, where high proportions of old residential bungalows occupy large blocks of lands, predominantly indicating more residential land uses (UNDP / UN-Habitat - Sustainable Cities Programme 2002). There is a trend of conversion of agricultural lands for residential activities enhancing the urban neighborhood character of both areas. Litman (2010) states it is more flexible to walk through a shorter distance like 100m, since a longer distance requires a combination of walking and usage of public transport. Therefore, 100m radius buffered circles were drawn around randomly selected 70 houses in Panadura urban neighborhood excluding main arterial and city center. Accordingly, from 70 buffered circles140 participants' residences were selected for the questionnaire survey. Same way, 100m radius buffered circles were drawn around randomly selected 50 houses in Maharagama urban neighborhood excluding main arterial and city center and two houses from each buffered circles were randomly selected being 100 participants' residences for the questionnaire survey in Maharagama.

Time spent for walking to places during a week was calculated considering walking time for each place daily. The total time spent for walking during a week is considered as a dependent variable being a continuous variable. Seventy six (76) factors refined above were considered as independent variables that affect the level of walkability in urban neighborhood of which eighteen (18) factors are categorical variables, thirty eight (38) factors are continuous variables and twenty (20) factors are ranked variables. Mixed land use diversity was examined calculating 'entropy' values within 100m buffered circle of selected houses. "Entropy" value was calculated by applying the following formula developed by Cervero and Kockelman (1997) to assess the similarity in the proportion of the area in parcels devoted to residential, commercial, educational and recreational, administrative and agricultural purposes.

$$H = -1\left[\frac{\sum(P_j) * \ln(P_j)}{\ln(K)}\right]$$

Source: Cervero, R., and Kockelman, K. (1997) 'Travel demand and the 3ds: Density, Diversity, and Design'

Where: H is the Entropy Value, K is the number of different types of land use in the buffer. Pj indicates the proportion of land area in the jth land use type and ln is natural logarithm using e (approximately 2.718) as its basis. Entropy values range between 0 and 1, with 1 representing equal proportion (20%) among the five uses in the neighborhood and 0 representing the presence of a single dominant land use. Auto ownership, ambient sound in area, foul air, bus service, open sewers, attractive and pleasant architectural designs, variety in routes, narrow and crowded streets, covered access from fences, development pattern, connectivity between uses, linkage of transport modes, efficiency of transport facilities, vehicle parking facilities, walking path modal conflict, continuity of sidewalk, quality and maintenance of walking path, shade and cover from harsh climate, clear route, disable facilities, personal safety, unattended dogs, enough street lightings, entrapment, enough visibility, canopies and landscaping treatment either side of the road existed within the buffer were measured on the basis of their 'availability'. Age of the respondent, income level, family members, number of employees, entropy, population density, residential density, employment density, retail density, road density, number of bus services per day, bus halts, foot paths, significant barriers, intersections, block length, block size, vehicle parking, number of houses with opened windows facing either side of the road, way finding signage, sidewalk width, width of home access roads, variety of activities, public park, street light, undesirable lands, abandoned buildings, people present, crime watch signs, reported crimes, vehicle speeds, road accidents, pedestrian crossings, noise mitigation signals, street trees, places for exercises, naturally attractive places and number of relatives within the buffer places were measured as 'numerical values' within the buffer.

Correlation analysis was conducted to ascertain whether the relationship between two continuous variables is linear (as one variable increases, the other also increases or as one variable increases, the other variable decreases) or not. In this empirical study, correlation analysis was used to identify the degree of relationship between walking time and each independent factors and the strength of

the relationship between each factors for one and another. For the analysis two types of correlation analysis were used; Pearson correlation analysis and Spearman correlation analysis. Pearson correlation analysis was carried out for thirty eight (38) continuous variables only. Spearman correlation analysis was used only for the twenty (20) numbers of ranked variables (ordinal data) considering the total time spent for walking during a week in to three rank categories (75-150,151-225,226-300) as 1,2 and 3.

Chi-square analysis and bivariate correlation analysis were applied to identify the most effective factors that affect walkability in the selected case study areas. Chi-square analysis was the statistical test used to compare observed data with data expected to be obtained according to specific hypothesis. Further, chi-square test was used to find the relationship between the level of walkability and other categorical variables. This is normally used to investigate the relationship between two categories of variables in order to find out whether they are independent or dependent. Here the dependent variable of the total time spent for walking during a week was categorized into two categories as 75-175 minutes and 176- 276 minutes for Panadura and Maharagama. This is normally tested based on two hypotheses. They are, H0 = Two categories of data are independent. H1 = Two categories of data are dependent .. If the value is < 0.05, H0 is rejected. It shows variables are dependent. Finally, Stepwise Multiple Linear Regression Analysis was used to develop a model to assess the level of walkability (spent time for walking per week by minutes) in Panadura and Maharagama Urban Neighborhoods based on seventy six (76) multiple independent variables.

4.0 ANALYSIS AND RESULTS

The assumption of normality of the dependent variable of total time spent for walking in Panadura was identified through bell shaped Histogram and the corresponding P-P plot (which most of the probability values are on or near to the line), coefficients of skewness (0.001), Kurtosis values (-1.007), Kolmogrorov Smirnov Test {D(140)=0.072 ,p=.073} and SharpioWilk Test (0.960,sig .000). These test values evidence that time spent for walking in Panadura is normally distributed and does not deviate significantly from normal. The assumption of normality of the dependent variable of total time spent for walking in Maharagama was identified through bell shaped Histogram and the corresponding P-P plot (which most of the probability values are on or near to the line), coefficients of skewness (0.101), Kurtosis values (-0.740), Kolmogrorov Smirnov Test {D(100)=0.053 ,p=.062} and SharpioWilk Test (0.850,sig .000). These test values evidence that time spent for walking in Maharagama is normally distributed and does not deviate significantly from normal. Mainly, thirty eight (38) continuous variables were considered including the total time spent for walking to calculate the correlation coefficient. Based on the results of the calculation, the relationship between dependent variable and independent variables was mapped. Correlation analysis for Panadura area reveals that ten (10) variables have a strong relationship with total time spent for walking during a week. They are age of the respondent (-0.575, 0.000), number of significant barriers (-0.844, 0.000), number of houses with opened windows facing either side of the road (0.955, 0.000), sidewalk width (0.907, 0.000), variety of activities :vendors, playing children on streets (0.817, 0.000), number of street lights within the buffer(0.962,0.000), people present on roads (0.956,0.000), number of reported road accidents within buffer (-0.935,0.000), number of street trees within the buffer (-0.935, 0.000) and number of relatives hoses within the buffer (0.920,0.000). Twenty eight (28) factors were not up to the expected sign and level of relationship. It means these variables have no significant relation with total time spent for walking. In Maharagama area, people present on the road (0.874,0.000), variety of activities on the road (0.984,0.000) and block length (0.645,0.000) have a strong relationship with total time spent for walking during a week being 33 factors were not up to the expected sign and level of relationship.

Spearman correlation analysis was used to analyze twenty (20) ranked variables and for Panadura area, only six (6) variables were associated with total time spent for walking during a week at 0.05 significant levels. They are efficiency of transport facilities (0.845,0.000), paving treatment of sidewalk (0.696,0.000), quality and maintenance of walking path (0.723,0.000), clear route (0.952,0.000), unattended dogs (-0.790,0.000) and feelings of personal safety (0.816,0.000). In Maharagama area, ambient sound with the environment (0.634,0.000) and availability of covered access from fences (0.805,0.000) are associated with the total time spent for walking during a week at 0.05 significant levels. Chi-square test was used to analyze the eighteen (18) categorical variables and only four (4) variables were related to total time spent for walking during a week at 0.05 significant levels in Panadura area. They are covered access from fences (136.040, 0.000), variety in routes (8.529, 0.003), walking path modal conflict (46.179,0.000) and foul air (33.257,0.000). In Maharagama area, feel personnel safety (9.732,0.045), clearance of the route (21.108,0.000) and connectivity between uses (12.265,0.035) were related to total time spent for walking during a week at 0.05 significant levels. A model to measure level of walkability was developed by applying step-wise multiple linear regression analysis based on significantly correlated factors. Multiple regression model developed for Panadura area indicates that nine (9) factors significantly contribute to decide the level of walkability at 0.05 significant levels. The significant factors are 'number of street trees within buffer, number of relatives' or friends' houses within buffer, feel personal safety when walk surround area, availability of covered access from fences, unattended dogs on the roads within the buffer, age of the respondent, reported road accidents within the buffer, people present on street within the buffer, number of houses with opened windows facing either side of the road. Finally, following model was developed based on the coefficient values relevant to above nine variables:

Level of walkability (Minutes)-Panadura =129.388 + (1.313 * Number of street trees within the buffer) + (5.636 * Number of relatives or friends houses within buffers) + (11.031 * Personal safety when you walk surround area) – (12.197 * Availability of covered access

from fences) – (5.911 * Unattended dogs within the buffer) – (0.282 * Age of the respondent) – (8.514 * Number of reported road accidents within buffer) + (1.434 * Number of people present on street within the buffer) + (1.597 * Number of houses with opened windows facing either side of the road)

It is important to assess how well this model fits into the actual data (goodness of fit of the model). R2 represents the 99.2% of variance in the total walking time can be explained by above nine variables. The F-statistic of 106.05 for the model shows that R2 is significant. Pearson's correlation coefficient of 0.996 indicates that there is a perfect relationship between the values of the total walking time predicted by the model and the values of the total walking time actually observed. F ratio of 1868.897 (>1,sig .000) for this model indicates that the improvement in prediction due to the model is expected to be large and the difference between the model and the observed data expected to be small. The t-statistic tests the null hypothesis that the b-value is 0. All t-statistic values relevant to the above mentioned nine variables contribute significantly (sig value <0.05) to estimate total walking time and indicate that the corresponding b-values are significantly different from 0. The standard error values relevant to b-values under above nine variables are comparatively very small and it implies that most samples are likely to have b-values similar to the one in this sample. It is important to assess whether a model can be used to make inferences beyond the sample of data that has been considered here. This model can be generalized since it has been met assumptions of additivity and linearity (total walking time is correlated with 20 predictor variables), independent error (Durbin-Watson test value =1.950), homoscedasticity, normally distributed error (sample size=140), variable types (continuous and categorical), no perfect multi-collinearity (all variance inflation factor <10), non-zero variance and predictors are uncorrelated with external variables. Sample size of 140 is adequate to test the overall regression model under 20 correlated factors since it indicates medium effect (Cohen's benchmark R2=0.14).

Further, a stepwise regression approach was used, because at the beginning it included all the independent variables and the variables which did not play a significant role to the walking time were discarded step by step. Finally, the best one out of nine models which has lowest standard error (5.305) was selected. Adjusted r^2 value indicated that 99.2% variance in total walking time would be accounted for, if this model had been derived from the population of Panadura urban area which the sample was taken. Histogram of the standardized residuals and normal probability plot indicated that the residuals in the model are normally distributed. Number of relatives or friends houses within buffer is making a significant contribution to the model since it has smaller the value of Sig. largest beta value and the largest the value of t. From the magnitude of the t statistic, unattended dogs within the buffer, age of the respondent and number of reported road accidents within the buffer have a similar impact, whereas number of people present on roads and number of houses with opened windows facing either side of the road have a less impact. Partial correlations values of all other excluded variables indicate less than 0.1 that imply their contribution would be very less if they were entered into the model. Multiple regression model developed for Maharagama area indicates that three (3) factors significantly contribute to decide the level of walkability at 0.05 significant levels. The significant factors are variety of activities either side of road (vendors, playing children on streets), width of sidewalk and availability of shade & cover from harsh climate. Following model was developed based on the coefficient values relevant to above three variables:

Level of walkability (Minutes)-Maharagama =118.733 + (21.353 * Number of activities either side of road) + (2.636 * width of side walk) + (1.757 * availability of shade & cover from harsh climate)

Adjusted r^2 represents that 97.4% of variance of the total walking time can be explained by above three variables in Maharagama area. The F-statistic of 5.538 for the model shows that R2 is significant. Pearson's correlation coefficient of 0.987 indicates that there is a perfect relationship between the values of the total walking time predicted by the model and the values of the total walking time actually observed. F ratio of 1176.453 (>1,sig .000) for this model indicates that the improvement in prediction due to the model is expected to be large and the difference between the model and the observed data expected to be small. The t-statistic tests the null hypothesis that the b-value is 0. All t-statistic values relevant to the above mentioned three variables contribute significantly (sig value <0.05) to estimate total walking time and indicate that the corresponding b-values are significantly different from 0. The standard error values relevant to b-values under above three variables are comparatively very small and it implies that most samples are likely to have b-values similar to the one in this sample. This model can be to make inferences beyond the sample of data that has been considered here since it has been met assumptions of additively and linearity (total walking time is correlated with eight predictor variables), independent error (Durbin-Watson test value =1.453), homoscedasticity, normally distributed error (sample size=100), variable types (continuous and categorical), no perfect multi-collinearity (all variance inflation factor <10), non-zero variance and predictors are uncorrelated with external variables. Stepwise regression approach was used to select best model out of three models which has lowest standard error (11.317) was selected. Adjusted r^2 value indicated that 97.4% variance in total walking time would be accounted for, if this model had been derived from the population of Maharagama area which the sample was taken. Histogram of the standardized residuals and normal probability plot indicated that the residuals in the model are normally distributed. Availability of number of varieties of activities either side of the road is making a significant contribution to the model since it has smaller the value of Sig.(0.000), largest beta value (0.971) and the largest the value of t (57.349). From the magnitude of the t statistic, width of sidewalk and availability of shade & cover from harsh climate have a similar impact. Partial correlations values of all other excluded variables indicate less than 0.1 that imply their contribution would be very less if they were entered into the model.

5.0 CONCLUSION

The findings of the two case studies reveal that people's level of workability depends not only on built environment factors but also on some factors such as feelings of personal safety, age of the respondent and availability of unattended dogs. Factors relevant to "safety" play a significant role to assess the level of walkability in Panadura area, such as feelings of personal safety, availability of unattended dogs on roads, reported road accidents, people present on roads and houses with opened windows facing either side of the road. People present on street and feel personnel safety are strongly correlated with the total walking time of the people in Maharagama area. The findings indicate that many people who live in urban neighborhood of Sri Lanka concern about their safety when they are walking. Second priority was given to the factors related to the "convenience and comfort", which can be listed as paving treatment of sidewalk, sidewalk width, quality of maintenance, less foul air, clearance of the route in Pandura area and variety of activities either side of road (vendors, playing children on streets), width of sidewalk and availability of shade & cover from harsh climate in Maharagama area. Ambient Sound with the environment and clearance of the route are also strongly correlated with the total walking time of the people in Maharagama area. McNally (2010) has also stated that 'by creating areas where pedestrians feel safety, welcoming, and comfortable, there is a greater opportunity for lively and walkable streets to become a reality'. The people who live in Panadura area reported high walking time if they have efficient transport facilities and less model conflict which are directly related factors to the "accessibility". Most of the people in Panadura use public bus service as their main transport mode. They have to walk to main bus halts from their homes. It appears that availability of efficient transport facilities motivate people for walking to transit points on their daily trips. Walking is highly encouraging when there is "connectivity" among the different land uses. Block length, availability of covered access from fences and connectivity between uses are strongly correlated with the total walking time of the people in Maharagama area while less covered access from fences enhancing the level of walkability in Panadura area.This study supports the findings of previous studies (Cerin et al., 2006 and Owen et al., 2004), that factors related to "Aesthetic" has a great concern for encouraging walkability. Also, "social company" particularly, presence of relatives and friends within the area concerned contributes to the level of walkability in Pandura area. The findings of the study further reveal that the common factors related to the land use diversity, density, weather and pedestrian facilities could be treated as contributive factors, but not significant enough to affect the level of walkability. This study proves that level of walkability depends on different factors of the built environment and also some other factors under different context. Therefore it is not advisable to apply those developed models to assess the level of walkability in another urban neighborhood in Sri Lanka with different to these two case studies, since the significant factors and the relevant coefficient values may be different with that context. The methodology and the findings of this study will be helpful to urban designers and town planners to identify the factors that affect to enhance the level of walkability in different urban neighborhoods and to create healthy and livable cities in the context of Sri Lanka.

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REFERENCES:

[1] Ariffin, R. N. R. &Zahari, R. K., (2013) 'Perceptions of the Urban Walking Environments', Social and Behavioral Sciences, Vol. 105,No. 589 – 597.
[2] Abley, S. (2005) "Walkability Scoping Paper". Retrieved March 04, 2011.
[3] Bahrainy, H., &Khosravi, H. (2013) 'The impact of urban design features and qualities on walkability and health in under-construction environments: The case of Hashtgerd New Town in Iran', Cities, Vol. 31, No.17-28.
[4] Besser, L. M. and Dannenberg, A. L. (2005) 'Walking to public transit steps to Help Meet Physical Activity Recommendations', Preventive Medicine, Vol. 29, No. 4: 273–280.
[5] Brownson, R. C. et al., (2009) 'Measuring the Built Environment for Physical Activity', Cities, Vol.36, No. 99-123.
[6] Campos, M.B., Chiaraida, A., Smith, A., Stonor, T. & Takamatsu, S. (2003) 'Towards a 'walkability index' in Proceedings of the European Transport Conference, Online 24th June 2013, http://trid.trb.org/view.aspx?id=771383.
[7] Cerin, E., Saelens, B. E., Sallis, J. F. and Frank, L. D. (2006) 'Neighborhood Environment Walkability Scale: Validity and Development of a Short Form', Medicine & Science in Sports & Exercise. Vol. 38, No.9: 1682–1691.
[8] Cervero, R., & Kockelman, K. (1997) 'Travel demand and the 3Ds: Density, diversity, and design', Transportation Research D, Vol. 2, No.3: 199–219.
[9] Cervero, R., and Kockelman, K. (1997) 'Travel demand and the 3ds: Density, Diversity, and Design',Elsevier Science, Vol. 2, No. 3: 199-219.
[10] Cervero, R., Duncan, M. (2003) 'Walking, bicycling, and urban landscapes: evidence from San Francisco Bay Area', Public Health, Vol. 93, No. 9: 1478–1483.
[11] Crane, R., &Crepeau, R. (1998) 'Does neighborhood design influence travel?A behavioral analysis of travel diary and GIS data', Transportation Research Part D, Vol.3, No. 4: 225–238.

[12] Doyle, S., Kelly-Schwartz, A., Schlossberg, M., and Stockard, J. (2006) 'Active community environments and health: the relationship of walkable and safe communities to individual health', American Planning Association, Vol. 72, No.1: 19-31.
[13] Ewing, R., &Cervero, R. (2010) 'Travel and the Built Environment', Journal of the American Planning Association, Vol. 76, No.1-31.
[14] Forsyth, A., Oakes, J. M., Schmitz, K. H., & Hearst, M. (2007) 'Does residential density increase walking and other physical activity?',Urban Studies, Vol. 44, No. 4: 679.
[15] Foster, S., & Giles-Corti, B. (2008) 'The built environment, neighborhood crime and constrained physical activity: An exploration of inconsistent findings', Preventive Medicine, Vol. 47, No. 3: 241–251.
[16] Frank, L. and Pivo, G. (1995) 'The impacts of mixed use and density on the utilization of three modes of travel: the single occupant vehicle, transit, and walking', Transportation Research Record, No: 1466- 4452.
[17] Frank, L. D., Andresen, M. A., &Schmid, T. L. (2004) 'Obesity relationships with community design, physical activity, and time spent in cars', Preventive Medicine, Vol. 27, No. 2: 87–96.
[18] Frank, L., Saelens, B., and Sallis, J. (2003) 'Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures', Annals of Behavioral Medicine, Vol. 25, No.2: 80–91.
[19] Frank, L.D., Sallis, J. F., Conway, T.L., Chapman, J. E., Saelens, B. E. and Bachman, W. (2007) 'Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality', American Planning Association, Vol. 72, No.1: 75-87.
[20] Krambeck, H. and Shah, J. (2006) 'The global walkability index: talk the walk and walk the talk', No.1-29.
[21] Krizek, K. J., Forsyth, A. and Agrawal, A. W. (2010) Measuring Walking and Cycling Using the PABS (Pedestrian and Bicycling Survey) Approach: A Low-Cost Survey Method for Local Communities, Mineta Transportation Institute, San Jose State University.
[22] Leslie, E., et al. (2005) 'Residents' perceptions of walkability attributes in objectively different neighborhoods: a pilot study', Health & place, Vol.11, No. 227–236.
[23] Litman, T. (2010) 'Measuring transportation: traffic, mobility and accessibility', ITE Journal, Vol.73, No. 10: 28-32.
[24] Lwin, K., & Murayama, Y. (2011) 'Modeling of urban green space walkability: Eco-friendly walk score calculator', Computers, Environment and Urban Systems, Vol. 35, No. 5:408-420.
[25] Maleki, M., &Zain, M. (2011) 'Factors that influence distance to facilities in a sustainable efficient residential site design', Sustainable Cities and Society, Vol. 1, No. 4: 236-243.
[26] Manaugh, K., & El-Geneidy, A. (2011) 'Validating walkability indices: how do different households respond to the walkability of their neighborhood? Transportation Research Part D', Transport and Environment, Vol. 16, No. 4: 309-315.
[27] McNally, K. (2010) 'Design Guidelines for Walkable Communities', No. 32: 1-16.
[28] Mitra, R., &Buliung, R. (2014) 'The influence of neighborhood environment and household travel interactions on school travel behavior: an exploration using geographically-weighted models', Journal Of Transport Geography, Vol. 36, No. 69-78.
[29] Nankervis M. (1999) 'The effects of weather and climate on urban bicycle commuters' decision to ride: A pilot survey', Road and Transport Research. No. 8: 85–97.
[30] Owen, N, Humpel, N, Leslie, E, Bauman, A, Sallis J.F. (2004) 'Understanding environmental influences on walking: Review and research agenda', Preventive Medicine, Vol. 27, No. 67-76.
[31] Özbil, A. and Peponis, J. (2012) 'The effects of urban form on walking to transit', Eighth International Space Syntax Symposium, No.1-15.
[32] Parks, J. R., &Schofer, J. L. (2006) 'Characterizing neighborhood pedestrian environments with secondary data', Transportation Research Part D, No. 11: 250–263.
[33] Saelens, B. E., & Handy, S. L. (2008) 'Built Environment Correlates of Walking: A Review', Health, Vol. 40, No. 128-200.
[34] Sapawi, R., &Said, I. (2012) 'Constructing Indices Representing Physical Attributes for Walking in Urban Neighborhood Area ', Social and Behavioral Sciences, Vol. 50, No. 179 – 191.
[35] Seneviratne, P. N. &Morral, J. F. (2013) 'Analysis of factors affecting the choice of route of pedestrians', Transportation Planning and Technology, Vol. 10, No. 2: 147-159.
[36] Southworth, M. (2005) 'Designing the walkable city', Urban Planning and development, Vol. 131, No.4: 246–257.
[37] Troy, A., and Grove, J. M. (2008) 'Property values, parks, and crime: A hedonic analysis in Baltimore, MD', Landscape and Urban Planning, Vol. 87, No. 3: 233–245.

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A CORPUS-DRIVEN MARATHI TEXT-TO-SPEECH SYSTEM BASED ON THE CONCATENATIVE SYNTHESIS APPROACH

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Abstract— In a text-to-speech system, spoken utterances are automatically produced from text. In this research paper, we present a corpus-driven Marathi text-to-speech system based on the concatenative synthesis approach. The most important qualities of a synthesized speech are naturalness and intelligibility. In this system, words and syllables are used as the basic units for synthesis. Our corpus consists of speech waveforms that are collected for most frequently used words in different domains. The speaker is selected through subjective and objective evaluation of natural and synthesized waveform. The proposed system provides utility to save the synthesized output. The output generated by the proposed Marathi text-to-speech synthesis system resembles natural human voice. Our text to speech reader software converts a Marathi text to speech wav file that has high rates of intelligibility and comprehensibility.

Keywords— Text-to-Speech, Syllabification, Concatenation, Speech Synthesis, Text Normalization.

INTRODUCTION

Over the past years, there has been a great development in speech understanding and synthesis technology. The voice user interface (VUI) plays an important role in human-machine communication applications such as computer systems, mobile multimedia, online ticket information, market information, customer services, personal banking information, voice-enabled equipment maintenance devices, and paperless tasks. Most of these voice-enabled applications have imparted huge financial benefits for the multimedia industries. Among the applications of speech technology, the automatic speech production, which is referred to as text-to-speech (TTS) system is the most natural-sounding technology [1]. The text-to-speech (TTS) system will convert ordinary orthographic text into acoustic signal which is indistinguishable from human speech [3] [2].Today‘s interest is high quality speech application combined with computer resources. Text-to-speech synthesis system can be useful for several multimedia applications. For developing a natural human machine interface, the TTS system can be used as a way to communicate back through human voice. The TTS can be a voice for those people who cannot speak. The TTS system can be used to read text from emails, SMSs, web pages, news, articles, blogs, and Microsoft office tools and so on. In such reading applications, the TTS technology can reduce the eye-strain. The TTS system can be useful for disabled person to make effective communications. The existing TTS systems can be broadly classified into three groups: i) articulatory synthesis; ii) formant synthesis; iii) concatenative synthesis [4], [5]. In the past decades, the TTS has been focused on automatic speech production in Indian languages.

Some of TTS systems for Indian languages like Hindi, Telugu, Marathi and Bengali have been developed using the unit selection and festival framework [2], [6]. In literature, each approach has its own purposes, strengths, and limitations. In practice, listener should be able to understand language information of the user textual information in generated synthesized speech waveform. In most of multimedia applications, listeners demand high quality of synthesized speech compared with natural speech. Generally speaking, the intelligibility and comprehensibility of synthesized speech should be relatively good in the naturalistic environments. Furthermore, listeners are able to clearly perceive the message with little attention, and act on synthesized speech of a command correctly and without perceptible delay in noisy environments. Although many TTS approaches, the intelligibility, naturalness, comprehensibility, and recall ability of synthesized speech is not good enough to be widely accepted by users. There is still considerable room for further improvement of performance of the text-to speech production system. In this paper, we propose corpus driven Marathi text-to-speech system. We use concatenative-based approach to synthesis desired speech through pre-recorded speech waveforms. Over past decades, this approach was very difficult to implement because of limitations of computer memory. With the advancements in computer hardware and memory, a large amount of speech corpus can be stored and used to produce high quality speech waveforms for a given text. Thus, the synthesized speech preserves the naturalness and intelligibility. In this work, we applied concatenation approach at word level and syllable level. The quality of synthesized speech via concatenative approach is very close to natural speech [10].

MARATHI PHONOLOGY

Marathi is an Indo-Aryan language spoken by about 71 million people mainly in the Indian state of Maharashtra and neighbouring states. Marathi is also spoken in Israel and Mauritius. Marathi is thought to be a descendent of Maharashtra, one of the Prakrit languages which developed from Sanskrit. Marathi first appeared in writing during the 11th century in the form of inscriptions on stones and copper plates. From the 13th century until the mid-20th century, it was written with the Modi alphabet. Since 1950 it has been written with the Devanāgarī alphabet. Marathi phoneme inventory consists of 38 consonants including two glides and 15 vowels (including 13 nasal vowels) [7].

CONCATENATIVE SPEECH SYNTHESIS

Concatenative speech synthesis uses phones, di-phones, syllables, words and sentences as basic units. Speech is synthesized based on selecting these units from the database, called as a speech corpus. Many researches have been made, selecting each separate unit as the basic unit. When phones are selected as basic units, the size of the database will be less than 80 units for Indian languages. Database may be small, but phones provide very less co-articulation information across adjacent units, thus failing to model the dynamics of speech sounds. Di-phones and tri-phones as basic units, it will minimize the discontinuities at the concatenation points and captures the co-articulation effects. But a single example of each di-phone is not enough to produce good quality speech. So we are selecting syllable as a basic unit. Indian languages are syllable centered, where pronunciations are based on syllables. The general form of Indian language syllable is C*VC*, where C is a consonant, V is vowel and C* indicates the presence of 0 or more consonants. There are defined set of syllabification rules formed by researchers, to produce computationally reasonable syllables. Some of the rules used to perform grapheme to syllable conversions [5][8] are:

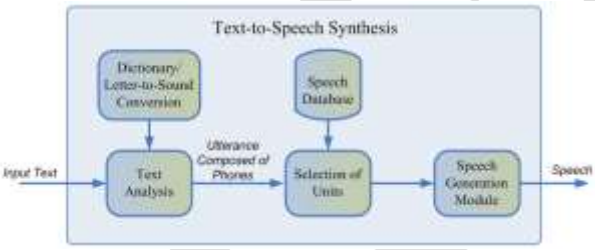

Fig. 1.Block Diagram of Marathi Text-To-Speech Synthesis System

- Nucleus can be Vowel(V) or Consonant (C)
- If onset is C then nucleus is V to yield a syllable of type CV
- Coda can be empty of C
- If character after CV pattern are of type CV then the syllables are split as CV and CV
- If the CV pattern if followed by CCV then syllables are split as CVC and CV
- If CV pattern is followed by CCCV then the syllables are split as CVCC and CV
- If the VC pattern is followed by V then the syllables are split as V and CV
- If the VC pattern is followed by CVC then the syllables are split as VC and CVC

These rules can be generalized to any syllable centric language. The text is pre-processed to remove any punctuations. Numerals1, 2, 3 and 4 in the algorithm represent the position of the alphabet in the text to be segmented. Algorithm for these rules are:

•Check the first character of the word:

•If the first character is a V then the second character is a C; Check the third character:

If the third character is a C; Check fourth character:

*If 3rd and 4th characters are equal;

VCC (123) is the syllable

∗ Else; VC (12) is the syllable

If the third character is a V ; Then V (1) is the syllable

• If the first character is a C then check for second character:

Second character is a V

The third character has to be a C; Check the 4th character:

▪If the fourth character is a C; check for 5thcharacter:

5th character is a V; CV C (123) is the syllable 5th character is a C or a word end; CV CC (1234) is the syllable

∗ If the fourth character is a V; CV (12) is the syllable

Second character is a C; we assume that the 3rd character has to be a vowel, and subsequently the 4th character has to be a C Check for 5th character:

∗If the 5th character is a C or a word end; Then CCVC (1234) is the syllable.

▪If the 5th character is a V; Then CCV (123) is the syllable.

Text syllabication example using the above mentioned algorithm:

पुणे शहरातील एक मध्यवर्ती ठिकाण

V CVC VC CVCV CVC

represents a word boundary. It should be noted that each word is syllabified separately. After a syllable is identified from a word, the remaining part of the word is processed again by the algorithm. The text syllabification algorithm gives units comparable to the units given by group delay based segmentation. The two units can be made equivalent by using some specific language or domain rules. Once the units are comparable or equivalent the segmented text can annotate the speech syllables. These syllabified texts can also be used to analyse syllable structure in the language like frequently occurring syllables or the syllables that can start or end a sentence. Syllable based N-gram language models can be built using these rules to segment large amount of text.

PROPOSED MARATHI TEXT-TO-SPEECH SYNTHESIS SYSTEM

In Fig. 1 illustrates the steps involved for the conversion of Marathi text to speech.

Text Normalization

In this stage, we perform remove punctuations such as double quotes, full stop, comma and all. Then we will get pure sentence. We need to know that the sentence ends after a full stop (.) and not between abbreviations. It is somewhat easy to tokenize a word with help of full stop as most of the sentences will be ending with full stop. But there are some other cases where it ends with semicolon or some other punctuation like previous case. This problem can be solved by expanding the abbreviation and removing the unwanted punctuation [11][12][13].

All the Marathi abbreviations cannot be expanded, because some mostly used abbreviations are stored in a separate database. When certain abbreviation comes in the text, then it will search the database for that abbreviation. If that abbreviation is present the system will replace the text, if not it will be leaving the original text as it is. It is difficult to add all the abbreviations in the database, so most commonly used abbreviations are used. The unwanted punctuation like (:, ; " ' ` $) etc. are to be removed from the given paragraph to avoid confusion and not to give any disturbance in the naturalness of the speech. Each and every text in the input should be assigned some sound file for the concatenation [18-21].

The second step in text normalization is normalizing non-standard words. Nonstandard words are tokens like numbers or abbreviations, which need to be expanded into sequences of Marathi words before they can be pronounced. For example the number 1900 can be spoken in at least three different ways, depending on the context [26-36].

०	१	२	३	४	५	६	७	८	९	१०
शून्य	एक	दोन	तीन	चार	पाच	सहा	सात	आठ	नऊ	दहा
śunya	ek	don	tin	chār	pāc	sahā	sāt	āṭh	naū	dahā
0	1	2	3	4	5	6	7	8	9	10

To solve this problem we have to add number system into TTS. It will be coming under future work. The algorithm will cancel all the numbers coming in text, and then it will become normal text without numbers or any extra punctuation.

Sentence Splitting

In this stage, the given paragraph will be splatted as sentences. Separating out sentences can also be done in parallel through Graphical Processing Unit computing. From these sentences, words are separated out. Example is given below

सर्व मनुष्यजात जन्मतःच स्वतंत्र आहे व सर्वजणांना समान प्रतिष्ठा व

The written sentence can be segmented easily by using whitespace as delimiter,

सर्व मनुष्यजात जन्मतःच स्वतंत्र आहे व सर्वजणांना समान प्रतिष्ठा व
समान अधिकार आहेत. त्यांना विचारशक्ती व सदसद्विवेकबुद्धी लाभलेली
आहे व त्यांनी एकमेकांशी बंधुबाच्या भावनेने आचरण करावे.

There are numerous cases where the conventional delimiter segmentation approach fails. The classification and segmentation cannot be done one after the other. The first step to perform a provisional segmentation into potential written form is called token and then examining each token in turn resolves the ambiguity. This process is called tokenization; the step which generates the words from the token is called text analysis [1] [14][15][16][17].

Speech corpus

Text-to-speech system based on concatenative synthesis needs well-arranged speech corpus. The quality of synthesized speech waveform depends up on the number of realization of various units present in the speech corpus. A good quality microphone should be used to avoid noise in speech wav file. In text-to-speech, the accuracy of the system is calculated in the ways of naturalness and intelligibility of the synthesized speech. In this work, we collected speech wav files for 5000 Marathi words and syllables.

We selected one person for recoding these words, who has uniform characteristics of speaking, pitch-rate and energy profile, and developed speech corpus [2]. Each sound file is unique. Speech corpus collected includes text from dictionary words, commonly used words, words from Marathi newspapers and story books, and covers different domain such as sports, news, literature, education etc. We have analyzed the speech with respect to the quality of the synthesized speech variations in natural prosody and the perceptual distortion with respect to prosodic and spectral modifications [25-35].

Concatenation

The final stage is the concatenation process. All the arranged speech units are concatenated using a concatenation algorithm. The concatenation of speech files is done in matlab.

Speech synthesis

In speech synthesis we are utilizing two approaches, the first one is word level synthesis that means all the words that are present in the input text is already in the speech corpus so synthesized output naturalness is very high. Second, when input word is not present in the database we synthesis the word using syllable level concatenation. In this case naturalness will bec comparatively less than word level synthesis. For Example,

1	**कारण आपल्याकडे ती पद्धत नाही**
2	**त्याने पहिल्या व दुसऱ्या महायुद्धात**
3	**तुम्हाला त्यातून बराच अंदाज येईल**
4	**सिंह रास सिंह नावाची खगोलीय रास**
5	**अशा प्रकारे अमेरिकेचा या युद्धात प्रवेश झाला**
6	**रत्नागिरी जिल्ह्याच्या माहितीसाठी येथे टिचकी द्या**
7	**पुणे शहरातील एक मध्यवर्ती ठिकाण**
8	**जलंधर शहरातील क्रिकेटचे मैदान आहे**
9	**आपण चर्चा करताना कृपया चार वापरून सही करावी**
10	**केवळ प्रबंधक ही पाने बदलू शकतात काय**

Then the matlab program searches the normalized database to find whether the word is present or not using the help of mapping file [9].

QUALITY TEST

Voice quality testing is performed using subjective test. In subjective tests, human listeners hear and rank the quality of processed voice files according to a certain scale. The most common scale is called MOS (Mean Opinion Score) [9] and is composed of five scores of subjective quality, 1-Bad, 2-Poor, 3- Fair, 4-Good, 5Excellent. The MOS score of a certain vocoder is the average of all the ranks voted by different listeners of the different voice file used in the experiment [14][15][16][17] .

Here tests are conducted with five students with the age group of 20-26 years. The tests were conducted in the laboratory environment by playing the speech signals through headphones. In this test, these five students were asked to audio perception for the three synthesized sentences. Then they were asked to judge the distortion and quality of the speech. The evaluation of Marathi TTS is shown in Table 1 [23-37].

Sentence-1 score is obtained by making 5 people to speak and evaluate the speech output of the test sentence with words present in the speech corpus. To obtain the score for Sentence-2, the test sentence is made with words present in the speech corpus and those which are not in the speech corpus. The score for Scentence-3 is obtained by making the test sentence with words not in the speech corpus [14][15][16][17].

Table 1. Subjective test results.

Test Set- Sentence	Mean Opinion Score
1	4.00
2	3.50
3	4.50
4	4.00
5	4.00
6	5.00
7	4.00
8	5.00
9	4.50
10	5.00

CONCLUSION

In this research paper, a speech synthesis system has been designed and implemented for Marathi Language. A database has been created from the various domain words and syllables. The speech files present in the corpus are recorded and stored in PCM format in order to retain the naturalness of the synthesized speech. The given text is analyzed and syllabified based on the syllable segmentation rules. The desired speech is produced by the concatenative speech synthesis approach. Fig. 2shows the concatenated synthetic speech signal for Marathi phrase. Thus we can conclude that the produced synthesized speech is preserving naturalness and good quality based on the subjective quality test results.

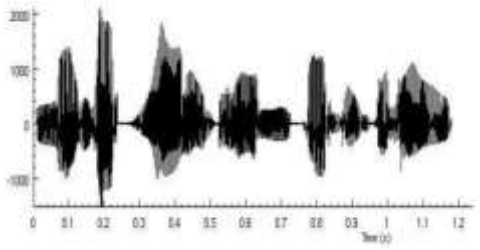

Fig.2: concatenate synthetic speech signal for Marathi phrase

REFERENCES:

[1] Sangramsing Kayte, Monica Mundada, Dr. Charansing Kayte "Di-phone-Based Concatenative Speech Synthesis Systems for Marathi Language" OSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 5, Issue 5, Ver. I (Sep –Oct. 2015), PP 76-81e-ISSN: 2319 –4200, p-ISSN No. : 2319 –4197 www.iosrjournals.org
[2] N. Sridhar Krishna, HemaA. Murthy and Timothy A.Gonsalves,. Text-to-Speech (TTS) in Indian Languages.Int. Conference on Natural Language Processing, ICON-2002, Mumbai, pp. 317.326, 2002.
[3] Sangramsing N.kayte "Marathi Isolated-Word Automatic Speech Recognition System based on Vector Quantization (VQ) approach" 101th Indian Science Congress Jammu University 03th Feb to 07 Feb 2014.
[4] Sangramsing Kayte, Dr. Bharti Gawali "Marathi Speech Synthesis: A review" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 3 Issue: 6 3708 – 3711
[5] Sangramsing Kayte, Monica Mundada, Dr. Charansing Kayte "Di-phone-Based Concatenative Speech Synthesis Systems for Marathi Language" OSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 5, Issue 5, Ver. I (Sep –Oct. 2015), PP 76-81e-ISSN: 2319 –4200, p-ISSN No. : 2319 –4197 www.iosrjournals.org
[6] N.P. Narendra, K. SreenivasaRao ,Krishnendu Ghosh, Ramu ReddyVempada, SudhamayMaity. Development of syllable-based text to speech synthesis system in Bengali.
[7] Sangramsing Kayte, Monica Mundada "Study of Marathi Phones for Synthesis of Marathi Speech from Text" International Journal of Emerging Research in Management &Technology ISSN: 2278-9359 (Volume-4, Issue-10) October 2015
[8] Sangramsing Kayte, Monica Mundada, Dr. Charansing Kayte "Di-phone-Based Concatenative Speech Synthesis System for Hindi" International Journal of Advanced Research in Computer Science and Software Engineering -Volume 5, Issue 10, October-2015
[9] Sangramsing Kayte, Monica Mundada, Santosh Gaikwad, Bharti Gawali "PERFORMANCE EVALUATION OF SPEECH SYNTHESIS TECHNIQUES FOR ENGLISH LANGUAGE " International Congress on Information and Communication Technology 9-10 October, 2015
[10] Sangramsing Kayte, Monica Mundada, Dr. Charansing Kayte "A Review of Unit Selection Speech Synthesis International Journal of Advanced Research in Computer Science and Software Engineering -Volume 5, Issue 10, October-2015
[11] Monica Mundada, Sangramsing Kayte "Classification of speech and its related fluency disorders Using KNN" ISSN2231-0096 Volume-4 Number-3 Sept 2014
[12] Monica Mundada, Sangramsing Kayte, Dr. Bharti Gawali "Classification of Fluent and Dysfluent Speech Using KNN Classifier" International Journal of Advanced Research in Computer Science and Software Engineering Volume 4, Issue 9, September 2014
[13] Monica Mundada, Bharti Gawali, Sangramsing Kayte "Recognition and classification of speech and its related fluency disorders" International Journal of Computer Science and Information Technologies (IJCSIT)
[14] Sangramsing Kayte, Monica Mundada, 2Dr. Charansing Kayte "Marathi Text-To-Speech Synthesis using Natural Language Processing "IOSR Journal of VLSI and Signal Processing (IOSR-JVSP)Volume 5, Issue 6, Ver. I (Nov -Dec. 2015), PP 63-67e-ISSN: 2319 – 4200, p-ISSN No. : 2319 – 4197
[15] Sangramsing Kayte, Monica Mundada, Dr. Charansing Kayte" Speech Synthesis System for Marathi Accent using FESTVOX" International Journal of Computer Applications (0975 – 8887) Volume 130 – No.6, November2015
[16] Sangramsing Kayte, Monica Mundada, Dr. Charansing Kayte "Screen Readers for Linux and Windows – Concatenation Methods and Unit Selection based Marathi Text to Speech System" International Journal of Computer Applications (0975 – 8887) Volume 130 – No.14, November 2015
[17] Sangramsing Kayte, Monica Mundada, Dr. Charansing Kayte " Performance Evaluation of Speech Synthesis Techniques for Marathi Language " International Journal of Computer Applications (0975 – 8887) Volume 130 – No.3, November 2015
[18] Sangramsing Kayte, Monica Mundada, Jayesh Gujrathi, " Hidden Markov Model based Speech Synthesis: A Review" International Journal of Computer Applications (0975 – 8887) Volume 130 – No.3, November 2015
[19] Sangramsing N. Kayte ,Monica Mundada,Dr. Charansing N. Kayte, Dr.Bharti Gawali "Approach To Build A Marathi Text-To-Speech System Using Concatenative Synthesis Method With The Syllable" Sangramsing Kayte et al.Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 11, (Part-4) November 2015, pp.93-97
[20] Sangramsing N. Kayte, Dr. Charansing N. Kayte,Dr.Bharti Gawali* "Grapheme-To-Phoneme Tools for the Marathi Speech Synthesis" Sangramsing Kayte et al.Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 11, (Part -4) November 2015, pp.86-92
[21] Sangramsing Kayte "Duration for Classification and Regression Tree for Marathi Text-to-Speech Synthesis System" Sangramsing Kayte Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 11, (Part-4)November2015
[22] Sangramsing Kayte "Transformation of feelings using pitch parameter for Marathi speech" Sangramsing Kayte Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 11, (Part -4) November 2015, pp.120-124
[23] Sangramsing Kayte,Dr. Charansing N. Kayte, Dr.Bharti Gawali " Artificially Generatedof Concatenative Syllable based Text to Speech Synthesis System for Marathi" OSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 5, Issue 6, Ver. II (Nov -Dec. 2015), PP 44-49e-ISSN: 2319 –4200, p-ISSN No. : 2319 –4197
[24] Sangramsing Kayte,Dr. Charansing N. Kayte, Dr.Bharti Gawali " Automatic Generation of Compound Word Lexicon for Marathi Speech Synthesis" OSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 5, Issue 6, Ver.II (Nov -Dec. 2015), PP 25-30e-ISSN: 2319 –4200, p-ISSN No. : 2319 –4197

[25] Sangramsing Kayte,Dr. Charansing N. Kayte, Dr.Bharti Gawali "Approach of Syllable Based Unit Selection Text-To-Speech Synthesis System for Marathi Using Three Level Fall Back Technique OSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 5, Issue 6, Ver. II (Nov -Dec. 2015), PP 31-35e-ISSN: 2319 –4200, p-ISSN No. : 2319 –4197

[26] Sangramsing Kayte,Dr. Charansing N. Kayte, Dr.Bharti Gawali "Implementation of Text To Speech for Marathi Language Using Transcriptions Concept" Sangramsing N. Kayte et al. Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 11, (Part - 5) November 2015, pp.33-36

[27] Sangramsing Kayte,Dr. Charansing N. Kayte, Dr.Bharti Gawali "Rule-based Prosody Calculation for Marathi Text-to-Speech Synthesis" Sangramsing N. Kayte et al. Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 11, (Part - 5) November 2015, pp.33-36

[28] Sangramsing Kayte, Dr.Bharti Gawali "The Marathi Text-To-Speech Synthesizer Based On Artificial Neural Networks " International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056Volume: 02 Issue: 08| Nov-2015-ISSN: 2395-0072

[29] Sangramsing N. Kayte, Dr.Charansing N. Kayte, Dr.Bharti Gawali "The Heart of Generating Hidden Markov Model Which Are Essential For Synthesis" Journal Of Modern Engineering Research (IJMER) International OPEN ACCESS|ISSN: 2249–6645 Vol. 5 | Iss.12| December 2015 | 26 http:

[30] Sangramsing N. Kayte, Dr.Charansing N. Kayte, Dr.Bharti Gawali "The Prosody Subsystem and Pitch Pattern for Marathi Text To Speech Synthesis " International Journal Of Modern Engineering Research (IJMER) OPEN ACCESS| ISSN: 2249–6645 |Vol. 5 | Iss. 12| December 2015 | 26

[31] Sangramsing N. Kayte,Dr.Bharti Gawali "The Marathi Text-To-Speech Synthesizer Based On Artificial Neural Networks " International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056Volume: 02 Issue: 08| Nov-2015-ISSN: 2395-0072

[32] Sangramsing Nathusing Kayte. "Festival and Festvox Framework Tools for Marathi Text-to-Speech Synthesis" International Journal of Computer Applications 132(4):38-43, December 2015. Published by Foundation of Computer Science (FCS), NY, USA

[33] Sangramsing Nathusing Kayte. Text To Speech for Marathi Language using Transcriptions Theory. International Journal of Computer Applications 131(6):39-41, December 2015. Published by Foundation of Computer Science (FCS), NY, USA

[34] Sangramsing Kayte, Bharti Gawali "A Text-To-Speech Synthesis for Marathi Language using Festival and Festvox" International Journal of Computer Applications (0975 – 8887)Volume 132 – No.3, December2015

[35] Sangramsing N Kayte, Charansing N Kayte and Bharti W Gawali. Article: Marathi Synthetic Voice using Synthesizer Modules of Festival Speech and HTS Straight Processing. Communications on Applied Electronics 3(7):9-12, December 2015. Published by Foundation of Computer Science (FCS), NY, USA

[36] Sangramsing Kayte "Marathi Speech Recognition System Using Hidden Markov Model Toolkit" International OPEN ACCESS Journal Of Modern Engineering Research (IJMER) | IJMER | ISSN: 2249–6645 || Vol. 5 | Iss. 12 | December 2015|13

[37] Sangramsing N.Kayte , Monica Mundada "Overview of Hidden Markov Model for Test-To-Speech Synthesis Methods " International Journal Of Engineering And Computer Science ISSN:2319-7242Volume –4 Issue -12 December, 2015Page No.15303-15311

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Networking Protocols for Multipathing in Cloud

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Abstract—Cloud computing is an ever-growing field in today's era. With the accumulation of data and the advancement of technology, a large amount of data is generated every day. Storage, availability and security of the data form major concerns in the field of cloud computing. With the beginning of virtualisation, data centre networking is reaching a high level of management. Interconnection in the data centres is not just based on practical knowledge but also on the traffic present in the particular network and the traffic engineering concerns. Scalability is a major concern for cloud service providers and data centre managers. Many researchers have proposed scalable ethernet as a solution for scalability but complex networking is a drawback for the scalable ethernet. Specific wiring topologies needed can create problems in deployment, network switch configuration. Network today, is the bottleneck which prevents businesses from realising the benefits of the information infrastructure. In this paper, various network protocols are discussed for multipathing and an insight is also given to view the improvisations from traditional data centres to the present day real time data centres. In this paper, we discuss about protocols such as LISP, MPTCP, TRILL, SPAIN, spanning trees and various other technologies, their proposals and the protocols used.

Keywords: Cloud computing, networking, protocols, multipathing

I. INTRODUCTION

Scalability is an important concern when it comes to cloud computing. High bandwidth, low latency is possible and advantageous in a scalable network. The cost of the equipment by a particular service provider is reduced only if the commodity is available off the shelf (COTS).Ethernet is highly used for connectivity in present times, specially over the fibre channel (FCOE).Self configuration, high bandwidth at low cost, high speed are all the benefits of the ethernet. The low scalability problem of the ethernet is solved by IP routers but which are available for a higher price. Layer 3 IP is added over the Layer 2 ethernet.

Several applications are hosted by cloud providers of different clients, thus providing a multi-tenant scenario in which the servers and the network is shared by tenants among each other. Without changing the tenants' systems, software's and protocols, services should be made available to the tenant by the cloud service provider. The requirement for high transmission rates, high bandwidth, less jitter are placed by the tenant to the provider. Multipathing is one of the ways in which these requirements can be met. Usually, redundancy is deployed at the data centre to avoid loss of information or data. Topologies are formed with multi rooted trees to offer multiple paths for fault tolerance. For easy deployment of services, it should be ensured that minimum modification is done at the infrastructure level.In this paper, an approach is discussed as well for efficient multipathing.This approach is formulated by using genetic algorithms.

In section II of the paper, we describe the issues related to the networking in traditional data centre and what is the ideal data centre network topology to overcome the drawbacks of the traditional data centre. In section III, we describe the two phase multipathing scheme evaluated by genetic algorithms. In section IV, a brief description is given about SPAIN COTS whereas in section V, a short brief about various protocols used for multipathing in networking is given.

II. COMPARISON BETWEEN LEGACY DATA CENTRES AND MODERN DATA CENTRES

A. Drawbacks of legacy data centres

To be concise, legacy data centres are highly location dependant and complex which greatly impacts their performance and has a negative effect on the user experience as well.

1) High Complexity: With the growth of the data centre, the number of devices also increase. It is necessary to manage the switch points and the switch interactions. The number of interactions between switches is given by the formula: n*(n-1)/2.Thus, according to the formula, 10 switches can generate 45 interactions while 100 can generate nearly 5000 interactions.

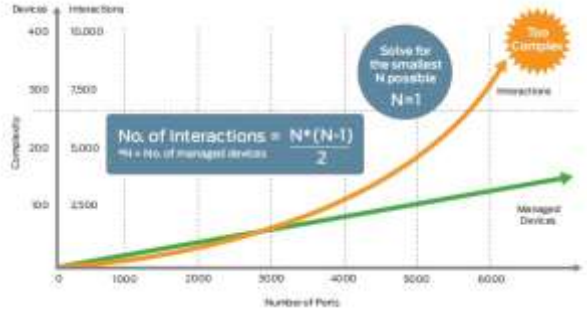

Fig 1: Growth in the number of interactions between switches when new devices are added to the network.[1]

To avoid this high a complexity, subnetworks are created within a network. If in such a scenario, spanning tree protocol is used, half the bandwidth will be unavailable as STP disables half the available links. Thus, in an organisation, the number of switches should be relative to the number of servers [1].

2) High location dependency: Application performance highly depends on the physical location of the servers ie where each server resides in the hierarchical structure. All switches are arranged in a hierarchical pattern in layers. This architecture forces each packet to transit switches up and down in the tree. Thus, the packets take divergent paths, thus low latency is difficult to maintain. Thus not fulfilling the SLA's as well.[1]
Engineering the networks to manage changing workloads is also difficult. The network traffic is engineered in such a way that it makes less number of hops, i.e. the source and destinations of the flows are close. This improves the performance of the application.

3) Inequality of data centres: Businesses often have to make trade-offs between performance, scalability, management complexity and cost as the requirements by each business differ. Some companies require a high performance for some interval of time and at regular times, require a normal performance. Instead of using individual equipment's provided by individual vendors, it is better to have an integrated product in the data centre network which addresses all their needs.

B. Ideal data centre characteristics

An ideal data centre offers simplicity and high performance.

1) Simplicity: The best way to induce simplicity in a network is to make the entire network behave as a single switch. Inside every switch is a flat fabric mesh and provides random connectivity between ports. There is no need for sharing protocols such as STP or control or management that is required. Server, storage and other devices can be connected seamlessly to the fabric offering high scalability and the performance does not degrade even if there are hundreds or thousands of ports [1].
2) Performance: With a flat fabric, the data path is all simplified. Latency is minimised and it is ensured that all the members of the fabric are via a single hop and each connection benefits from the bandwidth.
Eliminating tyres of switches has additional benefits. The fabric based data centre network requires few devices and interconnections which reduces the cost of building network infrastructures. Thus a fabric based architecture can pay heed to a lot of data centre requirements. By offering high scalability, performance and providing cost benefits, a fabric based network eliminates the need for IT to trade off one capability for the other [1].

III. TWO PHASE MULTIPATHING

A two phase multipathing scheme divides the problem in two phases: 1) Multipath configuration and 2) Multipath

Selection.

In multipath configuration, multiple paths are created using genetic algorithms with the objective of minimising path cost and maximising link usage diversity. The multipath share a common feature of the VLAN switches, ie they use VLAN tag to map multiple paths to multiple trees. Thus mapping problem is simplified by Genetic Algorithms which allows the creation of multiple VLAN trees with multiple objective functions such as the two mentioned above.

The two phase multipathing scheme explores path redundancy using algorithms. First, several independent trees are generated by the scheme to interconnect various servers of the data centres using genetic algorithms to minimise path sizes and maximise link usage diversity. Each tree is configured with a separate VLAN tag with the configuration performed offline, thereby not delaying the process of scheduling workflows. A network controller may take the advantage of SNMP (Simple Network Management Protocol) to gather topology and take VLAN advantage in switches. Only one path exists between each pair of servers. The use of several trees at a time spreads the traffic which increases the throughput and the load balancing. A single tree is selected to forward the flow and hence the packet follows only one path to avoid reordering at the receptor [4].Tree selection uses heuristics based on network usage.Smart Path Assignment in Networks (SPAIN) uses a similar technique to explore paths in a data Centre. The SPAIN approach is described in the next section.

IV. SPAIN COTS

SPAIN pre-computes the set of paths which utilises the redundancy in physical wiring. To provide high bandwidth and increased fault tolerance. These paths are then merged into a set of trees and each tree is mapped to a separate VLAN.These VLANs are installed on switches. Generally, a few number of switches are required to cover the network since a single VLAN ID can be re-used for multiple disjoint subtrees.

SPAIN highly improves performance as it uses COTS (Commodity off the Shelf) which provides the best TCO (Total Cost of Ownership).These COTS switches are used unmodified. SPAIN works with arbitrary topologies, supports incremental deployment and requires no centralised controllers. [6]

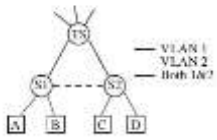

Fig 2: VLAN‘s used for multipathing.[6]

With SPAIN, a pair of end hosts can use different VLAN’s traversing potentially through different links at different times for different flows. Thus, high throughput and better fault tolerance can be achieved than the spanning tree.

In the figure shown above, VLAN 1 is reserved to include all the nodes.Thus, it is always available as a fallback path. Certain switch features required by SPAIN include:

- MAC address learning and VLAN support (already present in COTS switches). SPAIN can also exploit other switch features for improvised performance, high scalability and fault tolerance
- Switch is required to store multiple table entries. (One table per VLAN).

As shown in the above figure, Fig 2, there are two VLANs.VLAN 1 for normal spanning tree and VLAN 2 for the alternate link. Once the two VLANs are configured, VLAN 1 is used by endhost A for flows to C and VLAN 2 used by endhost B for flows to D, thereby doubling the bandwidth [6]. Offline configuration of the network includes

- Set of paths to be used.
- Mapping paths to VLANs.
- Handling unplanned topology changes.

V. NETWORKING PROTOCOLS

A. MPTCP-Multi Path TCP

MPTCP is an ongoing effort by engineers to enable the simultaneous use of IP addresses by a modification of the TCP which presents a regular interface to the applications, while in fact spreading data across various sub flows [9].

B. LISP-Locator/Identifier Separation Protocol

IP addresses, today, are assumed to have two functions:

1) Localisation 2) Identification of the owner.

When it comes to LISP, each endpoint (EID) is associated to one or many ip addresses of intermediate IP interfaces. named Routing LOCators (RLOC) which are typically supposed to be at the border routers of the endpoint network. Upon reception of the packet from the local network to an outer EID, the border acts as an Ingress Tunnel Router (ITR).It retrieved the EID to RLOC from the mapping system and assigns to it a LISP header, and an outer IP header with RLOC as destination IP address.The RLOC that is at the receiving end acts as the ETR (Egress Tunnel Router) which decapsulates the packet and then forwards it to the destination EID. If the traffic is not LISP compliant, the encapsulation or decapsulation process may be carried out by a Proxy ITR.The usage of RLOC priorities helps in load balancing [3].

C. TRILL-Transparent Interconnection of Lots of Links

TRILL(Transparent Interconnection of Lots of Links) runs a link state protocol between the routing bridges(Rbridge).It uses broadcast communication so that each Rbridge knows about all other Rbridges.Thus each RBridge has enough information to compute pairwise optimal path for unicast traffic. Distribution trees and an RBridge is used as a root for forwarding. Each node present in the network calculates the TRILL header and performs functions like the MAC address swapping.STP is not needed in TRILL.[2]

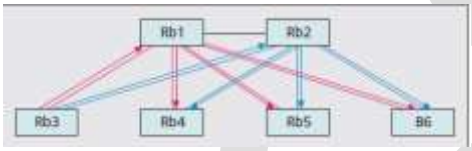

Fig 3: TRILL multicast domain with RBridges[2].

Benefits of TRILL:

- Introduces a loop free path
- Alleviates problems related to MAC address tables
- Handling unplanned topology changes.

D. SPB

Shortest Path Bridging(SPB) is a layer 2 protocol which was formerly introduced by IEEE as provider link state bridging(PLSB) which was developed for the telecommunication market.802.1 ah frame for separating MAC BOOK and VLAN ids thus enabling data centre virtualisation called ISID.The ISID abstracts service from the network.ISID provides mechanism for granular ID control as well.When a new device is attached to the SPB and wishes to communicate with an existing device, there is an exchange to identify the device and its immediate neighbours. This exchange is enabled by the ISIS protocol.The ISID is reachable to the end of the network where learning is .The bidirectional paths are then enabled from the requesting device to the destination using ECMP.The same kind of approach is used for Unicast as well as broadcast packets. Once the entire tree has been developed, the tree is pruned and traffic is assigned to a particular path. The endpoints reach each other by transmitting an address port. Thus the endpoints are well aware of the entire traffic path [2].

E. Virtual Cluster Switching

Brocade proposed virtual cluster switching.VCS is a layer 2 protocol based on the basic functionality of TRILL. It is compliant with TRILL and uses the basic TRILL framework format. The core of Brocade uses Shortest Fabric Path First (SFPF), which is the standard path selection protocol in Fibre Channel Storing area. According to Brocade, a single VCS fabric is synchronised with 32000 MAC addresses. Currently the Brocade switches can scale up to 600 physical ports in a single fabric.

F. QFabric

Juniper proposed QFabric using the ideal data centre strategy. At the heart of this strategy is the Juniper 3-2-1 Data Centre Network Architecture which eliminates the layers of switching to flatten them into two layers which is further reduced to a single layer by the Quantum Fabrics or the

QFabric. [2]

According to Juniper, QFabric allows multiple devices in the network to share a common management plane. This is just why the QFabric devices and switches are not referred to as edge core and the overall approach is that of a fabric than a network. Juniper can support upto 6144 physical ports with the oversubscription of 3:1 at the edge of the fabric. QFabric provides equal latency between any two ports in the fabric [2].

G. ODIN-Open Datacentre Interoperable Network

ODIN was released by IBM.ODIN helps in interoperability between the devices, thus facilitating multi-vendor interaction. It deals with various industry standards and the best of practices including TRILL, Lossless ethernet, Open flow, Wide Area Networking and ultra-low latency networks. It has been publicly endorsed by a number of companies, a few of the famous ones include Brocade, Juniper, Huawei, NEC, BigSwitch and Marist College. Some of these companies have developed individual protocols to support ODIN.Eg QFabric by Juniper, VCS by Brocade. Each of these protocols have different features such as scalability, latency, oversubscription and management. ODIN has not yet been implemented in the market but has high hopes associated with it. [2]

VI. CONCLUSION

In this paper, a detailed study of the various networking protocols for multipathing has been done. A comparison has been made between the legacy and present day data centres to show how the present day data centres have gone an improvisation since t6he past. The various protocols and their roles in the data centre management have been discussed.

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REFERENCES:

[1] Juniper white paper 2000380-003-EN (Dec. 2011), Revolutionizing Network Design: Flattening the Data Centre Network with the Qfabric
Architecture,http://www.juniper.net/us/en/local/pdf/whitepapers/
2000380-en.pdf, accessed 27-Dec-2011, see also independent Qfabric test results, available: http://newsroom.
juniper.net/pressreleases/juniper-networks-qfabric- sets-new-standard-for-net-nyse-jnpr0859594, accessed 30 June 2012.

[2] Carolyn J.Sher Decusatis,Casimer M.Decusatis ,Aprico Carranza,
”Communication Within Clouds: Open Standards and Proprietary Protocols for Data Centre Networking”, Communications Magazine, IEEE, vol.50, no.9, pp26-33, September 2012.

[3] M.Coudron et al,”Boosting Cloud Communications through a Cross Layer Multipath Protocol Architecture”, Proc of IEEE, SDN4FNS’13, Italy, Nov, 2013.

[4] Lyno Henrique,G.Ferraz,Diogo Mennez Ferrazani Mattos ”A two phase Multipathing Scheme based on Genetic Algorithm for Data Centre Networking ”,IEEE-GLOBECOM 2014,December 2014.

[5] D.Bellabed,S.Secci,D.Medhi,G.Pujolle ”Impact of Ethernet Multipath Routing on Data Centre Network Consolidation”,Proc of the 4th int workshop on Data Centre Performance,ICDCS,IEEE,June 2014.

[6] J.Mudigonda,P.Yalagandula,M.Alfares,J.Mogul,”SPAIN:COTS Data centre ethernet for multipathing over arbitrary topologies ”,Proc NSDI,2010,San Jose,CA,USA,April 2010.

[7] S.Secci,San Murugesan, ”Cloud networks:Enhancing performance and resiliency”,IEEE,Computer 2014:47(10):82-85

[8] P. Mell and T. Grance, The NIST Definition of Cloud Computing, 07 Oct. 2009: http://csrc.nist.gov/groups/ SNS/cloud-computing/, accessed: 29-Jan-2011.

[9] www.Multipath TCP.org

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PV Fed Non Isolated DC-DC Boost Converter

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Abstract- This paper deals with a new topology of the high static gain non-isolated DC-DC boost converter with central point on its output. Proposed converter is a high step up converter. The proposed converter is obtained from the three level boost converter and the quadratic single switch boost converter. The static gain of this proposed converter is bigger than the one from the traditional boost converter and the maximum voltage on two switches is half of the output voltage. Design and hardware implementation of the proposed converter is presented in this paper. The theoretical analysis, design procedure, experimental results and simulation results are presented. The experimental results are compared with simulation results.

Index Terms- Photo voltaic (PV), non isolated DC-DC converter, Boost converter, Quadratic single switch boost converter, high step up converter, three level boost converter, Traditional boost converter.

I. INTRODUCTION

Photovoltaic (PV) power-generation systems are fetching importance and prevalent in distributed generation systems. There are two principal barriers to the use of PV systems: the high installation cost and the low energy conversion efficiency [1]. A conventional centralized photovoltaic array is a serial connection of several panels to obtain higher dc-link voltage for main electricity through a dc–ac inverter [2]. Unfortunately, the power range of a single PV module is usually ranges from 100 Watts to 300 Watts, and the maximum power point (MPP) voltage range starts from 15 V to 40 V. These ratings are low as compared with the essential input voltage for inverters; as it is difficult to obtain high efficiency [3] which will be the input voltage of the inverter; in cases with lower input voltage, it is difficult for the inverter to reach high efficiency [4].

On the other hand, employing a high step-up dc–dc converter in the front of the inverter improves power-conversion efficiency and provides a stable dc link voltage to the inverter. Therefore, in this context, it is necessary to utilize a step-up DC-DC converter as intermediate stage between the Photovoltaic array and the inverter [5].

In addition to the isolated converters with transformers, traditional boost converters can be used for these applications. Within this type of converters, the voltage gain gets reduced because of the losses due to the filter capacitors, inductors, diode rectifiers and the switch operating with high duty ratios. Further, increasing level of the voltage during conversion [6, 7] provides the usage of cascaded boost converter, as the voltage gain of the converters operates with respect to duty cycle. Moreover, the design developed will be bulky and the voltage stress across the main switch will be raised. Applying the similar techniques in [8, 9] the high gain DC-DC converters using coupled inductors are introduced. Using the coupled inductors, with exact winding ratio, voltage stresses across the main switches are suppressed and the reverse recovery of the output diode is more focused. But, the voltage across the output diode remains high and the resonance between the leakage inductance and parasitic capacitor of the output diode cause electromagnetic interference problem and increases losses. Furthermore, the input current ripple is high due to the discontinuity of the current.

A PV panel is a non-linear power source, i.e., its output power/current depends on the terminal operating voltage and the maximum power generated by the system changes with temperature and solar radiation. To increase the ratio of output cost/cost of installation, it is important that PV panel operates at Maximum Power Point (MPP) [10]. Besides, due to the temperature, radiation and load variations, this efficiency can be highly reduced. In order to ensure that the photovoltaic modules always act supplying the maximum power as possible, a Maximum Power Point Tracking (MPPT) controller is employed. In most common applications, the MPPT is achieved through a DC-DC converter controlled through a suitable control strategy.

Basically, a MPPT system consists of a DC-DC converter controlled by a tracking algorithm and the combination of both, hardware and software, defines the tracking efficiency [11]. This work deals with the design and development of a MPP-tracker for photovoltaic systems, which is a high efficiency boost converter operating in continuous conduction mode. The converter is able to draw maximum power from the photovoltaic panel for a given solar radiation level and environment temperature by adjusting the duty cycle of the converter [12].

High gain non-isolated DC-DC boost converter acquired from single switch quadratic boost converter and the three level boost converter presented [13].

II. PROPOSED CONVERTER TOPOLOGY

The proposed scheme uses a DC-DC converter which is derived from the single switch quadratic boost converter and the three level boost converters. The static gain of the converter depends upon the operating duty cycle and the maximum voltage across the two switches will be half of the output voltage, so that stress across the switches can be reduced.

A. Power conversion scheme

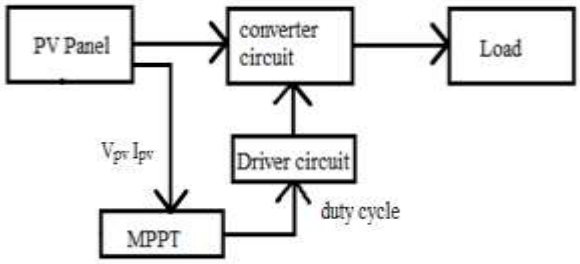


Fig. 1. Block diagram of the proposed converter.

The block diagram of the proposed converter connected with the pv panel is as shown in the Fig. 1. The duty cycle for the converter is set based on the photovoltaic voltage and current. The voltage and current of the photovoltaic panel are sensed and is given to the MPPT controller to generate the pulses. To increase the power level of the pulse, driver circuit is used. The driver circuit pulses are given to the boost converter connected with the load.

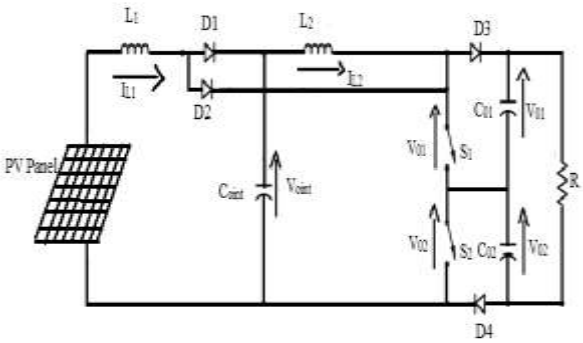


Fig. 2. Proposed high gain DC-DC boost converter.

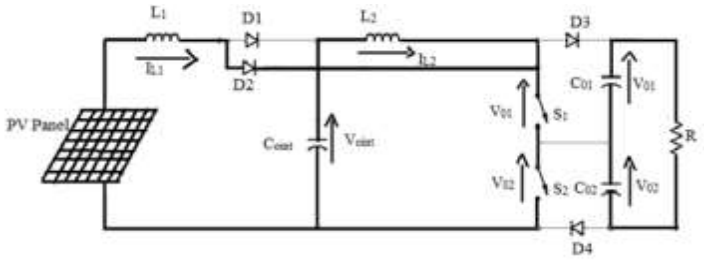
III. OPERATION MODES OF CONVERTER

Topology of the proposed converter connected with PV panel shown in Fig. 2. This converter has quadratic static gain as a function of duty cycle. The modulation strategy adopted for the proposed converter is a phase shift PWM modulation. This strategy of modulation results in two pulses of command delayed by 180º. To explain the principle of operation and analyze theoretically the proposed topology, the continuity of the current in both inductors is considered. The Continuous Conduction Mode (CCM) operation in both inductors will be presented. The converter is investigated for regions defined by the values of the duty cycle D (D > 0.5). Different modes of operation of proposed converter are shown in Fig. 3.

The four operation stages of the converter in CCM for duty cycle are greater than 50% (D > 0.5) are presented below. The topological states and the main waveforms of the operation stages are illustrated in Fig. 4.

- Mode I (t_0 - t_1)

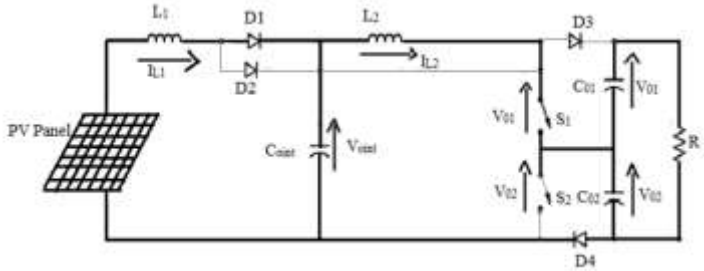
Switches S_1 and S_2 will be in conduction at the same time, starting the buildup of energy in the inductors L_1 and L_2. The energy is delivered to load through capacitors C_{o1} and C_{o2}, as shown in Fig. 4.



(a)

- Mode II (t_1- t_2)

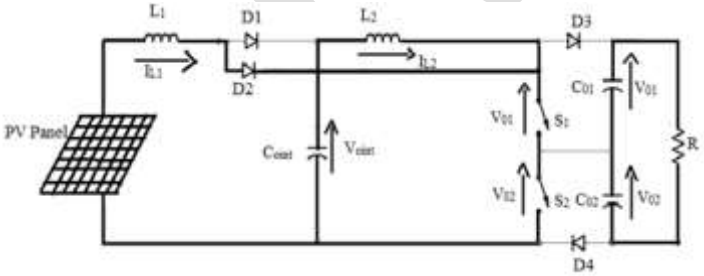
Mode II starts when S_2 is turned off. The energy is being transferred from input power source to the load. The voltage across S_2 is equal to $V_o/2$.



(b)

- Mode III ($t_2 – t_3$)

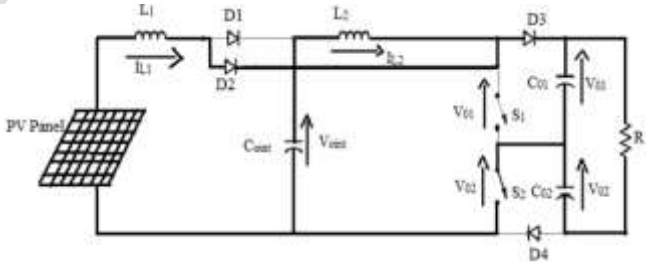
In mode III the S_2 is commanded to turn on again. The topological state and the principle of operation of this stage are equal to the first stage of operation.



(c)

- Mode IV ($t_3 – t_4$)

This stage starts when S_1 is turned off and the energy is being delivered to the load. The voltage across S_1 is equal to $V_o/2$.



(d)

Fig. 3. Operation modes of converter. (a) Operation of the circuit in mode I. (b) Operation of the circuit in mode II. (c) Operation of the circuit in mode III. (d) Operation of the circuit in mode IV.

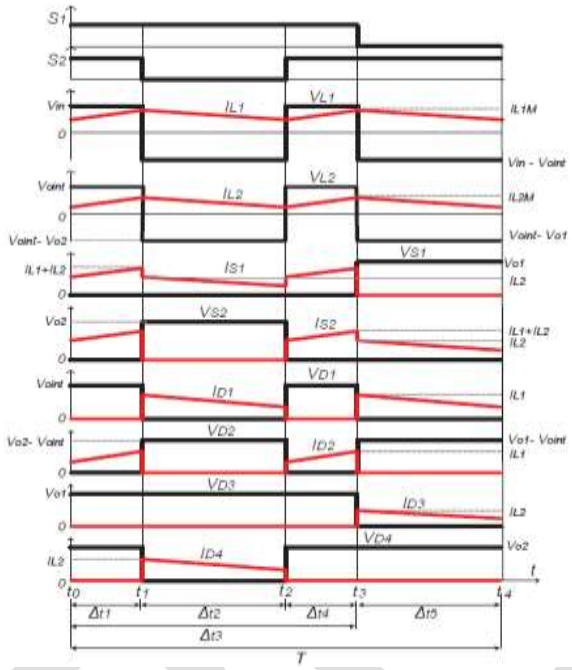


Fig. 4.Theoretical waveforms of the operating stages in CCM for D > 0.5.

IV. THEORETICAL ANALYSIS OF CONVERTER

According to the main waveforms illustrated in Fig. 4., the relationship between time intervals of each stage of operation as a function of the duty cycle can be defined in (1) and (2).

$$\Delta t_1 = \Delta t_4 = \frac{T.(2.D-1)}{2} \quad \ldots (1)$$

$$\Delta t_2 = \Delta t_5 = T.(1-D) \quad \ldots (2)$$

For analysing the steady state characteristics of the proposed high gain DC - DC converter in CCM, some assumptions are to be considered that all the power devices are ideal and capacitors are choosen at higher values to make sure constant output voltage without high ripple content.

The static gain of the converter in CCM for duty ratio D > 0.5 can be evaluated by studying each conversion stage alone. The partial static gains for the first and second stages of the converter are given by equation (3) and (4). Multiplying (3) and (4) , it is possible to obtain gain is given in equation (5)

$$\frac{V_{oint}}{v_{in}} = \frac{1}{2(1-D)} \quad \ldots(3)$$

$$\frac{V_o}{V_{oint}} = \frac{1}{(1-D)} \quad \ldots(4)$$

$$G_{CCM(D>0.5)} = \frac{1}{2.(1-D)^2} \quad \ldots(5)$$

For the given values of the switching frequency (f), duty cycle (D) and current ripple (ΔI_L), the inductance L_1 and L_2 are calculated as given in (6) and (7).

$$L_{1(D>0.5)} = \frac{V_0[(1-D)^2(2D-1)]}{\Delta I_{L1}.f} \quad \ldots(6)$$

$$L_{2(D>0.5)} = \frac{V_0[(1-D)(2.D-1)]}{2.\Delta I_{L2}.f} \quad \ldots(7)$$

The normalized current ripple (ΔI_L) of L_1 and L_2 for region of operations is represented by (8) and (9)

$$\Delta I_{L1}.\frac{L_1.f}{R_0} = 2.(1-D)^4.(2D-1) \quad \ldots(8)$$

$$\Delta I_{L2}.\frac{L_2.f}{R_0} = \frac{(1-D)(2.D-1)}{2} \quad \ldots(9)$$

The capacitors C_{oint}, C_{01} and C_{02} can be evaluated with a determined voltage ripple (ΔV_C), as given in (10) and (11)

$$\Delta V_{coint} = \frac{2.I_0(V_{oint}-V_{in})}{C_{oint}.f.V_{in}} \quad \ldots(10)$$

$$\Delta V_{c01} = \Delta V_{c02} = \frac{2.I_0.(2.V_{c01}-V_{oint})}{2.C_{01}.f.V_{c01}} \quad \ldots(11)$$

TABLE I : PARAMETERS OF PROPOSED CONVERTER

Parameters	*Values*
Input voltage V_{in}	60 V
Output voltage V_{out}	220 V
Output power P_0	220 W
Switching frequency	20 kHz
Duty ratio	61.3%
Gain	3.6
Inductance L_1	1.15 mH
Inductance L_2	1.812 mH
Capacitance C_{01}, C_{02}	100 uF
Internal capacitance C_{oint}	100 uF

TABLE II : PV PANEL RATINGS

Parameter	***Values***
P_{mpp}	250W
V_{oc}	37.25V
I_{sc}	4.35A
V_{mpp}	29.9V
I_{mpp}	8.4A
Efficiency	15.53%

V.SIMULATION RESULTS OF PROPOSED CONVERTER

The simulation results of proposed converter are obtained for an input of 60V and the output of 220V, at 61.3 percent duty cycle with power rating of 220W at switching frequency of 20 KHz. Parameters of the proposed converter is mentioned in TABLE I. Simulation model of proposed converter is shown in Fig. 5.

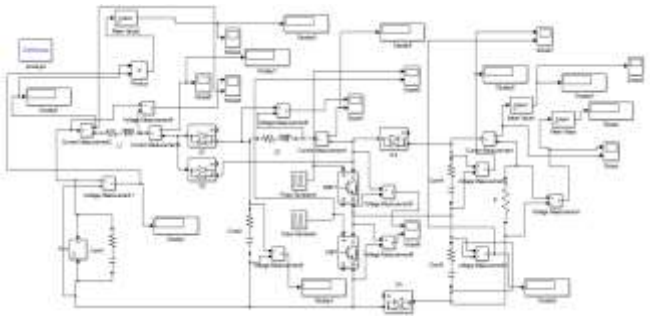


Fig. 5. Simulink model of the proposed converter.

A. Simulink model of the PV panel

Modelling of photovoltaic module is necessary for the design and simulation of photovoltaic system applications because it has non-linear characteristics. Modeling of the solar array (module) is done mainly for obtaining the performance characteristics. The performance characteristics of PV module mainly depend on the operating conditions, they also depend on solar array design quality. The output quantities (voltage, power and current) vary as a function of load current, irradiation, and temperature. The effects of these three variations are considered in the modeling, so that any change in the solar irradiation and temperature levels should not adversely affect the photovoltaic module output. The Simulink model of the photovoltaic module is as shown in the Fig. 6. Photovoltaic module is designed with the ratings as shown in the TABLE II.

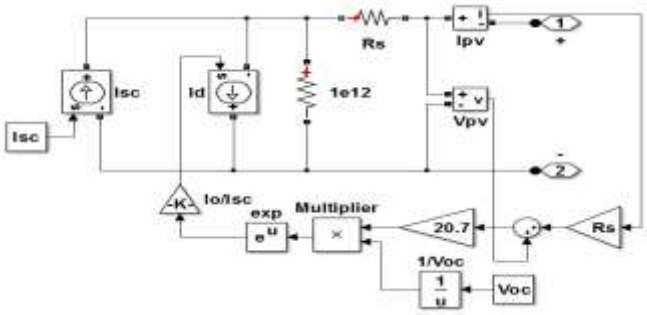


Fig. 6. Simulink of the PV panel.

B.Steady state response for various irradiation levels

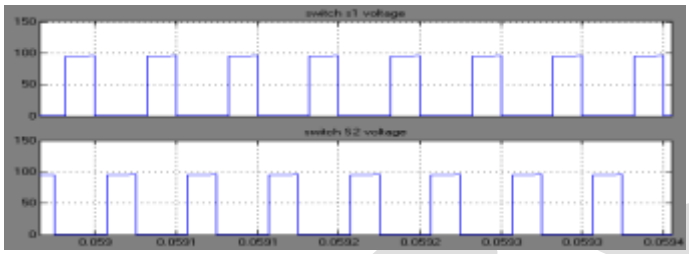
Stability of a converter is an essential requirement for any irradiation. Hence, the proposed converter connected with PV panel is tested with different irradiation levels. Simulation results for different irradiation levels are tabulated in TABLE III. Simulation results are shown in Fig. 7.

TABLE III : SIMULATION RESULTS FOR IRRADIATION LEVELS

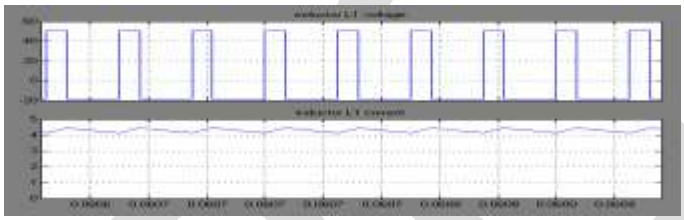
Q	D	V_m	I_m	P_m	V_0	I_0	P_0	η
0.9	62.5	57.86	3.646	218.7	190.2	0.9804	186.47	85.3
0.8	61.3	56.84	3.225	190	177.2	0.9136	161.88	85.2
0.7	60	56.08	2.791	162.1	163.7	0.8439	138.14	85.2
0.6	58.7	54.37	2.4	135.2	148.8	0.7668	114.09	85.2
0.5	56.8	53.48	1.974	108	133	0.6858	91.211	84.3
0.4	53.42	53.42	1.517	81.6	115.5	0.596	68.838	84.4


SWITCH S1 PULSES
SWITCH S2 PULSES

(a)


switch s1 voltage
switch S2 voltage

(b)



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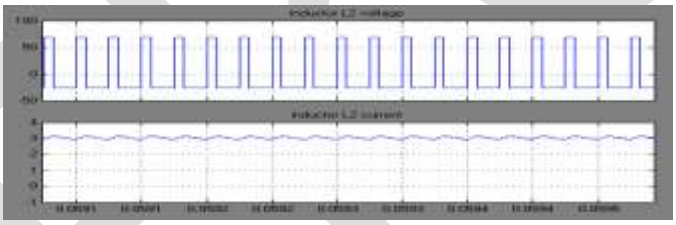
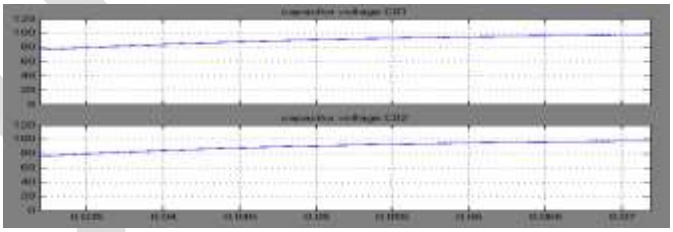
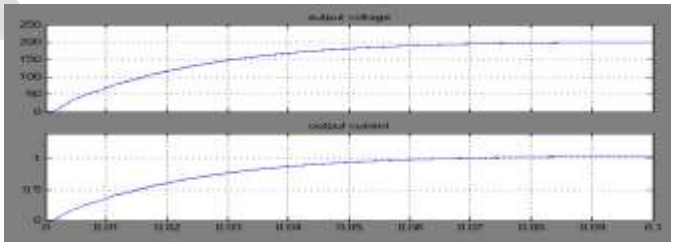
(c)



(d)



(e)


output voltage
output current

(f)

Fig. 7. Simulation results of proposed converter. (a) Gate pulses for switch S_1 and S_2. (b) Voltage across the switches S_1 and S_2. (c) Voltage and current in inductor L_1. (d) Voltage and current in inductor L_2. (e) Voltages across capacitors C_{01} and C_{02}. (f) Output voltages and output current.

VI.EXPERIMENTAL RESULTS OF PROPOSED CONVERTER

The experimental results of proposed converter are obtained for the input of 53.8V and the output of 168V, with 220W power at switching frequency of 20 KHz. Hardware model of modified SEPIC converter is shown if Fig. 8.

The values of the inductors and capacitors are calculated using the expressions (4), (5), (6) and (7) considering D = 61%, $\Delta I_{L1(max)} = \Delta I_{L2(max)} = 36\ \%$ and $\Delta V_{oint} = \Delta Vo = 10\ \%$.

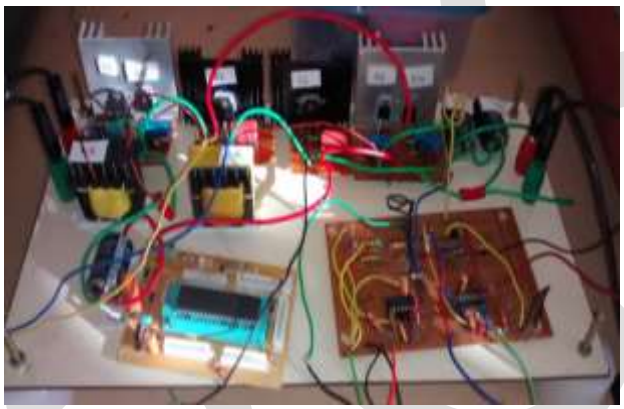


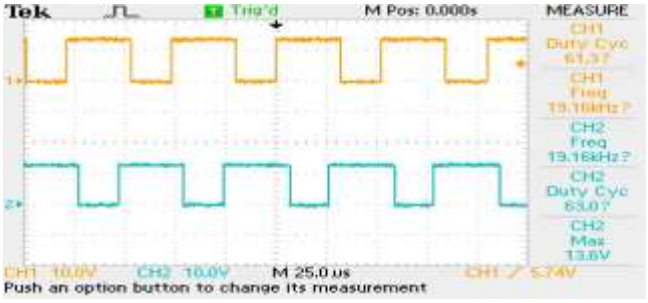
Fig. 8. Hardware model of the proposed converter.

A. Steady state response for various irradiation levels

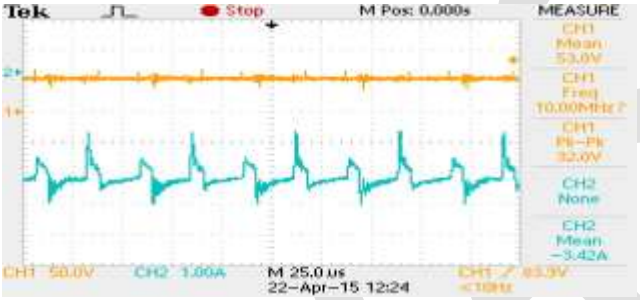
The proposed converter connected with PV panel with various irradiation levels. Based on the irradiation levels, the duty cycle for the operation of the switches has been set automatically by the microcontroller for obtaining the maximum output power in simulation based on this set values. The results are tabulated in TABLE IV. Experimental results are shown in Fig. 9.

TABLE IV: EXPERIMENTAL RESULTS OF IRRADIATION LEVELS

Q	D	V_m	I_m	P_m	V_0	I_0	P_0	η
0.9	62.5	57.8	3.64	208.08	188.7	0.924	174.35	83.78
0.8	61.3	56.83	3.09	166.64	166.6	0.887	147.7	88.6
0.7	60	56	2.67	149.52	155.3	0.825	128.12	85.68
0.6	58.7	54.3	2.39	129.77	137.5	0.808	111.1	85.61
0.5	56.8	53.5	1.99	106.46	125.6	0.737	92.56	86.95
0.4	53.42	53.5	1.53	81.6	117.5	0.612	71.391	87.85


Tek
Trig'd
M Pos: 0.000s
MEASURE
CH1
Duty Cyc
61.3 ?
CH1
Freq
13.16kHz ?
CH2
Freq
13.16kHz ?
CH2
Duty Cyc
63.0 ?
CH2
Max
13.6V
CH1 10.0V
CH2 10.0V
M 25.0 us
CH1 ∕ 5.74V
Push an option button to change its measurement

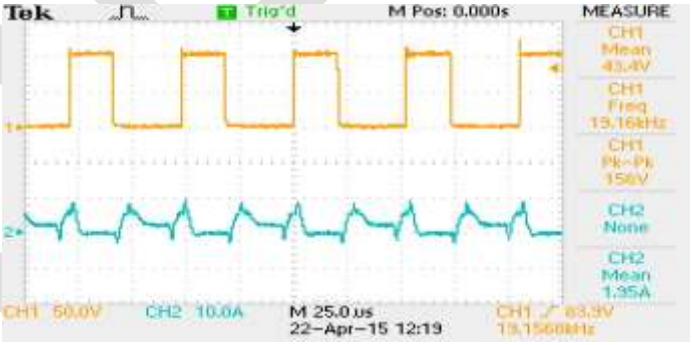
(a)


Tek
Stop
M Pos: 0.000s
MEASURE
CH1
Mean
53.0V
CH1
Freq
10.00MHz ?
CH1
Pk-Pk
32.0V
CH2
None
CH2
Mean
-3.42A
CH1 50.0V
CH2 1.00A
M 25.0 us
22-Apr-15 12:24
CH1 ∕ 63.3V
<10Hz

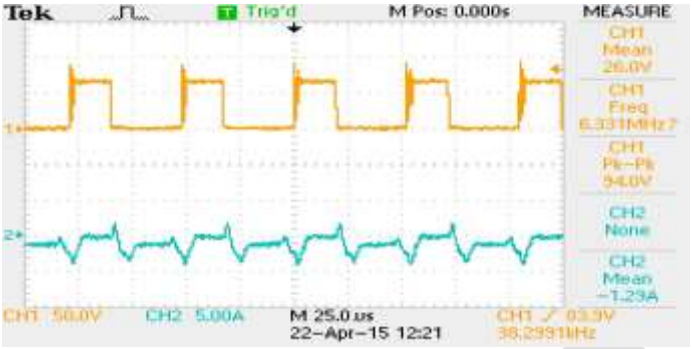
(b)


Tek
Stop
M Pos: 0.000s
MEASURE
CH1 Off
Mean
CH1 Off
Freq
CH1 Off
Pk-Pk
CH2
None
CH2
Mean
2.15A
CH2 1.00A
M 25.0 us
22-Apr-15 12:22
CH1 ∕ 63.3V
<10Hz

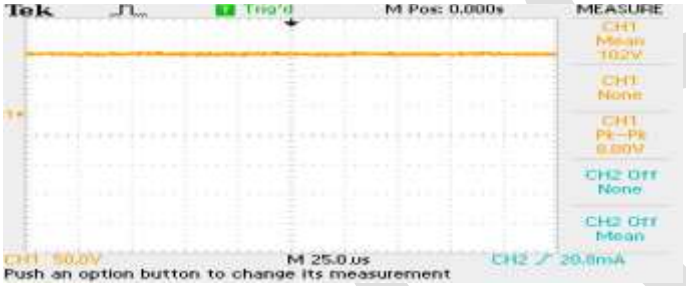
(c)


Tek
Trig'd
M Pos: 0.000s
MEASURE
CH1
Mean
43.4V
CH1
Freq
13.16kHz
CH1
Pk-Pk
156V
CH2
None
CH2
Mean
1.35A
CH1 50.0V
CH2 10.0A
M 25.0 us
22-Apr-15 12:19
CH1 ∕ 63.3V

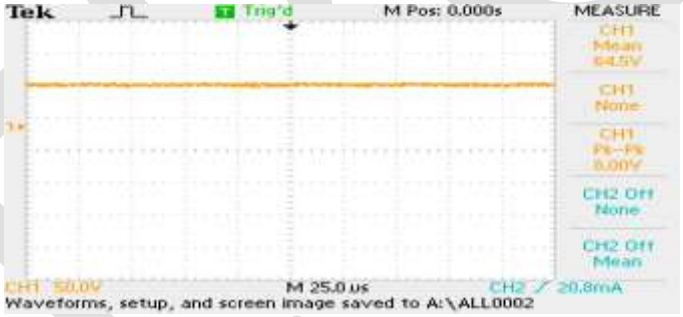
(d)



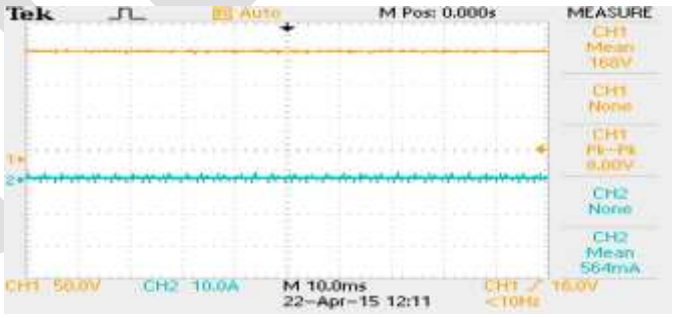
(e)



(f)



(g)



(h)

Fig. 9. Experimental results of proposed converter. (a) Gate pulses for switches S_1 and S_2. (b) Input voltage and current through inductor L_1. (c) Current through inductor L_2. (d) Voltage across and current through switch S_1. (e) Voltage and current of switch S_2. (f) Voltage across capacitor C_{01}. (g) Voltage across capacitor C_{02}. (h) Output voltage and current.

VII.COMPARISON OF SIMULATION AND HARDWARE

A graph is plotted in order to compare the performance of experimental results with simulation results. The graph is plotted by considering the duty cycle Vs power for both experimental and simulation results. The plotted graph is as shown in Fig. 10.

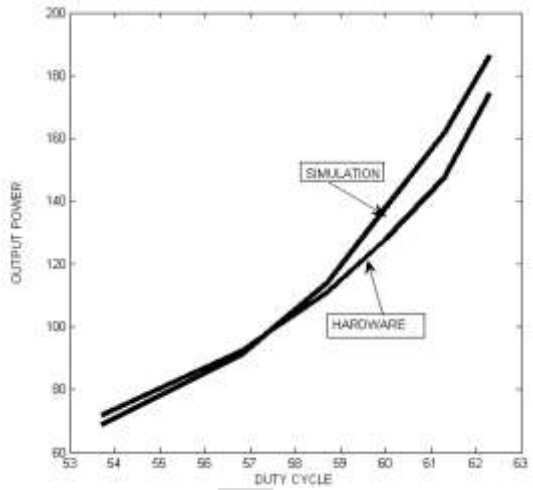


Fig. 10. Comparison of simulation and experimental results.

VIII.CONCLUSION

From the results, it is clear that proposed converter has higher circuit complexity than a conventional boost converter. The main advantage of the proposed converter circuit it has high gain a given duty cycle. The experimental results and simulation results validates our study.

REFERENCES:

[1] Riza M., et al., "A maximum power point tracking for photovoltaic-SPE system using a maximum current controller", *Solar Energy Materials & Solar Cells*, vol.75 , pp 697–706, 2003.

[2] T. Shimizu,K.Wada, andN.Nakamura, "Flyback-type single-phase utility interactive inverter with power pulsation decoupling on the dc input for an ac photovoltaic module system," *IEEE Trans. Power Electron.*, vol. 21, no. 5, pp. 1264–1272, Jan. 2006.

[3] S. M. Chen, T. J Liang, L. S. Yang and J. F. Chen, "A Safety Enhanced, High Step-Up DCDC Converter for AC Photovoltaic Module Application," *IEEE Trans. Power Electron*., vol. 27, no. 4, pp.1809-1817, 2012

[4] S. B. Kjaer, J. K. Pedersen, and F. Blaabjerg, "A review of single-phase grid- connected inverters for photovoltaic modules," *IEEE Trans. Ind. Appl.*, vol. 41, no. 5, pp. 1292–1306, Sep./Oct. 2005.

[5] João Bosco RF. Cabral, Tiago Lemes da Silva, Sérgio Vidal Garcia Oliveira, Yales Rômulo de Novaes Universidade do Estado de Santa Catarina – UDESC – Joinville,SC–Brazil

[6] L. Huber and M. M. Jovanovic, "A Design Approach for Server Power Supplies for Networking Applications," *In Proc. IEEE INTELEC*, pp. 1163-1169, 2000.

[7] T. F. Wu and T. H. Yu, "Unified Approach To Developing Single-Stage Power Converters," *IEEE Trans. Aerosp. Electron. Syst.*, vol. 34, no. 1, pp. 211-223, 1998.

[8] Y. Zhao, W. Li, Y. Deng, X. He, S. Lamber and V. Pickert, "High Step-Up Boost Converter With Coupled Inductor And Switched capacitor," *5th International Conference on Power Electronics, Machines and Drives (PEM)*, 2010.

[9] K. Kim, J. kim, Y. Jung and C. Won, "Improved Non-isolated High Voltage Gain Boost Converter Using Coupled Inductors," *International Conference on Electrical Machines and System (ICEM)*, 2011.

[10] D. Maksimovic and R. Erickson, "Uinversalinput, high-power-factor, boost doubler rectifier," *IEEE APEC*, vol. 1, pp. 459-465, 1995.

[11] R. P. T. Bascope, L. D. S. Bezerra, C. G. C. Branco, C. M. T. Cruz e G. Sousa, "A step-Up DC-DC converter for non-isolated on-line UPS applications," *IEEE International Symposium on*, 2010.

[12] L.-S. Yang, T.-J. Liang, H.-C. Lee e J.-F. Chen, "Novel High Step-Up DC-DC Converter with Coupled-Inductor and Voltage-Doubler Circuits," *IEEE Trans. on*, vol. 58, no. 9, pp. 4196- 4206, 2011.

[13] T. Esram, P. L. Chapman. "Comparison of Photovoltaic Array Maximum Power point Tracking Techniques". *IEEE Trans. on Energy Conversion. Vol. 22, N° 2, pp. 439-449, June, 2007*

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Use of Mobile Applications in Healthcare: A Review

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Abstract— In today's world smart phones have become ubiquitous. Due to their attributes such as mobility, instant connectivity, convenience, personalization, location awareness, smart phones have gained huge acceptance from all walks of life. Smart phones of this era are equipped with multi-core processors providing massive onboard processing power and are equipped with large storage capacity, and open operating systems. Mobile apps have become so popular because of their simplicity, user friendliness, speed, and portability. They make the required information available at fingertips to the user, wherever and whenever required. Mobile Apps have encompassed many areas including m-commerce, entertainment, advertisement, education, as well as healthcare. The far and wide reach of mobile devices and ease of use of mobile applications has made them a perfect choice for medical professionals. Mobile healthcare apps are increasingly being adapted to mainstream. Most commonly used apps in clinical practice can be listed as drug guides, medical calculators, coding and billing apps, pregnancy wheels, etc. These apps are revolutionizing the delivery of healthcare services across the globe and increasingly proving beneficial for chronic disease management, lifestyle interventions, and behavioral therapy.

Keywords— mobile apps, healthcare, mHealth, self-management, mobile health, chronic disease management, lifestyle interventions

INTRODUCTION

In today's world smart phones have become ubiquitous. They have revolutionized every walk of life and have become an integral part of our lives. They have been adapted so readily by everybody because of their ability to perform a variety of tasks that normally a desktop computer will do. Smart phones of this era are equipped with multi-core processors providing massive onboard processing power and are equipped with large storage capacity, and open operating systems. Due to their attributes such as mobility, instant connectivity, convenience, personalization, location awareness, smart phones have gained huge acceptance from all over the world. In the earlier days, phones were just a medium of voice communication but today's phones are viewed more as handheld computing devices rather than just communication devices. Nowadays, cell phones are being used more for surfing the web, checking email, snapping photos, and updating our social media status than actually placing calls.

Mobile applications or Apps have quickly become popular in mobile users. An app is a specialized software program that can be downloaded and accessed using one's own mobile device such as a smart phone or a tablet computer. Today, we have an app for practically everything, right from booking movie tickets, airline tickets, ordering food, online shopping for clothes, electronic items, to booking doctor's appointment. Apps have become so popular because of their simplicity, user friendliness, speed, and portability. They make the required information available at fingertips to the user, wherever and whenever required. Mobile Apps have encompassed many areas including m-commerce, entertainment, advertisement, education, as well as healthcare.

The far and wide reach of mobile devices and ease of use of mobile applications has made them a perfect choice for medical professionals. More and more apps are being developed in the healthcare sector. These apps are revolutionizing the delivery of healthcare services across the globe. The ever increasing popularity of such healthcare apps has resulted into creating of a

dedicated category for healthcare apps in Apple App Store (Dolan, 2011). These healthcare apps are benefitting many facets of healthcare industry such as remote monitoring of chronic diseases, helping elderly and expectant mothers, extending the reach of healthcare services to remote areas (West). Most commonly used apps in clinical practice can be listed as drug guides, medical calculators, coding and billing apps, pregnancy wheels, etc (Franko, 2012) According to a report published by IMS Institute for Healthcare Informatics, as of 2015 there are around 165000 mobile health applications available for consumers (Constantino, 2015). The report also notes that mobile healthcare apps are increasingly being adapted to mainstream as more and more healthcare providers as well as patients are expressing greater interest in such apps. Many of the apps specialize in sending biofeedback in the form of physiological function data from the patients with their ability to connect to a sensor. This has resulted into greatly enhancing the accuracy of data collection and convenience of the patients. As a result, the adaption rate of such apps is increasing faster. Following is an overview of various medical apps that are benefiting patients and healthcare providers alike.

MOBILE MEDICAL APPLICATIONS

mHealth or mobile health apps targeting the areas such as patient monitoring, data collection, documentation, and advertising are proving increasingly useful to clinicians. Healthcare apps can radically improve the ease and speed with which healthcare professionals can access, analyze, and respond to clinical data and reference information. Smart phones or touch screen devices also aide the clinicians by providing the capability of visual representation and manipulation of reference material (Cohen, 2013). General architecture of health monitoring application consists of three separate tiers. The first tier consists of sensors and wearable devices that monitor vital signs of human body. The second tier includes the devices at the end user such as PDAs or smart phones. These devices act as mediators that communicate the data between first and the third tier. At the third tier, there are servers that perform actual functionality and provide database operation facilities to the applications (Oguz Karan, 2012).

Mobile Applications for Diabetes Management

Diabetes is a chronic health condition that requires constant monitoring. Patients have to regularly visit the physicians just to monitor the vital signs essential for disease management. Various mobile apps are available that aide the patients in monitoring their glucose levels, food intake, physical activity and will enable individuals to have better control of their diabetes condition. These apps also help to reduce number of times the patients have to visit their healthcare providers thus proving to be a cost effective solution for diabetes management and also saving a lot of time of both patients and the physicians (Holtz, 2012). Interventions provided in this manner help in a holistic way to educate patient for successful self-management of the disease and to provide support to reduce risk of long-term disability caused by negligence of the condition. The primary functionalities provided by such apps include blood glucose monitoring, medication alerts, diet management, physical exercise monitoring, etc while the secondary functions fall in the range of education, decision support, weight/BMI monitoring, communication, social networking, etc (El-Gayar, 2013).

Authors Arsand, Tarata, et. al had conducted a study on a focus group through questionnaire and interviews and they have observed that mobile applications for diabetes management have a positive impact on patients where the apps motivate the users to follow a healthy diet, follow a regular exercise regimen, and regular blood glucose level testing leading to overall improvement in health habits (Aarsand, 2010). In their study, the authors have also noted some shortcomings of the current state of the mobile applications. They have observed that many of the commercial diabetes self-management applications do not include educational information even though clinical guidelines emphasize importance of self-management education in diabetes care. Automated data entry is a huge factor in usability and customer satisfaction of such apps yet the commercial apps that provide this kind of support is as less as 1%. Another important element that that authors found missing was linkage of such apps with personal health record.

Mobile Applications for Weight Management

Excess weight and obesity has become a prevalent problem worldwide. Obesity is a serious health hazard that can lead to many serious conditions such as type 2 diabetes, heart disease, bone and joint diseases, sleep apnea, metabolic syndrome, etc. Treatment for obesity can be complex as there are many interrelated factors such as genetic condition, lifestyle, metabolic rate, etc. and the response may differ from patient to patient. General methods used for weight reduction and management include lifestyle intervention, reducing caloric intake, increasing physical activity, intensive counseling, etc.

Mobile technology can be helpful in providing necessary intervention to do lifestyle and behavioral changes required for weight management. Authors Azar, Lesser, et.al. have reviewed weight management apps present in Health and Fitness category of iTunes App Store. They have observed that the functionality provided by these apps range from diet tracking, healthy cooking, weight tracking, to grocery decision making and even restaurant decision making. There are many strategies based on behavioral theory such as self-monitoring, realistic goal setting, stimulus control, self-reward, etc. that can be employed to increase the efficacy of weight reduction and management efforts. The authors have noted that even though majority of the reviewed apps help users in some way but they have failed to include these strategies (Azar, 2013).

Mobile Applications for Smoking Cessation

Smoking is a major public health hazard particularly in adolescents and young adults. There are at least 60 diseases that can be caused as a direct result of smoking, most prevalent cause of ill health and death. For every death as a direct result of smoking, there can be as many as 20 additional individuals that will suffer from smoking related illnesses (Lim, 2013).

Traditional smoking cessation methods include regular physician counseling, using nicotine patches, gums, sprays, etc. Self determination and motivation of an individual plays a major role in smoking cessation efforts. Mobile technology can prove as an effective intervention technique to improve self-determination and motivation. Adolescents and young adults are amongst the heaviest users of mobile phones and spend a lot of time of the day with mobile phones. This fact can be used to advantage to educate and motivate the youth against smoking. The authors Haug, Castro et.al have conducted a study to analyze the efficacy of SMS-based intervention for smoking cessation among students who smoke tobacco daily or occasionally. In the study the students received personalized text messages to support smoking cessation. The authors have noted this type of intervention has shown improved results reducing number of cigarettes smoked per day, number of smoking days per month, etc (Haug, 2014). This method is also proving more cost effective as compared to face-to-face intervention by avoiding high personal and infrastructural costs making such programs more scalable. This method also has a potential to have far and wide reach due to ubiquitous nature of the mobile phones and as the SMSs are received automatically, it makes this type of intervention more convenient and accessible (Ybarra, 2014).

Mobile Applications in Cardiology

Cardiovascular diseases or heart-related diseases are among the leading causes of deaths worldwide. Apart from medical treatment other important factors for disease maintenance and prevention are following a healthy lifestyle, regular physical activity, taking medication on time, reducing smoking and weight, etc. Mobile applications are looking promising in helping patients in self-management of the diseases. Authors Martinez-Perez, Torre-Diez, et.al have reviewed literature on currently available mobile applications as well as the mobiles applications available in leading app stores for cardiovascular diseases. Amongst the most popular apps for heart-related diseases are heart monitors and medical calculators. Other application categories include blood pressure tracking, ECG education and interpretation, CPR instructions, etc (Borja Martínez-Pérez, 2013).

Future Directions

For developing effective health management practices, apart from monitoring just health activities and states directly tied individual's health goals, understanding the context that influences health activities is also crucial for chronic disease management. This allows healthcare providers to better understand the circumstances influencing individual's health and create better management strategies. Developers of mobile apps should also explore the potential of leveraging social network for healthcare applications. A whole new class of apps can be envisioned with the social networking tools such as Twitter and Face book, powered by automatically added location data and lightweight tagging. These applications can make it possible for people to form a support group of individuals with similar health concerns where they can share their experiences, medical advice, and resources (Klasnja, 2012).

In addition to providing chronic disease management by means of monitoring symptoms and critical events, there is a vast landscape in healthcare that is yet to be explored. Such areas include providing individuals the tools to access their health-related information from anywhere, ease of collecting and grouping care-related information.

Even thought majority of applications have succeeded in achieving user satisfaction, there are some cases where the applications fail to achieve their goals. For mental illnesses such as bipolar disease, strict adherence to medication as well as patient education about the disease is essential for effective management of the disease. Majority of the currently available apps for management of bipolar disease fail to reference clinical practice guidelines, standard psycho-education information, or established self-management tools. Many apps fail to provide combined tools for disorder information, symptom monitoring, screening and assessment, and community support. Though apps are available that provide individual functionality mentioned in above list, they are not as effective. Failure of these apps is caused by low levels of adherence to quality assessment criteria, failure to comprehensively address main psycho-education domains, and nonendorsement of evidence-based practice guidelines (Nicholas, 2015). The desired benefits may not be realized by the apps that provide low quality generic information and do not adhere accepted medical practices. Unfortunately, such apps are predominant in the landscape of asthma care (Huckvale, 2015).

To improve the quality of apps, medical apps accreditation program should be undertaken that will assess the quality of available apps and certify or rank them for clinical use. Apart from establishing such a program, it is also essential to regularly revise the accreditation program and reassess and recertify the apps to accommodate for rapid turnover and feature evolution of apps (Huckvale, 2015).

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CONCLUSION

The popularity of healthcare apps is increasing by the day. They are proving beneficial for both clinicians and patients alike. Healthcare apps can radically improve the ease and speed with which healthcare professionals can access, analyze, and respond to clinical data and reference information. These apps are still in their primary stage of development. For developing effective health management practices, apart from monitoring just health activities and states directly tied individual's health goals, understanding the context that influences health activities is also crucial for chronic disease management. Although development in this space is vibrant and full of opportunities, the desired benefits may not be realized by the apps that provide low quality generic information and do not adhere accepted medical practices.

REFERENCES:

[1] Aarsand, Eirik and Tatara, Naoe and Hartvigsen, Gunnar and others. "Mobile Phone-Based Self-Management Tools for Type 2 Diabetes: The Few Touch Application." Journal of diabetes science and technology 4.2 (2010): 328--336.

[2] Azar, Kristen MJ and Lesser, Lenard I and Laing, Brian Y and Stephens, Janna and Aurora, Magi S and Burke, Lora E and Palaniappan, Latha P. "Mobile applications for weight management: theory-based content analysis." American journal of preventive medicine 45.3 (2013): 583--589.

[3] Borja Martínez-Pérez, Isabel de la Torre-Díez, Miguel López-Coronado, and Jesús Herreros-González. "Mobile apps in cardiology: review." JMIR mHealth and uHealth 1.12 (2013).

[4] Cohen, Adam B and Nahed, Brian V and Sheth, Kevin N. "Mobile medical applications in neurology." Neurology: Clinical Practice 3.1 (2013): 52--60.

[5] Dolan, Brian. Timeline: Medical milestones for the iPhone. 22 June 2011. <http://mobihealthnews.com/11290/timeline-medical-milestones-for-the-iphone>.

[6] El-Gayar, Omar and Timsina, Prem and Nawar, Nevine and Eid, Wael. "Mobile applications for diabetes self-management: status and potential." Journal of diabetes science and technology 7.1 (2013): 247--262.

[7] Franko, Orrin I and Tirrell, Timothy F. "Smartphone app use among medical providers in ACGME training programs." Journal of medical systems 36 (2012): 3135--3139.

[8] Haug, Severin and Castro, Raquel Paz and Filler, Andreas and Kowatsch, Tobias and Fleisch, Elgar and Schaub, Michael P. "Efficacy of an internet and SMS-based integrated smoking cessation and alcohol intervention for smoking cessation in young people: study protocol of a two-arm cluster randomised controlled trial." BMC public health 14.1 (2014).

[9] Holtz, Bree and Lauckner, Carolyn. "Diabetes management via mobile phones: a systematic review." Telemedicine and e-Health 18.3 (2012): 175--184.

[10] Huckvale, Kit and Morrison, Cecily and Ouyang, Jing and Ghaghda, Aseem and Car, Josip. "The evolution of mobile apps for asthma: an updated systematic assessment of content and tools." BMC medicine 13.1 (2015).

[11] IMS Health Study: Patient Options Expand as Mobile Healthcare Apps Address Wellness and Chronic Disease Treatment Needs. 17 10 2015. <https://www.imshealth.com/en/about-us/news/ims-health-study:-patient-options-expand-as-mobile-healthcare-apps-address-wellness-and-chronic-disease-treatment-needs>.

[12] Klasnja, Predrag and Pratt, Wanda. "Healthcare in the pocket: mapping the space of mobile-phone health interventions." Journal of biomedical informatics 45.1 (2012): 184--198.

[13] Lim, Stephen S and Vos, Theo and Flaxman, Abraham D and Danaei, Goodarz and Shibuya, Kenji and Adair-Rohani, Heather and AlMazroa, Mohammad A and Amann, Markus and Anderson, H Ross and Andrews, Kathryn G and others. "A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990--2010: a systematic analysis for the Global Burden of Disease Study 2010." The lancet 380.9859 (2013): 2224--2260.

[14] Nicholas, Jennifer and Larsen, Mark Erik and Proudfoot, Judith and Christensen, Helen. "Mobile apps for bipolar disorder: a systematic review of features and content quality." Journal of medical Internet research 17.8 (2015).

[15] Oguz Karan, Canan Bayraktar, Haluk Gümüskaya, Bekir Karlık. "Diagnosing diabetes using neural networks on small mobile devices." Expert Systems with Applications 39.1 (2012): 54--60.

[16] West, Darrell. "How mobile devices are transforming healthcare." Issues in technology innovation (2012): 1--11.

[17] Ybarra, Michele L and Holtrop, Jodi Summers and Prescott, Tonya L and Strong, David. "Process evaluation of a mHealth program: Lessons learned from Stop My Smoking USA, a text messaging-based smoking cessation program for young adults." Patient education and counseling 97.2 (2014): 239--243.

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Analysis and comparative study of topology and position based routing protocols in VANET

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Abstract— VANET deals with the wireless network communication among the high mobility nodes such as vehicles which provides safe and comfort inter-vehicular communication system. VANET has become an important part of intelligent transportation system with a variety of applications such as cooperative driving, collision avoidance, internet access to vehicles on the move etc. VANET are the subclass of MANET that uses vehicles as the mobile nodes .These nodes itself act as both terminals and routers to route the message among the neighbouring vehicles. The characteristics of VANET that distinguishes it from MANET are high mobility and dynamic constraints .So choosing the routing protocol is a challenging task in VANET environment. Routing protocols in VANET must handle the issues such as frequent disconnected network, high dynamic topology and communication environment. In this paper the focus is made on different topology based and position based routing protocols and the recently introduced advanced routing protocols that are more efficient for VANET environment. The aim of my work is to analyze the features of these protocols in VANET. This paper surveys different topology based and position based routing protocols for VANET environment. Several performance metrics have taken in to consideration such as packet delivery ratio, scalability and delay to compare various protocols.

Keywords— VANET, topology based routing protocols, position based routing protocols, Intelligent Transport System, VANET routing protocols, vehicular networking, Ad-hoc network

INTRODUCTION

VANET are a form of mobile ad-hoc network that provides communication among neighboring vehicles and between vehicles and nearby fixed point. The road traffic in developed countries extensively causes the wastage of time and fuel. As a result of the development of Intelligent Transportation system, vehicles have become smart enough to adapt to the dynamic changes in road traffic. The traffic related problems such as road accidents, traffic jam .etc can be avoided by implementing the intelligent transport system (ITS) that uses VANET.It offers a promising technolgoy for traffic management, road safety and ease of information exchange between drivers and passengers.VANET routing protocols are categorized into five classes: topology based, position based, broadcast based, geo-cast based and cluster based routing protocols.

2. VANET ENVIRONMENT

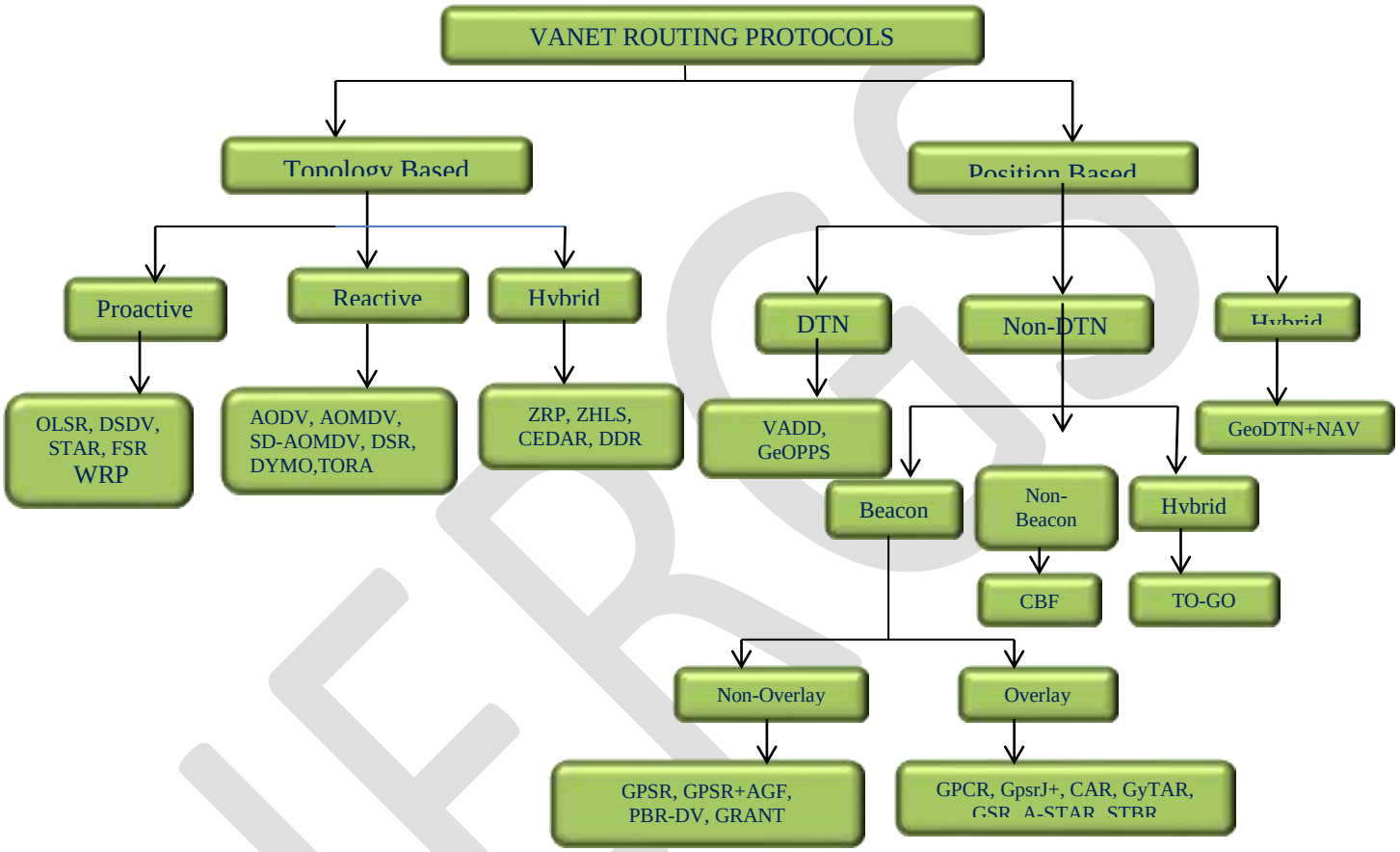
VANET is a self organized network structure that does nto depends on any centralised server system for communication.VANET uses dedicated short range communication with 5.9 GHZ spectrum and 75 MHZ bandwidth with a range of 1000msuitable for VANET communication [1].In VANET as the vehicles move out of the range they are dropped out of service and new vehicles may join and participate in forwarding the messages.Vehicles uses computerized control mechanisms and sensors for communication within short range.VANET uses WiFi IEEE 802.11p ,Wireless Aceess Vehicular Environment(WAVE) and WiMAX IEEE 802.16.

3. ROUTING PROTOCOLS

Transmission of packets from one end to another through optimal and efficient path in VANET environment is achieved with the help of various routing protocols.Routing occurs at the networl layer of the OSI model.Routing in VANET involves no central entity to identify the optimum path among the nodes ,so implementing a routing mechanism is a challenging and crucial task. Several routing

algorithms have been proposed by various researchers to adapt to the dynamic environment of VANET.The selection of routing protocol for VANET depends on the type of service needed. Routing protocols are classified based on different strategies but here the focus is made only on topology based and position based routing protocols.The need for a new hybrid protocol is also lighted upon to improve the efficiency of packet delivery mechanism in VANET.

Fig 1: Classification of VANET Routing Protocols



4. TOPOLOGY BASED ROUTING PROTOCOLS

Topology based routing protocols require the topology of all the nodes participating in the VANET for routing decision.These protocols discover and maintain the routes in a routing table before the transmission of data begins.These protocols are classsified as proactive,reactive and hybrid protocols.

A Proactive Routing protocols

These protocols are table driven routing protocols that stores the routing information of of every node participating in the network.The nodes keep on changing its position every second so it is necessary to updaye the information available in the routing table.The node send topological information among the each other and thereby update the routing table.There are two types of updates-periodic update and triggered update.In periodic update, the changes are communicated at the end of certain time period and thereby updating the routing table.The updations that are sent too frequently may congest the network. If the updates are sent too infrequently then the information might have been outdated since the vehicles are moving regularly.Bandwidth usage is high for periodic updates.In triggered updates the information is ecchanged only when there is a change in the network.There is no route discovery in proactive routing strategy because the infromation about the nodes are always available in the routing table.Each protocol that belong to this category may differ in the number of routing tables maintained and in the information exchange.It offers low latency for real time

implementations[2]. Various types of proactive routing protocols are: Optimized Link state Routing Protocol (OLSR), Destination Sequenced Distance Vector Routing (DSDV), Source Tree Adaptive Routing (STAR) and Fish Eye State Routing (FSR).

Optimized Link State Routing Protocol (OLSR)

It is the enhanced version of the link state routing algorithm.It keeps the information about all possible routes to the network nodes usign topology control message.On topologocal changes each node sentd the updated infroamtion to some selective nodes which will retransmit the information to other nodes.It chooses optimal path for route set up and maintenance.Multi Point Relays are selected among one hop neighbours and they inturn cover two-hop neighbours.Two types ofmessages are communicated in this protocol.they are hello message and Topological control message.The hello messages are used to find the status of link and neighbours.Topological Control messages are used to send the broadcast infromation to the neighbours in the selected list[3].This protocol give better performance among the proactive routing protocols.By fine tuning the parameters specified by RFC 3626[7],this protocol can be made efficient for VANETenvironment[4].

Destination Sequenced Distance Vector Routing (DSDV)

DSDV uses the distance vector routing algorithm which uses the shorthest path to find the route to the destination.The information stored in the routing table should be updated.Each node periodicaly broadcast the routing table infroamtion to its neighbours.It keeps only the optimal path to the destination rather than keeping multi path to the same destination.This protocol also guarantees loop free nodes, reduces count to infinity problem and also reduces control message overhead.This protocol is suitable only for smaller number of nodes[5].The regular updates of routing table require battery power consumption and bandwidth utilization and moreover flooding of messages causes network congestion.It is not suitable for highly dynamic networks.This protocol also maintains the routing information in routing table by periodic and triggered updates.

Source Tree Adaptive Routing (STAR)

This routing protocol is based upon link state protocol.This protocol maintains the topology of the entire network so it needs more memory requirements.It is suitable for larger networks.Each node creates a partial toplogy of the network based on the information aggregated from neighbouring nodes and the node has to maintain the source tree .This protocol works best for city scenarios.

Fish Eye State Routing (FSR)

The nodes in the network update the routing table besed on the information from neighbouring nodes i.e information of every node is collected from the neighbouring nodes.It combines the features of Link State and Global State routing.It exchanges only the partial routing infromation maong the neighbours thereby reducing the bandwidth [4].Link failure doesnot trigger any control message and hence the routing tables are not updated in such scenarios.Information form the farther end are broadcasted with lower frequency than that of nearer nodes.The growing network size causes increase in the routng tables and it fails to trace out the route when the destination moves out of scope.This protocol is not suitable for smaller networks.

Wireless Routing Protocol (WRP)

WRP is the enhanced version of distance vector routing protocol.It is similar to DSDV and also reduces the route loop and count to infinity problem.unlike DSDV it uses a set of table for keeping the up-to-date topological information. Nodes in the network periodically exchange routing tables information with its neighbors through update messages, or whenever there is a change in the link state table.It has faster convergence of messages and includes fewer updation of tables but it require larger memory and processing power among the nodes in the network just like STAR protocol.Like DSDV, it is also not suitable for highly dynamic wireless networks.

B. Reactive Routing Protocols

These protocols are known as on-demand routing protocol because the routing infromation is maintianed only when needed .Thus it reduces network overhead.whenever a source wants to send a message it floods the route request message to the network.Unlike proactive routing protocols it require route discovery mechanism since no information about the route is maintained before.This causes a little overhead at the beginning stage of message passing.when the request message reaches the destination it sends a route

reply message back to source through unicast communication.These protocols are suitable for large scale networks and for frequent topology changes and higher mobility scenarios.Some of the reactive protocols include Ad-hoc on-demand distance vector(AODV),Dynamic Source Routing(DSR),Dynamic MANET On Demand(DYMO),Temporally Ordered Routing Algorithm(TORA)

Ad-hoc on-demand distance vector (AODV)

This is one of the best explored reactive routing protocol by the researchers.This protocol discover routes only on demand[6] i.e. it establishes a route only when any node needs to send a message to the desination.It starts with the route discovery process through broadcating the route request message (RREQ) to the network.The destination upon receiving the RREQ message unicast the Route Reply message (RREP)back to the source.It uses the destination sequence number for each route entry which helps in avoiding routing loops.This feature distinguishes it from all other reactive routing protocols.It offers low network ovehead by avoiding the flooding of messages periodically.in the network.It requries less memory size and the routing tables only contains the recent active nodes.Itkeeps the information of only the next hop rather than keeping the entire route based on the topology.AODV is flexible to highly dynamic and large-scale network.The problem with this protocol include a new route discovery upon route failure which cause additional delays apart from the intial delay in route discovery.This may cause decrease in the data transmission rate and also increase network overhead.Many protocols were proposed as the enhancement of AODV protocols and they are AOMDV,S-AOMDV,RAOMDV,SD-OMDV.

Adhoc On-demand Multipath Distance Vector Routing (AOMDV)

This protocol has the advantage that the information is already available with AODV and can maintain multiple loop free path with minimum overhead.It stoes additional infromation in the routing table such as next hop, last hop, hop count and expiration timeout.It is suitable for high mobility nodes [7].Several other protocols with additional features towards AOMDV was also proposed by many researchers such as S-AOMDV, R-AOMDV, SD-AOMDV.

SD-AOMDV

SDAOMDV is an improvised version of AOMDV protocol to suit the VANET characteristics. It adds the parameters such as speed and direction to hop count as new AOMDV routing metric to select next hop which helps in the route discovery phase. SD-AOMDV performs well in city and highway traffic scenarios.

Dynamic Source Routing (DSR)

In this protocol, the source floods the route requst to all the nodes within the range.This protocol mainly consists of two mechanism-route discovery and route maintenance.this protocol uses a unique id request in the route request packet The query packet copies the ID of all the intermediate nodes it traversed.This entire path from the query packet is used by the destination to respond back to the source.When no route is found, the destination will discover route back to reach source node.Due to the change in the topology, the source node may be unable to use the curent route to the destination .Route maintenance mechanism can be used at this scenario. To find another route to destination, route discovery is invoked again to transmit the message to the destiantion.However the route maintenance mechanism doenot repair a broken link this protocol provide multiple routes to the destination and also avoid loop formation.This protocol causes large end-to-end delay, connection set up delay and scalability problems [8].

Dynamic MANET on Demand (DYMO)

This protocol is an enhancement of AODV protocol and works on on multi hop wireless environment.It is a simple,highly combact protocol and is easy to implement.It can behave proactively and reactively.Itcombines the features of AODV and DSR ie it uses AODV structure but works on DSR mechanism.It involves two basic mechanism-route discovery and management.In route discovery RREQ packets are broadcasted to the network to locate the destiantion.it replis with RREP message which is unicasted to the source.A bidirectionbal link is established betwwen source and dstination.In case of node failure a route error packet RERR is sent to source node which ehlps in reinitiating the route discovery process.It stores only little routing information which reduces network ovehead and saves both bandwidth and power consumption[9].

Temporally Ordered Routing Algorithm (TORA)

It is one of the distributed routing protocols which uses multi hop routes.This protocol is based on the link reversal routing algorithm which uses directed acyclic graph to identify the flow of packets .The node broadcast the packets to the neighbouring nodes which will re- broadcast it only if it is the predecessor's downward link. This protocol includes creation of route, maintenance of route and erasure of route when the route is not valid.TORA's performance is better than DSR in highly dynamic ad-hoc environment [10].

C. Hybrid Routing Protocols

Hybrid protocols combine the features of both reactive and proactive routing protocols.It discards the disadvantages of both types of routing protocols.the control overhead in proactive routing protocols and also the delay in on-demand routing protocols are reduced.Hybird protocols divides the the network into many zones to achieve relaibility.It has higher scalabiluty than the reactive and proactive routing protocols.Only the appropritae nodes are use dto set up a route between source and destination.

Zone Routing Protocol (ZRP)

This is the first hybrid routing protocol.The protocol divides the network into overlapping zones.the nodes are called peripheral nodes towards the edge. The peripheral nodes perform the route discovery outside the zone and for this purpose a reactive approach is used.It uses the proactive routing scheme inside the zone and reactive routing scheme outside the zone [11].

Zone based hierarchical link state (ZHLS)

This protocol divides the network into non-overlapping zones .Every netowork has its ID and zone ID .Every node must be within the zone radius to communicate with each other so that they can share and aggregate the topology available to each node to cereate the entire topology.For intra zone communication a proactvie routing protocol is used and for inter-zone routing ,an inner zone reactive protocol is used.Source can send the data to the destination if both are in the same routing zone otherwise the protocol initiates a route discovery.

Core Extraction Distributed AdHoc Routing (CEDAR)

It is a protocol with integared QoS support.A reactiverouting protocol is used for core nodes.Fast moving and slow moving increasing waves are used for propogating link information.This porotocol includes three important phases-establishment of routing infrastructure,link states and their propagation and Qos route computation[12].

Distributed Dynamic routing algorithm Protocol (DDR)

It is a tree based routing protocol that does not require the root node support for data transfer.Periodic beaconing messages are used and exchanged among the neighbouring nodes. These trees form a forest with gateway nodes that performs the function of a link. Neighbor election, intra-tree clustering, inter-tree clustering, forest construction, zone naming and zone partitioning are the six phases in the protocol.It doesnot depend on zone map like ZLHS[12].

5. POSITION BASED ROUTING PROTOCOLS

Position based routing protocols are also known as Geographic routing protocol.In this type of protocol, the routing process is based on the positional information of the moving nodes.Rather than using the network address the source will send the message to the destination based on the geographical postion-i.e latitude and longitude of the moving vehicles.These protocol uses GPS to identify the geographical location nodes paticipating in the network.Each node knows its own and its neighbouring nodes geographical position . The information from GPS is used to identify the route.The source stores the geographical information of the destination in the packet header and this will help in forwarding the packets without identifying the topology.Route discovery and route maintenance are not required for these types of protocols and hence no routing table is maintained Position based routing protocols are classified into Delay Tolerant Network (DTN), Non Delay Tolerant Network (Non DTN) and hybrid.

B. Non-Delay Tolerant network protocols

Non-DTNrpotocols does not guarantee for disconnection issues .This protocol is suitalb efor highly dense network as it assumes that there will always be successfulcommunication .In this type of protocol,the nodes forward the packet to its immediate neighbour to the destination but it may fail when there is no node closest to destination other than the same node itself. These protocols are again classified into beacon, non-beacon and hybrid.

Beacon protocols

Beacon protocols transmit short hello message periodically. It indicates the position of a node.If a node fails to obtain a beacon from the neighbouring node within a certain period of time it assumes that theprevious neighbouring node is now out of range and it will be rmeoved fron the neighbouring table.Beacon protocols are again classified into overlay and non-overlay protocols.

Non-Overlay Protocols

The non-overlay network uses the existing network. It does not use any type of representative node or other network. All the protocols use the greedy forwarding technique. The greedy forwarding fails if the neighbour closer to destination is none other than the current node itself.In sucht cases different protocols propose different recovery strategy.

Greedy Perimeter Stateless Routing (GPSR)

GPSR[15] selects node closer to the destination using beacon.A node need to know only one hop neighbour information.It uses greedy frowarding algorithm for packet transmission.If it fails then perimeter frowarding mechanism is used to select a node for packet transmission.

GPSR+AGF

To avoid the stale information about the neighbouring nodes position in the sending node table a new approach called Advanced GreedyForwarding protocol [16] was proposed which overcome the disadvantages of GPSR.

PBR-DV

This protocol combines various approaches such as topology based reactive routing approach along with greedy position based stretegy and if the packet falls in local maximum, it uses the traditional AODV recovery mechanism.

A Delay Tolearant Netowork Protocols

DTN is a wireless network protocol that uses carry and forward technique to overcome the frequent disconnection of nodes in the network.It also works efficiently on networks with long unavoidable delays,limited bandwidth and power constaints.the source node if unable to contact other node may store the packets and forward it when the nodes becoems reachable .all the nodesin the network help each other in carrying the packetson the way to the destination.however packet transmission may take larger delays.some of these protocls are VADD,GeOpps

Table 1: Difference between topology based and position based routing protocols

Topology Based Routing Protocols	Position Based Routing Protocols
Based on route discovery scheme	Based on location service scheme
Need for route maintenance for all network	No need of route maintenance
Require large bandwidth if network topology changes	Does not require large bandwidth
Forwarding decision based on source node	Forwarding decision based on position of destination and next hop neighbour

Vehicle assisted Data Delivery (VADD)

VADD [13] can be used to enhance the routing in frequently disconnected networks.It is based onc arry and forward strategy.In VADD a vehicle can make a choice at an intersection and chooses the path of packet forwarding that has negligible delay.Three packet modes are available in VADD.they are Intersection, Straight and Destination.the optimum path can be identified by swapping the three modes.Amon the VADDprotocols H-VADD shows better performance.

Geographical opportunistic routing (GeOpps)

GeOpps [14] protocols use the vehicles navigation system to select the vehicle travelling closer to the packet destination. GeOpps calculates the distance between the destination and the nearest point of the vehicles path and estimates the arrival time of a packet at the destination.During the forwarding of packets if any node has minimum ariival time the packet will be forwarded to that node.

Greedy Routing with Abstract Neighbor Table (GRANT)

To avoid the local maximum, a new concept called Greedy Routing with Abstract Neighbor Table[17] was introduced.it is and extension of greedy routing algorithm.This table divides the planes into areas and include a representative neighbour for only one area.This concept works well for city scenarios especially with obstacles.

Overlay protocols

Overlay protocols include network that are connected through virtual or logical links, which are built on top of existing network.

Greedy Perimeter Coordinator Routing (GPCR*)*

GPCR [18] is a position-based overlay routing protocol that uses greedy algorithms to forward packet based on a pre-selected path .It has been designed to meet the challenges of city scenarios.NoGlobal Information System required for GPCR.

GpsrJ+

GpsrJ+[19] reduces the dependecny on junction node.It uses geographic maps to recover formlocal maximum.it uses two hop neighbour beacon infromation to calculate the routing path and for detecting junction.It visualize the roads which might be occupied by the junction node. Each node will send a beacon message about its coordinates and the road segments on which its neighbours ate located.

Connectivity- Aware Routing (CAR)

CAR [20] is wellsuited for city and highway scenarios.It uses AODV for path discovery and PGB for data dissemination.it also uses guard concept for path maintenance.It ensures the shortest connected path and no digital map is required for CAR.It has the highest packet delivery ration than GPSR and GPSR+AGF

Greedy Traffic Aware Routing protocol (GyTAR)

GyTAR [21] is an intersection based routing protocol which searches for junctions to find the routes through the city.it uses carry and forward technique.It utilises digital map and selects the connection based on traffic density and curvemetric distance to the destination.It uses the greedy routing mechanism to deliver the packet through road connected by two junctions.It reduces the end-to-end delay and control message overhead with very low packet loss.

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GSR (Geographic Source Routing)

GSR [18], ideal for city environment, uses greedy forwarding approach along pre-selected path using Djkshtra's shortest path algorithm. It combines the features of topological information and position based routing.The source identifies the position of all nodes between source and destination with the help of digital maps.GSR does not depend on traffic density to choos ethe optimum path form source to destination.The packet delivery ratio is superior than AODV and DSR protocols [20].It ignores the spars enetwork conditionand also experiences high network overhead due to the freuquent usage of HELLO messages.

Anchor-Based Street and Traffic Aware Routing (A-STAR)

A-STAR [22] is specially designed for city scenarios.It guarantees high connectivity in packet dekivery using traffic city bus infromation for an end-to-end connection.It uses local recovery strategy suitable for real time application.

Street Topology Based Routing (STBR)

STBR [23] works on three valid states; master, slave and forwarder.in this type of network one node is selected as master, others as slave and the intermediate nodes between junctions as forwarders. STBR is not suitable for both city and highway scenarios because it would try to send junction beacons along a highway.

Non-Beacon Protocols

These protocols do not make use of periodic beacons for sending data packets.

Contention Based Forwarding (CBF)

CBF [24] is a geographic routing protocol that doesn't make use of beacons for data transfer. To send a data packet, the sending node broadcast the packet to all its neighbors & these neighbors will decide among themselves the one that will forward the packet.It reduces the probability of packet collosion.It provides a lower packet forwarding delay.This protocol works better in highway scenarios.

Hybrid Non DTN protocols

TO-GO (Topology-assist Geo-Opportunistic Routing)

TO-GO [25] is a geographic routing protocol which improves packet delivery in greedy & recovery forwarding that can bypass the junction area by using two hop beaconing.All nodes can hear one anotherso there is no problerm of hidden terminal.End -to-End delay is higher than GPCR,GPSR,GPSRJ+

C. Hybrid position based routing

These protocols combine the scheme of more than one location based protocols.

GeoDTN+Nav

GeoDTN+Nav [26] is a combination of both DTN & Non-DTN routing which includes a greedy mode, a perimeter mode and a DTN mode. It can switch from Non-DTN to DTN mode. This approach proposes virtual navigation interface which provides necessary information regarding the mode of routing and the forwarder.

Table 2: Comparison of VANET routing protocols

Routing Protocols	Mobility Models	Propagation Models	Scalability	Delay	Delivery	PDR	Best Scenario
OLSR	Random Way Point	Nakagami	Good	More	Best Effort	Up to 97%	City
AODV	IDM on Manhattan grid	Probabilistic shadowing	Low	More	Best Effort	Up to 95 %	Highway
DSDV	Random Way Point	Radio Propagation	Medium	Less	Best Effort	Up to 92%	City
DSR	Reference Point Group	Path Loss	Low	More	Best Effort	91%	City
GPSR	MTS	Probabilistic shadowing	Medium	More	Guaranteed	Up to 80%	Highway
GRANT	Static trace from a uniform distribution	Road blocking	Medium	Less	Guaranteed	Up to 80%	City
GPCR	VanetMobisim	Road blocking	Good	Less	Best Effort	Up to 80%	City
GpsrJ+	VanetMobisim	Road blocking	Good	Less	Guaranteed	Up to 80%	City
CAR	MTS	Probabilistic shadowing	Good	Less	Best Effort	Up to 80%	Highway
GSR	Videlio, M-Grid mobility	Road blocking	Good	Less	Best Effort	Up to 80%	City
A-STAR	M-Grid mobility	Road blocking	Good	Less	Best Effort	Up to 80%	City
GyTAR	Proprietory	Free space	Good	Less	Guaranteed	Up to 80%	City
CBF	Random way point	Two-Ray ground	Good	More	Best Effort	Up to 80%	Highway
TO-GO	VanetMobsim	Road blocking	Good	More	Guaranteed	Up to 80%	Highway

6. CONCLUSION AND FUTURE WORK

In this paper, various types of geographic and position based routing protocols in VANET has been surveyed.By analyzing these routing protocols we have seen that the performance evaluation is required to verify the efficiency of a routing protocol with other routing protocols in city,highway and mixed scenarios.Some protocols have been found to be suitable for either city or highway scenarios but when it comes to real world application we need to consider the mixed scenarios and hence it can be concluded that although the position based routing protocols are more efiicient than topology based routing protocols,these protocols suffer from large end-to-end delay and low packet delivery ratio. Only the development of a new hybrid protocol will be a better solution to deal with all types of traffic scenarios and can out perform well when evaluated using all VANET environment metrics.In future the fous is on the development of a hybrid protocol that can outcome all the drawbacks of existing protocols and works well in mixed scenarios

REFERENCES:

[1]. Bilal, S.M., C.J. Bernardos, and C. Guerrero, Position Based Routing in Vehicular Networks: A Survey. Journal of Network and Computer Applications, 2012.

[2] Bijan Paul, Md.Ibrahim, Md.Abu Naser Bikas, VANET Routing Protocols: pros and cons: International Journal of Computer Applications (0975 – 8887) Volume 20– No.3, April 2011

[3] Philippe Jaquet, Paul Muhlethaler and Amir Qayyum,"Optimized Link State Routing Protocol", IETF Draft,http://www.ietf.org/internet-drafts/draft-ietf-manetolsr-06.txt, 2001.

[4]Jamal toutouh,Jose Garcia-Nieto and Enrique Alba,Intelligent OLSR routing Protocol Optimization for VANETs,IEEE transactions on vehicular technology,vol.61,No.4,May 2012

[5]Bai, Y., S.B. Ji, and Y. Xue, A Comparative Study of AODV and DSDV Routing Protocol of the Vehicle Ad Hoc Network Based on NS2.

[6]C. E. Perkins and E. M. Royer, "Ad Hoc On-demand Distance Vector Routing", In Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications, New Orleans, LA, 1999, 90-100.

[7]. Marina, M.K. and S.R. Das, 2002. Ad hoc on-demand multipath distance vector routing. SIGMOBILE Mob. Comput. Commun. Rev., 6(3): 92-93.

[8] D. B. Johnson, D. A. Maltz, Yih-Chun Hu and Jorje tagJetcheva, "The Dynamic Source Routing for Mobile Ad Hoc Wireless Networks", http://www.ietf.org/internetdrafts/draft-ietf-manet-dsr-09.txt, IETF Internet draft, Nov.2001.

[9] Anuj K. Gupta, Harsh Sadawarti , Anil K. Verma ," Performance Enhancement of DYMO Routing Protocol with Ant Colony Optimization"International Journal of Electronics and Electrical Engineering Vol. 2, No. 3, September, 2014

[10]. Pirzada, A.A., C. McDonald and A. Datta, 2006.Performance comparison of trust-based reactive routing protocols. Mobile Computing, IEEE Transactions on, 5(6): 695-710.

[11] Kashif Naseer Qureshi and Abdul Hanan Abdullah ,"Study of Efficient Topology Based Routing Protocols for Vehicular Ad-Hoc Network Technology" World Applied Sciences Journal 23 (5): 656-663, 2013 ISSN 1818-4952 © IDOSI Publications, 2013 DOI: 10.5829/idosi.wasj.2013.23.05.1010

[12]Salim Bitam a, Abdelhamid Mellouk b, Sherali Zeadally c. (2013). HyBR: A Hybrid Bio-inspired Bee swarm Routing protocol for safety applications in Vehicular Ad hoc NETworks (VANETs). *ELsevier*.p.213-313.

[13] J. Zhao, G. Cao, "VADD: Vehicle-Assisted Data Delivery in Vehicular ad hoc Networks", In IEEE Transactions on Vehicular Technology, vol. 57, pp. 1910-1922, 2008.

[14] I. Leontiadis, C. Mascolo, "Geopps: Geographical opportunistic routing for vehicular networks", IEEE International Symposium on the World of Wireless, Mobile and Multimedia Networks, 2007, pp. 1-6.

[15] Karp, B. and Kung, H. T (2000), "GPSR: greedy perimeter stateless routing for wireless networks." In Mobile Computing and Networking, pages 243-254, 2000.

[16] Naumov, V., Baumann, R., Gross, T. (2006), "An evaluation of Inter-Vehicle Ad Hoc Networks Based on Realistic Vehicular Traces," Proc. ACM MobiHoc'06 Conf., May, 2006.

[17] Schnaufer, S., Effelsberg, W. (2008), "Position-based unicast routing for city scenarios," World of Wireless, Mobile and Multimedia Networks, 2008. WoWMoM 2008. 2008 International Symposium on a , vol., no., pp.1-8, 23-26 June 2008.

[18] Lochert, C., Mauve, M., F¨ussler, H., and Hartenstein, H., "Geographic routing in city scenarios," SIGMOBILE Mob. Comput. Commun. Rev., vol. 9, no. 1, pp. 69–72, 2005.

[19] Lee, K. C., Haerri, J., Lee, U., and Gerla, M. (2007), "Enhanced perimeter routing for geographic forwarding protocols in urban vehicular scenarios," Globecom Workshops, 2007 IEEE, pp. 1–10, 26-30 Nov. 2007.

[20] Naumov, V., Gross, T.R. (2007), "Connectivity-Aware Routing (CAR) in Vehicular Ad-hoc Networks," INFOCOM 2007. 26th IEEE International Conference on Computer Communications. IEEE , vol., no., pp.1919- 1927, 6-12 May, 2007.

[21] M. Jerbi, S. M. Senouci, R. Meraihi, Y. Ghamri-Doudane, "An improved vehicular ad hoc routing protocol for city environments", In Communications, 2007, pp. 3972-3979.

[22] Seet, B.-C., Liu, G., Lee, B.-S., Foh, C. H., Wong, K. J., Lee, K.-K. (2004), "A-STAR: A Mobile Ad Hoc Routing Strategy for Metropolis Vehicular Communications." NETWORKING 2004, 989-999.

[23]Forderer, D (2005). "Street-Topology Based Routing." Master's thesis, University of Mannheim, May 2005.

[24] F¨ußler, H., Hannes, H., J¨org, W., Martin, M., Wolfgang, E. (2004), "Contention-Based Forwarding for Street Scenarios," Proceedings of the 1st International Workshop in Intelligent Transportation (WIT 2004), pages 155–160, Hamburg, Germany, March 2004.

[25] Lee, K.C.; Lee, U.; Gerla, M. (2009), "TO-GO: TOpology-assist geo-opportunistic routing in urban vehicular grids," Wireless On-Demand Network Systems and Services, 2009. WONS 2009. Sixth International Conference on , vol., no., pp.11-18, 2-4 Feb. 2009.

[26] Cheng, P.-C., Weng, J.-T., Tung, L.-C., Lee, K. C., Gerla M., and Härri J. (2008), "GeoDTN+NAV: A Hybrid Geographic and DTN Routing with Navigation Assistance in Urban Vehicular Networks," Proceedings of the 1st International Symposium on Vehicular Computing Systems (ISVCS'08), Dublin, Irland, July

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A Survey on Efficient Algorithms for Mining HUI and Closed Item sets

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Abstract— High utility itemsets refer to the sets of items with high utility like profit in a database, and efficient mining of high utility itemsets plays a crucial role in many real-life applications and is an important research issue in data mining area. Mining high utility itemsets (HUIs) from large amount of databases is an essential data mining job, which refers to the finding of itemsets with high utilities or values (e.g. high profits). However, it may possible that exist too many HUIs to users, which also reduces the efficiency of the mining process. To accomplish high efficiency for the mining job and to provide a summarizing mining result to users from large amount of databases, we propose a new and innovative framework in this paper for mining closedþ high utility itemsets (CHUIs), which functions as a compact and lossless representation of HUIs. We propose three capable algorithms named AprioriCH (Apriori-based algorithm for mining High utility Closed þ itemsets), AprioriHC-D (AprioriHC algorithm with Discarding unpromising and isolated items) and CHUD (Closed þ High Utility Itemset Discovery) to find this representation. Later on, a scheme called DAHU (Derive All High Utility Itemsets) is proposed to recuperate all HUIs from the set of CHUIs without accessing the original database. Results which obtain from real and synthetic datasets indicates that the proposed algorithms are very efficient and that our methodologies reach a massive decrease in the number of HUIs. In addition, when all HUIs can be recuperated by DAHU, the combination of CHUD (Closed þ High Utility Itemset Discovery) and DAHU (Derive All High Utility Itemsets) overtakes the state-of-the-art algorithms for mining HUIs.

Keywords— Frequent itemset, high utility itemset, lossless and concise representation, closed itemset, utility mining, data mining.

INTRODUCTION

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1. INTRODUCTION

In data mining Frequent itemset mining is a very important research issue. Market basket analysis is the mostly use one of its widely held applications, in which sets of items (itemsets) discovers that are frequently purchased collected by customers. The traditional model of Frequent itemset mining may finds a huge quantity of frequent itemsets with less profit and miss the data on valuable itemsets having less retailing frequencies. These problems are occurs due to Frequent itemset mining considers all items as having the same importance/unit profit/weight and it imagines that every item in a transaction looks in a binary form, i.e., an item doesn't indicate its purchase quantity in the transaction it may be in the transaction or may be not. Hence, Frequent itemset mining cannot fulfill the necessity of users who want to find itemsets with high values such as high profits.

Utility mining plays as an important role in data mining to solve the above issues. In utility mining, each item has a weight (e.g. unit profit) and may appear more than once in each operation (e.g. purchase quantity). The value of an itemset shows its importance, as it measured in terms of weight, profit, cost, quantity or other data depending on the users first choice. An itemset is named a high utility itemset (abbreviated as HUI) when its utility is no less than a user stated bottom utility threshold. A wide range of applications utility mining has such as website click stream analysis, cross-marketing analysis and biomedical areas.

2. BACKGROUND

Now a days High utility itemset (HUI) is providing a no- binary frequency values of items and different profit values for each item so it becomes a very important research theme in data mining. An incremental and interactive data mining deliver the capability to use earlier structures and mining results in order to less unwanted calculations when the database is modernized or the bottom value of threshold is change.

In Dec. 2009 C. F. Ahmed, S. K. Tanbeer, B.-S. Jeong, and Y.-K. Lee, proposes an efficient tree structures for high utility pattern mining in incremental databases [2] which has three novel tree structures to efficiently accomplish incremental and interactive High Utility Pattern (HUP) mining. The first tree structure, Incremental HUP Lexicographic Tree ($IHUP_L$-Tree), is prepared according to an item's lexicographic manner. It can capture the incremental data without any rearrangement process. The next one tree structure is the IHUP transaction frequency tree ($IHUP_{TF}$-Tree), which gains a compressed size by ordering items as per their transaction frequency (descending order). The third tree, IHUP-transaction-weighted utilization tree ($IHUP_{TWU}$-Tree) is build to decrease the mining period, grounded on the TWU cost of items in descending order. General performance studies illustrates that these tree structures are very efficient and scalable for incremental and interactive HUP mining

A huge collection of transactions having items, a basic mutual data mining difficulty is to extract the so-called frequent itemsets (i.e., sets of items presenting in at least a provided number of transactions). In 2003, J.-F. Boulicaut, A. Bykowski, and C. Rigotti, proposed a Free-sets which is a condensed representation of Boolean data for the approximation of frequency queries [3] in Data Mining Knowl. Discovery. The paper propose a structure called free-sets, from which we can estimate any itemset support (i.e., the number of transactions containing the itemset) and they validate this idea in the framework of adequate representations (H. Mannila and H. Toivonen, 1996. In Proc. of the Second International Conference on Knowledge Discovery and Data Mining (KDD'96), pp. 189–194). It displays that frequent free-sets can be efficiently take out using pruning strategies established for frequent itemset discovery, and that they can be used to estimate the backing of any frequent itemset. Testing on real dense data sets show a markable reduction of the size of the output at time of compared with standard frequent itemset extraction. Additionally, the experiments show that the extraction of frequent free-sets is still possible when the extraction of frequent itemsets becomes inflexible, and that the supports of the frequent free-sets can be used to approximate very closely the supports of the frequent itemsets. Finally, it shows the effect of this approximation on association rules (a popular kind of patterns that can be derived from frequent itemsets) and display that the corresponding errors persist very low in exercise.

Current studies on frequent itemset mining algorithms resulted in significant performance enhancements. However, if the minimal backing threshold is set too near to the ground, or the data is highly interrelated, the amount of frequent itemsets own can be prohibitively huge. To solve this type of problem, recently multiple type proposals have been made to built a summarizing demonstration of the frequent itemsets, as an alternative of mining all frequent itemsets. The main objective of this paper is to recognize redundancies in the set of all frequent itemsets and to deed these redundancies in order to decrease the result of a mining process. The paper display deduction rules to originate tight bounds on the provision of candidate itemsets. It also specify how the deduction rules permit for building a bottom level demonstration for all frequent itemsets. It also displays connections in this current proposal and recently available proposals for summarizing demonstrations and they provide the results of research on real-life datasets which show the usefulness of the deduction rules. In brief, the research even show that in multiple types of cases, first mining the summarized representation, and then making the frequent itemsets from this demonstration outperforms previously present frequent set mining algorithms.

In 2008, K. Chuang, J. Huang, and M. Chen proposed a Mining top-k frequent patterns in the presence of the memory constraint [5].

This paper explore a practicably remarkable mining job to retrieve *top-k* (*closed*) itemsets in the occurrence of the memory constraint. Precisely, as contrasting to most existing works that hardly focuses on improving the mining efficiency or on decreasing the memory size by best strength, It firstly try to mention the presented top memory size that can be used by mining frequent itemsets. To obey with the top bound of the memory intake, two efficient algorithms, called *MTK* and *MTK_Close*, are invented for mining frequent itemsets and *closed* itemsets, correspondingly, *without* mentioning the subtle bottom support. In its place, users only necessity is to give a more human-clear parameter, specifically the desired number of frequent (*closed*) itemsets *k*. In rehearsal, it is pretty challenging to constrain the memory consumption while also efficiently obtaining *top-k* itemsets. To effectively obtain this, *MTK* and *MTK_Close* are invented as level-wise finiding algorithms, where the number of candidates are to be generated-and-tested in every database scan will be limited. A unique search approach, named as δ-*stair search*, is used in *MTK* and *MTK_Close* to effectively allocate the available memory for testing candidate itemsets with different type of itemset-lengths, which leads to a small number of essential database scans. As demonstrated in the empirical observations on real data information and synthetic data information, instead of only providing the flexibility of striking a negotiation between the execution efficiency and the memory utilization, *MTK* and *MTK_Close* can both obtain top efficiency and have a constrained memory bound, giving the prominent advantage to be real-world algorithms of mining frequent patterns.

In 2003, R. Chan, Q. Yang, and Y. Shen, proposed mining high utility itemsets where mining high utility itemsets from a transactional database [6] refers to the finding of itemsets with high utility like profits. Even if a number of relevant algorithms have been proposed in current years, they incur the problem of creating a huge number of candidate itemsets for high utility itemsets. Such a huge number of candidate itemsets reduces the mining performance in terms of accomplishment time and space necessity. As the

situation may become worse when the database contains tons of long transactions or long high utility itemsets. This paper propose two algorithms, viz. utility pattern growth (UP-Growth) and UP-Growth+, for mining high utility itemsets with a set of effective policies for pruning candidate itemsets. The data of high utility itemsets is maintained in a tree-based data structure named utility pattern tree (UP-Tree) like that candidate itemsets may be generated efficiently with only two scans of database. The performance of UP-Growth and UP-Growth+ is equated with the state-of-the-art algorithms on multiple types of both real and synthetic data sets. Experimental outcomes show that the proposed algorithms, mainly UP-Growth+, not only decrease the number of candidates effectively but also outperform many types of algorithms substantially in terms of runtime, especially when databases contain multiple long transactions.

Data Mining can be well-defined as an activity that extracts some new nontrivial data contained in huge databases. Traditional data mining methods have concentrated mostly on detecting the statistical correlations among the items that are more frequent in the transaction databases. Also named as frequent itemset mining, these techniques were built on the rationale that itemsets which appear more frequently must be of more importance to the user in view of the business perspective .In this paper they focuses on an emerging area called Utility Mining which not only considers the frequency of the itemsets but also considers the utility related with the itemsets. The term utility denotes to the importance or the usefulness of the appearance of the itemset in transactions quantified in profit, sales like terms or any other user preferences. In High Utility Itemset Mining the aim is to recognize itemsets that have utility values more than a given utility threshold. In this paper a literature review of the present state of research and the various algorithms for high utility itemset mining is present.

In 1994, R. Agrawal and R. Srikant, proposed Fast algorithms for mining association rules in which they consider the problem of determining association rules among items in a huge database of sales transactions. Paper provide two new algorithms for solving the problem that are basically different from the known algorithms. Experimental assessment shows that these algorithms outperform the known algorithms by factors ranging from three for minor problems to more than an order of magnitude for huge problems. It also display how the best features of the two proposed algorithms can be joined into a hybrid algorithm, called AprioriHybrid. Scale-up research show that AprioriHybrid scales linearly with the number of transactions. AprioriHybrid also has outstanding scale-up assets in view of transaction size and the number of items in the database

3. PROPOSED SYSTEM

The Existing system is Frequent itemset mining (FIM) is a basic research topic in data mining. The market basket analysis is one of its popular applications, which related to the discovery of sets of items (itemsets) that are frequently purchased jointly by customers. Where, in this application, the old regular model of FIM may discover a huge amount of frequent but less revenue itemsets and miss the data on valuable itemsets having less retailing frequencies. That type of problems are occur because of the facts that (1) FIM rates all items as having the same importance/unit profit/weight and (2) it consider that every item in a transaction present in a binary form, i.e., an item can be either present or absent in a transaction, which does not shows its purchase quantity in the transaction. Hence, FIM cannot fulfill the requirement of users who desire to find itemsets having high utilities such as high profits.

HUI mining is not an easy job as the downward closure property in FIM does not grasp in utility mining. In different way we can say that, the search space for mining HUIs cannot be directly reduced as it is done in FIM because a superset of a less utility itemset can be a high utility itemset. Were proposed for mining HUIs, but they also present a huge number of high utility itemsets to users. A very huge number of high utility itemsets makes it problematic for the users to understand the results. It may also root the algorithms in way to make it inefficient in terms of time and memory necessity, or may run it out of memory. It is broadly acknowledged that the more high utility itemsets the algorithms create, the more processing they consume. The performance of the mining job reducses significantly for less minimum utility thresholds or when dealing with condensed databases.

3.1 Block diagram of the proposed system

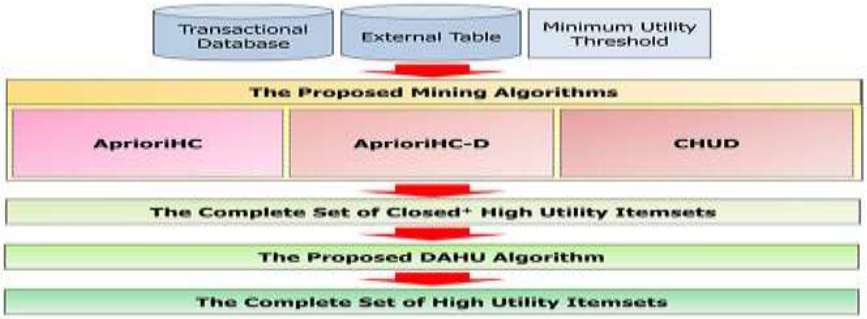


Fig. Block Diagram

4. MATHEMATICAL MODEL

4.1 Problem description

1) Input
2) Push Closed Property
3) Apriori HC Algorithm
4) Apriori HC D Algorithm
5) Recovery of HUI

Let the system be described by S,

S= {D, I, PCP, HC, HCD, R}

Where,

S: is a System.

D: is the set of Dataset.

I: Input.

PCP: Push Closed Property

HC: Apriori HC Algorithm

HCD: Apriori HC D Algorithm

R: Recovery of HUI

4.2 Activity

D= {d1, d2, … dn}

F= {f1, f2, … fn}

Y= { I, PCP, HC, HCD, R }

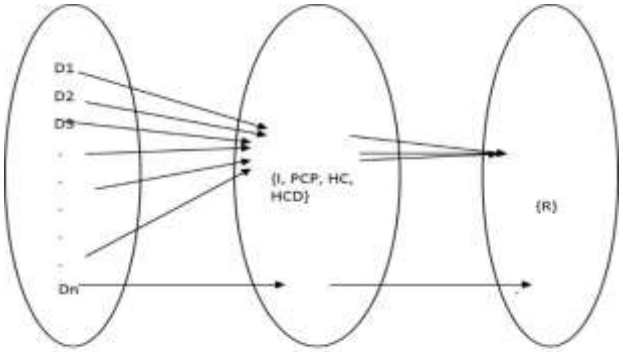
Where,

D is the Set of Dataset

F is the set of Function.

Y is a set of techniques use for Efficient Algorithms For Mining .

4.3 Vein Diagram



where,

D: is the set of Dataset.

I: Input.

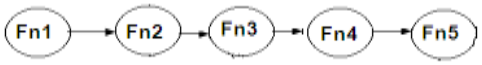
PCP: Push Closed Property.

HC: Apriori HC Algorithm.

HCD: Apriori HC D Algorithm.

R: Recovery of HUI.

4.4 State diagram



Where,

Fn1: Input

Fn2: Push Closed Property

Fn3: Apriori HC Algorithm

Fn4: Apriori HC D Algorithm

Fn5: Recovery

4.5 Functional Dependencies

	Fn1	Fn2	Fn3	Fn4	Fn5
Fn1	1	0	0	0	0
Fn2	0	1	0	0	0

Fn3	0	0	1	0	0
Fn4	0	0	0	1	0
Fn5	0	0	0	0	1

where,

Fn1: input

Fn2: push closed property

Fn3: apriori hc algorithm

Fn4: Apriori HC D Algorithm

Fn5: Recovery

5. CONCLUSIONS

In this paper, the difficulty of redundancy in high utility itemset mining by proposing a lossless and compact representation termed closedþ high utility itemsets is solved. To do the mining of this representation, three capable algorithms called AprioriHC (Apriori-based approach for mining High utility Closed itemset), AprioriHC-D (AprioriHC algorithm with Discarding unpromising and isolated items) and CHUID (Closedþ High Utility itemset Discovery). AprioriHC-D is an improved version of AprioriHC, which integrates approaches DGU and IIDS for pruning candidates. AprioriHC and AprioriHCD accomplish a breadth-first search for mining closedþ high utility itemsets from horizontal database, where else CHUD performs a depth-first search for mining closedþ high utility itemsets from vertical database. The strategies integrated in CHUD are efficient and unique and innovative. They have never been used for vertical mining of high utility itemsets and closed high utility itemsets. To efficiently recover all high utility itemsets from closedþ high utility itemsets, we proposed an efficient method termed DAHU (Derive All High Utility itemsets). The combination of CHUD and DAHU is also faster than UP-Growth when DAHU could be applied.

In the future, our aim is to combine many other compact representations like free sets, non-derivable frequent itemsets, Relative risk and odds ratio with high utility itemset mining.

REFERENCES:

[1] Vincent S. Tseng, Cheng-Wei Wu, Philippe Fournier-Viger, and Philip S. Yu, Fellow, "Efficient Algorithms for Mining the Concise and Lossless Representation of High Utility Itemsets", IEEE transactions on knowledge and data engineering, vol. 27, no. 3, March 2015.

[2] C. F. Ahmed, S. K. Tanbeer, B.-S. Jeong, and Y.-K. Lee, "Efficient tree structures for high utility pattern mining in incremental databases," IEEE Trans. Knowl. Data Eng., vol. 21, no. 12, pp. 1708– 1721, Dec. 2009.

[3] J.-F. Boulicaut, A. Bykowski, and C. Rigotti, "Free-sets: A condensed representation Of Boolean data for the approximation of frequency queries," Data Mining Knowl. Discovery, vol. 7, no. 1, pp. 5–22, 2003.

[4] T. Calders and B. Goethals, "Mining all non-derivable frequent itemsets," in Proc. Int. Conf. Eur. Conf. Principles Data Mining Knowl. Discovery, 2002, pp. 74–85.

[5] K. Chuang, J. Huang, and M. Chen, "Mining top-k frequent patterns in the presence of the memory constraint," VLDB J., vol. 17, pp. 1321–1344, 2008.

[6] R. Chan, Q. Yang, and Y. Shen, "Mining high utility itemsets," in Proc. IEEE Int. Conf. Data Min., 2003, pp. 19–26.

[7] A. Erwin, R. P. Gopalan, and N. R. Achuthan, "Efficient mining of high utility itemsets from large datasets," in Proc. Int. Conf. Pacific- Asia Conf. Knowl. Discovery Data Mining, 2008, pp. 554–561.

[8] K. Gouda and M. J. Zaki, "Efficiently mining maximal frequent itemsets," in Proc. IEEE Int. Conf. Data Mining, 2001, pp. 163–170.

[9] T. Hamrouni, "Key roles of closed sets and minimal generators in concise representations of frequent patterns," Intell. Data Anal., vol. 16, no. 4, pp. 581–631, 2012.

[10] J. Han, J. Pei, and Y. Yin, "Mining frequent patterns without candidate generation," in Proc. ACM SIGMOD Int. Conf. Manage. Data, 2000, pp. 1–12.

[11] R. Agrawal and R. Srikant, "Fast algorithms for mining association rules," in Proc. 0th Int. Conf. Very Large Data Bases, 1994, pp. 487–499.

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Apriori: a promising data warehouse tool for finding frequent itemset and to define association rules

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Abstract— Data Warehouse- not only the source of information or the place to store historical data but now its plays a vital role and act as a solution in today's fastest growing competitive world of IT and Business. It is obvious that if you keep information in proper place then you will definitely get it back in fast, efficient and easy mode. So to do so it is necessary to classify the data before placing it into the data warehouse. And it is also necessary to create analyses and correlate the association between the data items which is available or newly added. In this paper we represent here an algorithm which is used to find frequent item set from the given database which further used to classify items and to find association between. This paper also represents how to use correlation factor to know the actual and accurate bonding between items.

Keywords— apriori, association rule, correlation, candidate, dataset, data warehouse, data mining, frequent, lift,

INTRODUCTION

Data Warehousing & mining has recently motivated a database [4] practitioners and researchers mainly for building an application which is based on many fields such as market strategy, financial forecasts and decision support [10]. Many strategies and algorithms and application have been proposed to obtain useful and invaluable information from the large databases. Finding an Association rule is very important factor which is only possible after getting the list of frequent items. An association rule is of the form A => B: [Support=x%, confidence=y%]. And this rule has two very important measurements: support and confidence. The association rule mining problem is to find rules that satisfy user-specified minimum support and minimum confidence. Basically frequent patterns are patterns (such as item sets) that appear in a data set frequently. e.g., a set of items, such as milk & bread, which appear frequently together in a transaction data set, is a frequent itemset. A subsequence, such as buying first a PC, then a digital camera, and then a memory card, if it occurs frequently in a shopping history database, is a (frequent) sequential pattern. If a substructure occurs frequently, it is called a (frequent) structured pattern. Finding such frequent patterns plays a vital role in mining associations, correlations. Again, it helps in data classification, clustering, and other data mining tasks as well. Thus, frequent pattern mining has become an important data mining task and a focused factor in data mining research.

MARKET BASKET ANALYSIS

Market basket analysis [5] is a motivational example for frequent itemset mining which leads to the finding of associations and correlations among items in large transactional or relational data sets. With large amounts of data continuously being collected and stored, many industries are becoming interested in mining such patterns from their databases. The discovery of interesting correlation relationships among huge amounts of business transaction records can help in many business decision making processes, such as catalog design, cross-marketing, and customer shopping behavior analysis. A typical example of frequent itemset mining is market basket analysis. In market basket analysis we initiated with analyzing customer buying habits by finding associations between different items that customers place in their "shopping cart". These results help retailers and shopkeeper to develop business strategies by deciding that which items are frequently bought together by customers. For example, if customers are buying computer, then what is the percentage that they also tends to buy pen drive on the same trip to the supermarket? Such analysis can lead to increased sales by helping retailers do selective marketing and plan their shelf space. On the basis of same market basket analysis there exists an algorithm known as apriori algorithm which is going to be discussing in next section.

THE APRIORI ALGORITHM:

Apriori is a seminal algorithm proposed by R. Agrawal and R. Srikant in 1994 [5] for mining frequent itemsets for Boolean association rules. The name of the algorithm is based on the fact that the algorithm uses prior knowledge of frequent itemset properties. In apriori algorithm it actually do the iterative search of k-itemsets are used to explore (k + 1)-itemsets. In this we have to first need to find the set of frequent 1-itemsets by scanning the database to count for frequency of each items, and then checking for minimum support threshold. The resultant set is denoted by L1. Next, L 1 is used to find L 2, the set of frequent 2- itemsets, which is used to find L 3, and so on, until the system exhaust or no more is remaining. The finding of each L k requires one full scans of the

database. The Apriori property is actually used to preserve the efficiency of algorithm. The Apriori property said that -All nonempty subsets of a frequent itemset must also be frequent. i.e., if {PQ} is a frequent itemset, then both {P} and {Q} should be a frequent itemset. Once the frequent pattern itemset found then we can find an association between them. To elaborate this; we have an example based on apriori which is used to find frequent patterns and then used to build an association rule between an itemset.

Algorithm: Apriori. Find frequent itemsets using an iterative level-wise approach based on candidate generation.

Input:

- D, a database of transactions;
- min_sup, the minimum support count threshold.

Output: L, frequent itemsets in D.

Method:

```
(1)   L1 = find_frequent_1-itemsets(D);
(2)   for (k = 2;Lk−1 ≠ ϕ;k++) {
(3)      Ck = apriori_gen(Lk−1);
(4)      for each transaction t ∈ D { // scan D for counts
(5)         Ct = subset(Ck, t); // get the subsets of t that are candidates
(6)         for each candidate c ∈ Ct
(7)            c.count++;
(8)      }
(9)      Lk = {c ∈ Ck|c.count ≥ min_sup}
(10)  }
(11)  return L = ∪k Lk;
```

```
procedure apriori_gen(Lk−1:frequent (k − 1)-itemsets)
(1)   for each itemset l1 ∈ Lk−1
(2)      for each itemset l2 ∈ Lk−1
(3)         if (l1[1] = l2[1]) ∧ (l1[2] = l2[2]) ∧ ... ∧ (l1[k − 2] = l2[k − 2]) ∧ (l1[k − 1] < l2[k − 1]) then {
(4)            c = l1 ⋈ l2; // join step: generate candidates
(5)            if has_infrequent_subset(c, Lk−1) then
(6)               delete c; // prune step: remove unfruitful candidate
(7)            else add c to Ck;
(8)         }
(9)   return Ck;
```

```
procedure has_infrequent_subset(c: candidate k-itemset;
          Lk−1: frequent (k − 1)-itemsets); // use prior knowledge
(1)   for each (k − 1)-subset s of c
(2)      if s ∉ Lk−1 then
(3)         return TRUE;
(4)   return FALSE;
```

Fig. 1 The Apriori algorithms for discovering frequent itemsets [5]

WORKING OF AN APRIORI ALGORITHM:

In fig. 1 we can see the general algorithm used to generate candidates and then to check and make itemset efficient. In general, Apriori Algorithm can be viewed as a two-step process[5]: (i) Generating all item sets having support factor greater than or equal to, the user specified minimum support. (ii) Generating all rules having the confidence factor greater than or equal to the user specified minimum confidence.

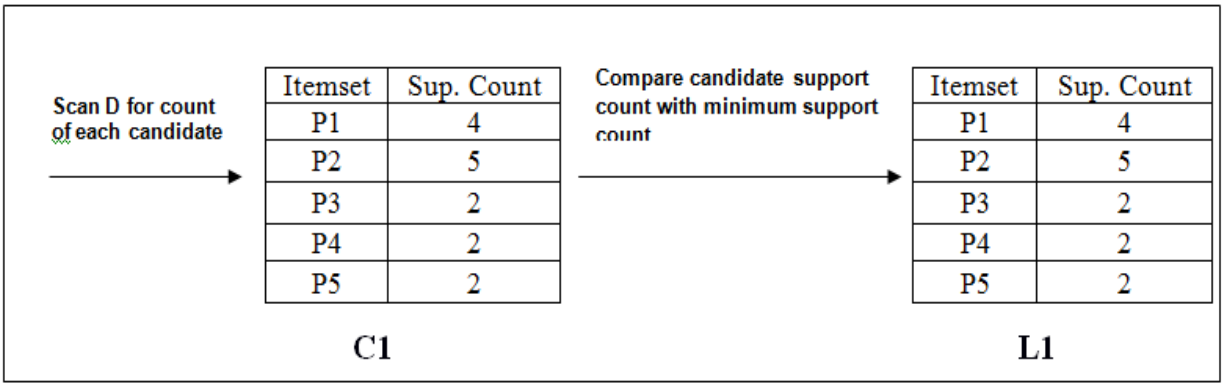
EXAMPLE OF AN APRIORI ALGORITHM:

In fig. 2, we have one example to consider which show the basic working of Apriori Algorithm, Consider a database, D, consisting of 5 transactions.
Consideration for example:
-Suppose min. support count required is 2 (i.e. min_sup = 2/5 = 40 %)
-Let minimum confidence required is 70%.
-We have to first find out the frequent itemset using Apriori algorithm.
-Then, we have to generate an Association rules using min. support & min. confidence.

Transaction ID	List of Products purchased by customer
T101	P1, P2, P5
T102	P2, P4
T103	P1, P2, P4
T104	P1, P2, P3, P5
T105	P1, P2, P3

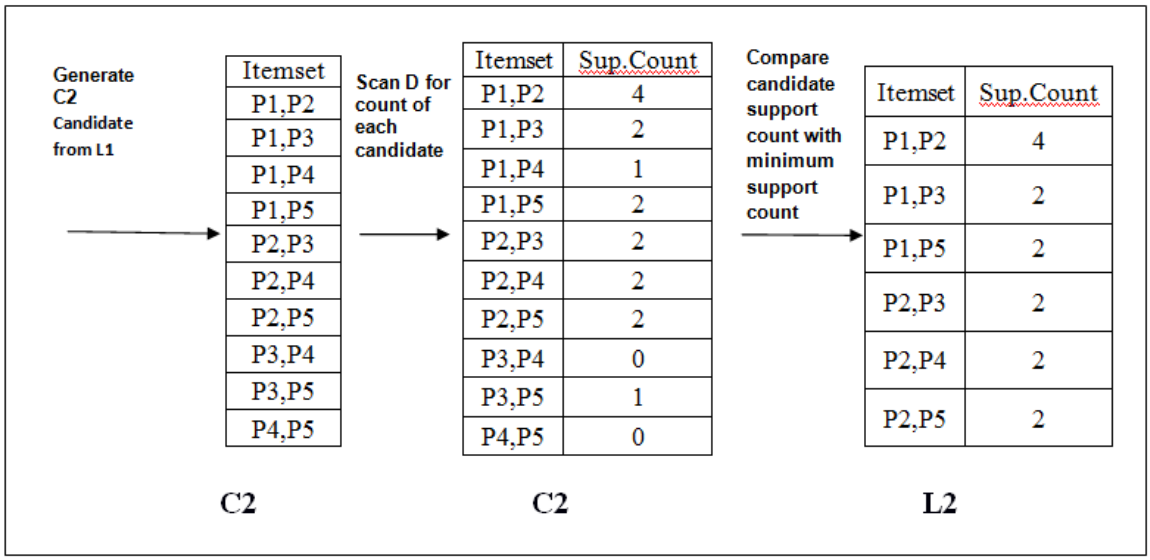
Fig. 2 a sample transaction snapshot for consideration.

Step 1: Generating 1-itemset Frequent Pattern



Here in 1st step, which is an iterative process, the dataset D is scanned and the support count (also called as frequency, count, occurrences) of individual product is calculated called as Candidate generation C1. Then we have to compare this with minimum support count which is given i.e. 2 (40%). Here we can see in the first iteration of the algorithm, each item is a member of the set of candidate.

Step 2: Generating 2-itemset Frequent Pattern



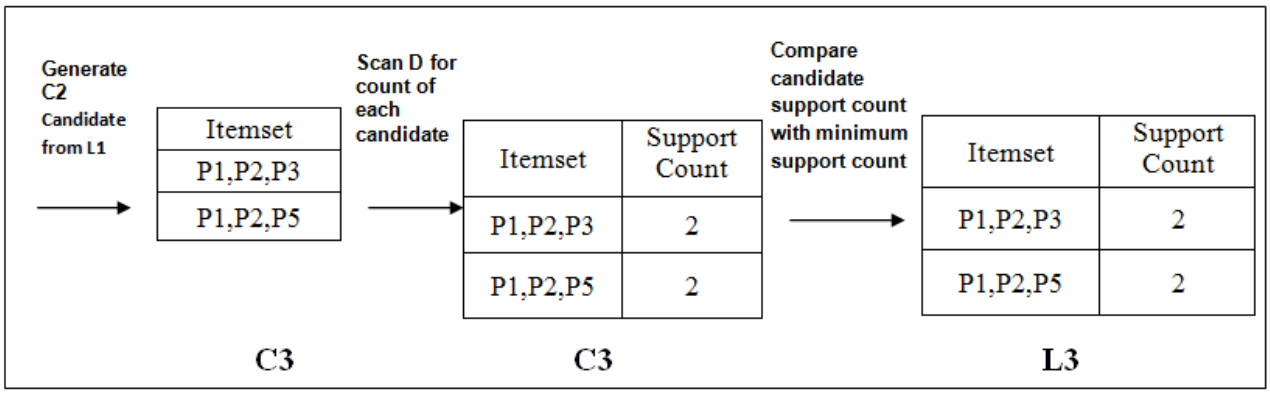
Itemset
P1,P2
P1,P3
P1,P4
P1,P5
P2,P3
P2,P4
P2,P5
P3,P4
P3,P5
P4,P5

Itemset	Sup.Count
P1,P2	4
P1,P3	2
P1,P4	1
P1,P5	2
P2,P3	2
P2,P4	2
P2,P5	2
P3,P4	0
P3,P5	1
P4,P5	0

Itemset	Sup.Count
P1,P2	4
P1,P3	2
P1,P5	2
P2,P3	2
P2,P4	2
P2,P5	2

To find out the set of frequent 2-itemsets, L2, we have to do L1 *Join* L1to generate a candidate set of 2-itemsets, C2. further, the transactions in D are scanned and the support count for each candidate itemset in C2 is gathered. The set of frequent 2-itemsets, L2, is then found out, consisting of those candidate 2-itemsets in C2 which is having minimum support.

Step 3: Generating 3-itemset Frequent Pattern



Itemset
P1,P2,P3
P1,P2,P5

Itemset	Support Count
P1,P2,P3	2
P1,P2,P5	2

Itemset	Support Count
P1,P2,P3	2
P1,P2,P5	2

The generation of the set of candidate 3-itemsets, C3, involves use of the Apriori Property. In order to find C3, we calculate L2*Join*L2.

-C3= L2 *Join*L2 = {{P1, P2, P3}, {P1, P2, P5}, {P1, P3, P5}, {P2, P3, P4}, {P2, P3, P5}, {P2, P4, P5}}.

-Here, Join step is completed and Prune step will be used to reduce the size of C3. Based on the Apriori property that all subsets of a frequent itemset must also be frequent, we can decide that four final candidates cannot possibly be frequent as there subsets are not frequent.

Step 4: Generating 4-itemset Frequent Pattern

Now, to generate C4 i.e. set of 4-itemset, we have to perform L3 Join L3. The join results is {{P1, P2, P3, P5}}, this itemset is pruned since its subset {{P2, P3, P5}} is not frequent. Thus, C4= φ, and algorithm terminates, having found all of the frequent items. Now our apriori algorithm is completed. Now, these frequent itemsets are used to generate strong association rules which further used to classify the data set or data items.

Step 5: Generating Association Rules from Frequent Itemsets

The concept of generating association rule [1, 2, 5] is very simple. Now, for each frequent itemset ***"l",*** generate all nonempty subsets of ***s.***

- For every nonempty subset ***s*** of ***l***, output the rule **"s-> (*l* - s)**

So here in our case,
We have L = {{P1}, {P2}, {P3}, {P4}, {P5}, {P1, P2}, {P1, P3},
{P1, P5}, {P2, P3}, {P2, P4}, {P2, P5}, {P1, P2, P3}, {P1, P2, P5}}.

–Let's take ***l*** = {P1, P2, P3}.
–then it's all nonempty subsets are: {P1, P2}, {P1, P3}, {P2, P3}, {P1}, {P2}, {P5}.
As mentioned before the minimum confidence threshold is 70%. Then with the consideration of above sample *l* = {P1, P2, P3}.

Following are the generated Association rule:

Rule No	Rule	Confidence	Result	Remark
R1	P1 ^ P2 → P3	SC {P1, P2, P3}/SC {P1,P2}	2 / 4 = 50%	R1 is rejected.
R2	P1 ^ P3 → P2	SC {P1, P2, P3}/SC {P1, P3}	2 / 2 = 100%	R2 is selected.
R3	P2 ^ P3 → P1	SC{P1, P2, P3}/SC {P2, P3}	2 / 2 = 100%	R2 is selected.
R4	P3 → P1 ^ P2	SC {P1, P2, P3}/SC {P3}	2 / 2 = 100%	R2 is selected.
R5	P2 → P1 ^ P3	SC {P1, P2, P3}/SC {P2}	2 / 5 = 40%	R1 is rejected.
R6	P1 → P2 ^ P3	SC {P1, P2, P3}/SC {P1}	2 / 4 = 50%	R1 is rejected.

So here we can find that only ***Rule No. R2, R3 and R4*** is strong association rule which are further useful for classification. Now, it is also true that the strong association is not all the time useful.

Efficiency of an Apriori algorithm:

Yes definitely an apriori algorithm is most suitable, important and easy to implement algorithm for finding frequent patterns item set. Here are some methods [8] available for improving efficiency of an apriori algorithm [5].

A) Hash-based technique [5, 6]: where hashing method is used and itemsets dump into corresponding buckets for efficient use.
B) Transaction reduction: in this method we reduce the number of transactions which are scanned in the future iterations.
C) Partitioning: as the name suggest this method do the partition of the data to find candidate itemsets.
D) Sampling: sampling is the method where we have to take a subset of the given data and then applying all methodology onto it. Definitely applying apriori method on small subset will give us the result in less time and it also confirm us that the superset contains frequent patterns or not.
E) Dynamic itemset counting: in this method we have to add candidate itemsets at different points during a scanning of whole dataset.

Obviously every system has some drawback so this too. This apriori method is really the basic and easy to implement but it generates huge number of candidate sets and it may also need to continually scan the database and make sure a large set of candidates by pattern Matching. And it is obvious that to go for each transaction to calculate support those items. To overcome this drawback many scholars have proposed some methods which includes FP-Growth (Frequent Pattern) itemset mining in which we generate frequent patterns without generating candidates [13]. Another technique is Vertical data format; both apriori and FP-growth uses horizontal data format for analysis but we also can view the in vertical format like *item-TID set* format (that is, {*item* : *TID set*}), where *item* is an item name, and *TID set* is the set of transaction identifiers containing the item. This format is known as vertical data format this is the essence of the ECLAT (Equivalence CLASS Transformation) algorithm developed by Zaki.[7]

CONCLUSION AND FUTURE WORK

The mentioned algorithm for mining frequent patterns and for defining association rules is definitely simple and easy to implement method for every data set and also useful for large amount of database [9] if used with any improving method mentioned above. The apriori method and its simple technique are also helpful to determine frequent patterns in sequential data and time-series database.

The current methods used for mining frequent patterns including apriori generate their result according to their algorithms without considering any other parameters. Some where we got the result where the items included in group are not associated with each other. Simply they are not correlate with each other. Yes this can be reviewed by using some correlation method like "lift" [5] but still some improvement is required in this field. An apriori algorithm can also be used for finding association between the satellite

images taken by the shuttle for various purposes like images of earth taken before, on and after the time of disaster to prevent future calamities.

REFERENCES:

[1] Agrawal, R et.al.,(1994) Fast algorithms for mining association rules. In Proc. 20th Int. Conf. Very Large Data Bases.

[2] Agrawal,R et al.,(1996), "Fast Discovery of Association Rules," Advances in Knowledge Discovery and Data Mining.

[3] Agrawal, R., Imielinski, T., and Swami et. al (1993). Mining association rules between sets of items in large databases. In Proceedings of the ACM SIGMOD International Conference on Management of Data, 207-216.

[4] M.S. Chen, J. Han, P.S. Yu, "Data mining: an overview from a database perspective", IEEE Transactions on Knowledge and Data Engineering, 1996, 8, pp. 866-883.

[5] J. Han, M. Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publisher, San Francisco, CA, USA, 2001.

[6] J. Park, M. Chen and Philip Yu, "An Effective Hash-Based Algorithm for Mining Association Rules", Proceedings of ACM Special Interest Group of Management of Data, ACM SIGMOD'95, 1995.

[7] M. Zaki, S. Parthasarathy, M. Ogihara, and W. Li, "New Algorithms for Fast Discovery of Association Rules", Proc. 3rd ACM SIGKDD Int. Conf. on Knowledge Discovery and Data Mining (KDD'97, Newport Beach, CA), 283-296 AAAI Press, Menlo Park, CA, USA 1997.

[8] Shruti Aggarwal, Ranveer Kaur, "Comparative Study of Various Improved Versions of Apriori Algorithm", International Journal of Engineering Trends and Technology (IJETT) - Volume4Issue4- April 2013

[9] Agrawal, R., T. Imielin´ ski, and A. Swami (1993). "Mining association rules between sets of items in large databases". In Proceedings of the 1993 ACM SIGMOD International Conferenceon Management of Data, SIGMOD '93, New York, NY, USA, pp. 207–216. ACM.

[10] Association Rule Learning – Wikipedia, the free encyclopedia.

[12] Zawaidah, Jbara and Zanona (2011) " An Improved Algorithm for Mining Association Rules in Large Databases" World of Computer Science and Information Technology Journal (WCSIT) ISSN: 2221-0741 Vol. 1, No. 7, 311-316, 2011.

[13] J. Han, J. Pei, and Y. Yin. Mining Sequential Patterns without Candidate Generation (PDF), (Slides), Proc. 2000

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A Light Weight Cryptographic Hash Algorithm for Wireless Sensor Network

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Abstract- Authentication of a message is a great research challenge in today's advanced wire and wireless communication. Cryptographic hash functions are used to protect the authenticity of information. Some of the most popular and commonly used cryptographic hash algorithms are MD5 and SHA1. These hash algorithms are used in a wide variety of security applications e.g. securing node/message in traditional networks.

However, the commonly used hash algorithms require huge computational overhead which is not affordable by applications in energy-starved network e.g. wireless sensor network (WSN). In these applications the major constraints are communication, computation and storage overheads; out of which communication and computation overheads consume high energy. Keeping this fact in mind, in this work, a light-weight, one-way, cryptographic hash algorithm is suggested with a target to produce a hash-digest with fixed and relatively small length for such an energy-starved wireless network. The primary focus is making the algorithm light-weight so that upon using it in application of network like WSN, the nodes can successfully run the algorithm with low energy. It is suggested that such algorithm must fulfill all the basic properties such as preimage resistance, collision resistance of a one-way hash function. The proposed algorithm is developed using NS2 simulation tool and results were compared with MD5 and SHA1.

Keywords: symmetric key, asymmetric key, message authentication, md5, sha1, cryptographic hash algorithm, ns2 simulation, wireless sensor network

1. INTRODUCTION

Symmetric key & Asymmetric key cryptography are two different techniques available to use keys or secrets for encryption. Both types of algorithms are used for data encryption and decryption in cryptography and network security. Symmetric key cryptography is a conventional encryption technique which is used to encrypt and decrypt the data. The process used to generate cipher text in Symmetric key algorithms is less complicated due to which these algorithms execute much faster than Asymmetric key algorithms. The number of bits (i.e. length) used to define the key determines the strength of the security. A key can be 160-512 bits long. NIST has provided recommendations regarding the key length. The major challenge in implementing Symmetric key cryptography is that 2 parties must share the secret key in a secure way.

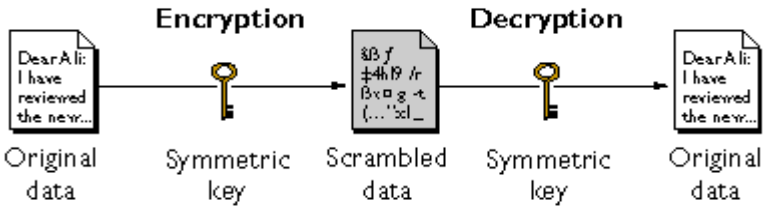

Fig 1.1 Symmetric Key Encryption

Asymmetric key cryptography uses a pair of mathematically related keys. The key pair contains a public key and a private key. Public key is known to everyone and the private key is always in possession of its owner only. The working mechanism of Asymmetric key cryptography takes away the security risk involved in key sharing between 2 parties. The private key is never revealed in this process. The message is encrypted by applying the public key before sending. The encrypted message can only be decrypted by using the corresponding private key. In another use of Asymmetric key cryptography, a message encrypted with the private key is decrypted by the corresponding public key. It is virtually impractical to compute the private key even if the corresponding public key is known.

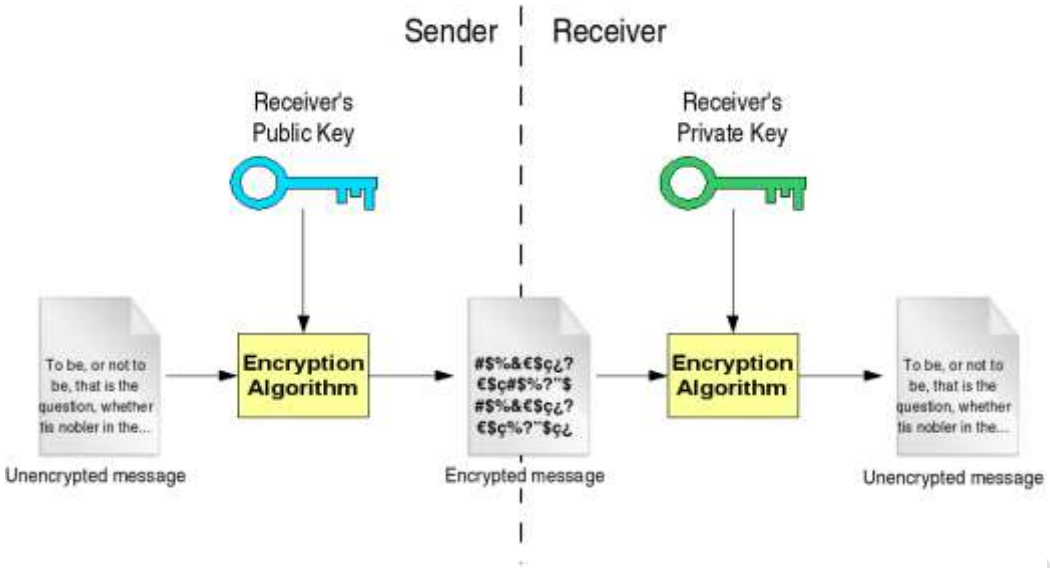

Fig 1.2 Asymmetric Key Encryption

A different set of problem is still there-
When a message is received by Bob sent from Alice, 2 things are to be verified

- Is the message authentic (Integrity of the message has not been compromised)
- Has the message originated from Alice herself?

The answer of these questions is the Cryptographic Hash Functions.

A hash (also known as message digest or signature) is a one way function that by some means computes a fingerprint of the message. It is more widely known as the hash value of the message.

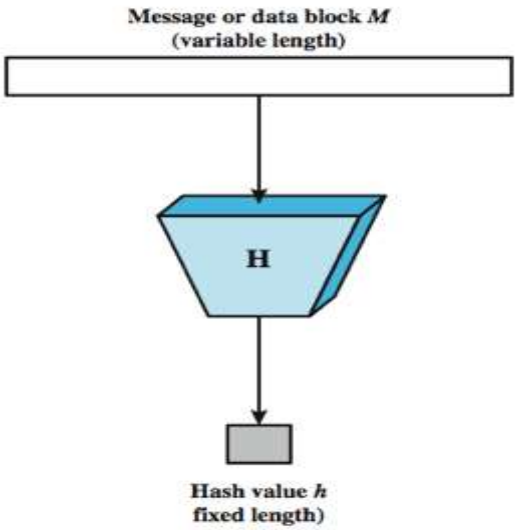

Fig 1.3 Signature of Long Message with a Hash Function

So if Alice wants to ensure the integrity of the contents of her document, she can attach the fingerprint of the message at the bottom of the document. Bob knows the function scheme used by Alice to generate the hash at his end. If it tallies with the hash value from Alice, Bob confirms the message is authentic.

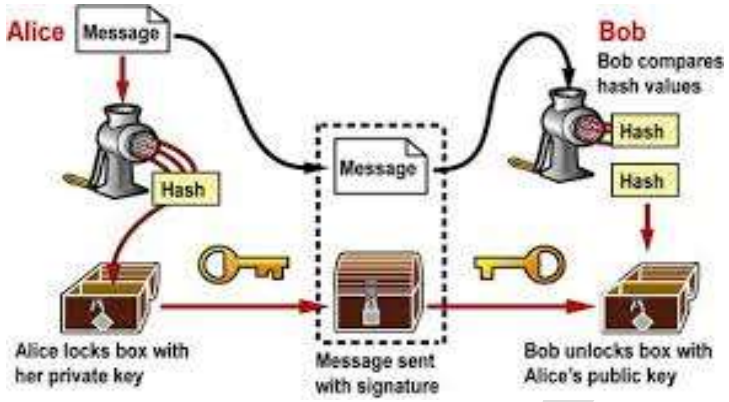

Fig 1.4 Checking Integrity at Bob's End

Some of the popular hash functions are MD4, MD5, SHA-1, and SHA-512.

Certainly there may be many messages that can produce the same hash digest, because a message can be arbitrarily long and the hash digest will be of some predetermined length, for instance 128 bits in MD5. For instance, for 1000 bit messages and a 128 bit hash digest, there are on the average 2^{872} messages that map to any of 2^{128} message digest. So undoubtedly, by trying lots of messages, one would eventually find two or more messages that can generate the same hash digest. The problem is that "lots" is so many that it is essentially impossible. Assuming a good 128 bit hash digest function, it would take trying around 2^{128} possible input messages before one would find a hash collision, or approximately 2^{64} messages before finding two that had the same hash digest.

A reasonable way of constructing a hash function is to combine lots of vicious operations into a potential digest function, and then play with it. If any particular patterns are detected repeatedly in the output the function perhaps requires a modification or it is summarily rejected.

Ideally, a good hash function should be very easy to compute. However, there is no dimension of minimal function which is fully secure. It is safer for a hash function to be overload and do a lot of shuffling beyond what is needed. The function must use all the input data. The hash function must uniformly distribute the hash values across the entire set of available values. The hash digest tend to be calculated in several rounds. The designers find the least number of rounds necessary to generate a hash output which qualifies various randomness tests, and then do a few more just to make it more robust and safe.

1.1 Communication Architecture of WSN

A Wireless Sensor Network is generally composed of few hundred to several thousands of tiny sensor nodes. Such networks are used to monitor environmental conditions. These sensor nodes are densely deployed to create a communication network in a sensor field. A sensor node consists of 4 basic parts: a sensing unit, a processing unit, a power unit and a transceiver unit [1]. Sometimes it may have a location tracking system which helps to keep track of the respective location. It may also have power generator which provide longer power backup. In addition to these, a node may also have mobilizer (Fig. 1.5). Sensors and analog-to-digital converters (ADCs) are the two subunits of sensing units. A processing unit is generally consists of microcontroller or microprocessor and a small storage unit. Its main job is to process the gathered data and execute the communication protocols. The power unit of a sensor is generally limited (e.g., a single battery). It is sometimes supported by power scavenging devices (e.g., solar cells). For large networks, battery replacement is very difficult or even impossible. A transceiver unit provides a connection of the node to the network. Most of the sensing tasks and sensor network routing techniques require knowledge of location, which is provided by a location tracking system. Depending upon the application, a mobilizer is sometimes used to provide movement to the sensor node.

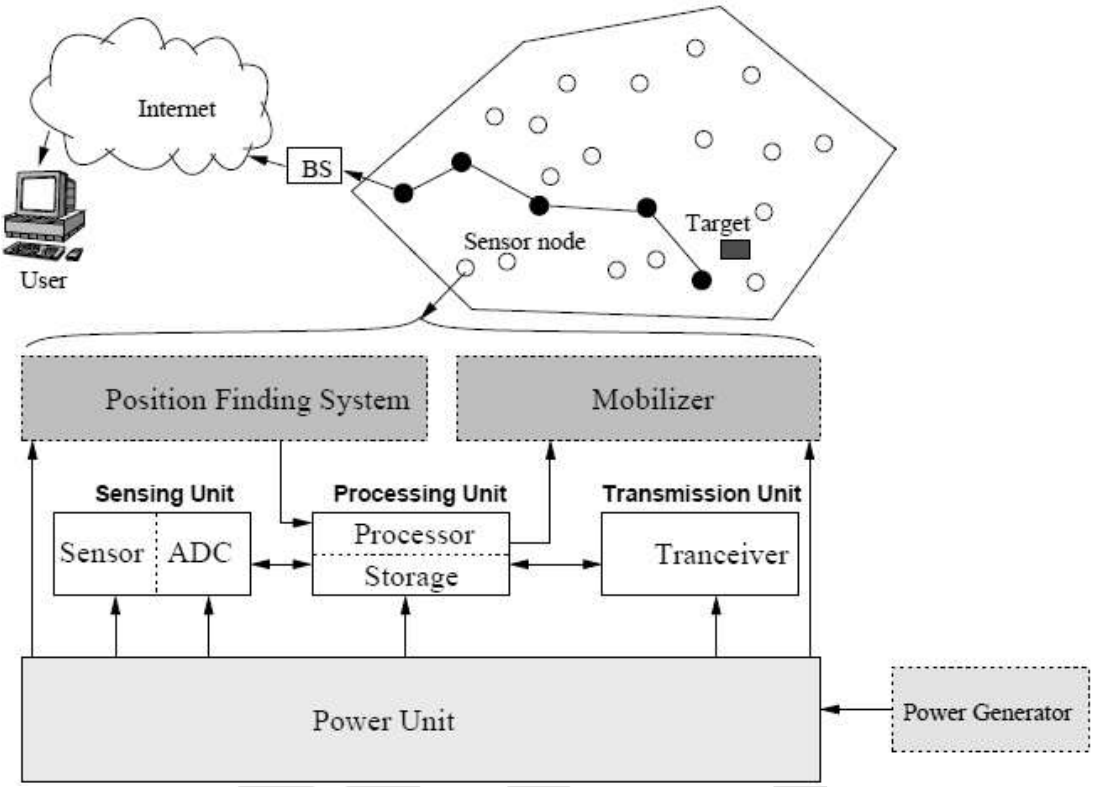

Fig 1.5 Wireless Sensor

The protocol stack used in sensor nodes contains the following layers [1]

• **Physical layer:** responsible for transmission and reception of data, generation and selection of carrier frequency, signal deflection, modulation, and data encryption & decryption.

• **Data link layer:** responsible for error detection and correction, the multiplexing of data streams, detection of data frames, medium access, reliable point-to-point and point-to-multipoint connections.

• **Network layer:** responsible for assignment of addresses and specify the process of packet forwarding to other nodes.

• **Transport layer:** responsible for the reliable transport of packets from one node to other node.

• **Application layer:** responsible for the interactions with the end users. It specifies how the data provided to individual sensor nodes upon request.

1.2 Constraints in WSN

Nodes of a Wireless Sensor Network are resource constrained as they have restricted computing capability, communication bandwidth and storage capacity. The small size of sensor node and limited computing power are 2 greatest constraints. So the security services in a sensor node must be implemented keeping in view of following hardware constraints of the sensor node:

• ***Energy*:**

–Energy is required for the sensor transducer which converts one form of energy into another

–Energy is required to establish communication among sensor nodes

–Energy is also required for microcontroller & microprocessor computation

• ***Computation*:**

Conventional complex cryptographic algorithms would require a lot of computing power for which the processors of sensor nodes is not feasible. Lightweight cryptographic algorithms are required to reduce the computing burden on sensor node.

• ***Memory*:**

Flash memory and RAM are usually included for the storage purpose in a sensor node. Flash memory is used to keep downloaded application code and RAM is used to keep sensor data, storing application programs, and intermediate computations. Generally, after loading OS and application code there is not sufficient space left to run complex algorithms. Due to the memory constraint it is not viable to use the majority of traditional cryptographic algorithms.

• ***Transmission range*:**

Limited operating power imposes restrictions on the communication range of sensor nodes. The actual transmission range of a signal depends on various environmental factors such as weather and terrain.

2. LITERATURE SURVEY

The most widely used hash functions are one-way functions for which finding an input which hashes to a pre-specified hash-value is very difficult. Two commonly used hash functions are MD5 and SHA-1. Both MD5 and SHA-1 are derived from MD4 in which weaknesses have been identified [3]. MD5 uses a hash algorithm with 128-bit long output hash was designed in 1991 and in 2005 it was shown [4] how rapidly random collisions for MD5 can be computed. MD5 is also not suitable for applications like SSL certificates or digital signatures. In [5] authors have revealed that how a couple of X.509 certificates can be produced that result in the same MD5 hash digest. This revelation led the cryptographers recommending the use of other algorithms like SHA-1 and other hash algorithms of SHA family. SHA-1 has been found to be weak [6] as well and most U.S. government applications now use the SHA-2 and SHA-3 family of hash functions [7, 8]. But most of the discussed hash functions are used in large traditional networks. Contrary to traditional networks, in a short-lived and energy-constrained network like Wireless Sensor Networks, a number of sensor nodes are deployed [9] in outdoor environment without human intervention. Reliability and data authenticity becomes the main worry to deal with such kind of networks. WSN suffers from number of constraints like low computing power, low battery life, and small memory. Due to these constraints, it is not able to deal with conventional cryptographic algorithms. So, it becomes compulsory to design a lightweight security hash algorithm for WSNs. Many similar works are reported towards hash-based security solutions and some of them [10, 11, 12] are mentioned here. Here [10, 11] prescribes solutions for WSNs whereas [12] is not usually meant for WSNs.

In [10], authors have presented a hash-based signature method which can be used to verify the messages for unicast and broadcast communication. It has claimed that both the signature generation and verification are quicker than the other existing schemes e.g. ECDSA (elliptic curve digital signature algorithm). In security analysis of the algorithm, authors have claimed that the signature scheme is preimage resistant and second preimage resistant**.** However, the authors have not claimed that the scheme is collision resistance, which is also another important property.

In [11] authors have designed a strong and efficient scheme against node capture attack using hash chain in WSN. The primary idea of the scheme is to use preloaded keys to calculate the hash value. The hashed key is used as a communication key. This scheme also shows an improvement in comparison of other existing schemes.

In another work [12] authors have proposed a cryptographic hash function Whirlwind which can be easily implemented in software. This method can be considered as an expansion in design compared to SHA-3 hash functions. This scheme uses large S-boxes which allow proficient implementation on a wide variety of platforms. The hash function produces 512-bit long hash digest by incorporating a compress function, computing initialization vector etc. The hash digest is represented by an 8x4 array of 16-bit elements each. Although the cryptanalysis of this scheme shows a progress but the performance of software implementation is not very fast compared to the other competing schemes.

3. PROPOSED LIGHT WEIGHT CRYPTOGRAPHIC HASH ALGORITHM FOR WSN

Any hash function which has to be evolved is required to satisfy a number of desirable characteristics.

3.1 Requirements of an Ideal Hash Function

Following are the essential characteristics which a hash calculating functions need to follow-

i. It should accept the arbitrary length inputs.

ii. Its output length must be fixed size.

iii. It should be efficient and its computation must be fast.

iv. **Pre-image resistant:** It is "one-wayness" property of the hash function (i.e. it should not be possible to calculate the input from the hash output).A hash function for which preimage/input cannot be efficiently solved is said to be preimage resistant. So, a preimage resistant function must ensure that given h(X), it should not be possible to calculate X.

v. **Second Preimage Resistant (Weak Collision Resistant):** Attacker should not be able to compute X' which has the same hash as X has. If it is computationally feasible h(X) cannot be considered as a fingerprint unique to X.

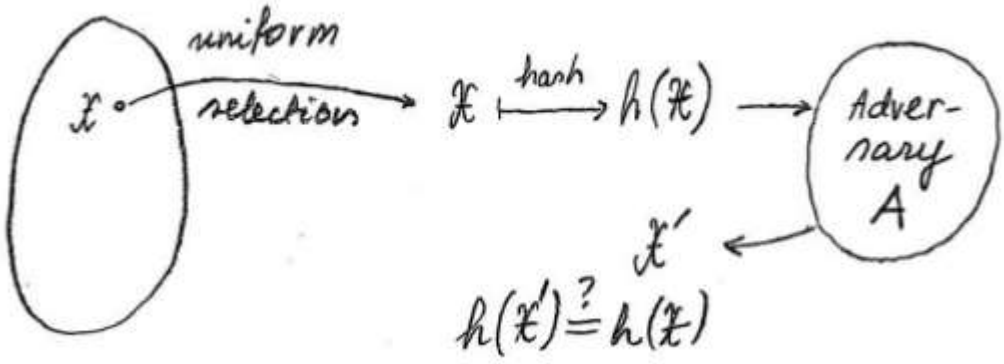

Fig 3.1 Example of Second Preimage Resistance

Fig. 3.1 explains that given a hash h(X) of a randomly chosen input X, it is hard to find an input X' with the same output h(X') = h(X).

vi. Strong Collision Resistant: The difference between weak and strong collision resistance is very subtle. This can be clarified using Birthday Paradox.

- Given a person (& his birthday), identifying the second person with the same birthday corresponds to weak collision problem.
  (There is a fix X1, finding an another element X2 where h(X1) =h(X2), this instance corresponds to weak collision)
- Identification of any 2 people in the group having the same birthday corresponds to the strong collision problem.

(Finding any 2 elements in a group of n elements s.t. h(X1) =h(X2), this instance corresponds to strong collision)

3.2 Proposed Hash Function

The proposed algorithm takes a message of arbitrary length as input. The output is a 12 byte (12*8 = 96 bits) hash digest. The steps of the algorithm are as follows-

1. Declare the substitution table STable_1 containing prime numbers chosen randomly. This table is used in first transformation.

STable_1[ ] = {521, 997, 983, 733, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151, 157, 163, 167, 173, 179, 181, 191, 193, 197, 199, 211, 223, 227, 229, 233, 239, 241, 251, 257, 263, 269, 271, 277, 281, 809, 293, 307, 311, 313,317, 331, 337, 347, 349, 353, 359, 367, 373, 379, 383, 389, 397, 401, 409, 863, 421, 431, 433, 439, 443, 449, 457, 461, 463, 467, 479, 487, 491, 499, 503, 509};

2. Declare the substitution table STable_2 which consists of 67 prime numbers chosen randomly to reduce overhead & ensure uniformity in transformation. This table is used in second transformation.

STable_2[ ] = {2911, 2899, 2893, 2887, 2871, 2857, 2851, 2837, 2833, 2827, 2809, 2797, 2791, 2779, 2773, 2767, 2749, 2743, 2737, 2731, 2723, 2719, 2713, 2711, 2701, 2687, 2683, 2677, 2659, 2653, 2647, 2641, 2629, 2623, 2617, 2611, 2587, 2563, 2539, 2503, 2497, 2447, 2431, 2419, 2413, 2407, 2401, 2389, 2383, 2377, 2359, 2347, 3193, 3173, 3157, 3139, 3121, 2257, 2251, 2239, 2227, 2221, 2197, 2191, 2179, 2173, 2167}

3. Initialize the following variables-

```
first_conv = 1;
second_conv_p3 = 7;
state[0] = 0x01234567;
state[1] = 0x89ABCDEF;
state[2] = 0xFEDCBA10;
```

where state[0], state[1] and state[2] are 3 variables which help in calculating the final hash value.

4. Preprocess the arbitrary long input message by converting each of the input character into 8 bit binary
5. Apply the padding in least significant position to make it divisible by 512
6. Split the message 3 times in a nested manner as follows
7. At first level, split the input message (of any length) in a block size of 512 bit each
   for (i = 0; i < t; i++) , t number of blocks of 512 bits each
8. At second level, split one block into 8 blocks of 64 bits each

   for (j = 0; j < 8; j++) , 8 blocks of 64 bits each
9. At third level, split each of 64 bits of one block into 8 subblocks of 8 bits each.
   for (k = 0; k <8; k++) , 8 numbers of 8 bit subblock each
10. Obtain subblock[i][j][k] // result of 3-level split.
11. First substitute the inner most block (8 bit) using substitution table Stable_1 as per follows and check subblock[i][j][k] contains for at least one 1, update subblock[i][j][k] accordingly-

```
if (subblock[i][j][k]!=0)  {
  p[k]=abs(subblock[i][j][k]-31)          //p[k] value doesn't exceed 97
   subblock[i][j][k]=STable_1[p[k]];
   }
else {
   p[k]=1;
   subblock[i][j][k]=STable_1[p[k]];
  }
```

12. Calculate the value of first_conv variable

```
first_conv = STable_1[p[k]]* first_conv;
if ( first_conv > 65535)
    first_conv = first_conv % 65536;
```

13. Once the first conversion is over, second conversion takes place

```
second_conv_p1= first_conv % 67;
if (subblock[i][j][7] = = 0)
    second_conv_p2 = second_conv_p1;
else
    second_conv_p2 = 67-second_conv_p1;

second_conv_p3 = second_conv_p3 + (second_conv_p1 +  first_conv) % 256;
```

14. Third conversion takes place and swapping of values are done-

```
after_second_conv = ( first_conv % second_conv_p3 ) + first_conv +
 STable_2[second_conv_p2];
after_third_conv = (after_second_conv % 256) + p[2] + p[0] % 127;
after_third_conv = after_third_conv^state[0];
Apply intra-hexnumber hexdigit swapping on each hexnumber.
state[0] = state[1];
state[1] = state[2];
state[2] = after_third_conv;
```

15. Compute the final hash digest

```
for (int i=0; i < 3; ++i) {
hash[i] = (state[0]>> (i*8)) & 0x0000ff;
hash[i+4] = (state[1]>> (i*8)) & 0x0000ff;
hash[i+8] = (state[2]>> (i*8)) & 0x0000ff;
```

16. Apply inter-hex number swapping on hash output.

The final hash digest is 96 bits long whatever may be the length of input message.

3.3 Performance Analysis

As discussed in section 5.1, every hash algorithm needs to follow six essential properties. The strength of the proposed algorithm can be evaluated by discussing the extent of maintaining these basic properties of a cryptographic hash function.

i. The proposed algorithm follows the first property of a cryptographic hash function as the input message can be arbitrary long.

ii. It satisfies the second property as it produces fixed length output.

The efficiency of the proposed algorithm can be observed from the implementation part as follows.

iii. **Preimage Resistance** - For a given hash digest H with respect to an unknown input, it is not feasible to find an input message m such that h (m) =H where h (m) is the message digest of m. It symbolizes the one-way property of a hash function. The final hash digest is the sum of t times of 12 byte hexadecimal numbers where, t is number of 512 bit blocks. Let H be the final hash digest.

$H=\sum H_i$, i varies from 0 to t-1 and H_i is hash digest of each of t number of 512 bit blocks. There will be ${}^{H+t-1}C_{t-1}$ ways to calculate H_i. If t=1, the number of solutions would become one.

In a brute force attack, upon capturing the digest H, it is attempted to find a message m such that h(m) = H(given). The attacker has to perform of the order of 2^{96} operations which will take high amount of time to perform brute force attack. Hence the algorithm is preimage resistant.

iv. **Collision Resistance** – To find out h(m1) = h(m2) the followings need to be true

i) *hexnumberij* (*m*1) = *hexnumberij* (*m*2) for all i, j where i ϵ {0,1,…,t-1} and j ϵ {0,1,…7} and

ii) $\text{subblock}_{ij}(m1) \neq \text{subblock}_{ij}(m2)$ for all i, j where i ϵ {0,1,…,t-1} and j ϵ {0,1,…7}

For these conditions to be correct at least one of the following conditions need to be satisfied:

a) first_conv (m1) = first_conv (m2) and $\text{sub\_block}_{ij}(m1) \neq \text{sub\_block}_{ij}(m2)$

b) after_second_conv (m1) = after_second_conv (m2) and $\text{sub\_ block}_{ij}(m1) \neq \text{sub\_ block}_{ij}(m2)$

c) after_third_conv (m1) = after_third_conv (m2) and $\text{sub\_ block}_{ij}(m1) \neq \text{sub\_ block}_{ij}(m2)$

So the only feasible method to satisfy at least one of the above conditions is brute force attack. Hence our algorithm is collision resistant. 2^{48} operations are to be performed by the brute force method to compute two messages having the same message digest which would be time consuming for a sensor node.

v. **Second Preimage Resistance** – For a given input message m1, if it is impossible to find another input message m2 where the hash output of first message is equal to the hash output of second input message m2 i.e., h (m1) = h (m2).

Second preimage resistance or weak collision resistance is an easier or weaker version of strong collision resistance. So, a strong collision resistant function would also follow the property of second preimage resistant.

4. IMPLEMENTATION

Network Simulator (Ver. 2), popularly known as NS2, is a discrete event driven simulation tool. There is a great need to simulate the protocols and algorithms before their actual implementation. NS2 has been proved useful in simulating the dynamic nature of communication networks. It is used to simulate the network functions and protocols of wired as well as wireless network. It provides the researchers a way to implement network protocols and help them to understand their corresponding behaviours using simulation.

In this work, cryptographic algorithm along with hash functions are being used to send data securely between two nodes. MD5, SHA-1 and one more protocol is being simulated while communicating between two nodes. In this work we have used CESAR cipher, for encryption/decryption of messages and MD5, SHA-1 and a proposed light weight cryptographic algorithm to calculate the hash digest. Results are compared. The proposed scheme is tested against MD5 and SHA-1. From the simulation of the experimental results, we can conclude that proposed algorithm may be used in Wireless Sensor Network for hashing the data exchanged between nodes.

4.1 Demonstration and Results

For the demonstration to be carried out, six nodes have been created. Node 0, 1 will send message to node 4 and 5 respectively and from node 4 and 5 back to node 0 and 1.An acknowledgement packet is expected by each sender node from the receiving node. A script is created using the TCL language to simulate this scenario. The following figures are the proofs to the demonstration. Figure 4.1 shows the communication of node 0 and 1 with the node 5 and 4 respectively using the hash digest calculated through MD5 algorithm. Corresponding acknowledgements are also being issued as can be seen in this figure. Figure 4.2 shows the communication among the nodes using SHA-1 hash algorithm whereas Figure 4.3 replicate the scenario using the proposed hash algorithm.

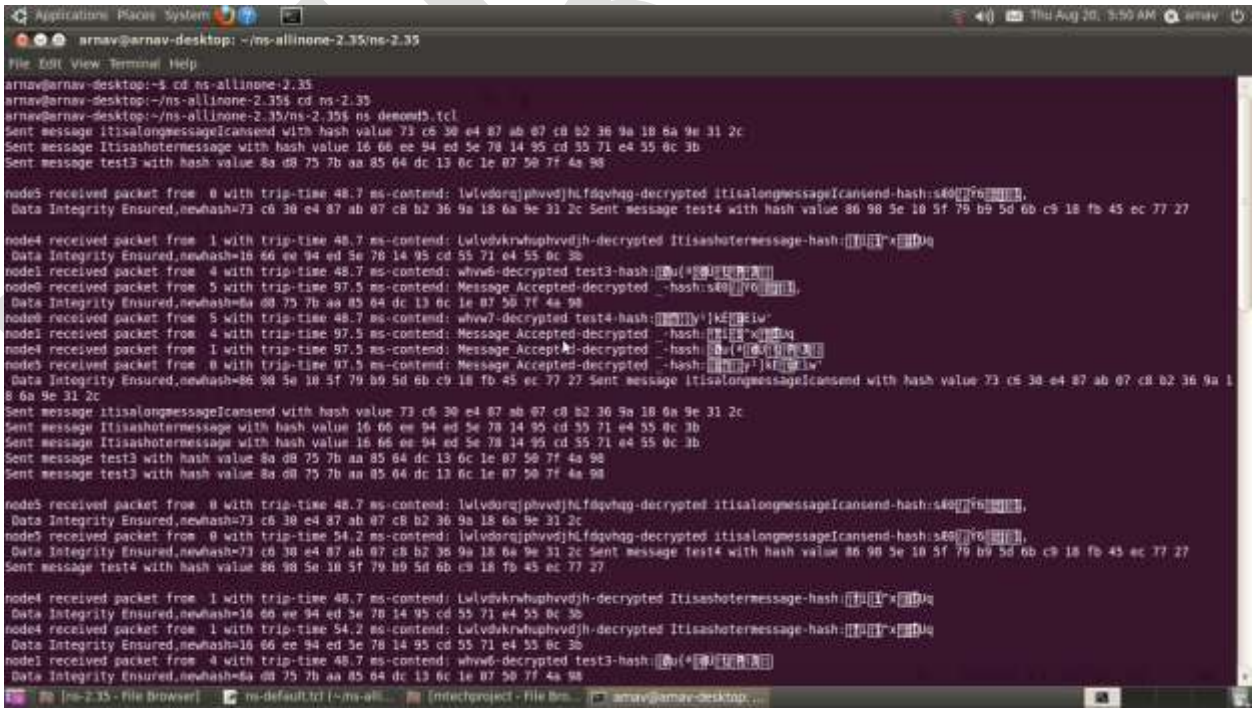

Fig 4.1 md5shot1

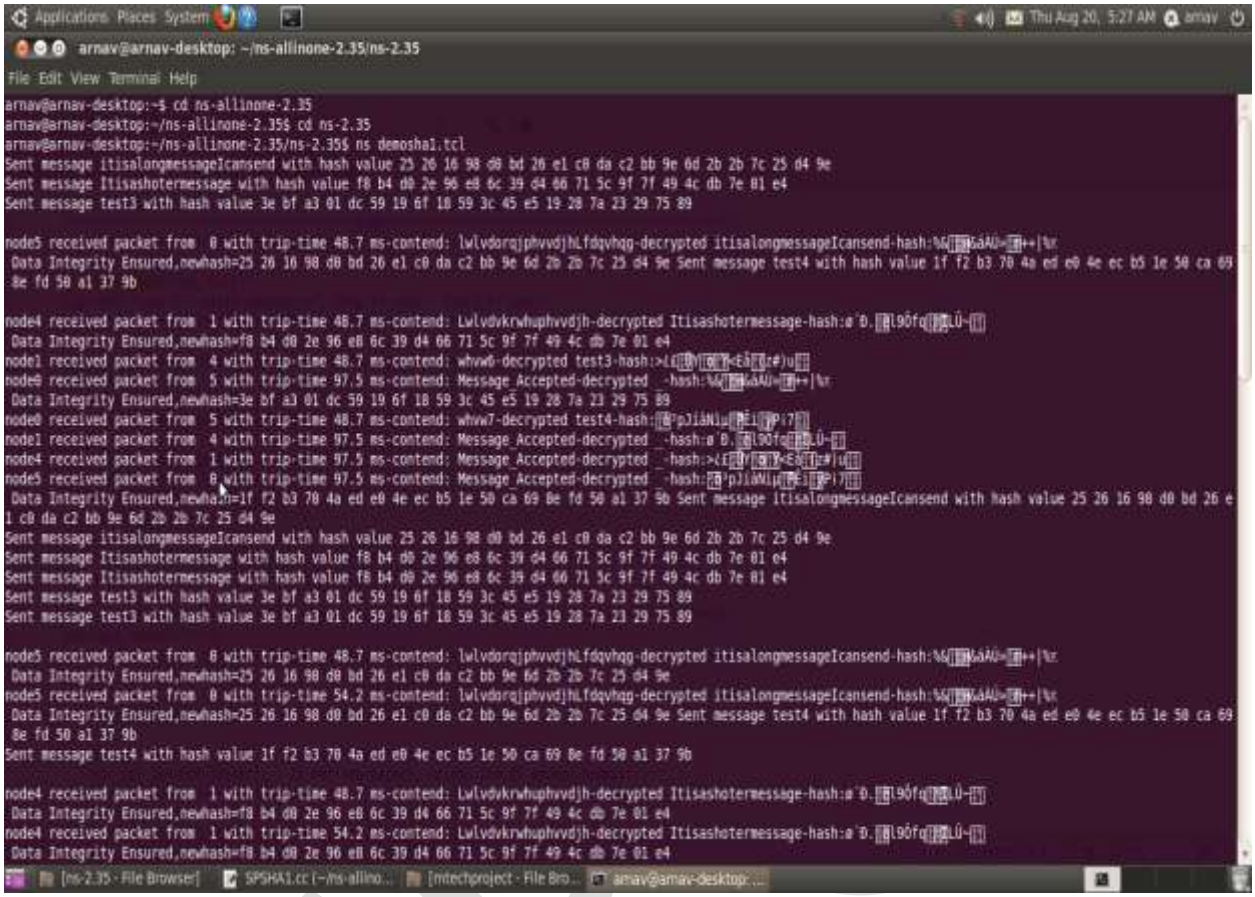

Fig 4.2 shashot1

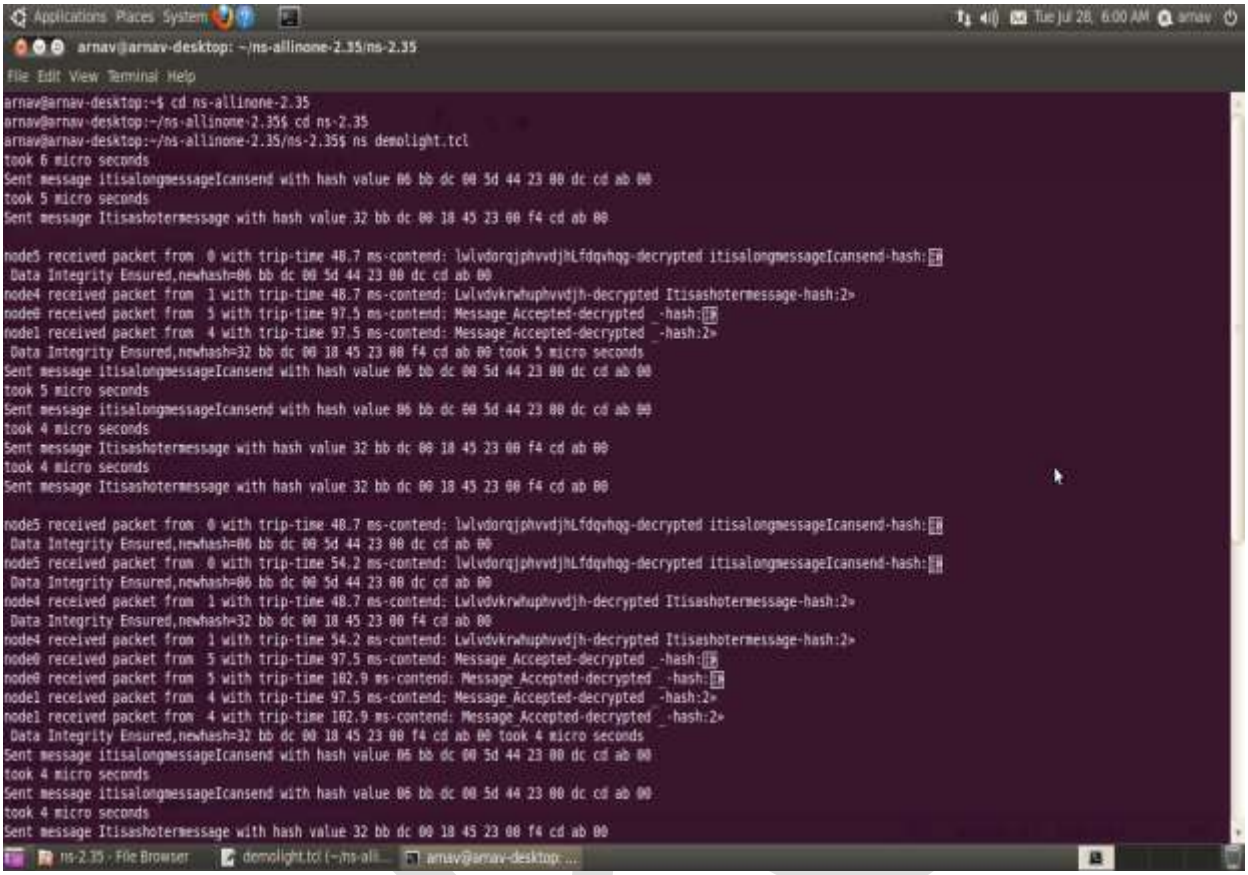

Fig 4.3 lightshot1

5. CONCLUSION AND FUTURE SCOPE

In this work the basic requirements to design a lightweight, one-way hash algorithm which produces a fixed & relatively small length hash digest which is applicable for securing energy-starved wireless network e.g. WSN are discussed. Operations like MOD and SWAP are used extensively to make the proposed hash algorithm lightweight. All the basic properties such as preimage resistance, strong collision resistance and weak or second preimage resistance are fulfilled in the proposed algorithm. The proposed algorithm is implemented using NS-2 simulator. It is compared with MD5 and SHA-1 has shown significant improvement in terms of communication overhead and computation speed.

As per Mica2 specification, energy consumption [15] [16] for transmitting one byte of data for ATMega 128 processor is 16.25µJ and energy required per clock cycle is 3.2nJ or 0.0032µJ. For the given specification, the energy requirements for all the competing schemes are computed below:

Communication overhead:

MD5 -- 16.25x128 (bit) = 16.25x16 (byte) = 260 µJ

SHA1-- 16.25x160 (bit) = 16.25x20 (byte) = 325 µJ

Proposed Algorithm—16.25x96 (bit) = 16.25x12 (byte) = 195 µJ

Comparison of Computation Speed:

Following snapshots clearly indicates that the time taken to calculate the hash of a sample string "ItisalongmessageIcansend" takes approximately 121, 134 and 115 micro seconds using MD5, SHA1 and the proposed light weight algorithm respectively.

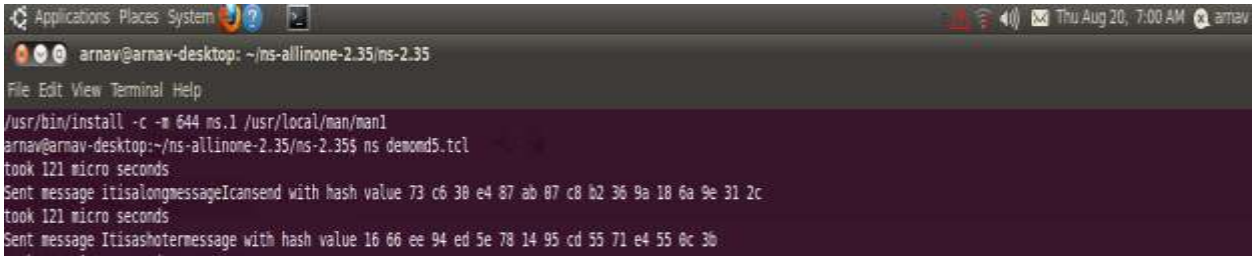

Fig 5.1 md5_time_shot

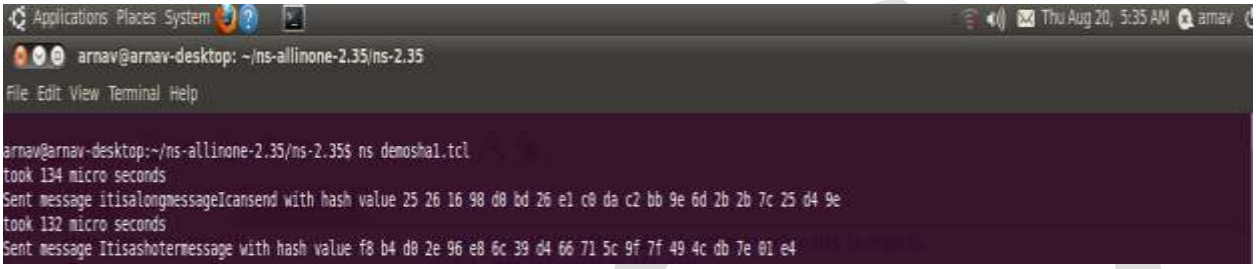

Fig 5.2 sha1_time_shot

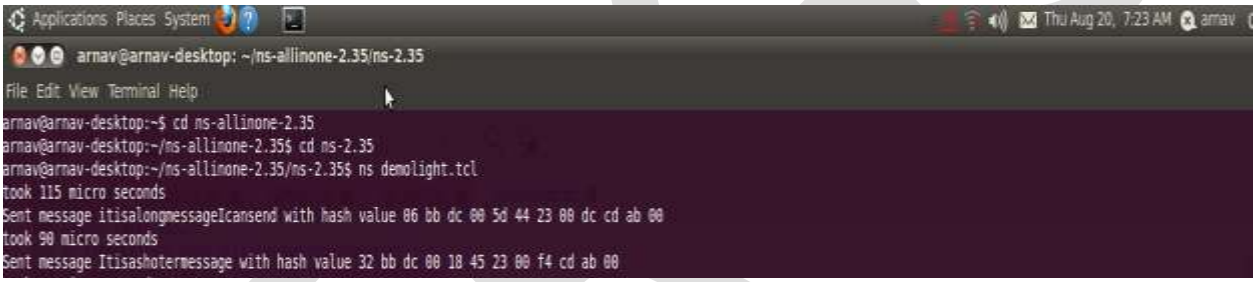

Fig 5.3 light_time_shot

The significant improvement in the communication and computation overhead has been observed while implementing the proposed light weight cryptographic hash algorithm in NS2. As a future extension, more efforts could be made to crosscheck the claim made in performance analysis using the Simulator.

REFERENCES:

[1] I. F. Akyildiz *et al.*, "A Survey on Sensor Setworks," *IEEE Commun. Mag.*, vol. 40, no. 8, Aug. 2002, pp. 102–114.

[2]. Handbook of Cryptography by A. Menezes, P. van Oorschot, and S. Vanstone, CRC Press, 1996.

[3]. H. Dobbertin: Cryptanalysis of MD4, Journal of Cryptology, vol. 11, No. 4, pp. 253-271, 1998.

[4]. X. Wang and H. Yu: How to Break MD5 and Other Hash Functions, EuroCrypt 2005, Springer LNCS 3494, pp. 19–35, 2005.

[5]. M. Stevens, A. Lenstra and B. Weger.: Chosen-Prefix Collisions for MD5 and Colliding X.509 Certificates for Different Identities, EUROCRYPT 2007: 1-22.

[6]. Rijmen, V.Oswald: Update on SHA-1, RSA 2005, LNCS 3376, pp. 58-71.

[7]. R. P. McEvoy, F. M. Crowe, C. C. Murphy and W. P. Marnane: Optimisation of the SHA-2 Family of Hash Functions on FPGAs, IEEE Computer Society Annual Symposium on VLSI: Emerging VLSI Technologies and Architectures (ISVLSI 06), IEEE Computer Society, Washington DC, pp. 317-322, 2006.

[8]. Y. Jararweh, L. Tawalbeh, H. Tawalbeh and A. Moh'd: Hardware Performance Evaluation of SHA-3 Candidate Algorithms, Journal of Information Security, vol. 3 No. 2, 2012, pp. 69-76. doi: 10.4236/jis.2012.3, 2008.

[9]. I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci: Wireless sensor network: a survey, Computer Networks, vol. 38, pp. 393-422, 2002.

[10]. Erik Dahmen and Christoph Kraus: Short Hash-based Signatures for Wireless Sensor Networks, 8th International Conference on Cryptology & Network Security (CANS), Kanazawa, Ishikawa, Japan, December, 2009.

[11]. Tao Qen, Hanli Chen: An Enhanced Scheme against Node Capture Attack using Hash Chain for Wireless Sensor Network, Information Technology Journal 11 (1), pp. 102-109, 2012.

[12]. Paulo Barreto, Ventzislav Nikov, Svetla Nikova, Vincent Rijmen, Elmar Tischhauser: Whirlwind: a new cryptographic hash function, Springer, vol. 56, pp.141–162, 2010.

[13]. Amrita Ghosal, Subir Halder & Sipra DasBit, : A Dynamic TDMA based scheme for securing query processing in WSN, Journal of Mobile Communication, Computation and Information, vol.18, number 2, pp. 165-186, 2012.

[14]. https://en.wikipedia.org/wiki/Cryptographic_hash_function accessed on 18-07-2015

[15]. Atmel AVR8-bit Microcontroller ATmega 128 processor datasheet (http://tools.ietf.org/html/rfc4270).

[16] Amrita Ghosal, Subir Halder & Sipra DasBit, : A Dynamic TDMA based scheme for securing query processing in WSN, Journal of Mobile Communication, Computation and Information, vol. 18, number 2, pp. 165-186, 2012

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Design and Analysis of Wing fuselage attachment bracket for fighter aircraft

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Abstract— Fighter aircraft is a highly complex structure. The aircraft needs to execute complicated maneuvers while fighting with enemies. Complicated maneuvers will require instant change in acceleration. The combination of high level of acceleration and complicated maneuvers will introduce high magnitude of loads on the wings. Normally the fighter aircraft will have wing-fuselage attachments at more than one location. Rarely an aircraft will fail due to a static overload during its service life. For the continued airworthiness of an aircraft during its entire economic service life, fatigue and damage tolerance design, analysis, testing and service experience correlation play a pivotal role. In the current project, an attempt will be made to predict the fatigue life of wing-fuselage attachment bracket in a fighter airframe. In a metallic structure fatigue manifests itself in the form of a crack which propagates. If the crack in a critical location goes unnoticed it could lead to a catastrophic failure of the airframe. Fatigue cracks will appear at the location of high tensile stress locations. These locations are invariably of high stress concentration. Fatigue life calculation will be carried out for typical service loading condition using constant amplitude S-N data for various stress ratios and local stress history at stress concentration.

Keywords— Fatigue life , Fighter aircraft , Finite element method , service loading condition, static load, stress concentration, wing-fuselage.

INTRODUCTION

An aircraft is a complex structure, but a very efficient man-made flying machine. Aircrafts are generally built-up from the basic components of wings, fuselage, tail units and control surfaces. The load-bearing members of these main sections, those subjected to major forces, are called the airframe. The airframe is what remains if all equipment and systems are stripped away. In most modern aircrafts, the skin plays an important role in carrying loads. Sheet metals can usually only support tension. But if the sheet is folded, it suddenly does have the ability to carry compressive loads. Stiffeners are used for that. A section of skin, combined with stiffeners, called stringers, is termed a thin-walled structure.

Fighter aircraft : A fighter aircraft is a high-speed military or naval airplane designed primarily for air-to-air combat with other aircraft, as opposed to a bomber, which is designed primarily to attack ground targets by dropping bombs (i.e., to destroy enemy aircraft in the air). It is a fast maneuverable fighter plane designed to intercept enemy aircraft. The hallmarks of a fighter are its small size, speed and maneuverability.

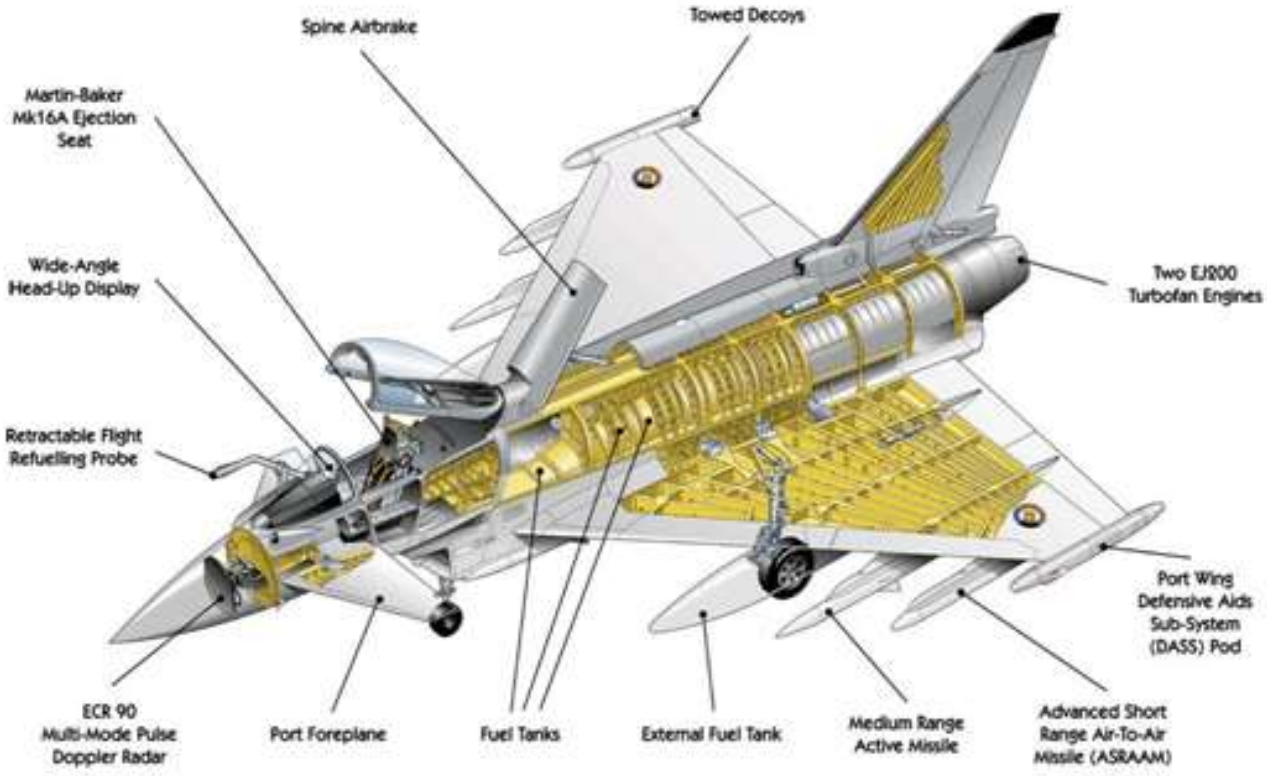

Fig.1: Euro fighter aircraft.

LITERATURE SURVEY

Literature papers from different international journals are collected and presented in the following sections. The literature papers collected are from the following international journals.

- International Journal of Fatigue
- Engineering Fracture Mechanics
- Engineering Failure Analysis
- Computers and Structures

The literature topics are more relevant to the design and analysis of wing fuselage attachment bracket as a part of aircraft design and development.

PROBLEM DEFINITION

- To design of a wing fuselage attachment bracket against fatigue failure.
- Linear static stress analysis of the wing fuselage lug attachment bracket.
- Calculation of the fatigue life to crack initiation in the wing fuselage lug attachment bracket.

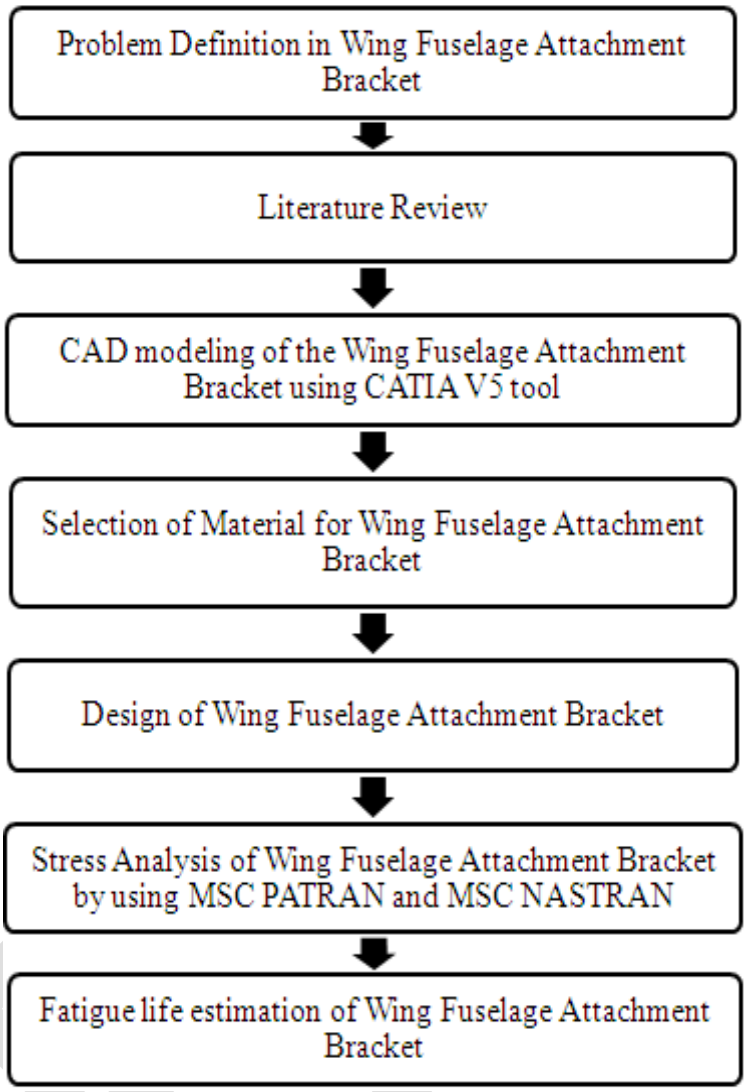

Fig.2: Methodology for Design and analysis of wing fuselage attachment bracket for fighter aircraft.

The above flowchart represents the sequence of operations which are going to performed on the present work respectively.

The below figure represents the Production drawing of Wing fuselage attachment bracket for fighter aircraft it represents the Top view and Front view of fuselage attachment bracket based upon this design production of wing fuselage is to be manufactured.

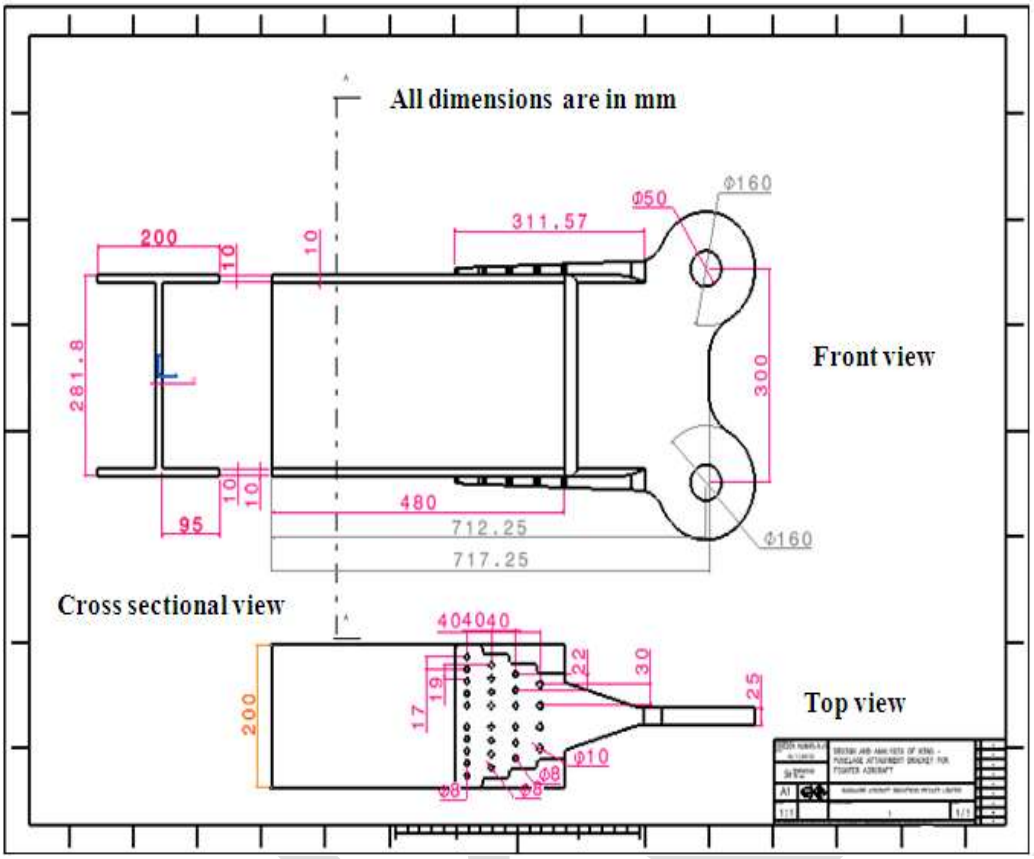

Fig.3: 2-D views of the wing- fuselage attachment bracket.

MATERIAL SPECIFICATION

- The material used for the lug attachment bracket of the structure is Steel Alloy; Heat Treated AISI-4340, with the following properties.
- The material used for the I-sectional spar and rivets of the structure is Aluminium Alloy – 2024-T351, with the following properties.

Table.1: Material Properties for Fuselage attachment bracket for fighter aircraft.

S.NO	PARAMETERS	Steel Alloy,AISI-4340	Aluminum Alloy-2024-T351
1	Young's Modulus(N/mm^2)	203000	72400
2	Poison's Ratio	0.32	0.33
3	Ultimate Tensile Strength (N/mm^2)	1835	503.7
4	Yield Stress, $б_y$ (N/mm^2)	1600.8	472.6

LOAD CALCULATION FOR THE WING FUSELAGE ATTACHMENT BRACKET

Aircraft category = medium size of fighter aircraft

Total weight of the aircraft = 6000kg = 58800N

Load factor considered in design = 6g

Design limit load on the structure = 58800*6 = 352800N

Factor of safety considered is = 1.5

Design ultimate load = 352800*1.5 = 529200N

Distribution of lift load on fuselage and wing = 35% and 65%.

Total load acting on the wings = 529200*0.65 = 343980N

Load acting on the each wing = 343980/2 = 171990N

Number of sparse in the wing = 3

Load sharing by spares is a) spar 1 = 30% b) Spar 2 = 45% c) Spar 3 = 25%

The wing fuselage attachment considered for the current analysis is at spare 3.

Therefore, load acting on the spare 3 = 171990*0.25 = 42997.5N

Therefore, Total load acting on the wing-fuselage (lug) attachment bracket is P_1 = 90584.62N.

FINITE ELEMENT ANALYSIS

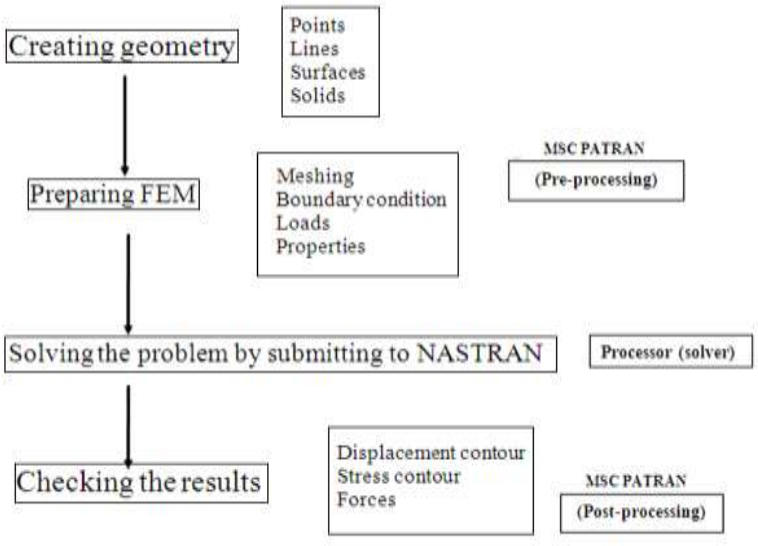

Fig.4: Different Stages of Finite Element Analysis

Developing a finite element model manually is a time consuming, tedious and error prone activity making sense of the large stake of finite element computer output is also a considerable challenge.A finite element pre and post processors (such as MSC/PATRAN) is a graphic based software package primarily designed to aid in the development of Finite Element Model (Pre processing) and to aid the display and interpretation of analysis results (Post processing). MSC/ PATRAN software is a mechanical computer aided engineering tool created for design engineers.

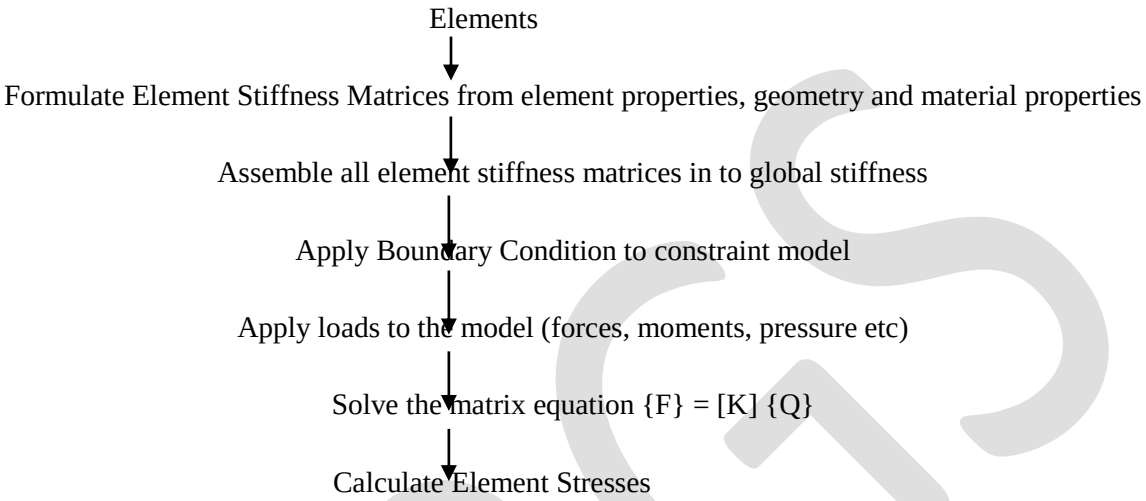

Fig.5: Flow chart of basic steps in MSC/PATRAN

PHYSICAL STRUCTURE OF WING FUSELAGE ATTACHMENT BRACKET IN FEA

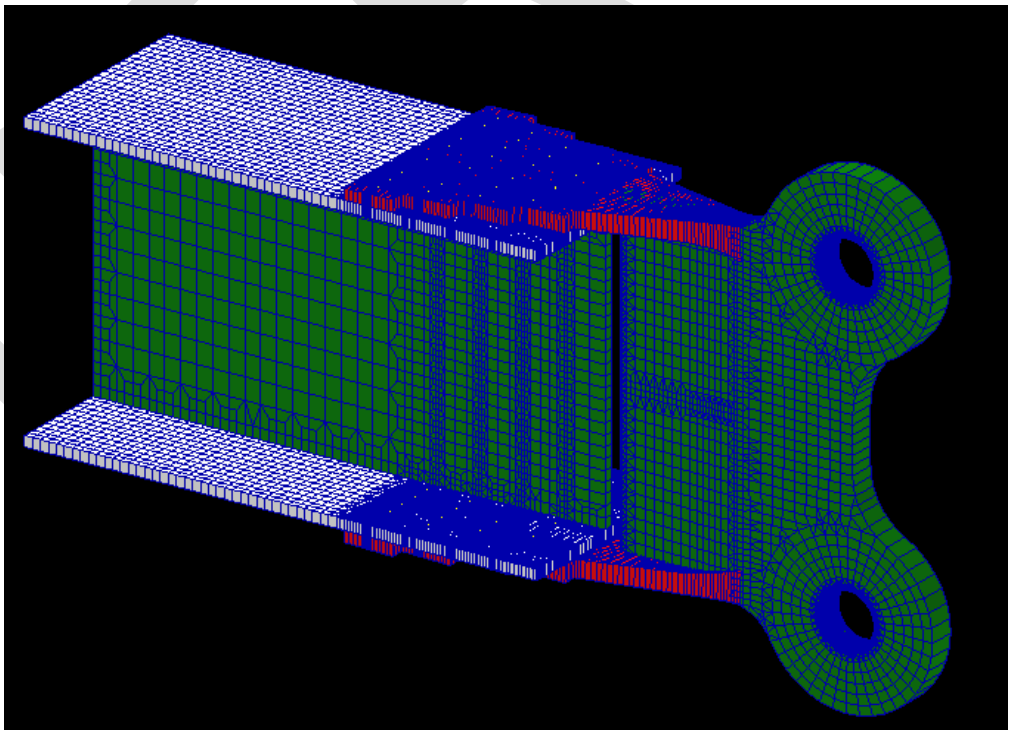

Fig.6: Physical structure of wing fuselage attachment bracket in FEA

As per the design calculations from the previous section the dimensions of the wing fuselage attachment bracket at the pin hole are used in the actual model of the lug attachment bracket.

LOADS AND BOUNDARY CONDITIONS

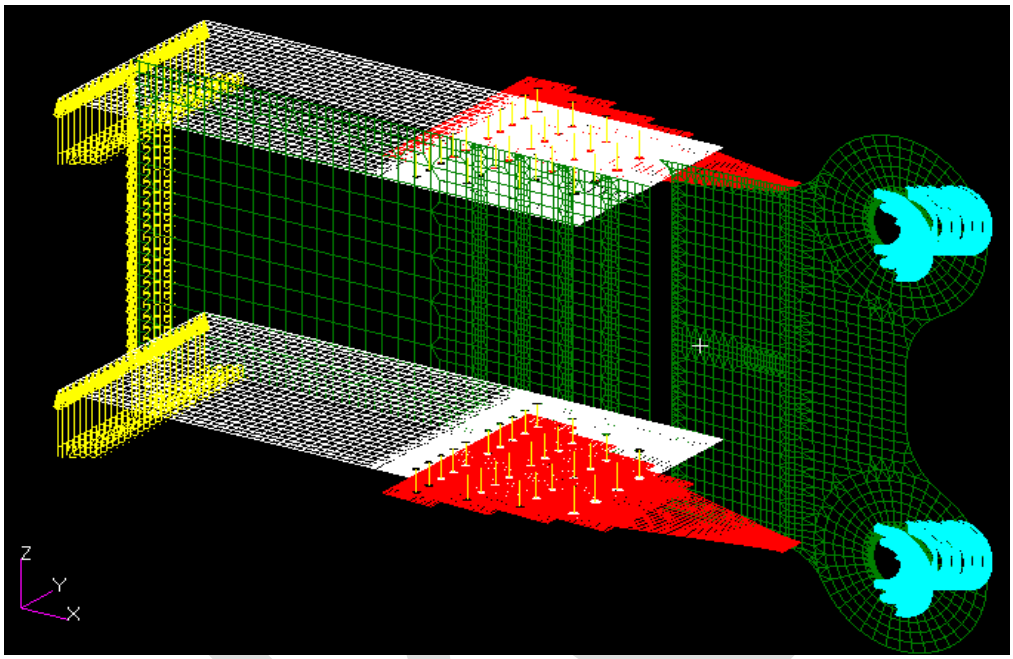

Fig.7: Loads & boundary conditions applied to the wing fuselage attachment bracket

The loads and boundary conditions along with the finite element model are shown in the Fig.7.A load of 90,584.62N is introduced at one end of the spar beam. This load will essentially create the required bending moment at the root.

MAXIMUM STRESS & MAXIMUM DISPLACEMENT IN WING FUSELAGE ATTACHMENT BRACKET

The stress values at the lug attachment bracket hole and the displacement contours are shown in the Fig.8 and Fig.9 respectively. A maximum stress of 968N/mm^2 is observed at the midpoint of the attachment hole section. Ultimate strength of Steel Alloy, Heat treated AISI-4340 is 1835 N/mm^2**.** Here max. Stress is less than the ultimate strength of structure; therefore we can say structure is safe for applied load.

The stress values at the lug attachment bracket hole and the displacement contours are shown in the figure 9 respectively. A maximum stress of 427N/mm^2 is observed at the riveted joints in I- sectional spar. Ultimate strength of Aluminium Alloy – 2024-T351 is 503.7N/mm^2.

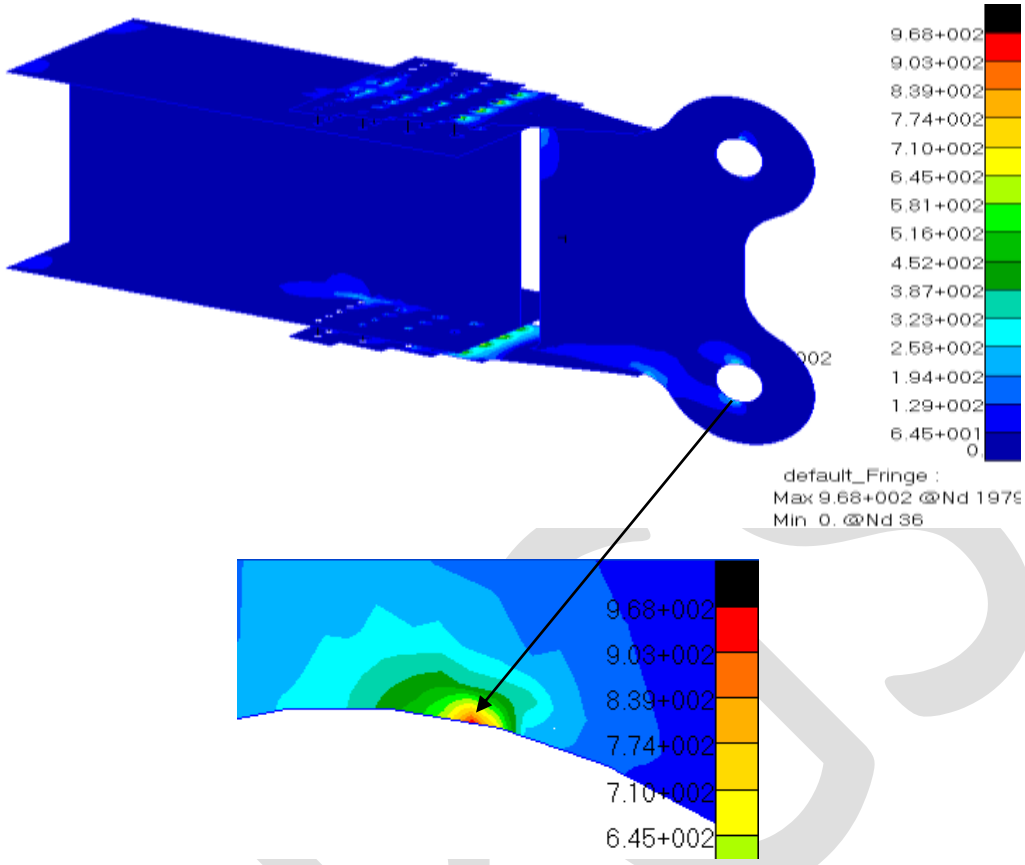

Fig.8: Max. Stresses in wing fuselage attachment bracket and Maximum stress at lug hole.

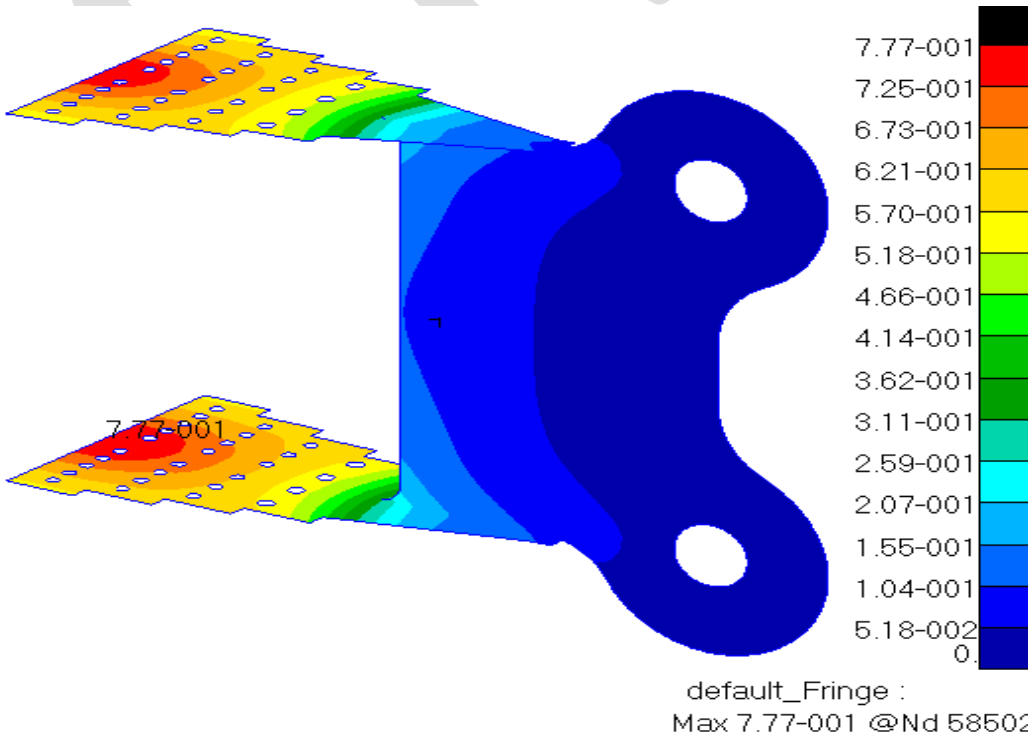

Fig.9: Maximum Displacement in wing fuselage lug attachment bracket.

FATIGUE LIFE

Fatigue is a phenomenon caused by repetitive loads on a structure. It depends on the magnitude and frequency of these loads in combination with the applied materials and structural shape. Structural members are frequently subjected to repetitive loading over a long period of time. Often machine members subjected to such repeated or cyclic stressing are found to have failed even when the actual maximum stresses were below the ultimate strength of the material, and quite frequently at stress values even below the yield strength. The most distinguishing characteristics are that the failure had occurred only after the stresses have been repeated a very large number of times. Hence the failure is called fatigue failure.

FACTORS THAT AFFECT FATIGUE LIFE

Geometry: Notches and variation in cross section throughout a part lead to stress concentrations where fatigue cracks initiate.

Material Type: Fatigue life, as well as the behavior during cyclic loading, varies widely for different materials, e.g. composites and polymers differ markedly from metals.

Residual stresses: Welding, cutting, casting, and other manufacturing processes involving heat or deformation can produce high levels of tensile residual stress, which decreases the fatigue strength.

Size and distribution of internal defects: Casting defects such as gas porosity, non-metallic inclusions and shrinkage voids can significantly reduce fatigue strength.

Direction of loading: For non-isotropic materials, fatigue strength depends on the direction of the principal stress.

Environment: Environmental conditions can cause erosion, corrosion, or gas-phase embrittlement, which all affect fatigue life. Corrosion fatigue is a problem encountered in many aggressive environments.

Temperature: Higher temperatures generally decrease fatigue strength.

MAXIMUM STRESS OBTAINED BY ANALYSIS OF WING FUSELAGE ATTACHMENT BRACKET (STEEL ALLOY AISI-4340)

In above analysis of wing fuselage lug joint, we considered the maximum loading condition and factor of safety. Therefore by considering the maximum conditions the stress in the structure is 968N/mm^2.The damage calculated at different g range with reference from S-N data is tabulated in the table 7.6 below.

Table 2: The range of "g", the damage accumulated from miner's formula

Range of "g"	**Applied no of cycles (ni)**	**No of cycles to failure from graph(Nf)**	**Damage accumulated from miner's formula (D_i)**
0.5 g to 1.0 g	15000	$>10^8$	1.5×10^{-4}
1.0 g to 1.5 g	25000	$>10^8$	2.5×10^{-4}
1.5 g to 2.0 g	10000	$>10^8$	1×10^{-4}
2.0 g to 2.5 g	12000	$>10^8$	1.2×10^{-4}
2.5 g to 3.0 g	15000	$>10^8$	1.5×10^{-4}
3.0 g to 3.5 g	20000	$>10^8$	2×10^{-4}
3.5 g to 4.0 g	5000	$>10^8$	0.5×10^{-4}
4.0 g to 4.5 g	450	$>10^8$	0.3×10^{-4}
4.5 g to 5.0 g	350	$>10^8$	0.1×10^{-4}
5.0 g to 5.5 g	250	$>10^8$	0.025×10^{-4}
5.5 g to 6.0 g	150	$>10^8$	0.015×10^{-4}

MAXIMUM STRESS OBTAINED BY ANALYSIS OF I-SECTIONAL SPAR(ALUMINIUM ALLOY 2024-T351)

IN ABOVE ANALYSIS OF I -SECTIONAL SPAR IN WING FUSELAGE ATTACHMENT BRACKET, WE CONSIDERED THE MAXIMUM LOADING CONDITION AND FACTOR OF SAFETY. THEREFORE BY CONSIDERING THE MAXIMUM CONDITIONS THE STRESS IN THE STRUCTURE IS $427N/MM^2$.

Table 3: The range of "g", the damage accumulated from miner's formula

Range of "g"	Applied no of cycles(n_i)	No of cycles to failure from graph(N_f)	Damage accumulated from miner's formula (D_i)
0.5 g to 1.0 g	15000	$>10^8$	1.5×10^{-4}
1.0 g to 1.5 g	25000	$>10^8$	2.5×10^{-4}

1.5 g to 2.0 g	10000	$>10^8$	1×10^{-4}
2.0 g to 2.5 g	12000	$>10^8$	1.2×10^{-4}
2.5 g to 3.0 g	15000	$>10^8$	1.5×10^{-4}
3.0 g to 3.5 g	20000	$>10^8$	2×10^{-4}
3.5 g to 4.0 g	5000	$>10^8$	0.5×10^{-4}
4.0 g to 4.5 g	450	$>10^8$	0.3×10^{-4}
4.5 g to 5.0 g	350	$>10^8$	0.1×10^{-4}
5.0 g to 5.5 g	250	4800	0.025×10^{-4}
5.5 g to 6.0 g	150	3700	0.015×10^{-4}

RESULTS & DISCUSSIONS

The maximum stress value is found in the case of bearing mode. As per the design consideration the maximum allowable stress in the lug attachment bracket is 40% of the UTS which is 1530 N/mm^2. Therefore the configuration used in wing fuselage attachment bracket for geometry is found to be satisfactory.

Table 4: Modes of failure with stress in N/mm^2

S. NO	**modes of failures**	**Max stress(σ_{max}) in N/mm^2**
1	Net-section failure	78.472
2	Bearing Failure	172.168
3	Shearing Failure	56.63

ANALYSIS OF WING FUSELAGE ATTACHMENT BRACKET

The max. Stress obtained in the structure, material used for the structure, ultimate strength of the material. In both the cases max. Stress is less than the ultimate strength of the material. According to stress-strain diagram of respective material, structure will not fail for applied load (i.e. load acting on wing fuselage attachment bracket is $90.677\times e^3$N). When the max. Stress is greater than or equal to the ultimate strength of structure than only structure is going to fail.

Table 5: Max. Stress obtained in the structures in N/mm^2

S.NO	Name of the structures	Material used	Ultimate strength of the material (in N/mm^2)	Max. stress by FEA(in N/mm^2)
1	wing fuselage lug attachment bracket	Steel Alloy, Heat treated AISI- 4340	1835	968
2	I-sectional spar	Aluminium Alloy –2024-351	503.7	427

FATIGUE LIFE ESTIMATION

The Total damage accumulated in both structure is 0.000296, which is less than 1. Therefore a crack will not get initiated from the location of maximum stress in both structures (i.e. wing fuselage attachment bracket) for given load spectrum.

Table 6: Fatigue Life Estimation.

S.NO	Name of the structures	Material used	Ultimate strength of the material (in N/mm^2)	damage accumulation per block (D_a)
1	wing fuselage lug attachment bracket	Steel Alloy, Heat treated AISI- 4340	1835	0.000296<1
2	I-sectional spar	Aluminium Alloy –2024-351	503.7	0.000296<1

ACKNOWLEDGMENT

If acknowledgement is there wishing thanks to the people who helped in work than it must come before the conclusion and must be same as other section like introduction and other sub section.

CONCLUSION

Stress analysis of the wing fuselage attachment bracket is carried out in this paper and maximum tensile stress is identified at one of the lug-holes. FEM approach is followed for the stress analysis of the wing fuselage attachment bracket.A validation for FEM approach is carried out by considering a plate with a circular hole. Maximum tensile stress of 968N/mm^2 is observed in the lug hole. Several iterations are carried out to obtain a mesh independent value for the maximum stress. A fatigue crack normally initiates from the location maximum tensile stress in the structure. The fatigue calculation is carried out for an estimation of life to crack initiation. From the calculations maximum damage fraction of 0.000296. The value of damage fraction is much less than 1. hence the crack will not get initiated for the given load spectrum. Therefore design is safe.

REFERENCES:

[1] O. Gencoz, U.G. Goranson and R.R. Merrill, "Application of finite element analysis techniques for predicting crack propagation in lugs". Boeing Commercial Airplane Company, Seattle, Washington, 98124, USA.

[2] T.R. Brussat, K. Kathiresan and J.L. Rudd, "Damage tolerance assessment of aircraft attachment lugs". Lockheed-California Company, Burbank, CA 91520, U.S.A., AT&T Bell Laboratories, Marietta GA 30071, U.S.A., AFWAL/FIBEC, Wright-Patterson Air Force Base, OH 45433, U.S.A.

[3] R. Rigby and M. H. Aliabadi, "Stress intensity factors for cracks at attachment lugs". British Aerospace, Filton, Bristol BS99 7AR, U.K. Wessex Institute of Technology, Southampton S040 7AA, U.K.

[4] J. Vogwell and J. M. Minguez, "Failure in lug joints and plates with holes". School of Mechanical Engineering, University of Bath, Bath BA2 7AY, U.K., Facultad de Ciencias, Universidad Del Pais Vasco, Bilbao, Spain.

[5] C. R. F. Azevedo, E. Hippert, Jr. , G. Spera and P. Gerardi, "Aircraft landing gear failure: fracture of the outer cylinder lug". Laboratory for Failure Analysis, Instituto de Pesquisas Tecnológicas, PO Box 0141, São Paulo, Brazil.

[6] Madan G. Kittur and Ronald L. Huston, "Finite element mesh refinement criteria for stress analysis". Aero Structures, Inc., 1725 Jefferson Davis Highway, Suite 704, Arlington, VA 22202, U.S.A., Department of Mechanical and Industrial Engineering, University of Cincinnati, Cincinnati, OH 45221-0072, U.S.A.

[7] J. SCHIJVE and A. H. W.HOEYMAKERS, "Fatigue crack growth in lugs". Department of Aerospace Engineering, Delft University of Technology, the Netherlands.

[8] K. Kathereean, H.S Pearson, and G.J. Gilbert, "Fatigue crack growth of a corner crack in an attachment lugs". Department 72-77, zone 415, Lock Head, Georgia Company, Marietta, Georgia, 30063, USA.

[9] S.Freidrich, J. Schijve, "Fatigue crack growth of corner cracks in lug specimens". Delft university of technology, Department of aerospace engineering, Netherlands, Jan 1983.

[10] O. Gencoz, U.G. Goranson and R.R. Merrill,"Application of finite element analysis techniques for predicting crack propagation in lugs", Boeing Commercial Airplane Company, Seattle, Washington, 98124, USA.

[11] R. Rigby and M. H. Aliabadi,"Stress intensity factors for cracks at attachment lugs". British Aerospace, Filton, Bristol BS99 7AR,U.K., Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton S040 7AA, U.K.

[12] J. Vogwell, J. M. Minguez , "Failure in lug joints and plates with holes". School of Mechanical Engineering, University of Bath, Bath BA2 7AY, U.K., Facultad de Ciencias, Universidad Del Pais Vasco, Bilbao, Spain.

[13] C. R. F. Azevedo, E. Hippert, Jr. , G. Spera and P. Gerardi,"Aircraft landing gear failure: fracture of the outer cylinder lug. Laboratory for Failure Analysis", Instituto de Pesquisas Tecnológicas, PO Box 0141, São Paulo, Brazil.

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Ethernet Based Data Acquisition System Using LabVIEW

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Abstract— In scientific research organizations like Institute for Plasma Research (IPR), Data Acquisition system is widely used for acquiring signal emanated from sensors in different systems. Thus multifunction board is designed which acquires as well as generate analog voltage. The hardware consists of ADC, DAC, FPGA and Ethernet controller. The control signal for interfacing Ethernet controller, ADC and DAC is generated in FPGA. The data is transferred from board to host PC through Ethernet. The software for acquisition is developed in LabVIEW.

The present work proposes a simple, robust multifunctional data acquisition with industrial standards for isolation and compactness. It is suitable for slow sampling analog data acquisition where data accuracy and resolution is more important than the rate of sampling.

Keywords — ADC, DAC, Data acquisition, Ethernet Controller, FPGA, Host PC, LabVIEW.

INTRODUCTION

Data Acquisition, a process of Measuring and study of various physical world parameters such as voltage, temperature, or pressure, etc. in digital domain, i.e. any monitoring and control system, which acquires the signals emanating from sensors or transducers, and an acquiring system or board which conditions the signals as a data for analysis, measurement and control as well. The most basic Data Acquisition system consists of various sensors and detectors mounted for capturing the respective physical condition, data acquisition hardware, and a monitoring and control unit.

The data acquisition system is focused at establishing the communication interfaces between front-end signals. During operation a large amount of data is generated from various front end components. The creation of more data per pulse will challenge our ability to analyse and assimilate all of the data. Enhanced visualization tools will be required that allow this increasing data volume to be effectively used for decision making by the experimental team and to advance the science. The Data Acquisition is the unit which serves this purpose. The goal of Data Acquisition is to make every bit productive, which means no physics information should be lost and at the same time no unnecessary data should be obtained. [11] .The needs of loss-less data acquisition have significant effect on instrumentation and specifically on the selection of acquisition hardware. [12]. In Industries, research centers and research institutes most of the machines and experimental setups are placed in a remote environment, such as a high magnetic field or high temperature etc. During the operation it's unsafe to access various instruments or devices. Hence in such cases the machine access control and personnel safety is a major issue and forms an integral part of its operational guidelines. Controlling, measuring and monitoring of different parameters and properties are done quite far from the machine. If done manually, then the probability of occurrence of human error cannot be neglected. Hence the design, development and deployment of an automatic and remotely operable system for the whole of these electronics systems and Data Acquisition and control unit are highly desirable.

MOTIVATION

In most of the diagnostic systems, the flow of signal acquired from the sensors to the Data Acquisition & control unit is as shown in figure below.

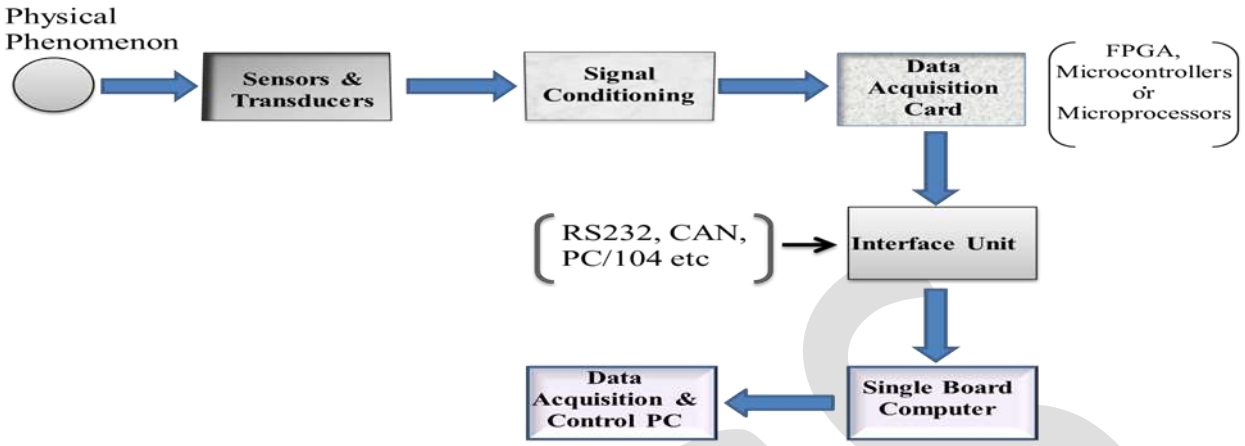

FIGURE 2: DATA ACQUISITION AND CONTROL FLOW

As can be observed, the signals from various sensors and transducers that acquires it from the physical architectures, are fed to the signal conditioning unit, which further sends the processed signal to the Data acquisition hardware board centralized with FPGA, where the signal is acquired and digitized. Now the data so obtained is sent to the Single Board Computer (SBC) through interfacing unit. The purpose here can be served using various interfacing and communication standards such as Serial communication through RS 232 based lines, or based on CAN bus, etc. But these options have some limitations as described below –

RS 232 :

- RS-232 Bus has a limitation of length.
- RS-232 found its applications where very low cost is more important than performance.
- RS-232 is comparatively slower.
- RS-232 supports peer to peer communication.
- RS-232 is a "Physical Layer" within the ISO/OSI model (not more).

CAN :

- Max speed is limited to 1Mbit/sec.
- All messages get broadcasted and there can be many recipients.
- Max length at full speed is limited to 30-40 Meters.
- Undesirable interaction more probable in case of CAN based communication.

Considering and overcoming these limitations we have selected the Ethernet communication.

ETHERNET :

The Ethernet has following hike over the options stated above:

- Ethernet is much faster than RS-232, max speed 10/100/1000 Mb/sec.
- Ethernet has a better shielding against magnetic disturbances (also in case of optical cables it's possible). On the other side RS-232 does not provided such property.
- Ethernet covers "Data Link as well as Physical Layer".
- Ethernet can go very long distance, i.e. not bound with length limitations.

Currently, for serving the purpose of transferring data to controlling PC using Ethernet is done with the help of an external processing unit i.e. a Single Board Computer (SBC). The single board computer is interfaced to acquisition module through PC/104 bus. The SBC used has its own limitations such as length and speed of PC/104 is limited; it requires an external separate power supply using SMPS. Use SMPS may cause damage to the circuitry due to its limitations which is undesired for the sensitive acquisition modules and circuitries. Also the whole assembly so made is bulky so as to be used as a general purpose board, and it also hikes the overall cost of the system.

These flaws can be resolved if any alternate module can be used which can serve the whole purpose with similar or enhanced efficiency and performance and using less power, space as well be cheaper than the current one.

RELATED WORK

In [2] authors used RS232 protocol based communication link between FPGA on DAQ board and the host PC. The signals digitized by serial ADC are sent to DAQ module centralized on SPARTAN 3 FPGA and further transmitted to the host PC as data via a RS232 interface. Authors associated with [3] used TCP/IP based communication to link the server and the client PC. The server PC communicates with the National Instruments (NI) make DAQ card over USB interface. The developed system provides good long range acquisition, but may cost high. Authors of [4] have proposed the concept and advantages of customized stand alone DAQP system with reconfigurable FPGA over the other DAQ boards present in market. For their design they have used NI make DAQ card with closest similarities with their proposed device, with multichannel multiplexed ADC for attaining 4 semi-simultaneous channels. In [5] authors have designed a data acquisition system with embedded PC/104 platform to cope with the ADITYA TOKAMAK's data acquisition system. The CPLD core is used to ensure control and bus interface logic. The embedded single board computer that supports PC/104 bus is used as a main processing unit which has Windows XP embedded operating system support. The designed system has MDSPlus and MATLAB based client application on host PC. A microcontroller based DAQ with PIC microcontroller as a core is designed by the authors of [6]. The system communicates with control PC via USB and the application program for the PC is developed using MATLAB. In [7] Authors had designed a Versa Module Europe (VME) based DAC for the SST-1 TOKAMAK's ECRH system based on gyrotron operation. The system uses Motorola make SBC, Power PC MPC107 and VME hardware as a target server while Fedora 6.0 based PC as a client. Here, Host PC and PowerPC are linked with 100 Mbps Ethernet link. MDSPlus has been used for the data management using the client/server model. In [8] authors with their work presented a Data Acquisition system in an Altys system from Digilent having FPGA core, and an ADC is attached with the Altys board. Instead of using any external processor like SBC the authors had implemented an 8-bit RISC processor with ATMEGA168 AVR architecture. A MAC logic core for system to support Ethernet compatibility is also implemented on FPGA.

PROPOSED DATA ACQUISITION SYSTEM

The main drawbacks of the present systems are slow data acquisition speed, low throughput, need of keen maintenance and bulky system due to SBC with PC/104 bus and the cost.

The focus of the work proposed is that if somehow SBC can be removed with suitable replacement that must be compact, having larger data throughput, reliable as well as easily reconfigurable.

The block diagram of the proposed system is shown in figure 2 below. In the proposed system, to avoid the bulkiness of the system, the whole assembly of the Single Board Computer (SBC), its power supply is replaced with the module of Ethernet controller, i.e. WIZNET's W5300 for the Ethernet communication operation. The purpose of control, processing and implementation of TCP server for the communication is fulfilled by the use of MicroBlaze's IP core of Micro Controller System (MCS), which is programmed using system C language in Xilinx Software Development Kit (SDK) Platform. The MCS serves the role of interfacing the FPGA with the Wiznet. The acquired data from the various sources are passed through MCS to the Wiznet and are then are feed to the network using Ethernet. Here, the flow of signal from FPGA to Wiznet is much higher as compared to the 1mbps speed of the PC/104 bus, due to a much faster 40 MHz clock which drives the MCS.

Now the Control PC connected to the same server as that of the assembly can access the data from Ethernet by the help of GUI made by graphical programming on the LabVIEW platform, which make the PC as a TCP client. The front panel of the GUI is shown in Figure 3. The analyst or controller can view, acquire, and also control the operation by manipulating various properties sitting far distant from the machine through Ethernet and proposed system.

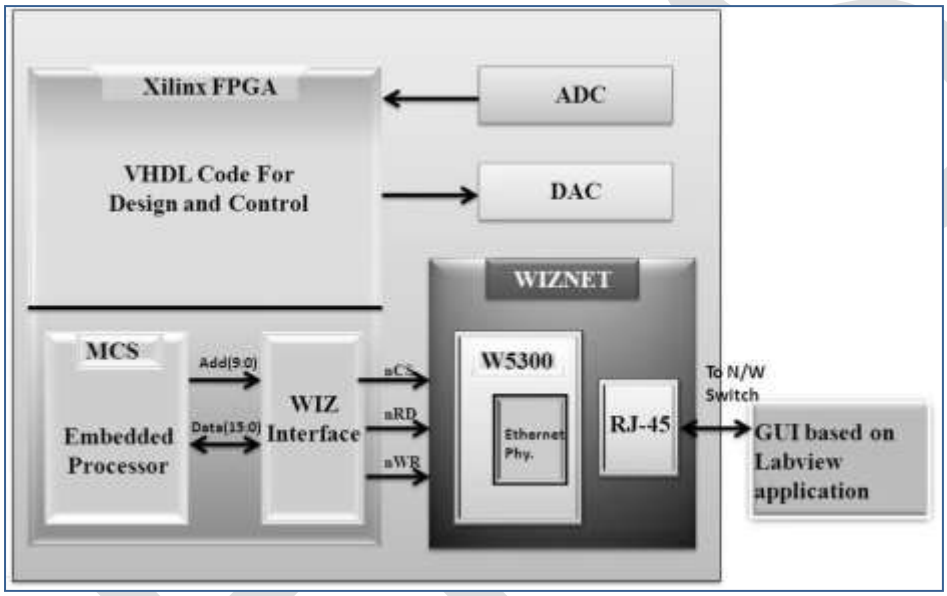

Figure 2: The Block Diagram Representation of the Proposed Hardware

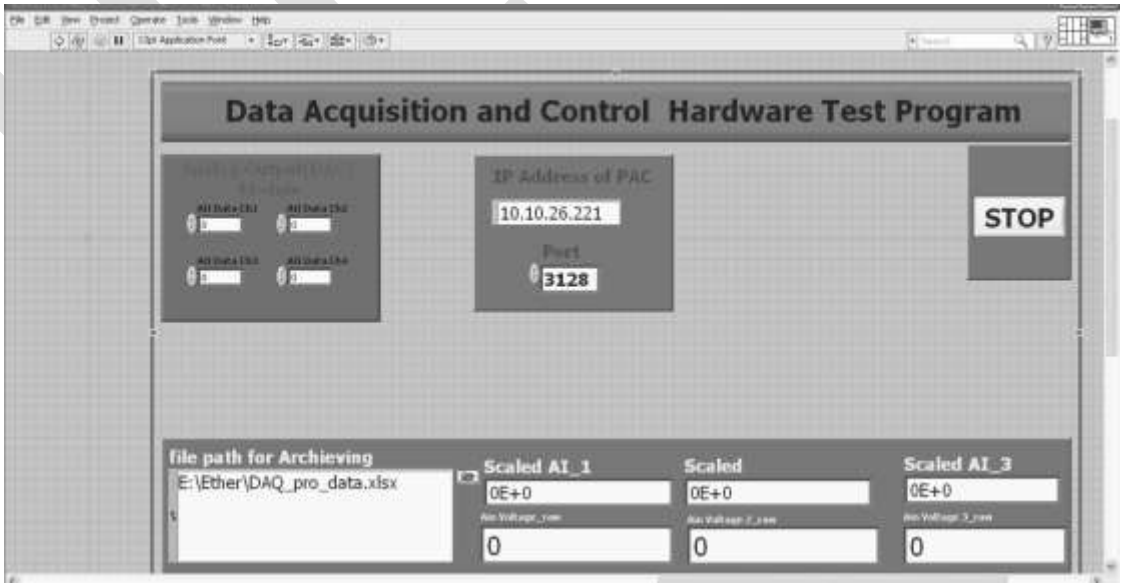

Figure 3: The Front panel of Client GUI on LabVIEW

There are various software platforms which can be used for serving the purpose of acquiring data and controlling for data acquisition system. Such as, MDSPlus, SCADA, LabVIEW, and various open source platforms for Linux O.S. based systems.

Among these, MDSPlus only have the characteristics of acquiring data but the purpose of controlling cannot be served by it, as well as it is not necessary that all the control and analysis systems have the Linux OS. Also, for fast data acquisition the hardware's made by National Instruments (NI) are well known and are used in the IPR. So, taking these aspects in mind the LabVIEW by NI is used Data acquiring and controlling.

To monitor and recording of the signals from the sensors or front end instruments a data acquisition system requires it to be digitized first. So for converting these analog signals to the digital equivalent Anlog to Digital converters (ADC) are essential. Here for our system, a Texas Instrumentation make, 4-channel ADC ADS1274 with 24 bit resolution is selected to get the better throughput and high precision of conversion. The ADC is interfaced with the Spartan 6 FPGA using SPI mode. The interfacing can be seen by the block diagram shown below:

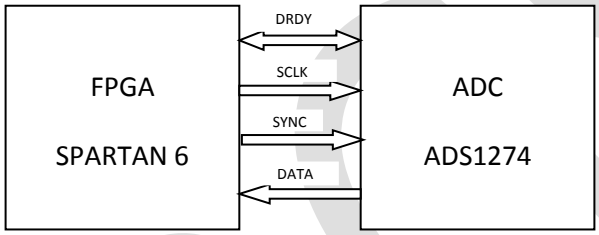

Figure 4: Interfacing of FPGA with ADC using SPI format

This ADC provides the sampling rate of about 128ksps with a wide bandwidth of 62MHz. The digitized data received by FPGA is then fed to DAC as well to the Ethernet controller (W5300), which feds this data further to the network through Ethernet link and hence to the control PC having TCP client GUI on LabVIEW. The flow of signal or data between client program on LabVIEW and Ethernet controller via Ethernet link is a two way flow, i.e. the control signal sent from the client GUI on LabVIEW is also sent to the DAQ via the Ethernet link which can be routed to analog out channels after conversion from digital form to analog by DAC. The flow can be seen in figure 2.

The digital control signals in digital domain need to be converted to the analog domain so as to feed the front end instruments. So a Digital to Analog Converter (DAC) comes to lime light. For proposed design AD5684 a 12 bit DAC made by Analog Devices (AD) is used. It is a 4 channel, low power DAC which offers 12 bit buffered voltage output. The DAC supports SPI interface, so it communicates with the FPGA via SPI link. The interfacing block diagram is shown below:

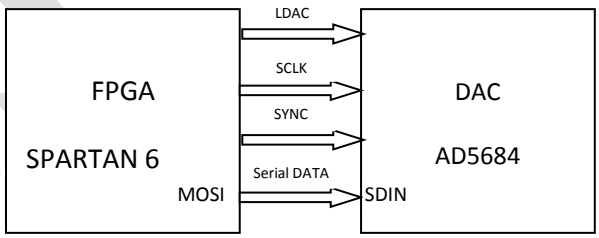

Figure 5: SPI interface between FPGA and DAC

IMPLEMENTATION AND RESULT

All the components are placed and properly interfaced with each other. Now, the software codes are written for FPGA on Xilinx ISE 14.6, using Very High Speed Integrated Circuit Hardware Description Language (VHSIC HDL or VHDL). A soft IP core of 32 bit

RISC micro-controller system (MCS); MicroBlaze is implemented on SPARTAN 6 FPGA. The firmware part that includes control signals for all the devices and the TCP server specifications are written on it using one of the Xilinx Embedded Development Kit; Software Development Kit (SDK). This program helps to configure Wiznet's Ethernet controller W5300 to establish the TCP/IP communication link between the TCP server, FPGA in DAQ board and the TCP client program on LabVIEW.

As a result of establishing TCP/IP link between DAQ board and the control PC, The board should respond to the PING command having IP address allocated to board. The response of Pinging is shown below:

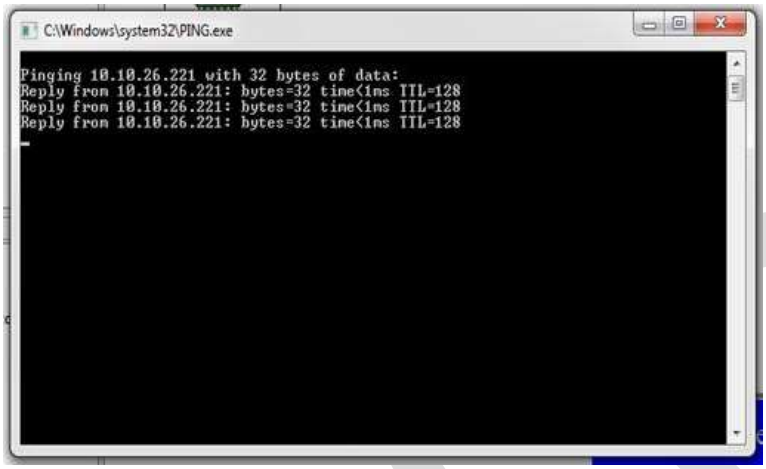

Figure 6: Response of PING command

The goal of the work is to design a Data Acquisition System which can acquire the external analog signals and the observer sitting far from the operational setup should be able to monitor and store those signals as a data for future calculations and study. Also, there is a provision that a observer or controller can manipulate the instrument's physical control parameters by sending a control signal with the help of control made on LabVIEW GUI from a remote location over an Ethernet link.

So, our system is able to achieve the above stated goals, the images below the LabVIEW front panel, the measurement of the output taken from DAC. The figure shows the measured output from analog output pins of the proposed board i.e. nearly equals the control voltage provided from the front panel of LabVIEW and also the input voltage to DAQ board can be monitored on LabVIEW (represented by white arrows).

Figure 7: Acquired voltage and control voltage output monitoring

CONCLUSION

The discussion on results shows that the proposed system performs as expected. A Data Acquisition board is designed keeping the survey results [1] in mind. A MicroBlaze IP core is included in the design. We have succeeded to establish a TCP/IP link between the designed Data Acquisition Board with the help of Wiznet's Ethernet controller and client GUI on LabVIEW. With the designed system we are able to acquire the voltage from outside and monitor it on LabVIEW front panel. Also the control voltage provided as an input from the LabVIEW client GUI on host PC to the board is received from the analog out pin of the board. As a future work it is thought to increase the number of channel, to increase the functionality of the board by making it compatible for Digital I/O and inclusion of memory. The improvement in throughput will also be on focus.

REFERENCES:

[1] Hemant Shrivastava, Utsav Malviya, "Survey and Analysis of Data Acquisition Systems" , International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), Vol. 3, Issue 11,11341-11344, November 2015

[2] Swamy TN, Rashmi KM, "Data Acquisition system based on FPGA", International Journal of Engineering Research and Applications (IJERA), Vol. 3, Issue 2, pp.1504-1509, April 2013.

[3] Bingsheng Wu, Chaozhi Cai, "Remote Data Acquisition and Signal Processing System Based on LabVIEW", Proceedings of the International Conference on Measuring Technology and Mechatronics Automation, 2009.

[4] Mohammed Abdallah, Omar Elkeelany, and Ali T. Alouani, "A Low-Cost Stand-Alone Multichannel Data Acquisition, Monitoring, and Archival System with On-Chip Signal Preprocessing", IEEE Transactions on Instrumentation and Measurement, Vol. 60, No. 8, August 2011.

[5] Rachana Rajpal, Jigneshkumar Patel, Praveena Kumari, Vipul Panchal, P.K. Chattopadhyay, Harshad Pujara, Y.C. Saxena "Embedded data acquisition system with MDSPlus" Fusion Engineering and Design 87, 2166– 2169, 2012.

[6] Anindita Bora, Kanak Chandra Sarma, "Design of a USB based Multichannel, Low Cost Data Acquisition System using PIC Microcontroller", International Journal of Computer Applications, Volume 59– No.6, 0975 – 8887, December 2012.

[7] Jatinkumar Patel, H. Patel, N. Rajanbabu, P. Dhorajiya, B. K. Shukla, R. Jha and D. Bora, "VME Based Data Acquisition and Control System for Gyrotron Based ECRH System on SST-1", Fusion Engineering (SOFE), 2013 IEEE 25th Symposium on; 01/2013

[8] A. Mazare, L. Ionescu, G. Serban, I. Lita, "FPGA-based system for data acquisition and remote communication", IEEE 20th International Symposium for Design and Technology in Electronic Packaging (SIITME), 23-26 Oct, 2014.

[9] Yonghai Ning, Zongqiang Guo, Sen Shen,Bo Peng , "Design of Data Acquisition and Storage System Based on the FPGA", International Workshop on Information and Electronics Engineering (IWIEE) ,pp- 2927 – 2931, 2012.

[10] David Potter "Using Ethernet for Industrial I/O and Data Acquisition" IEEE Instrumentation and Measuring Technology Conference, pp: 1492-1496,1999

[11] T. W. Fredian, M. J. Greenwald, D. C. McCune, D. P. Schissel, J. Stillerman "A Discussion On Data Acquisition, Data Management And Remote Participation For ITER" presented in Columbia university's fusion department.

[12] **www.ipr.res.in**

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PV BASED DUAL-OUTPUT DC/DC CONVERTER WITH SIMULTANEOUS BOOST AND BUCK OUTPUTS

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Abstract—The future of electrical system is being propelled by a fundamental shift to cleaner and more efficient converter systems. This lead to the emergence of photovoltaic (PV) cell based generation of electricity for electric systems. A PV based dual output DC-DC converter with simultaneous boost and buck outputs is discussed. The topology consists of a dual output converter with simultaneous boost as well as buck outputs. The energy harvested from solar energy can be thus utilized for producing different dc outputs. The system has lesser number of components, as well as lesser coordination communication requirements compared to other integrated topologies. Compared to traditional buck converters, the proposed converter has higher reliability, due to its inherent shoot-through protection and has a wider range of step-down outputs.

Keywords— photovoltaic, direct current, dual output, harvest, inherent, shoot-through, step-down

INTRODUCTION

Due to the drastic increase of global energy demand and rapid consumption of conventional fossil fuel resource, renewable energy has become more popular. The renewable energy resources as those derived from natural processes and replenished at a faster rate than they are consumed. Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves, and geothermal heat. Among several renewable energy resources, energy harvesting from the photovoltaic (PV) effect is the most essential and sustainable way because of abundance and easy accessibility of solar radiant energy around the earth[1]. The photovoltaic technology for converting solar energy to electricity can be utilized in many areas such as dc nanogrids, multilevel inverters, plug-in hybrid electric vehicles etc for energy conversion[3]. For conditioning the dc voltage to the required levels a DC/DC converter is usually needed. Different types of DC/DC converters are nowadays widely used in industrial as well as communicational sectors for power conditioning. A PV based dual output dc/dc converter with simultaneous boost and buck outputs for power conditioning of a renewable power system is presented. A photovoltaic source is modeled as a representation of renewable source system[2]. The topology consists of a PV sourced multiple output converter with simultaneous boost as well as buck outputs. The energy harvested from solar panel can be thus utilized for producing different dc outputs of different voltage levels. The system has lesser number of components, as well as lesser coordination communication requirements compared to other integrated topologies. Compared to traditional buck converters, the proposed converter has higher reliability, due to its inherent shoot-through protection and has a wider range of step down outputs. The Conventional IBuBuBo converter [1] is also analyzed and compared with proposed PV based dual output DC/DC converter.

PHOTOVOLTAIC CELL AND MPPT

Photovoltaic Cell

The renewable energy sources like wind, solar, geothermal and biomass represent an alternative to traditional methods of producing electrical energy. Among them solar source is becoming popular due to its effectiveness nowadays. Solar energy can be converted directly into electricity using photovoltaic panels (PV) through the photovoltaic effect. The photovoltaic effect is the basic physical process through which a solar cell converts sunlight into electricity. A PV panel may consist of a number of solar or photovoltaic cells arranged in series or parallel.

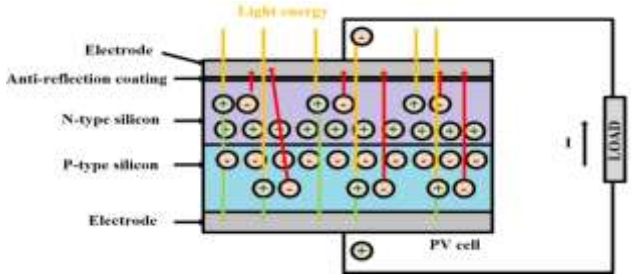

Fig 1 Representation of PV cell working

The PV cell is basically a PN junction diode so when light is incident on it, free charge carriers are created i.e. electron hole pairs are created. From light energy absorbed by them gives the charge carriers the energy to cross the potential barrier. The electrons will start moving towards N type semiconductor layer and holes will be started moving towards P type semiconductor material. Thus by connecting a metal electrode in both ends we can channelize these charges to either side of the load. The fig 1 shows the representation of a PV cell working. The PV cells can be modeled as a current source in parallel with a diode. When there is no light present to generate any current, the PV cell behaves like a diode[2]. As the intensity of incident light increases, current is generated by the PV cell. The current source I_{ph} represents the cell photocurrent. R_{sh} and R_s are the shunt and series resistances of the cell, respectively. R_s represents usually the structural resistance of the device like contact resistance, p-n bodies etc and R_{sh} exists mainly due to leakage current of p-n junction, fabrication methods of PV cell etc. Usually the value of R_{sh} is very large and that of R_s is very small, hence they may be neglected to simplify the analysis. Load is connected across it. I_{pv} represents PV current. The fig 2 shows (a) PV cell modeled as a diode circuit and (b) Simplified equivalent circuit of PV array.

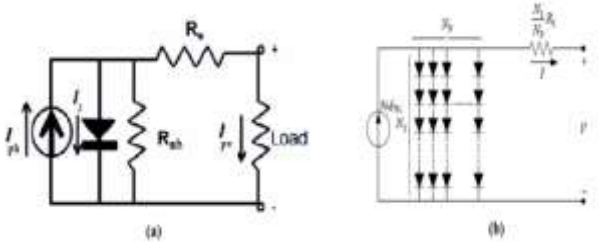

Fig 2 (a) PV cell modeled as a diode circuit (b) Simplified equivalent circuit of PV array

Maxing Power Point Tracking

The power characteristic of the PV is nonlinear and has a particular point for which the power generated by the PV is maximal. This is usually noted MPP (Maximum Power Point). In order to get maximum power of the PV panel several Maximum Power Point Tracking (MPPT) algorithms are used. There are several MPPT algorithms, among them "Perturb and Observe" (P&O) is widely used. The fig 3 shows the flowchart representation of P&O algorithm.

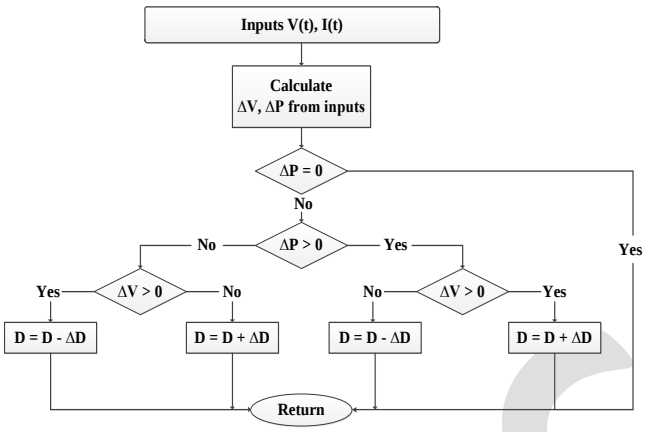

Fig 3 P & O algorithm

The principle of P&O is to send perturbations in the operating voltage of the PV array which makes the output power is approaching to maximum. To be specific, the array terminal voltage is perturbed periodically. The perturbation is incrementing or decrementing. Then the P&O algorithms operate by comparing the PV output power with that of the previous perturbation cycle. If the PV array operating voltage changes and power increases, the MPPT controller moves the PV array operating point in that direction; otherwise the operating point is moved in the opposite direction. In the next perturbation cycle the algorithm continues in the same way.

CONVENTIONAL IBUBUBO CONVERTER

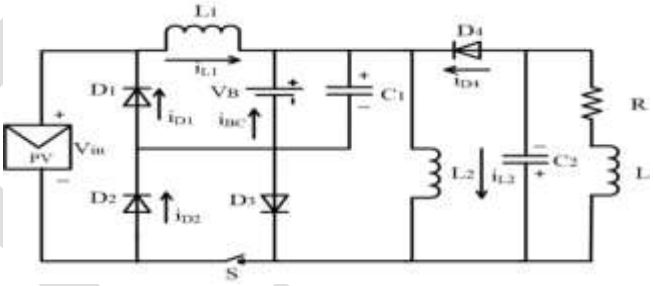

Fig 4 Conventional IBuBuBo Converter

The Conventional IBuBuBo converter is a single stage converter. It is an integrated buck buck boost (IBuBuBo) converter. The converter allows a portion of the input power to be processed once only, resulting in enhanced conversion efficiency. Additionally, due to the absence of a transformer, the size and manufacturing cost of the converter can be reduced. It is derived through the integration of a buck converter into a buck-boost converter. The conventional IBuBuBo converter [1] is shown in fig 4. It consists of an input inductor L_1, a rechargeable battery V_B, a capacitor C_1 to absorb the ac current ripple of the battery, an output inductor L_2 to supply the load, a power switch S, four diodes (D_1 to D_4), and an output capacitor C_2. The battery current, i_{BC} denotes the total current flowing out of the battery and capacitor C_1. Diodes D_1 and D_3 provide the current paths of negative i_{BC} during different operation periods while diode D_2 serves as a path for positive i_{BC}. Diode D_4 links the energy to the load from inductor L_2.

Modes of operation

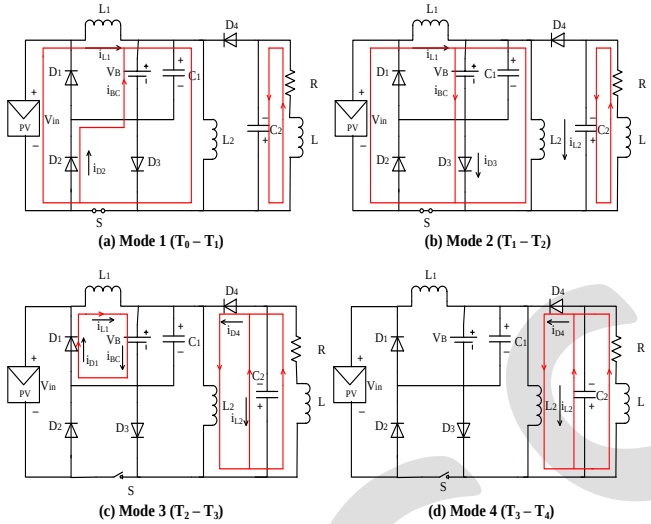

Fig 5 Modes of operation

To explain the working principle of the converter, the circuit operation modes is shown on fig 5 and the key theoretical waveforms up to two switching cycles are given in fig. 6.

The different modes of operation of converter are explained as follows.

- **Mode 1** ($T_0 - T_1$): In Fig 3.2(a) shows operation in this mode. During this stage, switch S is ON, diodes D_1, D_3, and D_4 are reverse biased, and diode D_2 is forward biased. The PV source charges the inductor L_1. The battery current i_{BC} is positive and flow through inductor L_2, S, and D_2.
- **Mode 2** ($T_1 - T_2$): This mode happens when the PV source is enough to charge inductor L_2 as shown in Fig 3.2(b). The extra energy from PV source charges the battery and the capacitor C_1, and hence, i_{BC} is reversed. Diode D_3 provides the path for the negative i_{BC} while diode D_2 is reverse biased. Currents of the two inductors reach their peaks at time T_2 when the switch is just turned OFF. During the first two modes of operation, the load is sustained by the output capacitor C_2.
- **Mode 3** ($T_2 - T_3$): Mode 3 starts when switch S is turned OFF. The operation stage is shown in Fig 3.2(c). Diodes D_2 and D_3 are reverse biased, and inductor L_1 discharges its stored energy to the battery and capacitor C1 through diode D_1. Inductor L_2 begins to release its stored energy in previous stages to the output capacitor C_2 and the load through diode D_4.
- **Mode 4** ($T_3 - T_4$): During this stage, switch S is OFF, and the input inductor L_1 is completely discharged. The operation stage is shown in Fig 3.2 (d). Inductor L_2 continues to discharge its stored energy to the output capacitor C_2 and the load through diode D_4 until the next switching period.

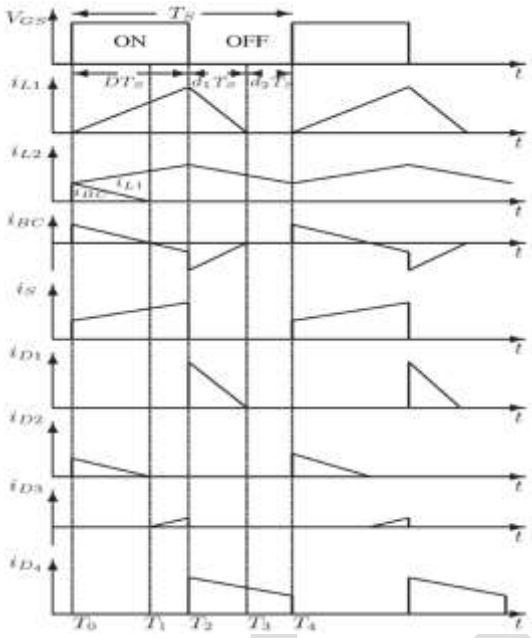

Fig 6 Waveforms of Conventional IBuBuBo Converter

The control logic of Conventional IBuBuBo converter is shown in fig 7, the MPPT output is compared with a repeating sequence to produce gate pulses.

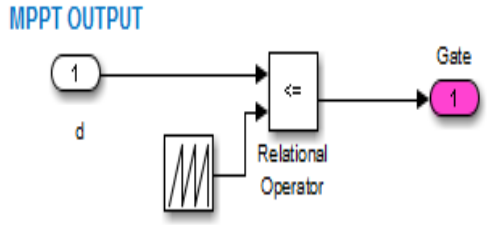

Fig 7 PWM generation of Conventional IBuBuBo converter

The Conventional IBuBuBo converter can only operate in buck mode. Therefore only buck output can be obtained. As the component count is more the loss of the converter will be high. The conventional IBuBuBo converter is simulated for sufficient PV input condition and verified the result. For an input of 12 V, the converter output is 5.7-4.8 V. The output is varying within a range. The large number of component count increases the losses of the converter. The Conventional IBuBuBo converter is limited to step down applications.

PV BASED DUAL OUTPUT DC/DC CONVERTER WITH SIMULTANEOUS BOOST AND BUCK OUTPUTS

Most of the consumer products require voltages at different levels with respect to loads. Therefore the need of power conditioning circuits to create these different levels is important. A PV based dual output DC/DC converter topology which can produce simultaneous boost and buck outputs is proposed. The PV Based Dual output DC-DC converter is synthesized by replacing the control switch of a boost converter topology with series connected switches and using the additional switch nodes to generate step-down dc outputs. The converter consists of a single input and multiple outputs. Simultaneous buck as well as boost output can be produced. The fig 8 shows circuit diagram of PV based dual output DC/DC converter.

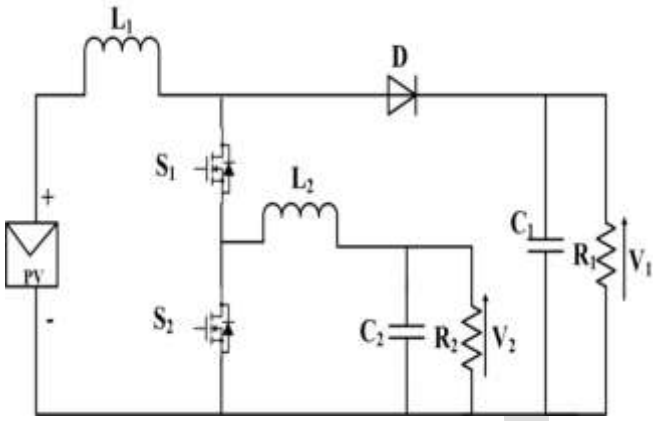

Fig 8 PV based dual output DC/DC converter with simultaneous boost and buck outputs

The fig 8 shows PV based dual output DC/DC converter, it consist of two switches, S_1 and S_2, two inductors L_1 and L_2, two capacitors C_1 and C_2, one diode D, and two load resistors R_1 and R_2.

Modes of operation

The topology consists of three modes of operation depending on the status of two bidirectional switches, S_1 and S_2. The modes of operation are shown in fig 9 and the key waveforms of converter are shown in fig 10.

- **Mode 1** (Both S_1 and S_2 are ON): This mode of operation is similar to the controllable switch S of conventional boost converter being turned ON. The equivalent circuit of mode 1 is shown in fig 9 (a). The diode D is reverse biased during this interval, while the buck inductor current i_{L2} freewheels through the switch S_2. As this mode has two switches in ON state, the converter has inherited shoot-through protection.
- **Mode 2** (S_1 ON and S_2 OFF): In this mode of operation the switch S_1 is ON and the switch S_2 is OFF. The equivalent circuit of mode 1 is shown in fig 9 (b). The diode D is forward biased. The inductor current i_{L1} will be divided into two, one part flows through D to capacitor C_1 and load and the other part flows through inductor L_2 to linearly charge it. In this mode, the step-down converter draws energy from the source.
- **Mode 3** (S_1 OFF and S_2 ON or Both S_1 and S_2 OFF): In this interval, the inductor current i_{L2} freewheels through the switch S_2 or through its anti-parallel diode (if S_2 is not being gated). This interval is thus analogous to freewheel period associated with conventional buck converters, either the lower switch conducts in synchronous switching scheme or the diode conducts. The diode D conducts the inductor current, i_{L1}. Hence, both the inductors give out their energy to their respective outputs. The operation stage is shown in Fig 9(c).

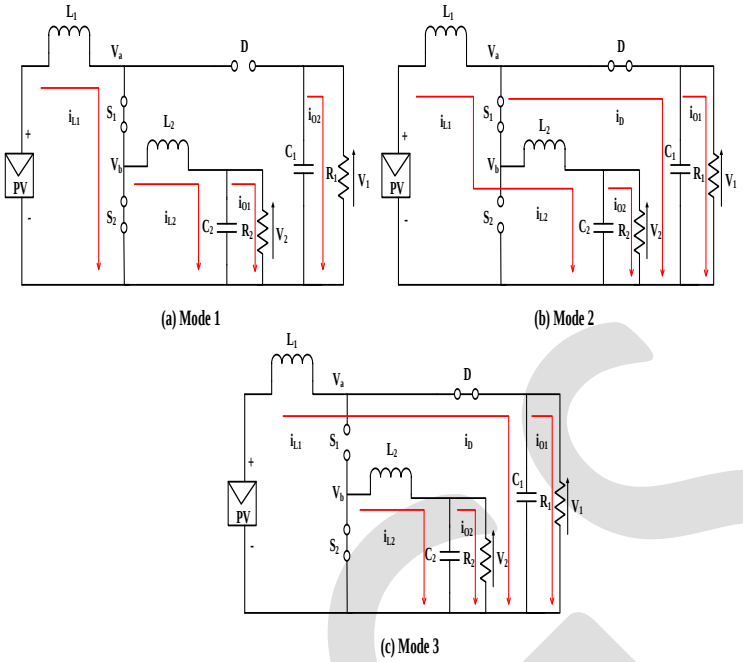

Fig 9 Operational stages of PV based dual output DC/DC converter

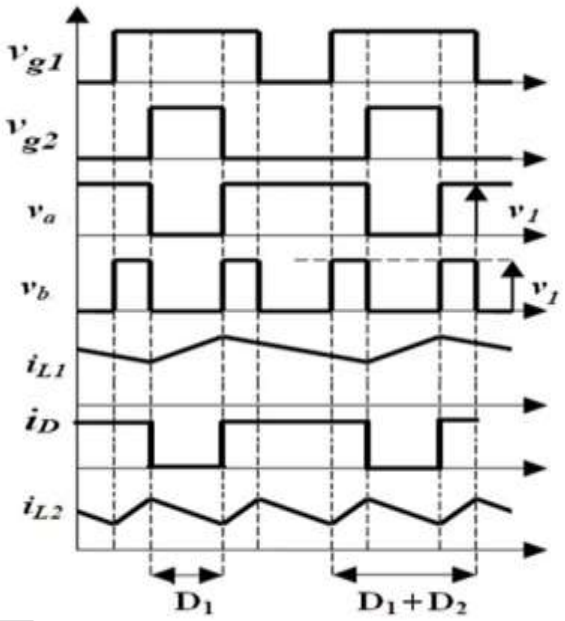

Fig 10 Key waveforms of PV based dual output DC/DC converter

Steady state analysis

For steady state analysis, the duty cycles are defined as the time duration of modes 1 and 3. The equations can be written as below:

For inductor L_1,

$$V_{in} * D_1 + (V_{in} - V_1)(1 - D_1) = 0 \quad \ldots\ldots\ (1)$$

$$\frac{V_1}{V_{in}} = \frac{1}{1-D_1} \quad \text{..... (2)}$$

For inductor L_2,

$$(V_1 - V_2)D_2 + (-V_2)(1 - D_2) = 0 \quad \text{..... (3)}$$

$$\frac{V_2}{V_1} = D_2 \quad \text{..... (4)}$$

Control stratergy

The PV based dual output converter uses P & O (Perturb and Observe) MPPT (Maximum Power Point Tracking) method. The control logic of PV based dual output converter DC/DC converter is shown in fig 11, the MPPT output is compared with a repeating sequence to produce gate pulses.

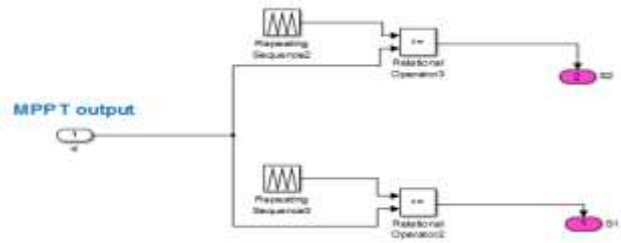

Fig 11 Control logic of PV based dual output converter DC/DC converter

The PV based dual output converter DC/DC converter is able to produce simultaneous buck as well as boost output can be obtained. Compared to Conventional IBuBuBo converter, PV based dual output converter has better performance as it is capable of producing buck as well as boost outputs. For a 12V input voltage from PV panel, 6V and 18V buck and boost outputs are produced. The component count is also less. Therefore the loss of the system is low.

MATLAB SIMULINK MODEL AND RESULTS

Conventional IBuBuBo Converter

The Simulink model of conventional IBuBuBo Converter is shown in fig 12.The simulation of conventional IBuBuBo Converter is done using MATLAB Simulink software. The ripple component of the output is high. The switching frequency is chosen to be 10 KHz. The inductor1 current of the converter is discontinuous where as inductor2 current of the converter is continuous. The battery voltage, current and state of charge (SOC) is also shown. The battery current is reversed and SOC remains the same. For an input of 12 V, the converter output is 5.7-4.8 V.

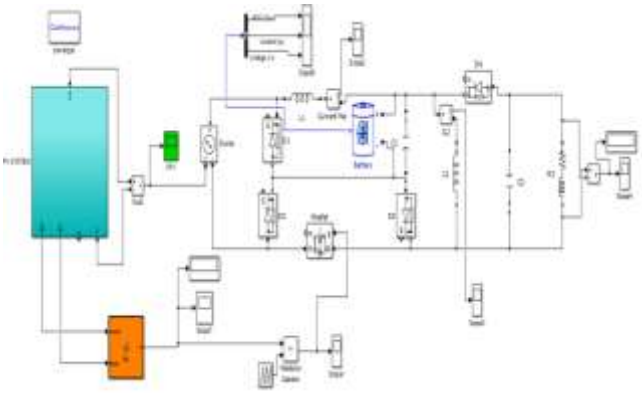

Fig 12 Simulink model of conventional IBuBuBo Converter

Table 1 Parameters of IBuBuBo Converter

Components	**Specifications**
Inductor L_1	15 µH
Inductor L_2	100 µH
Capacitor C_1	100 µF
Capacitor C_1	100 µF
R L load	30 Ω, 20mH

The large component count increases loses of the converter. The ripple content in the output voltage is high. The output is varying within a range. The output waveforms are shown in fig 13.

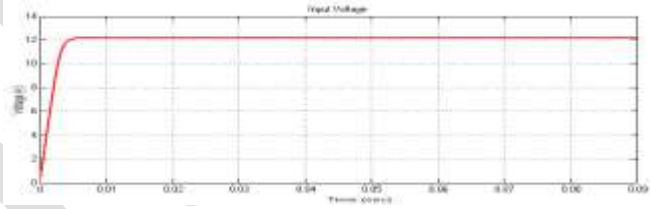

Fig 13 (a) Input Voltage

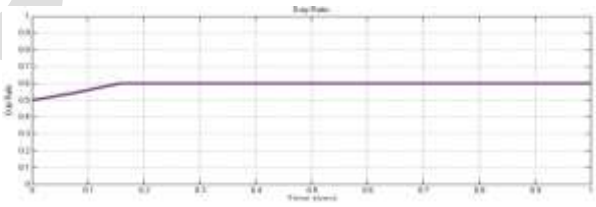

Fig 13 (b) MPPT Output

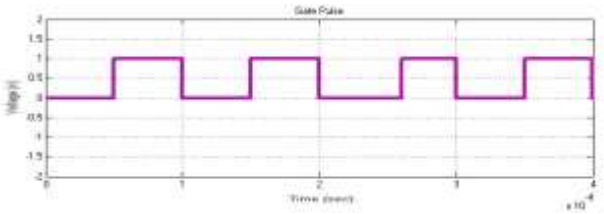

Fig 13 (c) Gate Pulses

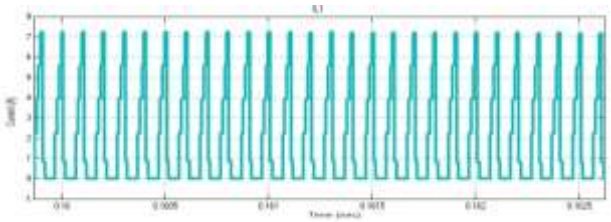

Fig 13 (d) Inductor 1 Current, i_{L1}

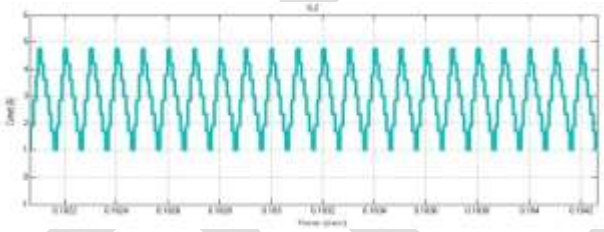

Fig 13 (e) Inductor 2 Current, i_{L2}

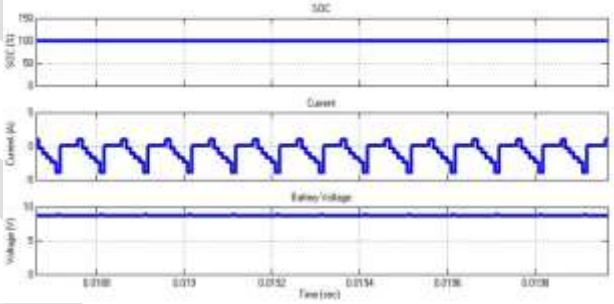

Fig 13 (f) Battery SOC, Current, Voltage

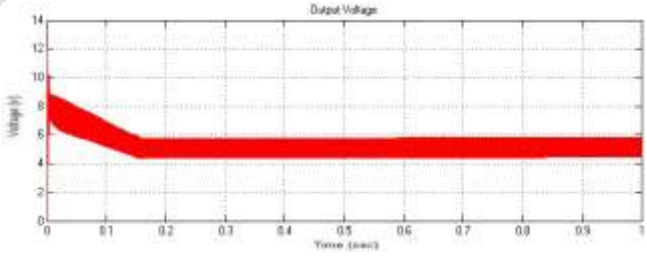

Fig 13 (g) Output Voltage

PV Based dual output DC/DC converter with simultaneous boost and buck outputs

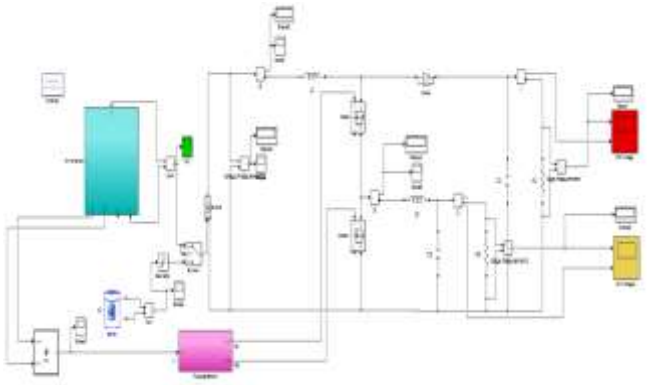

Fig 14 Simulink model of PV based dual output DC/DC converter

The simulink model of the PV based dual output converter is shown in fig 14. The converter is able to produce buck and boost outputs simultaneously. The switching frequency is chosen to be 10 KHz. The inductor currents are continuous

Table 2 Parameters of PV based dual output DC/DC converter

Components	**Specifications**
Inductor L_1	3 mH
Inductor L_2	2.2 mH
Capacitor C_1	421 µF
Capacitor C_1	250 µF
Load R_1	27.27 Ω
Load R_2	9.09 Ω

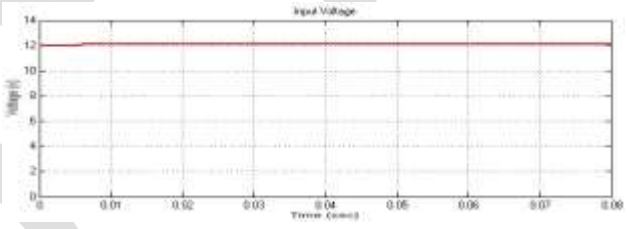

Fig 15 (a) Input Voltage

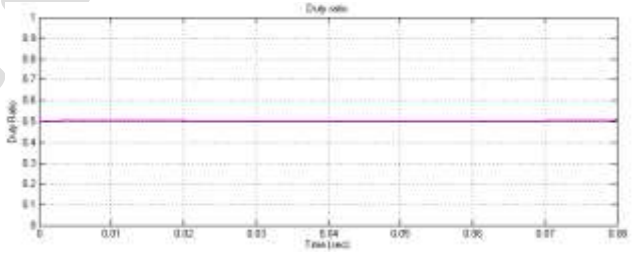

Fig 15 (b) MPPT output

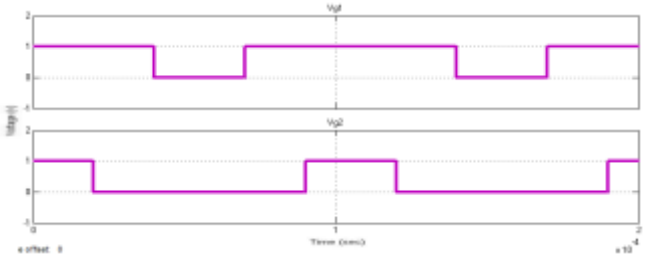

Fig 15 (c) Gate Pulses

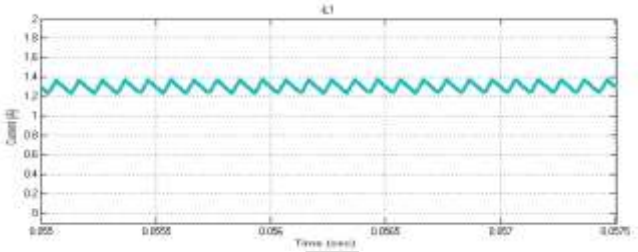

Fig 15 (d) Inductor 1 Current, i_{L1}

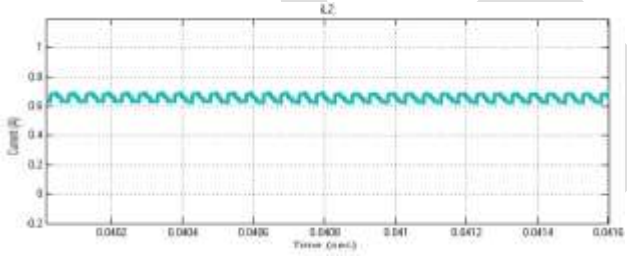

Fig 15 (e) Inductor 2 Current, i_{L2}

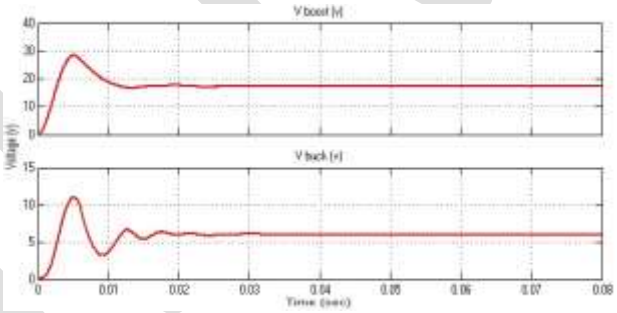

Fig 15 (f) Output Voltages

The output waveforms are shown in fig 15. Compared to Conventional IBuBuBo converter, PV based dual output converter has better performance as it is capable of producing buck as well as boost outputs. For a 12V input voltage from PV panel, 5.9V and 17.3V buck and boost outputs are produced. The component count is also less. Therefore the loss of the system is low.

Converter comparision

Comparing the Conventional IBuBuBo converter, the PV based dual output DC/DC Converter has better performance. It is capable of producing buck as well as boost outputs simultaneously. The Table 3 shows the comparison between two converters. For an input of 12V, the Conventional IBuBuBo converter has buck output varying within a range. The component count of the converter is also high compared to the PV based dual output DC/DC Converter. This increases the losses of the converter.

Table 3 Comparison of Converter performances

DC/DC Converter	**Conventional IBuBuBo Converter**	**PV based Dual output converter**
Converter Type	Single Output	Multiple Output
Vin (V)	12	12
Vout (V)	5.7-4.8	V_{buck} = 5.9 V_{boost} = 17.3
Component Count	More	Less
Losses	More	Less
Applications	Limited to buck applications	Buck and boost applications

The Conventional IBuBuBo converter is limited to buck applications but PV based dual output DC/DC Converter can be used to systems that needs both buck and boost voltages simultaneously. It can be used in several applications like multilevel inverters, computer mother boards, dc nano grids etc.

CONCLUSION

A PV based dual output DC-DC converter with simultaneous boost and buck outputs is discussed. The use of renewable energy as source reduces the emission of green house gases and it is absolutely noise free. The topology consists of a multiple output converter with simultaneous boost as well as buck outputs. The energy harvested from solar energy can be thus utilized for producing different dc outputs. The system has lesser number of components, as well as lesser coordination communication requirements compared to other integrated topologies. Compared to traditional buck converters, the proposed converter has higher reliability, due to its inherent shoot-through protection and has a wider range of step-down outputs. The PV based dual output DC-DC converter be used in several applications like multilevel inverters, computer mother boards, dc nano grids etc.

REFERENCES:

[1] Le An and Dylan Dah-Chuan Lu, "Design of a Single-Switch DC/DC Converter for a PV-Battery-Powered Pump System With PFM+PWM Control," *IEEE Trans. Ind. Electron.*, vol. 62, no. 2, Feb 2015.

[2] Huan-Liang Tsai, Ci-Siang Tu, and Yi-Jie Su, "Development of Generalized Photovoltaic Model Using MATLAB/SIMULINK", *Proceed., World Congress on Engineering and Computer Science*, October 22 - 24, 2008, San Francisco, USA.

[3] Olive Ray, Anil Prasad J., and Santanu Mishra, "A Multi-port DC-DC Converter topology with simultaneous Buck and Boost outputs", *IEEE Trans. Power. Electron.*, vol. 62, no. 2, Feb 2015.

[4] Sathish Kumar Kollimalla and Mahesh Kumar Mishra "Adaptive Perturb & Observe MPPT Algorithm for Photovoltaic System", *IEEE Trans. Power Electron.*,vol.18, no. 3, pp. 42–47, May 2013.

[5] Marcelo Gradella Villalva, Jonas Rafael Gazoli, and Ernesto Ruppert Filho, "Comprehensive Approach to Modeling and Simulation of Photovoltaic Array", *IEEE Trans. Power Electron.,* Vol. 24, No. 5, May 2009.

[6] Sonal Panwara, Dr. R.P. Sain, "Development and Simulation of Solar Photovoltaic model using Matlab/simulink and its parameter extraction," *International Conference on Computing and Control Engineering (ICCCE 2012), 12 & 13 April, 2012.*

[7] K.K. Gupta and S. Jain, 'Topology for multilevel inverters to attain maximum number of levels from given DC sources*', IET Power Electron.*, 2012, Vol. 5, Iss. 4, pp. 435–446.

[8] D. D. C. Lu, H. H. C. Iu, and V. Pjevalica, "A Single-Stage AC/DC converter With high power factor, regulated bus voltage, and output voltage," *IEEE Trans*. Power Electron., vol. 23, no. 1, pp. 218–228, Jan. 2008.

[9] T.F. Wu and T.-H. Yu, "Unified approach to developing single-stage power converters," *IEEE Trans*. Aerosp. Electron. Syst., vol. 34, no. 1, pp. 211–223, Jan. 1998.

[10] M. de Brito, L. Galotto, L. Sampaio, G. de Azevedo e Melo, and C. Canesin, "Evaluation of the main MPPT techniques for photovoltaic applications," *IEEE Trans. Ind. Electron.*, vol. 60, no. 3, pp. 1156–1167, Mar. 2013.

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COMPUTERIZED ROBOT FOR GROUND NAVIGATION IN HOSPITAL BUILDINGS

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Abstract— In certain situations people need to go some places without having any previous knowledge about the locality. This condition may occur when the place is not visited ever before, or even when there is not any available sources to situate them in the current position. In those cases, the marks of the environment are essential for achieving the area. The same condition may happen for an autonomous machine i.e., robot. This kind of robots must be talented of solving this problem in a talented way. In order to do this, the robot must use the resources present in their atmosphere. This paper offers a RFID based system, which has been developed to guide and give important information to an autonomous robot. This robot will detect the patient's abnormal condition and it immediately communicates it to the doctor. This system has been implemented in a real indoor environment and it has been successfully proved in the autonomous and social robot. At the end of the paper some experimental results, carried out inside the hospital building, are discussed.

Keywords— autonomous robot; navigation; RFID; social robot; path finding

INTRODUCTION

In a large multi floor hospital consisting of various medical departments, it will be too difficult for the peoples visiting to reach the place they need. In case the patients get appointment to visit the particular medical department at specified time, they may get lost, finding throughout the hospital. This may happen exactly to the elderly peoples. Many guidance systems have been proposed for them. For example Wi-Fi positioning system enables the user to find the exact location. But it uses the frequency of 2.4GHz radio waves affects the working of medical equipment. On the other hand Received Signal Strength Indication (RSSI) and Dead Reckoning with acceleration methods rectifies the disadvantages in Wi-Fi positioning but it produces some errors. The error values further increases with respect to the RSSI values.

To overcome the above hindrances, an RFID based autonomous robot is designed for field navigation for elderly peoples who were in need of guidance to reach their destinations. And also in case of delivering the equipment or files to the specific user, it can be used to reduce the man work. The temperature, heart beat and other parameters of the patient are monitored and in abnormal situations it is communicated to the doctor for providing the first aid. Here our robot uses advanced technologies for elderly and severely diseased patients for their health and transportation needs. Our autonomous robot finds the shortest path to reach the destination via routing algorithm. If any obstacles found, it will wait for some time for the route clearance and in case the obstacle is immovable then the robot finds the alternate way to the destination.

The majority of smart-home applications are oriented to make the environment more comfortable for people. However, our objective is to incorporate radio frequency identification (RFID) technology in those environments to facilitate the navigation of autonomous robots, as future human companions. In order to implement the proposed system, it is necessary to slightly modify the environment by adding the signals. Therefore, the robot has access to the needed information to guide itself in the environment and to carry out its navigation task successfully.

This paper is organized as follows. Section II shows some related works which use signals as support for navigation tasks, mainly those using RTLS and GPS technology. Next, the design of the proposed system is explained in Section III, and its implementation in a real robot is described in Section IV. Later, some experiments, carried out with the social robot in a real environment, are shown in Section VI. Finally, in Section VII, the main conclusions and some future works are presented.

RELATED WORKS

A. Guidance in Hospitals

The various guidance schemes proposed earlier for the simplicity for the peoples are discussed below. As we know that there are various medical departments in multi-specialty hospitals. Many guidance systems were introduced in hospitals demonstrating the direction of the various medical departments. The peoples should visit a lot of checkup rooms (e.g., XRAY scan, ICU, endoscopy, etc.) that are apart from each other. For this reason, route of medical examination is complicated and guidance in a hospital is an important issue. The people may feel difficult to reach out the department they need to visit.

However, automated guidance which can lead visitors to an appropriate place at an appropriate time has not been established yet although IT is utilized for various activities (e.g., Electronic Health Record) in hospitals.

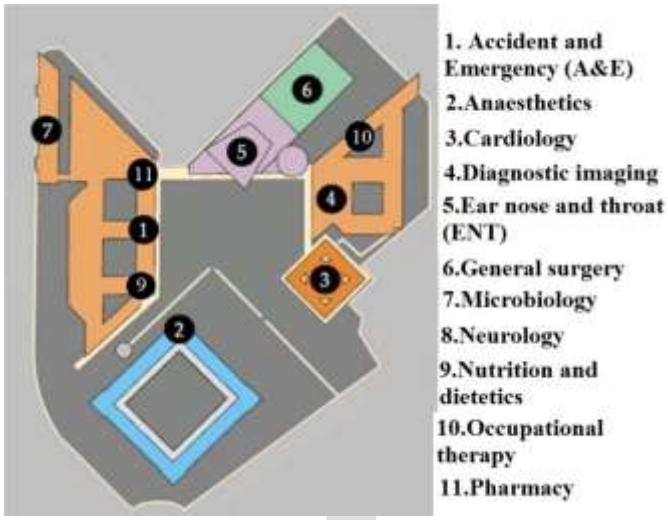

Figure 1. A lot of destinations listed above in a hospital

B. Existing Studies

The term Indoor Positioning Systems (IPS) primarily concerns location-based services on mobile phones where GPS does not work. The term Real Time Locating Systems (RTLS) primarily concerns locating people and things at a distance, securely, using second generation RFID. This subject heavily involves short range communications notably Wi-Fi and Bluetooth and inertial navigation and advanced RFID as it progresses to determining 3D position including orientation and line of travel.

Real-time locating systems (RTLS) are used to automatically identify and track the location of objects or people in real time, usually within a building or other contained area. Wireless RTLS tags are attached to objects or worn by people, and in most RTLS, fixed reference points receive wireless signals from tags to determine their location. Examples of real-time locating systems include tracking automobiles through an assembly line, locating pallets of merchandise in a warehouse, or finding medical equipment in a hospital.

Wi-Fi positioning system (WPS) is used where GPS is inadequate. The localization technique used for positioning with wireless access points is based on measuring the intensity of the received signal strength (RSS) and the method of "fingerprinting". Typical parameters useful to geo-locate the Wi-Fi hotspot or wireless access point include the SSID and the MAC address of the access point. The accuracy depends on the number of positions that have been entered into the database. The possible signal fluctuations that may occur can increase errors and inaccuracies in the path of the user.

Radio Frequency (RF) trilateration uses estimated ranges from multiple receivers to estimate the location of a tag. RF triangulation uses the angles at which the RF signals arrive at multiple receivers to estimate the location of a tag. Many obstructions, such as walls or furniture, can distort the estimated range and angle readings leading to varied qualities of location estimate. Estimation-based locating is often measured in accuracy for a given distance, such as 90% accurate for 10 meter range.

Systems that use locating technologies that do not go through walls, such as infrared or ultrasound, tend to be more accurate in an indoor environment because only tags and receivers that have line of sight (or near line of sight) can communicate.

But the main disadvantage is that GPS positioning system may produce inaccuracy in indoor areas while positioning using Wi-Fi, may not available in hospitals.

C. Objectives of this study

Considering these situations we propose a guidance system which utilizes RFID technology to identify the exact place the people need to visit with the help of autonomous robot. The aim of our study is to develop a guidance system on device including smart user interface which can be used by elderly people.

PROPOSED SYSTEM

A. Overall structure of proposed system

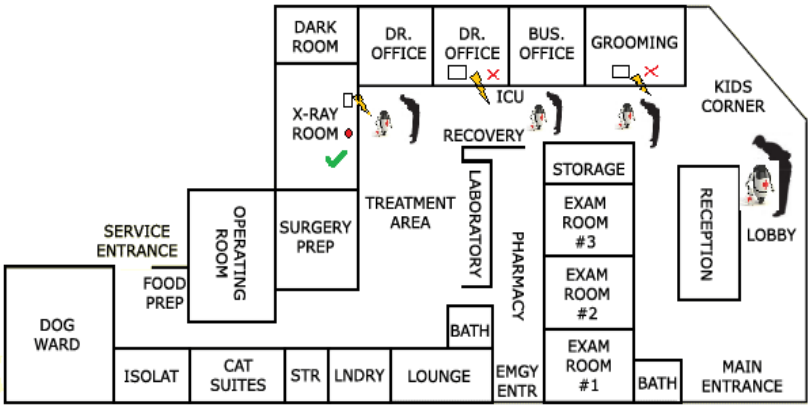

Figure 2. Overview of the guidance system in a hospital using RFID

Figure 2 shows an overview of the proposed guidance system in the hospital. The autonomous robot guides the people to reach their destinations in the simple approach.

The procedures of the system are given as follows.

1. First of all user need to enter their destination in the robot.
2. The robot searches for the paths available and locates the destination by finding shortest path among the routes available.
3. The RFID tags are placed in the walls of every room.
4. Then the robot guides the people to reach the destination when the tag matches with the frequency preset earlier.

In this study the user need to select the destination where they need to reach. It can be used to carry or transport the equipment to certain places. It also monitors and reports the abnormal conditions of people who are accompanying with to the doctor.

Figure 3. RFID Tag

A. Real time experiments

In real life, generic signals are used to indicate common places such as the "Exit" signals, the "All directions" found in highways, and so on. In our design, connections to generic places are proposed. Therefore, the robot has other options in case of being in case 4 so, if it wants to go to another floor, it will look for the "Escalators or Elevators" generic signal. In summary, the process can be described as follows.

1. The assigned goal is compared with the place indicated by the signal.
2. If there is a coincidence, then this means that the robot has arrived at its destination.
3. If the current place does not coincide with the goal place, then the robot looks for a connection which indicated how to get to the goal.
4. In case of coincidence, the action (or set of actions) to reach the goal or the next signal is executed.
5. In the case of no coincidence, the robot can select among the actions previously explained in case 4).

REAL TIME IMPLEMENTATION

The implementations of this real time system are easy to design and are discussed below. The exact floor plan of the hospital is first considered. Then the algorithm is designed to calculate the shortest path to reach the medical departments form the lobby. The Radio Frequency Identification tags are placed on the walls of the each medical departments, reception, escalators and floors, which will be very useful for the robot to locate where now it is.

Whenever the people enter the key for where they need to go for, the robot locates the place where it is and finds the shortest path for the medical department. The robot follows the path calculated and RFID tags placed on walls. Occasionally if any obstacle is detected on the path then it calculates another path to go through and follows it. When the destination place RFID tag frequency matches with the frequency set by the user by entering the key, then that will be the destination. The robot can be used for carry out the medical equipment. And also in addition to this the patient's normal and abnormal condition are monitored regularly and it is communicated to the doctor when it goes to serious level.

Figure 4. Model robot

EXPERIMENTAL RESULTS

Here, we present two experiments made to prove the successful performance of the signage system and the navigation algorithm proposed in this paper. These experiments were carried out on the third floor of the Apollo Hospital building shows a view of the navigation area of the robot and its initial location.

A. Experiment 1

1. ***Objective:*** The robot must go to the XRAY Lab (1.3.C.13).

Description: *Initially, the robot is beside the reception, which is located in the corridor in the zone C. The robot does not know its own location until it reads the RFID signal located on the wall. The autonomous robot identifies its exact position once it reads the Radio Frequency Identification tag (RFID tag), which is also situated next to the reception. This experiment tests the behavior of the robot when mobile obstacle is situated at the goal's position. Therefore, the robot will not be able to read the signal goal.*

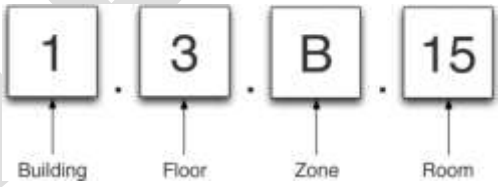

Figure 5. Alphanumeric code for identification

1. Input Data:

Assigned goal: *XRAY LAB– 1.3.C.13*.

First detected signal: place: *Reception – 1.3.C.f*

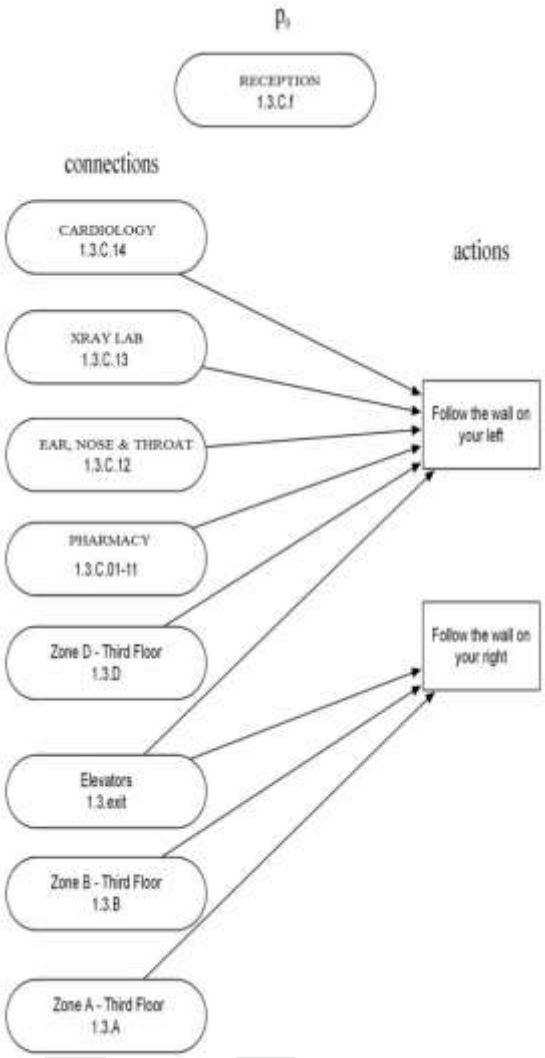

Figure 6. Information stored in the first signal

4. ***Process:*** Initially, the robot detects the first signal and reads the information about its current location and the possible places where the robot can go to from that place.

As already explained, the robot compares the assigned goal with the place indicated by the signal. If those places are different, then it starts to compare the goal with the places indicated by the connections. In this occasion, the assigned goal corresponds to one of the connections. Then, the robot activates the *"follow the wall on your left"* skill and is executed until it finds a new signal. As shown in fig when the robot arrives to its destination, it is not able to read the correspondent signal since there is an object (the grey square) in front of it. Therefore, the robot finds another route with the help of RFID tag placed on another side of the wall

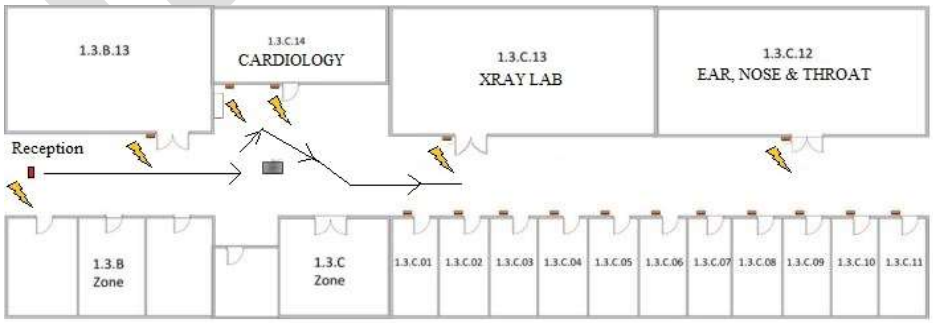

Figure 7. The path of robot towards the destination

CONCLUSION AND FUTURE WORK

Thus the low cost public service robot is easy to implement as it takes almost care for the elderly people who were to search for the examination room among the multi-floor building. In the experimental result it has been proved that signals are a great support for autonomous robot navigation, when they do not have a previous knowledge of the environment.

Finally as future works it can be expanded from RFID signals to various convenient signals to the environment. Whenever if the RFID signal is lost, then it should works with the alternate signal. The navigation algorithm can be proposed in new way to increase the performance of the public health care robot.

REFERENCES:

[1] K. Sagawa, K. Koiwa, M. Susumago, H. Inooka, "Estimation of an indoor 3D walk course by acceleration integration", 22th Joint Conference on Medical Information Japan Journal of Medical Informatics 22, pp.242-243, Nov. 2002.

[2] M. Yamamoto, E. Kamioka, "Location Estimation System using Acceleration Sensor", The Institute of Electronics, Information, and Communication Engineers Technical Report, Mobile Network and Applications, vol.110, no.40, pp.139-144, May. 2010.

[3] M. Kourogi, T. Kurata, "Personal Positioning Based on Walking Locomotion Analysis with Self-Contained Sensors and a Wearable Camera", in Technical Report of The Institute of Electronics, Information, and Communication Engineers Technical Report, PRMU 103(737), pp.25-30, Mar. 2004.

[4] N. Kawaguchi, "Locky.jp: Wireless LAN Position Estimation and Its Application", The Institute of Electronics, Information, and Communication Engineers Technical Report, ITS vol.107, no.161, pp.1-4, Jul.2007.

[5] Y. Yokota, T. Hitoyasu, M. Miki, H. Yokouchi, M. Yoshimi, "Location Estimation in Indoor Environment based Distribution of the RSS", in Proc. the Annual Conference of The Japanese Society for Artificial Intelligence, vol.24, no.3C2-2, pp.1–4, Jun. 2010.

[6] Research Committee on the use of radio waves for regional development, "Research Report on Telecommunications in the Hospital", p.8, Mar. 2002.

[7] K. Anzai, S. Okajima, H. Tsubokawa, "The estimate of the indoor position that used a smartphone and the suggestion of the walk navigation system", in Multimedia, Distributed, Cooperative, and Mobile Symposium 2011, pp..921-927, July 2011.

[8] T. Takakai, M. Fujii, Y. Watanabe, A. Ito, "A Study on Location Awareness System using cellular phone with Bluetooth", The Institute of Electronics, Information, and Communication Engineers Technical Report ITS, vol.108, no.205, pp.31-36, Sep. 2008.

[9] Medsafe.Net. "Utilizing PHS for communication tools in hospital", Medsafe.Net, Nov.21, 2006

[10] Y. Uramoto, S. Kitamura, "Examination of simplified position information acquisition depending on PHS utilization", in Proc. TheInstitute of Electronics, Information, and Communication Engineers General Conference,no.B-5-138,p.525,Mar.1997.

[11] H. Ookura, H. Yamamoto, K. Yamazaki, "Development and evaluation of walking path estimation system using sensors of Android device and vector map matching", in Proc. The Institute of Electrical and Electronics Engineers, The International Conference on Information Networking.2012, pp.25-29, Feb. 2012.

[12] K. Katsuhiko, N. Kawaguchi, "Gate-Passing Detection Method Based on Wi-Fi Significant Points", in Proc. of the World Congress on Engineering 2013, Voll.II, pp.1409-1414. July 2013

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Determining Bug Epidemic Patterns Using Decision Tree Algorithm

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ABSTRACT- Data mining is the process of extracting useful and vital information from large sets of data that involves learning in a practical and non-theoretical sense (Witten et.al, 2011). Research topic involves the application of data mining techniques in agriculture field for predicting future trends such as bug epidemic. This acquires algorithms for describing hidden patterns frequently from large sets of data. Applications of appropriate data mining techniques are advised to apply to deliver productive decision making (Tripathy et.al, 2012). This application is known as Insect Epidemiology Data Mining (IEDM).

IEDM is an additional exploration of Discrete Mathematics and Theoretical Computer Science (DIMACS) that aims to provide an opportunity to develop and test problem instances and other methods of testing and comparing performance of algorithms (Abello and Cormode, 2004).

Researchers nowadays are able to offer number of information on agricultural-related activities which then can analyze the potential data mining and collect the relevant information. Data mining in agriculture requires historical data that helps to create automated prediction and analysis of various trends and behaviors to provide relative solutions.

However, data mining in agriculture can be used to improve the agricultural production such as rice crop and awareness in bug infestations. Discovering patterns in massive data sets will enable to predict possible outcomes by using this technique. This will be helpful for the agricultural farmers in forewarning about bug epidemic and enables to identify the factors that influence the pest population density. Farmer benefits will learn more about ecological and sustainable management options for pest epidemic and can apply pest control strategies to reduce crop loss. Technically, data mining in agriculture is a popular in a nontrivial process useful in classification applications since it resembles human reasoning and can be easily understood

Keywords— data mining, agriculture data mining, decision tree algorithm, bugs, epidemic, prediction

INTRODUCTION

The research concentrated on analyzing the prediction of bug's epidemic. Bugs epidemic is a widespread outbreak in the rice field in a severe form in the region. Every year, thirty seven percent (37%) is the estimated average of farmer's rice crops that suffer due to diseases and bugs species outbreak (Norton et al. 2010). Based from the study of Joshi et.al. (2007), invasive species such as Rice Black Bug(RBB) infest rice plants at all growth stages from maximum tilling to ripening stage.

According to Barrion et. al (2007), invasive bugs could not emigrated by flight or displaced by wind but they invade through insects swarming on boats that operate from island to island. Different bugs inhabit majority in different areas like rain fed and irrigated wetland environments, nearby woodlands, extensive weedy areas near rice fields, wild grasses near canals and staggered rice planting since they have constant food supply for the entire season.

Controlling of pests becomes difficult since the presence of host such as grasses and broadleaves are available regularly (PhilRice, 2000; Catindig and Heong, 2003). Application of insecticide should be avoided by the Agricultural institution because it affects the health and natural balance. Bureau of Plant Industry (BPI, 2015) stated that the practice of inorganic pesticide to RBB would also destroy its natural enemies. For this reason, farmers are advised to avoid spraying inorganic pesticides to control bugs.

Several fake chemicals emerge on the market which leads in development of insecticide resistance and pest resurrection. Authorities' outcome to limit this pest is disappointment and challenging them to further investigation (Sepe and Demayo, 2014).

The expansion of bug's habitat and weather are very important in determining the precise epidemiology of outbreak. This could give a certain pattern in bug's prediction. Predictive modeling could offer great beneficial to the farmers to enhance the bug prediction.

The main objective of this study is to explore the use of IEDM in addressing the infestation of bugs in the Philippine rice fields. The bug's damage covers several parts of the Philippines' result in 15–23% yield loss including Laguna, Cavite and Quezon. By abusing broad-spectrum, non-selective synthetic pesticides resulted to environmental degradation, immediate economic losses and damage the population of natural enemies of the pest.

This shows that agricultural farmers could probably have economic distress on the declined income from rice production. Hence, the occurrence of bugs in the rice field under study believed that plain cultivation of wetland habitats and host plants, and the lack of indigenous natural enemies are considered imbalanced.

This study includes the identification of bug's occurrence that will help predict bugs epidemic in the rice field. The data to be processes will include bug's classification, rice stages and ecology, climate such as temperature and humidity, lunar cycle and soil status. CRosss-Industry Standard Process for Data Mining (CRISP-DM) will also be used as a guide for this study.

STATEMENT OF THE PROBLEMS

Based on the study of Tripathy et.al (2012), there is an irregularity in the occurrence of pest in the rice field. The purpose of this study is to design and develop a device that will cater primarily on helping to monitor rice bug in order to predict the bug infestation.

Specifically, the study required responses and answers the following problems:

1. How effective the light trapping device in terms of bug counting?
2. How effective is decision tree algorithm in predicting bug outbreak?
3. What data model can be created in predicting bug epidemic?

Scope and Limitation of the Study

In connection with the relationship of agriculture and technology, "Rice Field Insect Light Trap (RFILT)" device will used on the study. This device will limit on the operation such as bug classifying manually, bug counting and rice field temperature using thermometer. It will be used in low-land and high-land rice field near Mt. Banahaw de Lucban. RFILT operates every night from 7:30pm in the evening up to11:00 midnights which will be placed in the rice field. The study shows that these sap-sucking bugs are strongly attracted to high intensity light. It is a prospective system appropriate for collecting the data on different parameters relating to temperature and environment.

In the technical part of the device, it has a minimal cost which contains Arduino 168 Microcontrollers that acts as a brain which is perfectly suited to agriculture where decisions are to be made at micro-climatic level; two (2) 12V power sources that consume low-energy; an infra-red sensor that is used to count and sense bug; and 20w-LED light. C++ codes were used to control the device since it runs on real-time operation. ISO 9126 software quality assessment tool was also used to measure the quality of software and hardware evaluated by ten (10) experts from different related departments in the Southern Luzon State University.

The three (3) flying bugs are the main target of this research since (1) Rice Black Bug is identified as invasive species; (2) Rice Bug considered as pest found in all rice environments and (3) Rice Grain Bug recognized as the latest insect pest of rice (Convention on Biological Diversity, 2001).

The Huey helicopter of the Philippine Air force will be used to observe the aerial view of different rice field areas in Quezon. Agricultural farmers and rice crop technicians will be interviewed to acquire some past experiences related to rice field bugs.

The study also focused on the historical data obtained from different municipalities and cities in CALABARZON from the year 2005 up to 2015. Historical data are delimited within ten (10) years. Some data were obtained from the Office of the Department of Agriculture-Bureau of Plant and Industry (BPI), Agriculture department in University of the Philippines-Los Baños Laguna, and Philippine Rice Research Institute (PhilRice). Most retrieved data are obtained from Internet historical data such as lunar cycle. Data sets are consisting of five hundred eighty seven (587) records.

The study will focus on Computer Science and Agriculture courses only since integration of technology are now applied in the new curriculum courses.

The research data will be evaluated using WEKA or SPSS to prevent mistakes on computation. Decision Tree will also be used to determine the rice field bug prediction and verify the accuracy rates. Data mining techniques that create models can be applied to other similar invasive pest.

The study will utilize CRISP–DM techniques which contain Business Understanding where the primary goal is to determine the business objectives; Data Understanding described as collecting, describing and verifying of data; Data Preparation where the

primary keys are selecting, cleaning, and constructing of data; Modeling where the study used Decision Tree to produce data model for the project; Evaluation where the results are evaluated and reviewed; and Deployment where the primary goals are planning and monitoring of the deployment of results.

The research output contains the Predictive Analytics of Bug's Epidemic, data models for the prediction of bug's epidemic and prototype device of insects.

Related Literature and Studies

Agriculture Data Mining

Nowadays, data mining in agriculture are new in research topic because of rapid growing amount of data available from different areas which can be used effectively. Agricultural data virtually are being harvested along with the crops and are being stored in databases. With the ever-increasing amount of information about the farms, farmers are not only harvesting in terms of agriculture output but also a large volume of data.

Today, agricultural sectors particular in rice production suffered greatly from political turmoil and agronomic problems from pest since 1970s (Joshi et.al 2007). Surveying the pest and evaluating the density of the pest population in fields as a way of monitoring rice pest population is very important agricultural decisions.

With the advent of Information Technology, Data mining in agriculture is relatively a different research field. They have used techniques to find relationships between ecology and insect to predict the target episodes and developed solving complex agricultural problems.

Epidemiology Data Mining

Epidemiology is defined as observational science that concerns itself with finding and explaining patterns of health and disease in populations, usually of humans, but also populations of animals, insects and plants (Abello etal. 2004). Data mining involves by the used of techniques to find patterns in data using automated or machine assisted. The goal is to identify fundamental problems that can help from efficient computation, statistical, mathematical models that can aid in the processing and understanding of combined epidemiological data. Limitation experienced in conventional methods using statistical techniques of data analysis where certain situations are commonly encountered.

Epidemic in Data mining is mainly focused on determining the precise epidemiology of bug's outbreak in the rice field. Discovering patterns in massive data sets are required in the bug issues which can help in determining the spread and infestation of bugs.

Decision Tree

A Decision Tree is a powerful tool for classification and prediction intended to facilitate decision making in sequential decision problems. It represents rules that can readily be expressed so that user can be understood or directly used in a database where records dropping into a particular category may easily be retrieved.

Decision Tree is a classifier in the figure of a tree structure where the root node serves as the topmost node. A node with outgoing edges is called an internal node which denotes a test on an attribute. Each branch signifies a result of the test and each leaf node holds a class label.

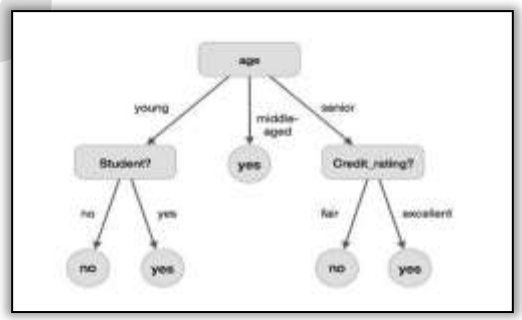

Figure 3. The concept of *buy_computer* whether a customer is likely to buy a computer or not

The Decision Tree can be easily converted to either three analyses: {1} Classification tree when the predicted outcome is the class to which the data belongs; {2} Regression tree when the predicted outcome can be considered a real number such as price of a house; and lastly {3}CART is an acronym from the words Classification And Regression Trees analysis used to refer to both of the two procedures (Moore, 2001).

Methods and Techniques Used

The researcher used Decision Tree Algorithm to predict future patterns. The created model combines and analyzes multiple sets of data to determine the pest infestation. The study used Classification Tree since it is designed for prediction problem where the dependent variable that needs to be predicted with greater accuracy based on several independent variables is nominal and ordinal. SPSS and WEKA are utilized to prevent mistakes and generate data model.

Instrument of the Study

The researcher used observation as a technique to gather data that involves watching and recording how the device functions and progress all throughout the given time. Bugs specimens are collected within a 3-month period at irregular intervals from different locations in Quezon Province. The collected specimens will be analyzed for manual identification and examination. Results seen on these materials will be an indicator to formulate the predictions of the study. (Barrio et.al, 2007)

The study also used the acquired basic data and information coming from agricultural farmers, rice crop technicians and related agricultural offices. It also concentrated on the historical data obtained from different municipalities and cities.

ISO/IEC 9126 software quality model was also used to evaluate the prototype device in order to meet the quality engineering requirements. The software criteria were based on the following characteristics: Efficiency, Functionality, Maintainability, Reliability, Portability, and Usability.

Figure 2. ISO/IEC 9126 Software Quality Model

External quality is used to measure the characteristics of the prototype. Functionality, Reliability, Usability are the main focused characteristics of the prototype (Azuma 2004), whereas the remaining characteristics are difficult to measure by the experts. The functionality requirements provide decision criteria that contribute in deciding the priority of each function when the software product

is used under specific condition. It focused on accuracy and interoperability. The reliability requirements focused on the recoverability and fault tolerance. Finally, the usability requirements focused on operability and learnability of the product (Kim et.al, 2014).

Table 1 shows the sub characteristics per criteria which are used by the researcher in developing indicators or questionnaires.

Table 1. ISO/IEC 9126 Sub Characteristics

The Four–point Likert Scale for the responses was used in rating the system. Arithmetic average was used to evaluate the overall performance of the device.

Table 2. Likert Scale

Range	Description
4	Strongly Agree (SA)
3	Agree (A)
2	Disagree (D)
1	Strongly Disagree (SD)

The respondents are composed of ten experts with a relatively high level of skill or knowledge in the study. They consist of seven (7) agriculturists and farmers which the device can be optimized its capacity and the rest are related in-line Professors.

Population and Sample of the Study

The records of the study are consisted of different occurrences of bug's infestation from different municipalities and cities from the 2005 up to 2015. The instance of data comprise of five hundred eighty seven (587) records. The instance of data was partitioned to training sets and test sets. Subsequently, it process using decision tree tool to generate data models which were used for bug prediction.

Development Methodology

CRISP-DM methodology was used in the development in creating the study. It helps the researcher to understand the data mining process and provide a road map while planning a data mining project. The study follows the six phases of a data mining process which indicate the researcher the importance of frequent dependencies between the phases. *(See figure 1)*

RESULTS AND DISCUSSIONS

Research Questions

Rice Field Insect Light Trap (RFILT) is one of the effective tools of management of the insect pests of the researcher as it mass traps both the sexes of insect pests and also substantially reduces the carryover pest population. This provides information related to insect distribution, abundance, flight patterns and helps in deciding the timing of the application of pesticides.

The researcher designed an ordinary light as an attractant and funnel to direct lured insects into a container. It is battery-operated and made up of different types of wood and metal products that are easily to modify. Counting of pests using sensor technology was also included. The aim of the device is to monitor rice pest population in particular areas suitable in early predicting pest outbreak.

In order to fully examine the device, the researcher selected ten (10) experts to validate the performance of the device based on the ISO/IEC 9126 standard. Six (6) of them came from the agricultural institution capable of conducting experiments and research on farms to improve production in crops while the rest are rice crop farmers who are responsible for preparing land for planting, caring for the crops and harvesting.

Expert's Assessment on the performance of the Rice Field Insect Light Trap (RFILT) Prototype

Efficiency was assessed using the following indicators: (1) The system responds quickly to the command; (2) The system uses appropriate program language; (3) The system performs according to specifications; and (4) The system provides efficient voltages to give signal to other components. Below is the experts' response for the acceptability of the software.

Usability	Experts										**MEAN**	Expert's Response Description
	A	B	C	D	E	F	G	H	I	J		
1. The user can use the system easily.	4	4	4	4	4	4	3	4	4	4	3.9	Strongly Agree
2. The device is presentable.	4	4	3	4	4	4	3	4	4	4	3.8	Strongly Agree
3. The system can easily be learned by the end – user.	4	4	3	4	3	4	4	3	4	4	3.7	Strongly Agree
4. The system remains to standard or regulation to usability.	4	4	3	4	3	4	3	3	4	4	3.6	Strongly Agree
	Gen. Weighted Mean										3.75	

Table 3. Weighted Mean and Description of the Usability of the Rice Field Insect Light Trap (RFILT) Prototype

Table 9 shows that the respondents graded the Usability of the Rice Field Insect Light Trap Prototype as "Strongly Agree" in terms of all indicators with a mean performance of 3.75.

System Criteria	**Weighted Mean**	**Expert's Response Description**
Efficiency	3.05	*Agree*
Functionality	3.23	*Agree*
Maintainability	3.08	*Agree*
Reliability	3.05	*Agree*
Usability	3.75	*Strongly Agree*
Overall Weighted Mean	**3.23**	**Agree**

Table 4 . Summary of the Weighted Mean of the Five (5) Criterias for Rice Field Insect Light Trap (RFILT) Prototype

Table 10 shows the summary results of the prototype based on ISO/IEC 9126 standard. Usability got the highest result 3.75, which means that the device was presentable and is easy to use. Functionality got second with the weighted mean of 3.23 showing that the device meets the expected output. Maintainability ranked as third with the score of 3.08 which reveals that provision for enhancement and faults can be easily diagnosed. Efficiency and Reliability got the same score of 3.05; this reveals that the device has the capability to provide desired performance relative to the amount of resources used under stated conditions and capability to maintain its level of performance under stated conditions for a stated period of time.

Overall, the Rice Field Insect Light Trap (RFILT) Prototype, based on the respondents' response, recorded an overall mean performance of 3.23 that has an interpretation of "Agree" and concluded that the device can be now used for operation.

In order to fully test the RFILT, the researcher conducted a five (5) day experiment to test the validity of the prototype. There were two methods to count the bugs. Automated counting using sensor-technology was administered to determine the bugs that entered into the funnel trapped into the container.

Performance Measure of the Algorithm

The confusion matrix is an effective evaluation tool for analyzing how well the classifier can recognize if the model is confusing two classes. A confusion matrix displays the number of correct and incorrect predictions made by the model compared with the actual classifications in the test data. The matrix is *n*-by-*n*, where *n* is the number of classes. The rows present the number of actual classifications in the test data. The columns present the number of predicted classifications made by the model.

The confusion matrix table illustrates a tabular display that evaluates the forecasting precision of a predictive model.

Table 5. Confusion Matrix Table

		Bugs Epidemic	
		Yes	**No**
Predicted	**Yes**	True Positive	False Positive
	No	False Negative	True negative

The table above shows how to maximize the correctness of classified in instances. For binary classification scenarios, the misclassification rate gives the overall model performance with respect to the exact number of categorizations in the training data.

To determine the accuracy level of the confusion matrix table the equation were used:

$$\boldsymbol{Accuracy\ (ACC) = \frac{TN + TP}{TP + FP + TN + FN}}$$

ACC/Accuracy signifies the amount of the total number of bug predictions that were correct. True Positive (TP) signifies the amount of actual outcomes of bug outbreak accurately classified as predicted bug's outbreak and True Negative (TN) refers to the number of bug infested accurately classified as predicted bug infested status.

To answer the last research question, Decision Tree was applied to create data model which includes all predictor variables. The rules set shown below predicts the probability of bug epidemic. A target value of 1 means rice field are in the stage of infestation; 2 means rice field are in the stage of outbreak condition.

Table 6 Rules for contains 5 Rules

CHAID Results (Note: 1=Infested, 2=Outbreak)

RULE SETS (CHAID Model)

IF (Lunar cycle != "First Quarter" AND Lunar cycle != "New Moon") AND

(Rice Phase = "Vegetative Stage") THEN

Node = 3

Prediction = 2 (Outbreak)

Probability = 1.000000

IF (Lunar cycle != "First Quarter" AND Lunar cycle != "New moon") AND (Rice phase != "Vegetative Stage" AND Rice Phase != "Reproduction Stage" AND Rice Phase != "Resting Stage") AND (Temperature <= "32 to 38")

THEN

Node = 6

Prediction = 2 (Outbreak)

Probability = 0.828571

IF (Lunar cycle != "First Quarter" AND Lunar cycle != "New moon") AND (Rice phase != "Vegetative Stage" AND Rice phase != "Reproduction Stage" AND Rice phase != "Resting Stage") AND (Temperature > "32 to 38 ")

THEN

Node = 7

Prediction = 2 (Outbreak)

Probability = 0.972603

IF (Lunar cycle != "First Quarter" AND Lunar cycle != "New moon") AND (Rice phase = "Reproduction Stage" OR Rice phase = "Resting Stage")

THEN

Node = 5

Prediction = 1 (Infested)

Probability = 0.527132

IF (Lunar cycle = "First Quarter" OR Lunar cycle= "New moon")

THEN

Node = 2

Prediction = (Infested)

Probability = 0.992424

Decision Tree nodes

In order to visualize the generated model, Decision tree nodes are used in the prediction of bugs to describe several possible paths representing deliberate actions or choices, followed by events with different chances of occurrence.

The nodes shown below are the diagram which predicts the probability of bug epidemic.

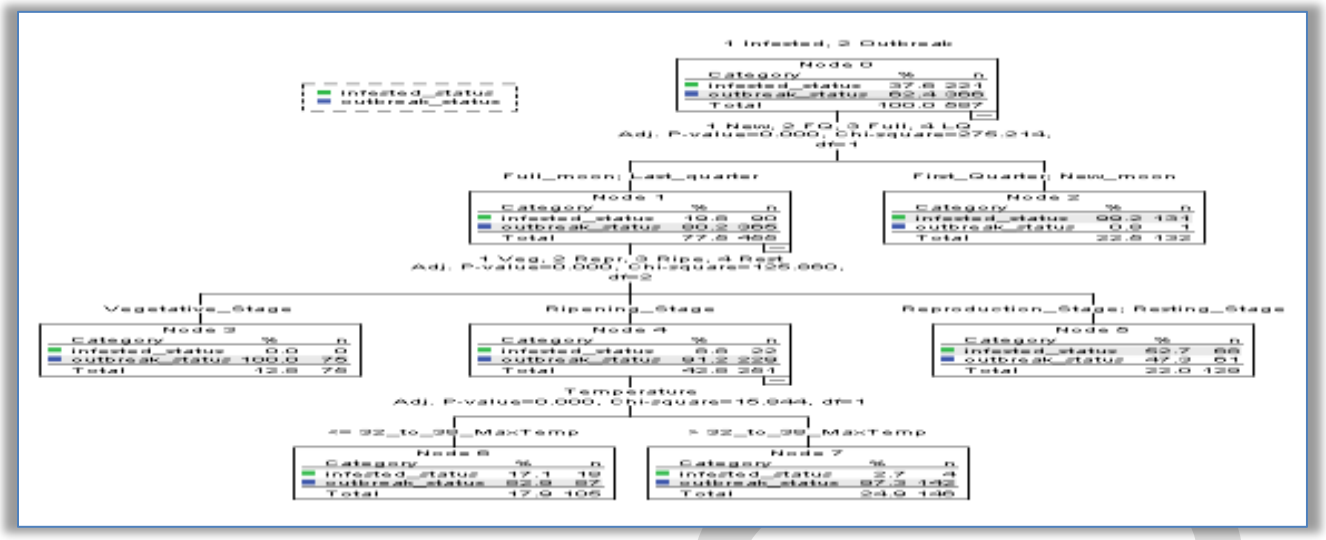

Table 7. Decision Tree diagram of Bug epidemic probability

Table 30 reveals the CHAID method which shows that the Lunar Cycle level is the best predictor of epidemic status. For the Lunar Cycle category, Lunar level is the significant predictor of Epidemic status followed by Vegetative level. In Vegetative stage level, 100% resulted in outbreak status. Since there are no child nodes below it, this is considered a terminal node.

For the Ripening stage, the next best predictor is temperature. Over 82% bugs occurred in the outbreak status if the temperature is lesser or equal to 32 to 38 temperatures while 97.3% if the temperature greater than to 32 temperatures. For Reproduction and Resting stage, 52.7% bugs occurred in the infested status and this is also considered a terminal node.

REFERENCES:

1. Abdullah, A., et al., (2004*), Learning Dynamics of Pesticide Abuse through Data Mining*, Australian Computer Society, Inc. Darlinghurst, Australia
2. Abello, J. & Cormode, G., (2004), *Data Mining and Epidemiology*, DIMACS Report, Center for Discrete Mathematics and Computer Science Rutgers University, Piscataway NJ
3. Abello, J. & Cormode G., (2006), *Report on DIMACS Tutorial on Data Mining and Epidemiology*, DIMACS Center, CoRE Building, Rutgers University
4. Al-Daajeh, S., (2009), *Balancing Dependability Quality Attributes Relationships for Increased Embedded Systems Dependability*, School of Engineering, Blekinge Institute of Technology SE – 372 25
5. Azuma, M., *Applying ISO/IEC 9126-1 Quality Model to Quality Requirements Engineering on Critical Software*, Department of Industrial and Management Systems Engineering, 2004
6. Barrion, A.T, Joshi R.C., and Sebastian, L.S., (2007*),"Rice Black Bugs, Taxonomy, Ecology, and Management of Invasive Species"*, Philippine Rice Research Institute
7. Batista, G. et al., (2011), SIGKDD *Demo: Sensors and Software to Allow Computational Entomology, an Emerging Application of Data Mining*, Bill and Melinda Gates Foundation
8. Frias, P.M., (2012, September 8), *Rice Grain Bug: New Insect Pest Eyed in Caraga*. Retrieved from http://ati.da.gov.ph
9. Hsu, William H., (2001), *Knowledge Discovery and Data Mining in Databases*, Machine Learning and Pattern Recognition
10. *Tropical Asian Irrigated Rice*, Annu. Rev. Entomol, Hanoi Vietname, 45:549–574
11. PhilRice (2015), *Diskarteng Wais Laban sa Peste*, Vol 2 Number 2, Philippine Rice
12. PhilRice (2006), Management of the Rice Black Bug- revised edition, Philippine Rice Research Institute, *Rice Technology Bulletin p2*
13. Ponweera P.A.D.M.D., Premaratne S.C.(2011), Enhancing Paddy Cultivation in Sri Lanka through a Decision Support System, *International Journal of Emerging Technology and Advanced Engineering* , Volume 1, Issue 2

14. Pratheepa, M, et al., (2011), A decision tree analysis for predicting the occurrence of the pest, Helicoverpa armigera and its natural enemies on cotton based on economic threshold level, *Current Science, vol. 100, no. 2, 25*
15. Ramamurthy V. etal. (2010), *Efficiency Of Different Light Sources In Light Traps In Monitoring Insect Diversity, Division of Entomology*, Indian Agricultural Research Institute, Munis Entomology & Zoology, p109-114
16. Ramesh, D., & Vardhan, B., (2013), Data Mining Techniques and Applications to Agricultural Yield Data, *International Journal of Advanced Research in Computer and Communication Engineering*
17. Zaïane, O. R., (1999), *Principles of Knowledge Discovery in Databases - Introduction to Data Mining*, Department of Computing Science, University of Alberta

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Analysis of Domestic Split Unit Air Conditioning System of Outdoor Unit

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Abstract — This paper presents the results of FEA analysis carried for domestic split unit air conditioner system outdoor unit. In the current investigation dynamic analysis is carried out to know the natural frequency of the outdoor unit to check the resonance. So what is resonance?-The resonance is phenomena which is occur due to matching of natural frequency with the external excitation frequency, Due to this we can observe high amplitude of vibration and it leads to failure. In the current work the external excitation is due to AC fan motor and air compressor.

The current work is carried out using software tools CATIA, HYPRMESH, NASTRAN and HYPERVIEW. The Finite Element Method (FEM) is the most commonly used numerical technique, which provides accurate estimates of vibration parameters for these classes of problem. In this work it is found that the natural frequency does not match with excitation frequency. This results in the normal operation of split unit air conditioner system outdoor unit.

Keywords: Air conditioner, CATIA, Model analysis, HyperMesh, Nastran.

INTRODUCTION

Air conditioners are typically categorized into split-type and multi-type air conditioners. Split-type air conditioners have an indoor unit and an outdoor unit connected by communication pipes. Multi-type air conditioners have plural indoor units connected to an outdoor unit. Air conditioners may also be categorized into ones that air conditioners operate a refrigerant cycle in one direction to only supply a room with cool air, and ones that selectively operate a refrigerant cycle in two directions to supply a room with hot or cool air. Now days, mostly every home has their own air conditioner system is to provide comfort during hot days and nights. A frequent problem for the air conditioner manufacture is the noise comes from the air conditioner. Noise is considered undesirable and the cause of the noise may in some cases even limit the heating or cooling efficiency of the air conditioner [1].

Many mathematical models have been proposed in the past for modeling refrigeration systems. These models can be classified as steady state and transient simulations. Steady state simulations are commonly used for performance prediction and product design.[2]. For particular applications, efficiencies of both living and non-living creatures depend, as it were, on the physical environment. The nature keeps conditions in the physical environment in the dynamic state extending from one great to the next. Temperature, mugginess, weight and air movement are a percentage of the critical environment variables that at any area continue changing as the year progressed. Adjustment to these numerous a times an eccentric variety is unrealistic and hence meeting expectations productively is not attainable either for the living creatures or the non-living ones. In this manner for any particular reason, control of nature is crucial. Refrigeration and cooling is the subject which manages the methods to control the situations of the living and non-living subjects and consequently give them solaces to empower them to perform better and have longer lives [3].

Increasing concern about noise from electrical devices has led to increasing demand for quieter cooling fans. With the increasing of small axial fans released on the market, it is difficult to judge which ones have better acoustical performance [4]. The development and implementation of an online disturbance state-filter for the suppression of multiple unknown and time-varying vibrations of air conditioning systems. The proposed design has a form of the state-filter based on a Luenburger-style closed-loop speed observer [5].The clamor delivered by a ventilating and warming unit may be brought about by a few mechanical and aeromechanic sources, including: vibration of the compressor shell, electric engine vibration, and fan commotion. The compressor shell vibration and

subsequent acoustic radiation may be investigated expecting the methods of vibration to be equal to a conveyed monopole source field [6]. A couple of test and numerical studies have been found of barbecues and supporting development's real effect on the exact determination of fan's working trademark. However those studies have not explored the reason for working point change particularly on the air acoustic field [7]. When the rotary compressor *is* operated at a relatively high frequency range (such as 30 Hz - 90 Hz) and the reciprocating compressor is operated at a relatively low frequency range (25Hz-75Hz), the capacities of these compressors *in* proportion to a change in operating frequency can be obtained with low input and at high efficiency [8].

METHODOLOGY

In this work, three dimensional modeling was carried out using Catia V5, HyperMesh is used as a preprocessor tool and the discretized component is solved using Nastran tool.

Dynamic analysis (free natural frequency) carried out to determine the natural frequency of split air conditioner system outdoor unit. This is done mainly to determine weather is system under the influence of resonance or not. The excitation frequency of split unit air conditioner system outdoor unit should not match with natural frequency of any of member of split air conditioner system outdoor unit. The iges file is imported to the HyperMesh. The element type and element size were to be determine by the geometry and size of structure. These are the following different type of element used based on the component geometry.

Table 1.Different type of element and component

Element	Type of element	Component
1D	C bar	Back side grill
2D	SHELL (quad)	Top cover, front cover, right side cover, left side cover, supporting stand, fans, air compressor
3D	SOLID (Hexa)	Finn & condenser

The RBE2(rigid body element) entity stimulate an infinitely rigid element which couple a set of nodes/dofs by enforcing the same amount of motion for each of them, which simply yield in no relative displacement between the nodes upon it is attached. In this analysis the RBE2 is used to stimulate a rigid connection and pin joints. Similarly RBE3 is an interpolation element which defines a linear relationship between nodes/dofs and is usually used to distribute loads and mass upon the corresponding nodes and to constrain the displacement of one node by the weighted average of the displacement of the other nodes. The AC motor fan was idealized or simulated using a CONM2 and RBE3 element. CONM2 element was to represent the mass of AC motor fan and RBE3 being deformable element transfers the load to the supporting structure.

CAD AND FEM DESCRIPTION

GENERAL ASSEMBLY

A concept of split air conditioner outdoor unit was developed using CATIA V5 and is shown in Figure 1.

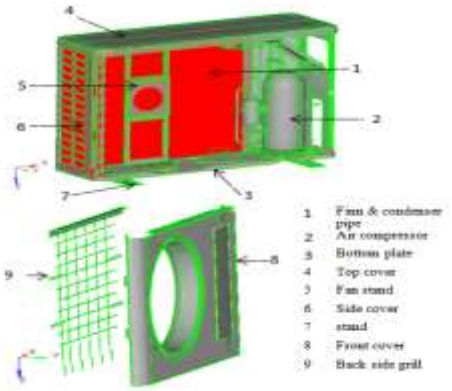

Figure 1: Three Dimensional Model and different parts

MESHED 3D MODEL OF SPILT UNIT AIR CONDITIONER SYSTEM OUTDOOR UNIT

The 3D model was imported and meshed using the HyperMesh (v11.0) tool as shown in Figure2. The FE modelling of a back side grill is carried using the CBAR element (1D) because one of the dimension is very large compared other two. The components like covers, compressor, and stand are modelled using 2D shell elements. In Finn and condenser pipe all the dimensions are dominant so the FE modelling of these components is carried by 3D Hexa elements.

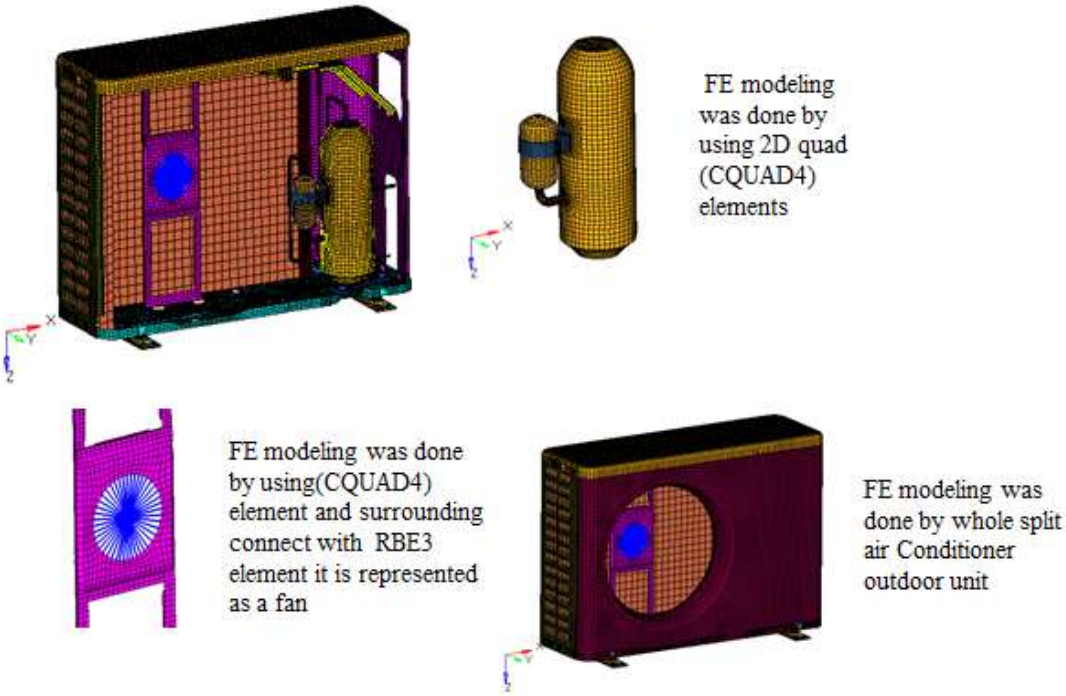

Figure 2: Finite element model of split unit air conditioner system outdoor unit

Table 2.FE model summary

Model summary		
Number of grid	Points	52041
Number of CBAR	Elements	1167
Number of CONM2	Elements	*3*
Number of CQUAD4	Elements	44163
Number of RBE2	Elements	480
Number of RBE3	Elements	3
Number of HEXA	Elemnts	1924

MATERIAL PROPERTIES

Spilt unit air conditioner system outdoor unit is manufactured with the help of material such as, galvanized sheet metal, copper alloy and mild steel. All the cover is of galvanized sheet metal due to good anti corrosive of property. All condenser pipes should transfer heat and temperature respectively. In order to transfer the heat and temperature properly we are using copper alloy. Instead of copper aluminum alloy can be used, as it being a light in weight.

The following are the metal properties for that are used in the component:

Table 3. Material properties

Sl.no	Material	Mechanical properties		
		E	μ	ρ
1	Galvanized sheet metal	$2E10^5$ N/mm^2	0.3	$7.85e10^{-9}$ tonnes/mm^3
2	Copper alloy	$1.25E10^5$N/mm^2	0.33	$9.75e10^{-9}$ tonnes/mm^3
3	Mild steel	$2.10E10^5$N/mm^2	0.3	$7.89e10^{-9}$ tonnes/mm^3

BOUNDARY CONDITIONS

The split unit air conditioner system is standing on the supporting stand and these stands are rigidly fixed to any structure. This is accomplished by constraining all degrees of freedom of the stand as shown in below Fig.3.

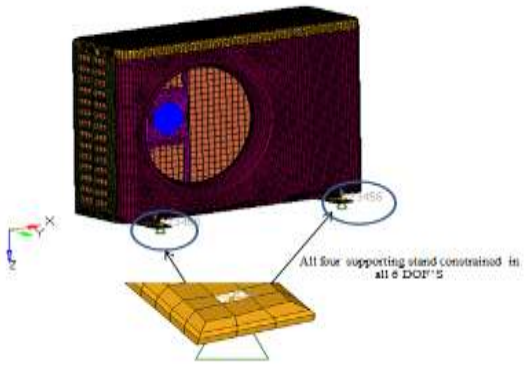

Figure.3. Boundary conditions

RESULTS AND DISCUSSION

As already mentioned earlier, the modal analysis was carried out. The natural frequencies and their corresponding mode shapes are extracted from the analysis. The mode numbers and the corresponding natural frequencies obtained are listed in Table4.

Table 4: Mode numbers and corresponding natural frequencies

Mode number	Frequency in (Hz)	Mode number	Frequency in (Hz)	Mode number	Frequency in (Hz)	Mode number	Frequency in (Hz)
1	6.027	12	27.782	23	66.548	34	78.263
2	7.831	13	27.868	24	66.641	35	78.968
3	8.834	14	30.808	25	66.781	36	80.121
4	13.925	15	32.205	26	68.530	37	82.113
5	13.549	16	36.53	27	68.998	38	84.754
6	14.682	17	44.215	28	70.513	39	86.719
7	16.095	18	44.911	29	70.700	40	87.673
8	21.285	19	49.8031	30	72.527	41	88.978
9	23.550	20	50.24	31	73.305	42	90.320
10	25.083	21	55.679	32	75.99	43	92.250
11	26.45	22	57.338	33	77.538	44	94.418

Figures 4 and 5 shows typical mode shapes Corresponding to 6^{th} and 10^{th} matching with fan and air compressor respectively.

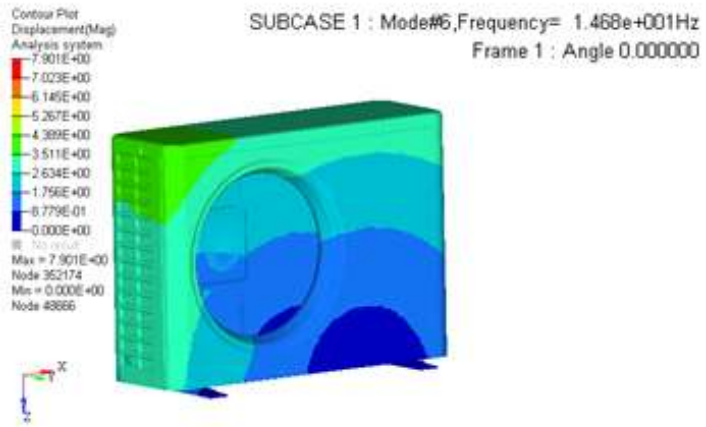

Figure 4: Mode shape for 6th mode of vibration (*f2*=14.682Hz)

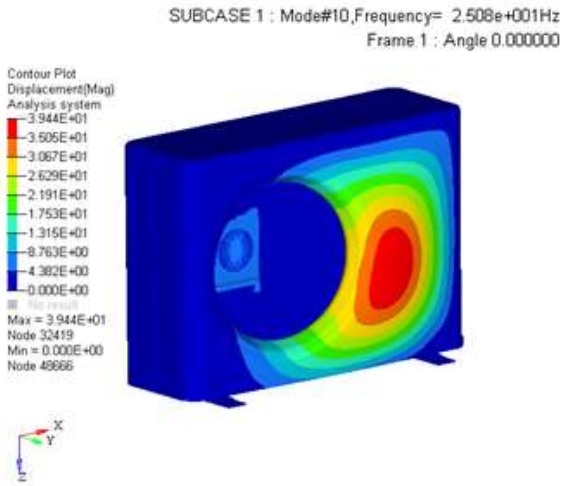

Figure 5: Mode shape for 10th mode of vibration (*f10*=25.083 Hz)

Table 5: operating frequency of fan and rotary air compressor

Operating condition	
Fan	Rotary air compressor
1075-1100 rpm (18Hz)	1800-5400rpm (30-90Hz)

In order to avoid resonance the operating frequency should lie outside 15% range of natural frequency.

CONCLUSION

During the analysis the natural frequency of the component is found to be matching with the operating frequency of air conditioner fan and compressor as shown in table 5. The compressor operating frequency is 30 to 90 Hz. The frequency obtained from the analysis is found to be matched from 10 modes to 43 modes as shown in table 4. The 7^{th} mode is matching with the operating frequency of fan i.e. 18 Hz. Further study is carried to reduce the frequency coincident from operating frequency of fan and compressor by using forced vibration analysis.

REFERENCES:

[1] M.S.M.Sani, M.H.A. Rasid, M.R.M.Rejab, M.M.Noor, K.Kadirgama & M.M.Rahman "Experimental study on noise source identification of split Unit air Conditioner system" International Conference on Advance Mechanical Engineering (ICAME09)22~25 Jun, 2009.

[2] Prof. Dr. Khalid Ahmed Al-Joudi Asst. Lect. Qusay Rasheed Abd Al-Amir "Performance Evaluation of Small Scale Air-Conditioning System Using R22 and Alternative Refrigerants" , Journal of Engineering 62,Volume 20 ,January 2014.

[3] Refrigeration and air conditioning, www.ignou.ac.in/upload/Unit%201-32

[4] Li Zhang1,2, Yingzi Jin1 "Numerical Investigation on Vortex Structure and Aerodynamic Noise Performance of Small Axial Flow Fan", Open Journal of Fluid Dynamics, pp 359-367, 2012.

[5] Cheon-Su Park, SeHwan Kim, Gwi-Geun Park, and Jul-Ki Seok, "Active Mechanical Vibration Control of Rotary Compressors for Air-conditioning Systems" Journal of Power Electronics, Vol. 12, No. 6, November 2012.

[6] M.J.Crocker, J.P. Arena, R.E. Dyamannavar, "Identification of noise on a residential split-system air conditioner using sound intensity measurements", pp 545-558, Journal of Applied Acoustics 65, 2004.

[7] Stefano Bianchi, Alessandro Corsini and Anthony G. Sheard "Synergistic Noise-By-Flow Control Design of Blade-Tip in Axial Fans: Experimental Investigation, Noise Control, Reduction and Cancellation Solutions in Engineering", ISBN 978-953-307-918-9, 02, March, 2012

[8] Okoma, T.Itami K. and Misawa, K., "An Experimental Study of Frequency- Controlled Compressors".International Compressor Engineering Conference. Paper 411. (1982)

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Study of Static Cutting Forces in Face Milling And Simulation of Forces Using Matlab

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Abstract— **Due** to the extensive use of highly automated machine tools in the industry, the manufacturing requires reliable models for the prediction of output performance of machining processes. The prediction of cutting forces plays an important role in the manufacturing industry. The focus of this paper is to develop a program using MATLAB software for simulation and verification of cutting forces in face milling process. Though we have many types of indirect methods available, to carry out this process, a lot of experiment has to be done resulting in high cost and time requirement. This paper involves a procedure for the simulation of static and dynamic cutting forces in face milling operation. The mechanistic model which is selected for simulation and verification are the ones which take in to account the initial position errors of the inserts and spindle eccentricity for the analysis. The relevant equations are studied and static and dynamic model are simulated.

Keywords— MATLAB, face milling process, dynamometer, mechanistic model, simulation, initial position errors

1.INTRODUCTION

Manufacturing is an value added process that had always been of significant importance to human civilization. Machining operations comprise a substantial portion of the world's manufacturing infrastructure, making the enhancement and control of metal removal processes one of the main concerns of the industry [1]. Means of achieving the said enhancement is to estimate the product and process quality, tool life and stability of the machining process because they facilitate effective planning of machining operations, optimum performance, quality and cost and hence can lead to the proper selection of machining conditions, optimal fixture design and avoidance of tool failure. An accurate indicator of the mentioned factors is the cutting force resulting from the cutting process. Numerous attempts and methods have been proposed to predict the forces. In this study, The main objective is to study in detail the various techniques of analytic and mechanistic modeling of cutting force in face milling operation and develop a flexible program software by using a MATLAB. The current study is aimed at investigating the optimum method of predicting the cutting forces during the face milling operation. Different techniques have been used to predict cutting forces.

1. Study and analysis of mechanistic modeling of face milling process.

2. Development of generalized MATLAB program.

3. Validation of the program results with experimentally published data.

Investigation of cutting forces is a key part in the development of cutting technologyt. They are one of the main criteria for evaluating machinability of material and as such attract the attention of many researchers in this field. Knowledge of cutting forces beforehand is valuable as it leads to an efficient and automated process through the proper selection of machining parameters, fixture design and appropriate machines and tools used. These vary in their generality, accuracy and amount of data required as an input into the model. Analytical methods are hindered by their low accuracy in predicting forces and by their lack of generality as well as the large amount of experimental data needed for each work piece and tool material under various cutting conditions [1].This renders their use expensive and time consuming. Whereas, mechanistic methods have a higher accuracy in predicting cutting forces. The objective of this thesis is to study in detail the various techniques of analytic and mechanistic modeling of cutting force in face milling operation and develop flexible program software by using a MATLAB

2.Face milling

Face milling and face milling cutters have always been subjects for intensive study. Face milling is widely used for milling operations involving high rate of metal removal and hence any improvement in productivity of this process would have great impact on machining costs. Further the wide use of numerically controlled machines have necessitated a greater and more detailed understanding of this process. In face milling the cutter is mounted on a spindle having an axis of rotation is perpendicular to the workpiece surface. The cutter axis is vertical, but in the newer CNC machines it often is horizontal. In face milling, machining is performed by teeth on both the end and periphery of the face-milling cutter. Face milling is usually applied for rough machining of large surfaces.

3.Mechanistic Cutting Force Model

A number of different methods to predict cutting forces have been developed over the last fifty years. These models can be classified in to three major categories, Empirical, Analytical and Mechanistic methods. In the empirical method, a number of machine experiments are performed and performance measure such as cutting forces, tool life and tool wear are measured. These responses are then correlated to the cutting conditions using empirical functions. The empirical methods often require a lot of experiments and have limited extrapolation value. Analytical approximation model gives the physical mechanism that occurs during cutting. However, due to complex mechanism such as high stress values, high temperature gradients and combined elastic and plastic deformations the analytical model is unable to completely characterize the phenomena that occur on the rake and flank faces of the cutting insert. Mechanistic models predict the cutting force based on a method developed by Sabberwaal [2].

4.Theoretical Modeling of Cutting Forces

Here a procedure for the simulation of static and dynamic cutting forces in face milling operation are studied. Major factors like initial position errors of the inserts and spindle eccentricity are considered for the analysis. The relevant equations are studied for both static and dynamic condition. The cutting force systems in face milling have been extensively studied both analytically and empirically. Most of the researchers have dealt with development of force equation and the modeling of specific cutting pressure under the simplest conditions such as plane surface, limited consideration of cutter geometry, and no run out considerations. A force model which deals with more complicated machining situation should be systematically organized and computerized. In this view, general approach to develop a mechanistic face milling force model is presented by Kling and Devor [3, 4].

4.1 Static forces Analysis in Face Milling Operation

The instantaneous static force can be obtained as the resultant of all the forces acting on the individual inserts engaged in cutting at a certain instant [2]. Based on the conventional static force model assumption the initial position errors of inserts and the eccentricity of spindle are taken into consideration for the model development. Figure 4.1(b) shows cutter and cutter geometry in face milling operation. Figure 4.1(a) clearly indicates the various cutter geometry such as axial rake angle γA, radial rake angle γR and lead angle γL. Since feed rate is much smaller than the cutter radius the path of face milling cutter can be approximated as a circle without much loss of accuracy [2].

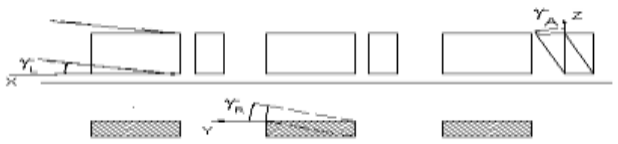


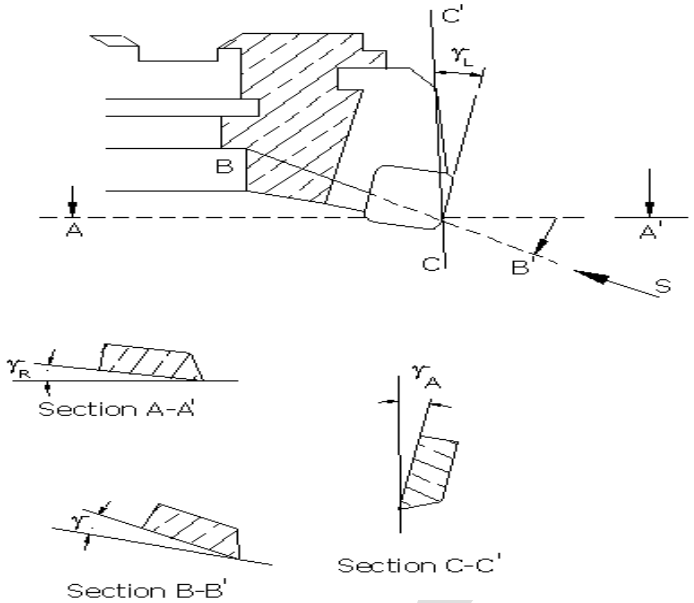
Figure 4.1(a) Lead, Radial and Axial Inclination of the Cutter Tip

Fig. 2 illustrates a typical face milling process in which the various cutting force components are marked on single insert. Ft ,Fr and Fa are the tangential, radial and axial forces acting on the tip of the insert respectively. Figure 4.1(c) shows a Cutting Force Components on I^{th} Insert at Angleθ.

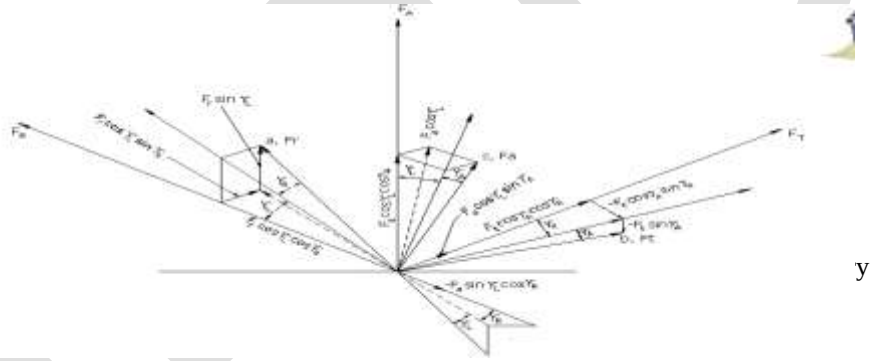
The cutting edge enters the work piece at an entry angle $\boldsymbol{\delta_1}$leaves at exit angle $\boldsymbol{\delta_2}$The included angle **ψ** within which the cutting tooth and the work piece are in contact can be expressed as [14]:

$$\psi = \delta_2 - \delta_1 = Sin^{-1}\left[\frac{2m}{D}\right] + Sin^{-1}\left[\frac{2(b-m)}{D}\right] \quad (1)$$

Where **m** is the distance between work piece edge and centre of the cutter, **D** is the diameter of the cutter and **b** is the width of the work piece. Using the equation (1) the number of inserts simultaneously in contact with the work piece can be determined.



For instance, consider the tangential force $\mathbf{F_T}(i,\varphi)$ in global coordinate system which can be obtained as the summation of the force components tangential force $\mathbf{F_t}$, radial force $\mathbf{F_r}$, and axial force $\mathbf{F_a}$ acting on the insert. The $\mathbf{F_t}$ component can be resolved first into axial rake angle γ_A and then to radial rake angle γ_R as $\mathbf{F_t\ Cos\ \gamma_A\ Cos\ \gamma_R}$. Similarly, $\mathbf{F_r}$ components resolved to $\mathbf{F_r\ Cos\ \gamma_L\ Sin\ \gamma_R}$ and axial component to $\mathbf{F_a\ Cos\ \gamma_L\ Sin\ \gamma_A}$. Summation of the force components gives:



y

FT (i, ϕ) = Ft C

FR (i, ϕ) =Ft Cos A Sin R Fr CosL Cos R Fa Sin LCos R

FA (*i*, ϕ) =*Ft Sin A Fr Sin L Fa Cos LCos A*

Development of Program Using Matlab

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

5.1 Wilson Theta Method

Wilson theta method is used for numerical analysis. To carry out step-by-step numerical integration of linear or non linear equation of motion Wilson -Theta method was employed. Two very important properties of the numerical integration are stability and accuracy which is good using Wilson –Theta method.

5.2 Program Details for STATIC Force Computation

The static force modeling for the face milling operation are simulated by the use of the MATLAB program developed based on the mechanistic model, Flow charts for developing the static cutting forces are given below.

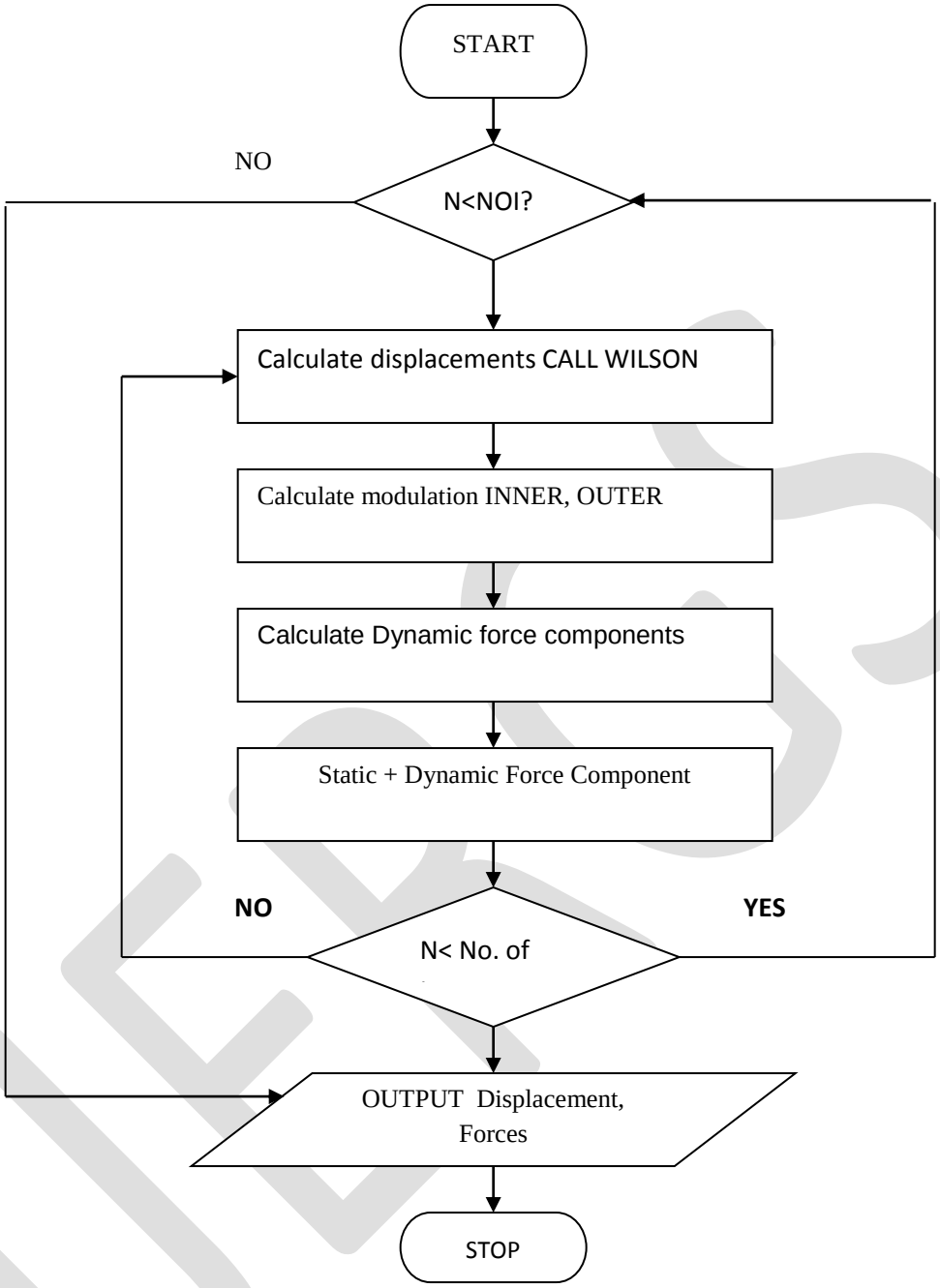


Figure 5.1 Flow Chart for Static Cutting force Calculation

CONCLUSIONS

This paper involves a procedure for the simulation of static cutting forces in face milling operation. The mechanistic model which is selected for simulation and verification are the ones which take in to account the initial position errors of the inserts and spindle eccentricity for the analysis. The relevant equations developed by researchers have been studied and compared with different mechanistic models for simulating both static forces. Program has been written using MATLAB software and Wilson Theta method is used for the numerical iteration process in the program. The simulated forces of static are closely scrutinized with the measured force given in references. The program developed has been tested and verified for its working and accuracy by running it using cutting

conditions and modal parameters for different number of inserts and varying depth of cut and fed rate given by researchers whose simulated result itself has been validated by the experiments.

REFERENCES:

1. Amal A. Khattab, Candidate for the Master of Science Degree American University of Sharjah, 2011
2. A.J. Sabberwaal, "Chip section and cutting force during the milling operation", Annals of C.I.R.P, pp121, 1961.
3. KLINE, W. A. DEVOR, R. E., AND LINDBERG, J. R., *"*The prediction of cutting forces in end milling with application to cornering cuts.*"* Int J. Mach. Tool Des. Res., **22 (1),** 7, 1982.
4. Das, M.K., Tobias, S.A., "The relation between static and dynamic cutting of metals", International Journal of Machine Tool Design and Research, vol.7, pp.63-89, 1967
5. Kovac, P., Savkovic, B., Mijc, A., Sekulic. "investigation of the effect of non uniform insert pitch on vibration during face milling''
6. A.J. Sabberwaal, "Chip section and cutting force during the milling operation", Annals of C.I.R.P, pp121, 1961.
7. PANDEY, P. C., AND SAN, H. S., "Analysis of cutting forces in peripheral and face milling operatios," Int J. Prod. Res., **10 (4), 3**79, 1972.
8. KLINE, W. A. DEVOR, R. E., AND LINDBERG, J. R., *"*The prediction of cutting forces in end milling with application to cornering cuts.*"* Int J. Mach. Tool Des. Res., **22 (1),** 7, 1982.
9. KLINE, W. A.DEVOR, R. E., "The effect of run out on cutter geometry and forces in end milling." Int J. Mach. Tool Des. Res., **23,** 123, 1983.
10. Sridhar, R., Hohn, R.E., Long, G.W., "A stability algorithm for special case of milling process, Contribution to Machine Tool chatter research – 6", ASME Journal of Engineering for Industry, vol.90, pp.325-329, 1968.
11. Sridhar, R., Hohn, R.E., Long, G.W., "A stability algorithm for general milling process, Contribution to Machine Tool chatter research – 7", ASME Journal of Engineering for Industry, vol.90, pp.330-334, 1968
12. Budak,E., Altintas,Y., "Analytical prediction of chatter stability in milling, part I: General formulation", proceedings of ASME Dynamic Systems and Control Division, vol.57, pp.545-556, 1995.

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DATA WAREHOUSE AND DATA MINING TECHNIQUES

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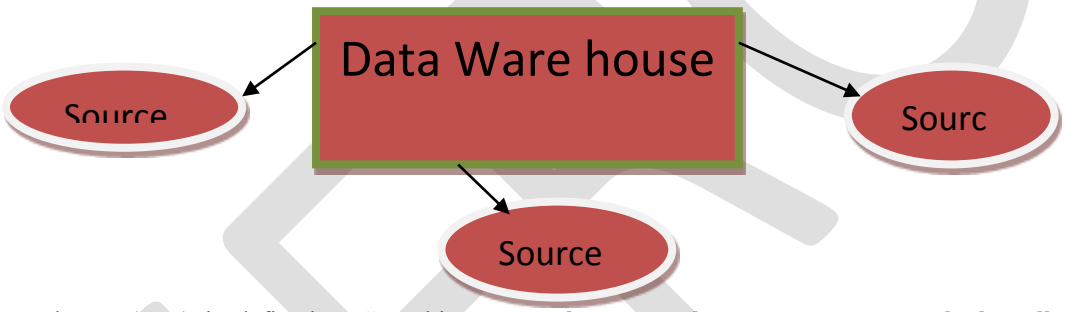
Abstract—The data mining techniques and applications are marked as important field in the data mining which we used in this paper. These are very helpful to understand the concept of data mining. Even beginners' are understand it very easily The concept of data mining was summarized and its significance towards its methodologies was illustrated. With the wide application of business intelligence in corporate, the demand for data mining software increases daily. To improve the efficiency and quality of the reusing data mining software and reduce the period and cost of developing data mining application system .Data Warehouse is today's biggest need so it's very important to learn about this, and we are trying to give our best to make people understand about data ware house and data mining by this paper.
Keywords- Data mining, DWH, Data mining application, data mining techniques

INTRODUCTION

Data Warehouse is a central managed and integrated database containing data from the operational source in an organization. A data warehousing is not just the data responstries to create a new ,central database but also the architecture and tools to collect, query and analyze the data. Data warehouse is a subject oriented ,integrated time varying, non-volatile collection of data that is used for organization decision making.



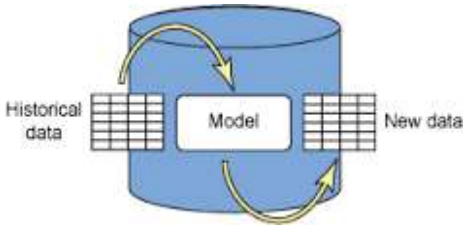
Data Warehouse (DW) is defined as "a subject-oriented, integrated, time-variant, non-volatile collection of data in support of management's decision-making process". Data warehouses store huge amount of information from multiple data sources which is used for query and analysis. Therefore, the data is stored in the multidimensional (M D) structure. [4]

A data warehouse is a kind of management technique that collect business data from different stations of the enterprise network, so that it can provide efficient data analysis to decision makers. There are some architectural requirements which would govern development of architecture, some of them are: identifying potential users, defining security requirements, skill requirements etc.[2]

Some important points about data warehouse-

- Historical Data
- Large volume of data
- Update in frequently
- It is subject oriented

A multidimensional model stores information into facts and dimensions. A fact contains the interesting concepts or measures (fact attributes) of a business process (sales, deliveries, etc.), whereas a dimension represents the perspective or view for analyzing a fact (product, customer, time, etc.) using hierarchically organized dimension attributes.



Database Design Modal

The database design consists of following five phases. The first phase is Analysis of operational systems whose aim is to collect the information concerning the pre existing operational system. It involves the designer, along with the people involved in managing the information system and produces in output the (conceptual or logical) schemes of either the whole or part of the information system. The next phase consists in gathering and filtering the user requirements [4]

Database Design Modal

Step	Input	Output
Analysis of operational system	Information regarding the operational system	Database schema
Requirement elicitation	Database schema	Specification for DWH
Conceptual design	Database schema and specification	Conceptual schema
Logical design	Conceptual schema	Logical schema
Physical design	Logical schema	Physical schema

After gathering interest information they used different OLAP tools to provide different dimension of data and based on these different dimensions, decisions can be made. Distinguish between OLTP and OLAP: Online Transactional Process (OLTP) is day to day operation of an organization primary business. Such as ATM of banks, flight ticket of travel agency etc. Whereas Online Analytical Processing (OLAP) is capable of handling huge amount of integrated data to process ad-hoc queries, e.g. which books customers likely to buy together.[2]

Views regarding a data warehouse design must be considered: the top-down view, the data source view, the data warehouse view, of the information system.

- **The Top** - Down view allows the selection of the relevant information necessary for the data warehouse. This information matches current and future business needs.
- **The Data source view-** exposes the information being captured, stored, and managed by operational system. This information may be documented at various levels of detail and accuracy, from individual data source tables to integrate at various levels of detail and accuracy, form individual data source tables to integrated data source tables. Data sources are often modeled by traditional data modeling techniques, such as the E-R model or DASE tools.
- **The Data warehouse view**- includes fact tables and dimension tables. It represents the information that is stored inside the data ware house, including pre calculated totals and counts, as well as information regarding the source, date and time of origin added to provide historical context.
- **The Business Query View** -is the data perspective in the data warehouse form the end-user's view point
  So, building and using a data warehouse is a complex task[6]

DATA MODELING TECHNIQUES

Two data modeling techniques that are relevant in a data warehousing environment are ER modeling and Multidimensional modeling.

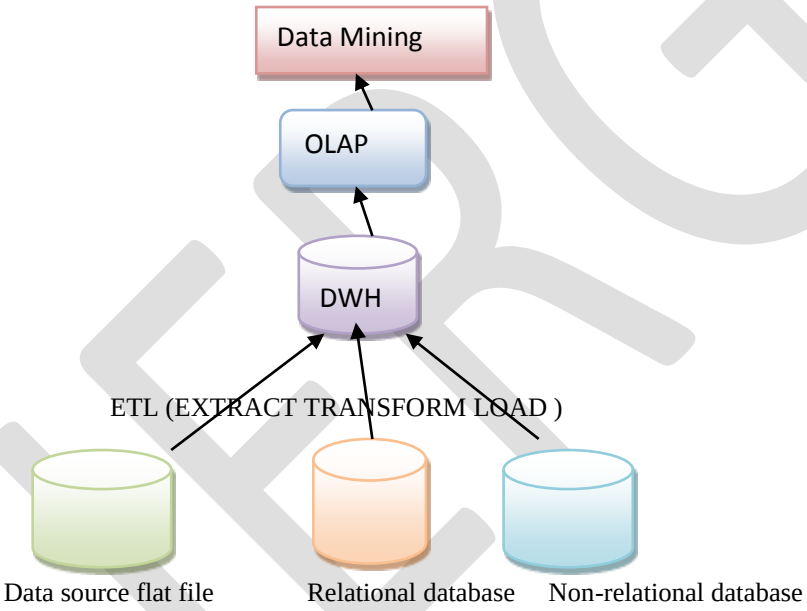
ER modeling produces a data model of the specific area of interest, using two basic concepts: entities and the relationships between those entities. The ER model is an abstraction tool because it can be used to understand and simplify the ambiguous data relationships in the business world and complex systems environments.

Multidimensional modeling uses three basic concepts: measures, facts, and dimensions. Multidimensional modeling is powerful in representing the requirements of the business user in the context of database tables. Both ER and Multidimensional modeling can be used to create an abstract model of a specific subject.[3]

Business metadata is content from the data warehouse described in more user-friendly terms. The business metadata tells you, what data you have, where it comes from, what it means and what its relationship is to other data in the data warehouse. We are solving the modern business problems like market analysis and financial forecasting requires query- centric databases schemas that are array-oriented and multidimensional. These business problems are specified by the need to manipulate large numbers of records from very large data sets.[6]

Data Mining-

The Data Mining is the collection of the data, when the data is in the current state then it is called data mining. The inaccurate information is not persisting in data mining. It is the process of discovering hidden data. Purpose of data mining is to extract useful information from different sources for future planning. Data mining is also called KDD (Knowledge Discovery in database) We are live in a world where vast amount of data are collected daily. Analyzing such data is an important need. Data mining used for analyzing data .Given diagram help us to illustrate the Data mining.



DATA MINING LIFE CYCLE:

The life cycle of a data mining project consists of six parts. It depends on the outcome of each part. The main parts are:

- **Business Understanding:**
  This phase focuses on understanding the project objectives and requirements from a business perspective, then converting this knowledge into a data mining problem definition and a preliminary plan designed to achieve the objectives.
- **Data Understanding:**
  It starts with an initial data collection, to get familiar with the data, to identify data quality problems, to discover first insights into the data or to detect interesting subsets to form hypotheses for hidden information.
- **Data Preparation:**
  In this stage, it collects all the different data sets and constructs the varieties of the activities basing on the initial raw data
- **Modeling:**
  In this phase, various modeling techniques are selected and applied and their parameters are calibrated to optimal values.
- **Evaluation:**

In this stage the model is thoroughly evaluated and reviewed. The steps executed to construct the model to be certain it properly achieves the business objectives. At the end of this phase, a decision on the use of the data mining results should be reached.

- **Deployment:**
  The purpose of the model is to increase knowledge of the data, the knowledge gained will need to be organized and presented in a way that the customer can use it. The deployment phase can be as simple as generating a report or as complex as implementing a repeatable data mining process across the enterprise.

DATA MINING APPLICATIONS

Data mining in Healthcare: Data mining applications in health can have tremendous potential and usefulness .However, the success of healthcare data mining hinges on the availability of clean healthcare data. In this respect, it is critical that the healthcare industry look into how data can be better captured, stored, prepared and mined. Possible directions include the standardization of clinical vocabulary and the sharing of data across organizations to enhance the benefits of healthcare data mining applications [10]

Data Mining in Banking and Finance: Data mining has been used extensively in the banking and financial markets. In the banking field, data mining is used to predict credit card fraud, to estimate risk, to analyze the trend and profitability. In the financial markets, data mining technique such as neural networks used in stock forecasting, price prediction and so on.

Data Mining in Market Basket Analysis: These methodologies based on shopping database. The ultimate goal of market basket analysis is finding the products that customers frequently purchase together. The stores can use this information by putting these products in close proximity of each other and making them more visible and accessible for customers at the time of shopping.

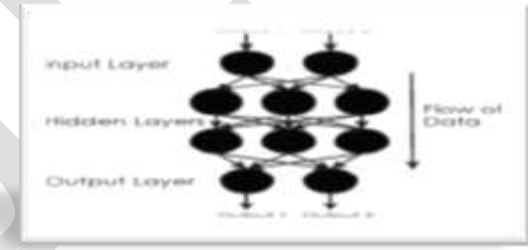
Data Mining in Earthquake Prediction: Predict the earthquake from the satellite maps. Earthquake is the sudden movement of the Earth's crust caused by the abrupt release of stress accumulated along a geologic fault in the interior. There are two basic categories of earthquake predictions: forecasts (months to years in advance) and short-term predictions (hours or days in advance).

Data Mining in Bioinformatics: Bioinformatics generated a large amount of biological data. The importance of this new field of inquiry will grow as we continue to generate and integrate large quantities of genomic, proteomic, and other data [11]

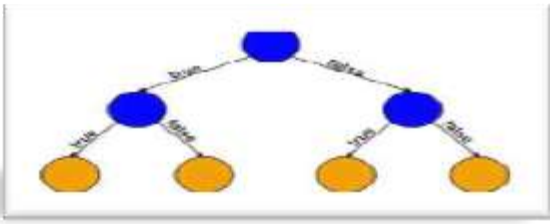
DATA MINING TECHNIQUES

(1). Artificial neural networks:

Non-linear predictive models that learn through training and resemble biological neural networks in structure.[12]

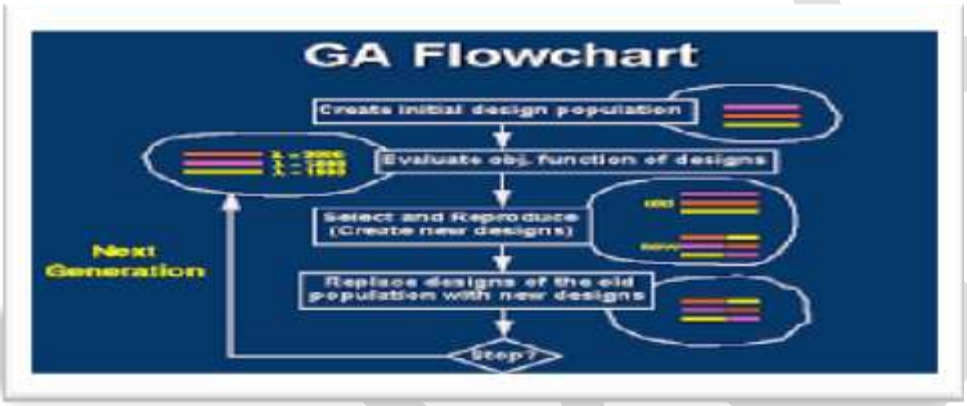


(2). Decision trees:
Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset. Specific decision tree methods include Classification and Regression Trees (CART) and Chi Square Automatic Interaction Detection (CHAID).



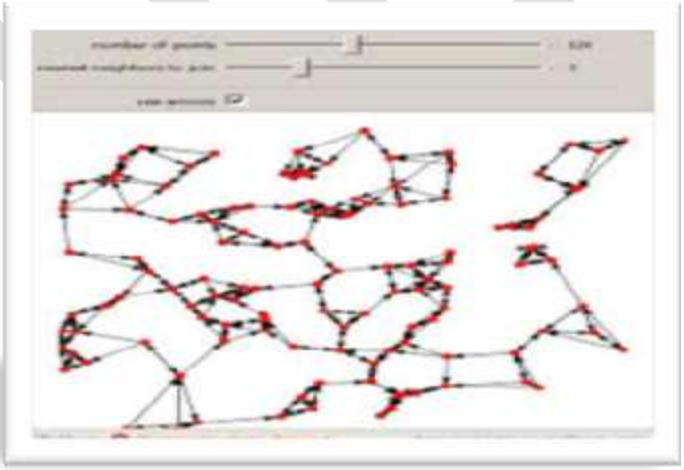
(3). Genetic algorithms:

Optimization techniques that use process such as genetic combination, mutation, and natural selection in a design based on the concepts of evolution.



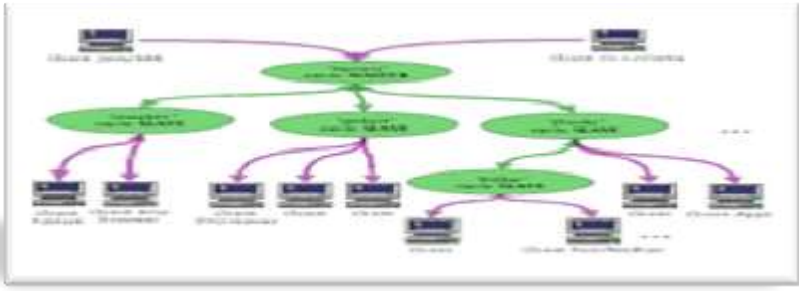
(4). Nearest Neighbor method:

A technique that classifies each record in a dataset based on a combination of the classes of the k record(s) most similar to it in a historical dataset (where k ³ 1). Sometimes called the k-nearest neighbor technique. [10]



(5) Clustering:

Clustering is a collection of similar data object. Dissimilar object is another cluster. It is way finding similarities between data according to their characteristic. This technique based on the unsupervised learning (i.e. desired output for a given input is not known). For example, image processing, pattern recognition, city planning. [11]



(5).Association:

Association is one of the best known data mining technique. In association, a pattern is discovered based on a relationship of a particular item on other items in the same transaction. For example, the association technique is used in market basket analysis to identify what products that customers frequently purchase together. Based on this data businesses can have corresponding marketing campaign to sell more products to make more profit. **Applications**: market basket data analysis, cross-marketing, catalog design, loss-leader analysis, etc.

Types of association rules: Different types of association rules based on

- Types of values handled
  - Boolean association rules
  - Quantitative association rules
- Levels of abstraction involved
  - Single-level association rules
  - Multilevel association rules
- Dimensions of data involved
  - Single-
-dimensional association rules
  - Multidimensional association rules [13]

CONCLUSION

A data warehouse is a kind of management technique that collect business data from different stations of the enterprise network, so that it can provide efficient data analysis to decision makers. There are some architectural requirements which would govern development of architecture, some of them are: identifying potential users, defining security requirements, skill requirements etc with the wide application of business intelligence in corporate, the demand for data mining software increases daily. To improve the efficiency and quality of the reusing data mining software and reduce the period and cost of developing data mining application system. In this paper we also include different views of DWH and also explain data ware house life cycle. We have included the detail of data mining techniques which are beneficial to understand the data mining. Everyone should aware about data mining and data warehouse so that we can take advantages of modern technology.DWH has become the necessity for the modern word so that our little

effort helps people to learn about this.

REFERENCES:

[1] Stefano Rizzi, Alberto Aiello's, "Research in Data Warehouse Modeling and Design: Dead or Alive?"

[2] Muhammad Arif, 1Ghulam Mujtaba," A Survey: Data Warehouse Architecture, International Journal of Hybrid Information Technology", Vol.8, No. 5 (2015), pp. 349-356 http://dx.doi.org/10.14257/ijhit.2015.8.5.37

[3] MS. Alpa R. Patel, Pro f. (DR.) Jayesh M. Patel**, "Data Modeling Techniques For Data Warehouse, International Journal Of Multidisciplinary Research", Vol.2 Issue 2, February 2012, ISSN 2231 5780

[4] Rajni Jindal1 and Shweta Taneja2, "Comparative Study Of Data Warehouse Design Approaches: A Survey",International Journal of Database Management Systems (IJDMS) Vol.4, No.1, February 2012

[5]Nirmal Sharma1 and S.K. Gupta2, "Design And Implementation Of Access The Contents In TheData Warehouse", International Journal of Information Technology and KnowledgeManagementDecember2012,Volume 6, No. 1, pp. 61-641 Aryan Institute of Technology, Ghaziabad (UP). E-mail:nirmal1709@rediffmail.com2 B.I.E.T. Jhansi (UP), E-mail: guptask_biet@rediffmail.com

[6] Mr. Dishek Mankad1, Mr. Preyash Dholakia2, " The Study on Data Warehouse Design and Usage, International Journal of Scientific and Research Publications", Volume 3, Issue 3, March 2013 1 ISSN 225315www

[7] Dr. Mohamed F. AlAjmi, Shakir Khan Dr. Arun Sharma "Studying Data Mining And Data Warehousing With Different E-Learning System", (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 4, No.1, 2013

[8] David Sushil, 2B.Siva NagaRaju,3K.RaghavaRao, "Comparative Study Of Data Warehouse Design Approaches From Security Perspective", David et al. / IJEA Vol. 2 Issue 2 ISSN: 2320-0804

[9] P.Veeramuthu, Dr.R.Periasamy, "Application of Higher Education System for Predicting Student Using Data mining Techniques", International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163Volume 1 Issue 5 (June 2014) http://ijirae.com

[10] Neelamadhab Padhy, Dr. Pragnyaban Mishra, and Rasmita Panigrah "The Survey of Data Mining Applications And Feature Scope"Vol.2, No.3, June 2012

[11] Smita1, Priti Sharma "Use Of Data Mining In Various Field: A Survey Paper ",e-ISSN: 2278-0661, p- ISSN: 2278-8727Volume 16, Issue 3, Ver. V (May-Jun. 2014), PP 18-21 www.iosrjournals.org www.

[12] Nikita Jain1, Vishal Srivastava2 "Data Mining Techniques: A Survey Papere", ISSN: 2319-1163 | pISSN: 2321-7308

[13] Kalyani M Raval, "Data Mining Techniques", Volume 2, Issue 10, October 2012 ISSN: 2277 128X

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ISSN 2091-2730

An integrated approach to assess the quality of groundwater in and around Neyveli lignite mine area, Cuddalore District,Tamil Nadu, India

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Abstract— In the current study 23 groundwater samples collected in and around Neyveli lignite mine area, Cuddalore district, Tamil Nadu, India to assess groundwater quality by analyzing the major cations (Ca^{2+},Mg^{2+},Na^{+} and K^{+}) and anions (SO_4^{2-}, $HCO_3^{-}$and Cl^{-})besides physico-chemical parameters (namely pH, Temperature, Electrical Conductivity, Total Dissolved Solids).Also, geographic information system-based groundwater mapping in the form of visually communicating contour maps was developed using ArcGIS-9.3to delineate spatial physico-chemical characteristics of groundwater samples. Different parameters of water have been analyzed and are in adherence to Bureau of Indian Standard permissible limit. It reveals that groundwater in and around Neyveli lignite mine area is not polluted and therefore was considered suitable for human consumption.

Keywords— Groundwater quality, physico-chemical parameters, geographic information system, Neyveli lignite mine area.

INTRODUCTION

Medically it has been confirmed that, the average human body is composed of 65% water and dehydration starts just at only 6% loss of body water [1]. Again, it is well established that about two – thirds of the earth surface is occupied by water in liquid, gas and solid forms. Besides, researches have showed that the total volume of water on the Earth surface is about 1400 Km^3 and more than 97% of this is sea water. Notwithstanding these figures, only about 0.8% is fresh water out of which groundwater constitute only 0.6%. Thus, the total easily accessible safe and drinkable surface fresh water is only 0.2% which represents approximately 11.2 km^3 of volume on earth.

Groundwater, though makes up about 0.6% of the water on Earth, it is an important resource for potable water, irrigation, domestic purposes, food production or recreational purposes, and industry [2]. Groundwater dissolves various soil, ground, and rock minerals through the action of chemical weathering and on its traverse through the groundwater system.

Therefore six ions are predominant in most ground waters. These are called the major ions; there are 3 major cations Ca^{2+}, Mg^{2+}, Na^{+}, and 3 major anions HCO_3^{-}, $SO_4^{2-}$and Cl^{-}, with concentrations usually higher than 5 mg/l. Minor ions have concentrations in the range of 0.01 to 10 g/m3; examples are K^{+}, Fe^{2+}, Fe^{+3}, F^{-}, B^{-}, NO_3^{-} and CO_3^{2-} .These ionic species when added together account for most of the salinity that is commonly referred to as total mineralization or total dissolved solids (TDS)[3].

Because groundwater is largely hidden from view, it is often forgotten and subject to contamination by careless humans. The sources of contamination can be classified into anthropogenic and natural causes. Among the notable natural causes include: (1) mineralization of water from dissolved salts present in soil, (2) contamination from dissolved ground emitting gases such as radon, (3) the decomposition of biological products on the ground, etc. Major anthropogenic activities that significantly contaminate ground water

include: (1) agricultural activities such as fertilizers and pesticides applications, (2) Precious mineral extractions processes such as mining activities which often involve the disposal of waste rock, tailings deposition, and effluent discharges, (3) sewage and septic tanks discharges, (4) seawater intrusion results from excessive discharge of fresh groundwater in coastal areas, etc. Thus, all these activities lead to increasing content of ionic species in groundwater.

Consequently, groundwater quality assessment is invariably directed towards factors which may lessen the suitability of pumped groundwater with respect to its potability and use in agriculture and industry. The overall goal of a groundwater quality assessment programme, as for surface water programmes, is to obtain a comprehensive picture of the spatial distribution of groundwater quality and of the changes in time that occur, either naturally, or under the influence of man [4].

Therefore an attempt has been made in the current study to assess the effects of opencast mining activities on groundwater quality and their variation by defining the principal hydrochemical nature of the groundwater in and around Neyveli lignite mining area.

MATERIALS AND METHODS

Sampling and Physico-chemical Analysis:

Twenty three groundwater samples were collected in 1000-ml polyethylene bottles from hand pump/bore holes during pre-monsoon (April-June 2014) in and around Neyveli lignite mine area. The sampling bottles at the time of sampling were thoroughly rinsed three times, using groundwater to be sampled. The chemical parameters viz. pH, Total Dissolved Solids (TDS) and Electrical Conductivity (EC) were measured, using digital instruments immediately after sampling. The bottles were labeled, tightly packed, transported immediately to Annamalai university laboratory, and stored at 4°C for chemical analyses. The specific methods used for physico-chemical parameters analysis of groundwater samples are given below in table.

Table 1 .Methods used for physico-chemical parameters analysis.

Parameters	Methods
SO_4^{2-}	Turbidity method
HCO_3^-	Volumetric titration
Ca^{2+}	EDTA titration method
Mg^{2+}	EDTA titration method
K^+	Flame photometer (Systronics, mk-V/mk-III)
Na^+	Flame photometer (Systronics, mk-V/mk-III)
Cl^-	Volumetric titration
TDS	TDS meter

The results were evaluated to the suitability of drinking water for human consumption and compared with the water quality guidelines of Bureau of Indian Standards (BIS, 2003).

Geo-database creation-GIS model:

The various physico-chemical parameters obtained from analyses are created as attribute database in generating the spatial distribution maps. These attributes data then transformed into a point layer for GIS analysis. Each sample point was assigned by a unique code and

stored in the point attribute table. The database file contains the values of all physico-chemical parameters in separate columns along with a sample code for each sampling station. The attribute data were linked to the spatial data and maps showing the spatial distribution were prepared to model the variation in concentrations of the physico-chemical parameters using Inverse Distance Weighted (IDW) raster interpolation technique of Spatial Analyst TM module in ArcGIS 9.3 software. IDW is an algorithm for spatially interpolating or estimating values between measurements. Each value estimated in an IDW interpolation is a weighted average of the surrounding sample points. Weights are computed by taking the inverse of the distance from an observation's location to the location of the point being estimated [5]. In a comparison of several different deterministic interpolation procedures, [5 and 6] found that using IDW with a squared distance term yielded results most consistent with original input data. In the present study, the geospatial attributes data were utilized for the generation of spatial distribution maps of selected water quality parameters.

RESULTS AND DISCUSSION

In order to determine the potability of the groundwater, the quality of physico-chemical parameters of the collected water samples is to be understood in detail. Therefore, the following water quality parameters were selected for the generation of spatial distribution maps using Arc GIS namely pH, EC, TDS, K^+, SO_4^{2-} ,HCO_3^-,Ca^{2+}, Mg^{2+} ,Na^+ and Cl^- (Figs. 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10).

A statistics summary of the analytical results of the physical parameters of groundwater samples collected from different sampling sites of Neyveli Lignite Mine area is presented in Table 2 and Table 4. Also, a statistics summary of the analytical data of the chemical parameters of analyzed components in groundwater is presented in Table 2. Comparative analyses of groundwater samples of the study area exceeding the desirable and permissible limits prescribed by BIS [7] for drinking purposes are furnished in Table 4.

Table 2: Summary Statistics of the analytical data of the physical parameters of groundwater samples collected from the study area

Parameters	N	Minimum	Maximum	Mean	Std. Deviation
pH	23	6	7	6.57	0.507
EC	23	76	1277	453.17	380.425
TDS	23	52	867	297.87	242.738

Table 3: Variables, symbols and units

Variable	Symbol	Units
pH	pH	pH units
Conductivity	EC	µS/cm
Total dissolved solids	TDS	mg/L

Table 4: Summary Statistics of the analytical data of the chemical parameters of groundwater samples collected from the study area

Parameters	N	Minimum	Maximum	Mean	Std. Deviation

SO_4^{2-}	23	5	34	14.74	7.436
HCO_3^-	23	24	464	186.17	128.519
Ca^{2+}	23	12	148	58.04	28.124
Mg^{2+}	23	2	57	21.30	13.109
K^+	23	0	7	1.70	1.743
Na^+	23	1	162	61.26	54.100
Cl^-	23	53	408	175.04	102.672

Table5: Comparative Analyses of the Groundwater samples of the study area exceeding the desirable and permissible limits

Parameters	**BIS 2003**		**No. of samples exceeding desirable limit**	**No. of samples exceeding permissible limit**
	Desirable limit	**Permissible limit**		
pH	6.5-8.5	8.5-9.2	-	-
EC (µS/cm)	-	1500(WHO)	-	-
TDS (mg/L)	500	2,000	4	-
Ca^{2+} (mg/L)	75	200	5	-
Mg^{2+} (mg/L)	30	100	4	-
SO_4^{-2} (mg/L)	200	400	-	-
Cl^- (mg/L)	250	1,000	6	-
***Na^+ (mg/L)**	50	200	12	-

pH is most important in determining the corrosive nature of water with optimum range between 6.5 to 8.5.The maximum permissible limit is 8.5 and may be extended up to 9.2 in the absence of alternate water source. In the present investigation during the pre-monsoon period, the values of pH in the groundwater samples collected from the study area ranged between 6.73 and 7.93(Fig.1). The pH values of all the samples are within the desirable limit of BIS (2003).

The Electrical Conductivity (EC) of water at 25°C ranged from 76 to 1277 µS/cm during pre-monsoon period and maximum of 1277 µS/cm with a mean value of 453.17 µS/cm (Table 2).EC is measured in microsiemens per centimeter and is a measure of salt content of water in the form of ions [9].A higher concentration is recorded in the southeastern part of the study area as shown in Fig.2.

Figure 1.Spatial distribution of pH

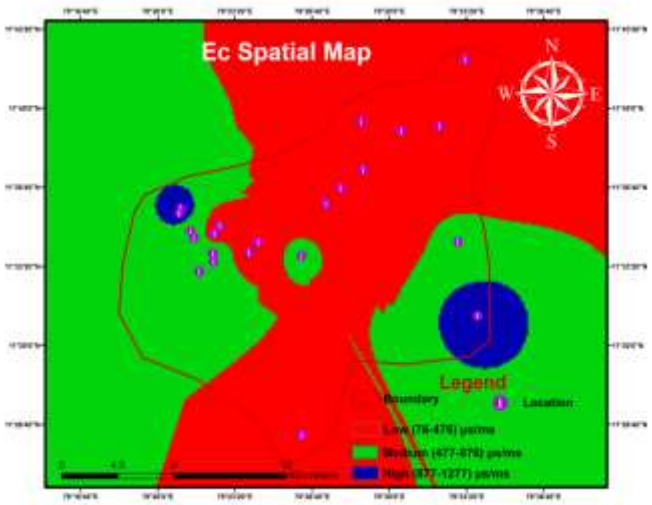

Figure 2. Spatial distribution of EC

The TDS values in the study area varies from 52 to 867 mg/L, which indicates a variation of degree of water quality due to entering of mobile charged ions into groundwater system. Four samples exceed the desirable limit of BIS standard but are within the permissible limit. The spatial distribution of TDS is shown in Fig 3 and a maximum is observed on the southeastern and northwestern part of the study area.

The concentration of K^+ in the study area varied from 0 to 7 mg/L during pre-monsoon period. The spatial distribution of K^+ is shown in Fig 4 for and a maximum concentration of Potassium is observed at the centre part of the study area.

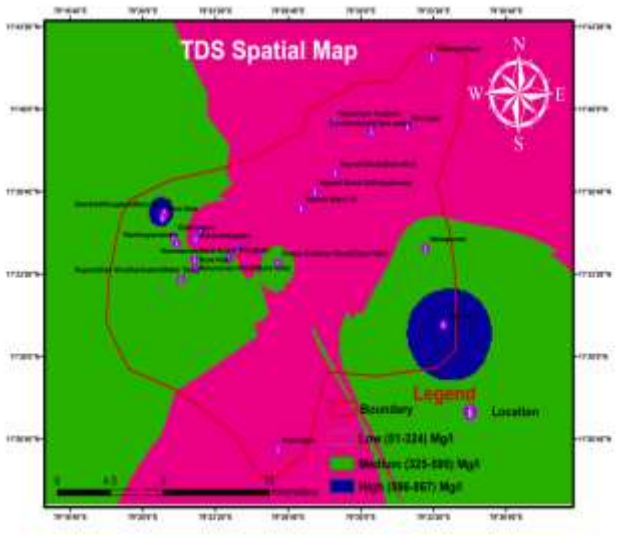

Figure 3.Spatial distribution of TDS

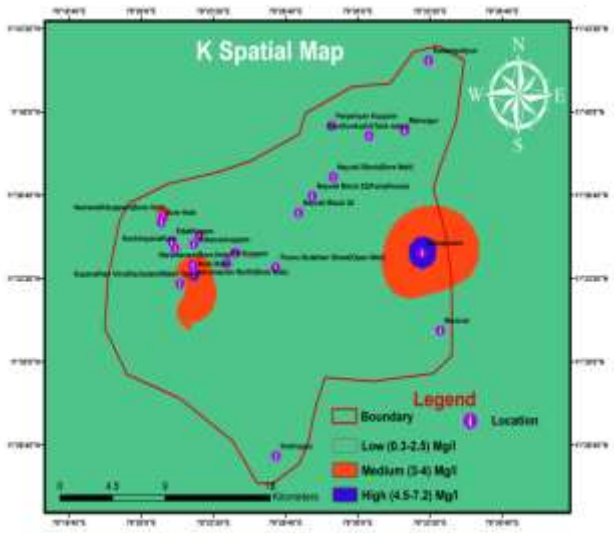

Figure 4.Spatial distribution of K

The concentration of SO_4^{2-} in the study area ranges from 5 to 30 mg/L, which are below the recommended limit of SO_4^{2-} for BIS drinking water. The spatial distributions of SO_4^{2-} concentration is given in the Fig.5.

The concentration of HCO_3^- in the study area ranges from 24 to 464 mg/L. The carbonates (HCO_3^- and CO_3^{2-}) which are dominated ions in the groundwater; they are result from the CO_2 that is released from the decay of organic matter and root respiration in soil zone. The higher content of carbonates indicates an intense weathering of rocks, which favors an active mineral dissolution [8].

$$CO2 + H2O \rightarrow H_2CO_3$$

$$H_2CO_3 \rightarrow H_2 + HCO_3$$

$$HCO_3 \rightarrow H+ + CO_3$$

The spatial distribution of HCO_3 is given in Fig.6 and the maximum concentration of bicarbonate observed on Eastern part area.

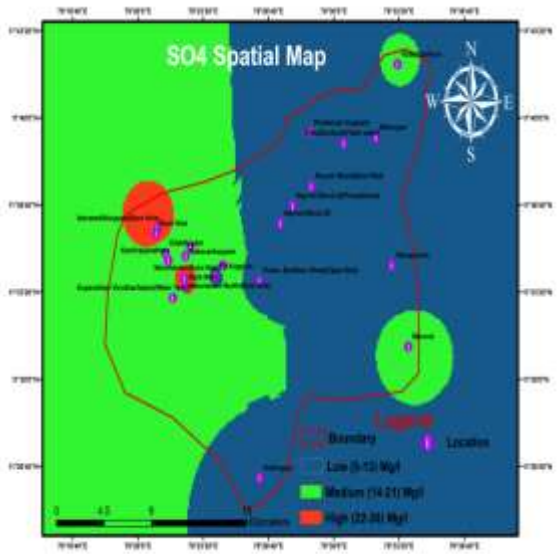

Figure 5.Spatial distribution of SO_4^{2-}

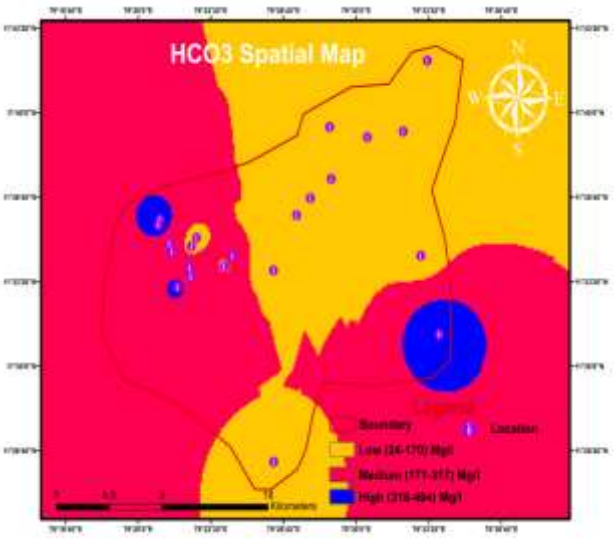

Figure 6.Spatial distribution of HCO_3^-

The concentration of calcium ranges from 12 to 148 mg/L during pre-monsoon period with an average mean value of 58.04 mg/L.Five sample exceeds BIS desirable limit of 75 mg/L (Table 5). The Calcium maximum value is trending from the Eastern to Western (Fig.7).

Magnesium ion concentration ranges from 2 to 57 mg/L during pre-monsoon period with average mean value of 21.30 mg/L (Fig.8).Magnesium is an essential ion functioning of cells in enzyme activation, but at higher concentration, it can cause laxative effect upon people after consumption[10].Four samples exceeds BIS desirable limit of 30 mg/L (Table 5).

The concentration of Na^+ in the study area ranges from 1 to 162 mg/L with a mean average value is 61.26 mg/L during the pre-monsoon period and twelve samples exceeds the recommended permissible limit of 200 mg/L (Table 5, Fig.9).This is because of the silicate weathering of soil salts stored by the influences of evaporation and anthropogenic activities [11, 12 and 13].

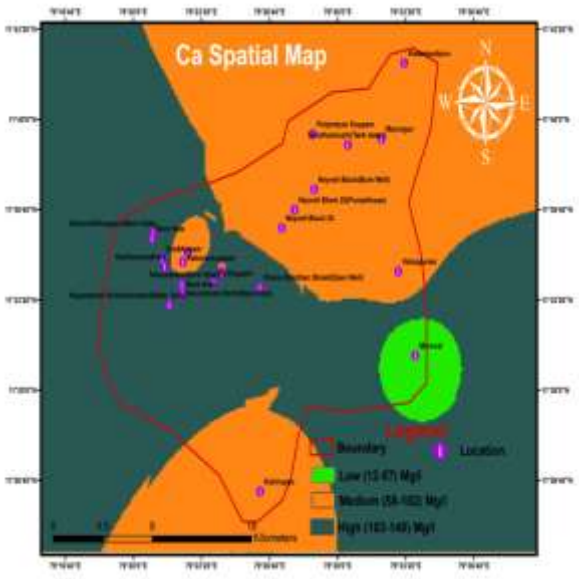

Figure7.Spatial distribution of Ca

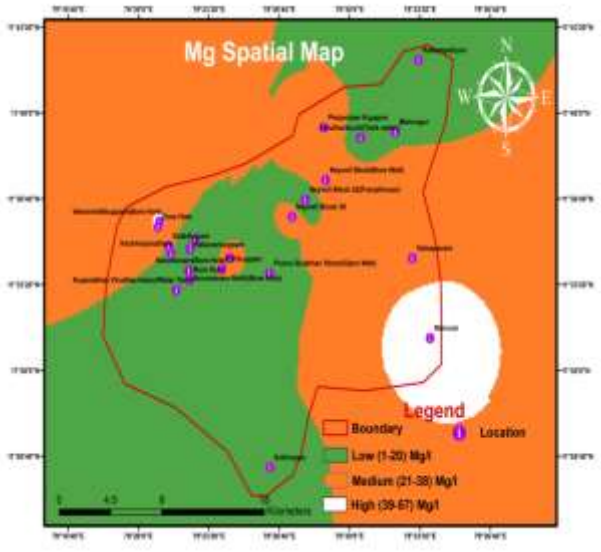

Figure 8.Spatial distribution of Mg

The concentration of Cl^- varied from 53 to 408 mg/L with a mean average value of 175.04mg/L during the pre-monsoon period and six samples exceeds the recommended permissible limit of 200 mg/L (Table 5, Fig.10).High chloride in groundwater samples may be due to the pollution from chloride rich effluents of sewage and municipal waste[14].

Figure 9.Spatial distribution of Na^+

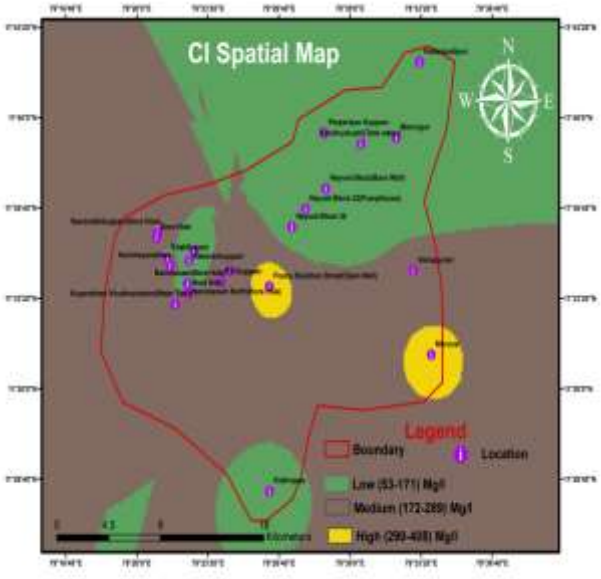

Figure 10.Spatial distribution of Cl^-

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CONCLUSION

The spatial distribution maps of selected water quality parameters namely pH, EC, TDS, TH, Ca^{2+}, Mg^{2+} ,Na^{+} , K^{+} ,HCO_3^{-},Cl^{-} and SO_4^{2-} were developed by using GIS. Therefore, it is inferred from the study that the majority of groundwater quality parameters in and around Neyveli lignite mine are within the desirable and permissible limits of BIS (2003) .It is generally concluded that groundwater quality is good for drinking purposes. Further research should be conducted in both wet and dry seasons to obtain more information pertaining to physico-chemical parameters in many groundwater samples within the study area, so as to determine the effect of seasonality.

REFERENCES:

[1]. Popkin BM, D'Anci KE, Rosenberg IH, *Water, Hydration and Health*, **2010**; 68(8):439-458.

[2]. Bozeman. Only a Drop to Drink on Earth. Adapted from: "A Drop in the Bucket" in Project WET: Curriculum and Activity Guide. *The Watercourse and the Council for Environmental Education*, **1995**.

[3] Prof. Dr. Ir. F. De Smedt, *Groundwater Hydrology* **2009**, pp.38.

[4]. Wilkinson and Edworthy, 1981.Water Quality assessments.

[5]. Burrough PA, McDonnell RA, Principles of geographical information systems for land resources assessment. Oxford University Press, New York, **1998**.

[6]. Mathes ES, Rasmussen TC, Hydrogeol J, **2006**, 14, 1493–1507.

[7]. BIS, *Indian standard drinking water specifications IS10500:1991, edition 2.2 (2003–2009). Bureau of Indian Standards, New Delhi*, **2003.**

[8]. Methods for Chemical Analysis of water and Wastewater, EPA-600/4-79-020, USEPA. Method 9253.

[9]. Karanth KR, *Ground water assessment development and management*, **1987,** 217–275.

[10]. Garg VK, Suthar S, Singh S, Sheoran A, Meenakshi Garima, Jai S, *Env Geol*, **2009**, 58, 1329–1340.

[11]. Meyback M, *American Journal Science*, **1987**, 287, 401–428.

[12]. Stallard RF., and Edmond JM, *Journal of Geophysical Research*, **1983**, 88, 9671–9688.

[13]. Subba Rao N, *Environmental Geology*, **2002**, 41, 552–562.

[14]. Ravikumar, P., Venkateshraju, K. and Somashekar, R. K**. 2010**. Major ion chemistry and hydrochemical studies of groundwater of Bangalore South Taluk, India, Environ Monit Assess. 163: 643-653.

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Review on loss reduction by improving ratio of HT/LT line in Electrical Distribution System

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Abstract— In this paper review has been taken on technical loss reduction technique that can be implemented by improving ratio of HT to LT lines. In this technique of loss reduction secondary distribution network is minimized as possible as such that the ratio of HT lines to LT lines is higher. As this ratio increases we can see a lot reduction in technical losses in electrical distribution system. The advantage of this review paper is to see the improvement in supply quality and reliability. In these technique first losses in existing distribution network in which L.T. line is higher than H.T. line has been calculated. Then L.T. line network is dismantled. H.T. line network is erected in place of L.T. line network. The high capacity distribution transformers in existing Low tension lines are also replaced by nos. of low capacity distribution transformers. The L.T. conductor is also replaced with fine quality high voltage conductor. Then losses are calculated when this H.T. network is in system. The savings of energy is calculated in terms of units. Then it is converted in terms of rupees. Capex fund required for dismantling of existing Low tension lines and erection of new H.T. line network. Rate of Revenue Return is finally calculated with the help of these figures i.e. Energy saved in terms of rupees and capital expenditure required to implement this project. We also take a review on improvement of line voltage at far end consumer. In Low tension lines we always face a problem of voltage regulation. The voltage at consumer nearby to distribution transformer center is high and it goes on decreasing as we move towards the tail end consumer of L.T. line. The voltage at last consumer is below the standards that must be supplied as per electricity regulation authority. We can see the constant voltage for each and every consumer in this high tension distribution network. In this paper we can also review on reliability of supply. In Low tension lines erection of L.T. lines is such that the distance between Phase to Phase conductors is low as compared to distance maintained at high voltage distribution network. Due to less distance in windy and rainy atmosphere conductors comes in contact with each other and phase to phase fault occurs frequently in Low tension lines. In case of high voltage distribution network the distance is higher due to which chances of conductors touching to each other are less and hence reliability of supply is also maintained. Another advantage of distribution of electricity at high voltage is that less nos. of consumers are affected in case of failure of distribution transformer.

Keywords— High Tension line (HT line), Low Tension Line (LT line), Loss, Phase, Transformers, Energy, Voltage

INTRODUCTION:

Electricity is generated at generating stations then it is supplied to consumers through large and composite networks. This network consists of primary transmission, secondary transmission, primary distribution and finally secondary distribution. This transmission and distribution consist of Power transformers, extra high voltage lines, High voltage lines, distribution transformers and low tension lines. In India the power is generated generally at the voltage of 11kV.This Voltage is stepped up to 440kV. In primary transmission system energy is transmitted at this high Voltage of 440kV from substation near to generating station to EHV substations .At EHV substations this energy is transformed from 440 KV to 132 KV and 220 KV.From this substation secondary transmission starts. Energy is transmitted at the voltage of 132 KV or at 220 KV up to secondary transmission substations. From these 132 KV /220 KV substations primary distribution starts at 33 KV and 11 KV voltages. Energy is transmitted at 33 KV voltages up to distribution substations rated as 33/11 KV substations. From these substations 11 KV feeders runs in villages and cities. Distribution transformers are located in the center area of consumers. From that energy is again transformed from 11 KV to 440 V/220 V which is connected to consumer's premises.

It is the fact that a unit generated at generating stations does not go with the units supplied to consumers. The units supplied at consumer end are always less than that of the units generated. Some percentage of units is lost in Primary and Secondary transmission and distribution network. The difference between energy generated at generating stations and supplied at consumer end is called transmission and distribution loss. Normally transmission and distribution losses in India comes around 22 % to 26 % of the electricity generated. The major amount of losses in a power system is in primary and secondary distribution lines. The transmission and sub transmission lines carry the losses of 30 % of the total system losses from generation point to consumer point. Remaining 70 % of losses occur in primary and secondary distribution system. Again the high percentage of losses comes under secondary distribution i.e. at 440 V and 220 V. In our country the efficiency in distribution system is very poor because of power is supplied at low voltage. The technical losses causes due to energy dissipated in conductors.

The analysis is carried out to determine the losses in the presented low tension distribution system and then reconfiguring this low tension distribution system to high voltage distribution system (HVDS).

Need for this project review:

- The T & D losses in India are in the region of 25 to 32 % and this figure is higher compared to the established International norms. T and D losses is an important sign, depicting the performance of electrical power distribution Utilities. The demand for electrical energy is increasing exponentially at a rate of 5 to 10 % to meet the economic developments. The lack of resources and long lead time needed to build the new generating capacity has resulted in wide gap between demand and supply of electric energy. The. The cost of new energy is also rising hastily due to price rises, exhaustion of fossil fuels and other economic factors.
- The improvement of power system performance to bridge the gap between demand supply and the minimization of cost of energy have assumed higher importance for the power utilities of developing countries.
- The reduction of losses has significant impact on the revenue

Example; A utility using 30, 000 M U in a year can save 300 M U an additional revenue of Rs 600 millions , if 1% of the T and D losses are reduced. The need for this project in India will be clear by observing following statistics.

Losses scenario in India and World:

- The average percentage of energy losses in Indian Power System was less than 15% in 1965 and has increased 20% TO 25% in 1980 and is continuing at that level
- The percentage T and D losses in the developed countries are up to 15%
- Two Asian countries ; Japan and Korea have achieved remarkable progress in reducing the power losses from 25 to 30%in 1960's to 6% in 1980's

T&D Losses in Various Countries:

Country	T & D Losses (%)
Korea	3.35
Japan	5.06
Germaney	5.53
Canada	6.22
Italy	6.68
France	7.2
Australia	7.38
USA	7.57
China	7.71
UK	8.37
South africa	11.42
Russia	14.88
India	**32.53**

Table 1. T&D Losses in Indian Utilities-2010-11

Table.1 shows the T& D losses in all over the world. In India the state wise literature survey is carried on and the following Table.2 shows the state wise T& D losses in India.

NAME OF THE STATE	T&D Losses (%)
Andhra Pradesh	22.55
Delhi (DVB)	45.40
Gujarath	30.43
Haryana	32.11
Karnataka(KPTCL)	26.08
Kerala	22.48
Madya Pradesh	41.30
Orissa(Gridco)	44.02

Punjab	25.42
Rajasthan (TRANSCO)	44.68
Tamil Nadu	19.28
Uttar Pradesh	34.39
West Bengal	28.54
Maharashtra	32.40
ALL INDIA	**32.53**

Table 2. State wise T & D losses

Norms for technical Losses			
Review of system Losses			
System Components	Exsisting Level	International norms	
		Max Tolerable	Target Level
Transmission	4	4	2
Sub Transmission	4	4.5	2.25
High Voltage Distribution	6	5	3
Low Voltage Distribution	18	2	1
Total	**32**	**15.5**	**8.25**

Table 3. Norms for technical losses

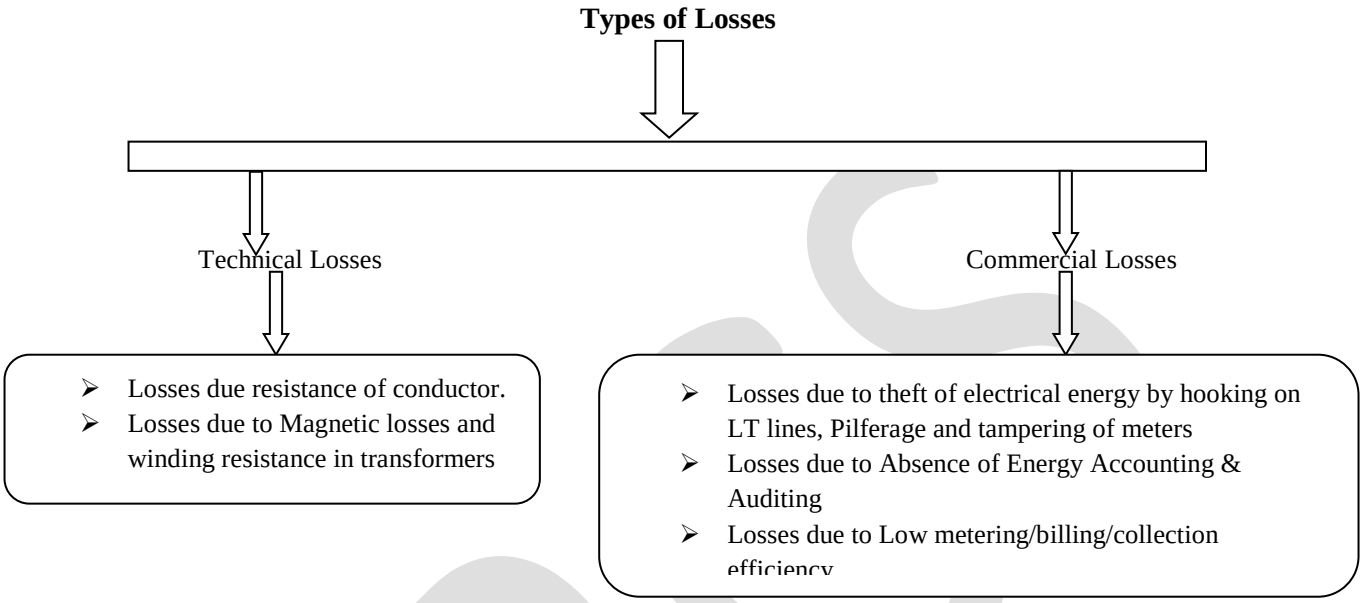
Silent features of Indian Distribution Network (A review):

- In India distribution transformers are mostly 3phase with delta star vector group and the rating are 315 ,200 , 160 and 100 KVA in urban areas and 100,63,25 KVA in rural areas.
- Power losses in the network are high and are of the order 20 to 25% .In agricultural sector voltage at tail end customer may go down to as low as 70%of rated voltage. The voltage regulation may go beyond 6%.
- The power factor of load is poor .The major load due to which power factor is low is fluorescent lamps in urban areas and pump sets in agricultural area.
- Practically 11 KV and 440 V lines in rural areas are extended over long distances to meet demand which is caused from premises established over large geographical area. The distribution lines in semi urban and urban area are largely of radial type. Due to this long distance lines resistance losses in the lines are high. The L V lines are lengthy, the ratio of HV to LV lines are varying from 0.25 to 0.50.Large scale rural electrification has been done through long 11 KV and LT lines.
- The average expansion rate of energy generation during the past decade for the country is around is 7% .
- State electricity boards and other utilities in India are facing power deficiency. The shortfall between power demand and supply is in the range of 2 to 30 % and the average figure for the country is 13.8 %.
- The power deficiency is met by imposing load shedding programmers and restriction of usage of electricity for agricultural consumers. i.e. 8 hours supply within a day which is shifted at night for 3 to 4 days in a week.
- Computer aided mapping and updating network are yet to be introduced .Therefore identification of pockets of higher power losses is a problem.
- Data acquisition system is not available at the distribution substations.
- Many utility are facing with the problems of very high losses due to theft of energy and non paying culture of some part of society.
- The investigations performed on the existing network revealed that the high losses in the distribution network can be effectively reduced by reconfiguration of the network.

Wrong choice of distribution practices:

Distribution system in vogue can be classified as HVDS and LVDS HVDS is based on North American practice, best suited to meet the scattered loads of low load density .LVDS is based on European practice , best suited to meet the concentrated loads of

high load density. LVDS which is in vogue in India in metropolitan and large cities at the time of independence was adopted to extend the supply to remote villages and energies Agl. Pump sets without considering the characteristic of the load and the cost of losses. The number of pump sets energized as risen from 6500 in1947 to 10.27 millions in 1994 registering 1580 folds increases, this has resulted in the energy losses from 15% in 1960 to 22-25% by 1980 and remain at the same level Two Asian countries Korea and Japan have reduced their losses from 23 to 30% losses in 1960 to 6% in 1980 by adopting HVDS.



Causes of higher technical losses:

Losses are inherent to the distribution of electricity and cannot be eliminated. Hence we have to try to keep it at minimum level. To keep it at minimum possible level it is necessary to find out the causes of losses in system. There are two types of technical losses i.e. fixed losses and variable losses. Fixed losses do not change as per change in current. These losses appear in the form of heat and noise. When the transformer is given supply these losses starts to occur. These losses are around 25% to 30% of total technical losses. In primary and secondary transmission corona losses must have to be considered.

- Variable technical losses in system are mainly due to current opposition by resistivity of material like conductor and winding material of transformers. Variable losses differ with the amount of current. These losses are directly proportional to square of the current. The percentage of these losses turn around 75 to80 that of total technical losses. We can reduce these losses by increasing the cross sectional area of lines and cables for a given load. These losses are estimated by Computer Aided Simulations of Distribution Network. Accuracy depends on network operating parameters i.e. Load, Load Factor, System Configuration, Conductor Size, Diversity Factor, Voltage, Frequency, and Length of Line, Transformers and Load Density.Major reasons are described as below:

Spontaneous and disorganized expansion of networks:

- At the time of independence in 1947 electricity was available to 1500 villages out of 579132 total villages. There was a need to enlarge electricity to all villages. The aim of system planners at that time was to extend to power supply to each and every citizen of the country at the minimum capital investment. Due to lack of proper planning this has resulted in spontaneous and disorganized expansion of distribution network resulting in high distribution power losses. The investigations carried out on the present network discovered that the high losses in the distribution network can be effectively reduced by reconfiguration of the network.
- **Low ht/lt ratio:**
  The presented distribution system involves three-phase 11KV feeders from 33/11 KV substation up to distribution transformers of rating 11KV/440V. From these distribution transformers three-phase four wire lines come out. Distribution system with low voltage consists four core cables and long low voltage lines and various loads fed from a bulk power transformer resulting in the

increase in system losses affecting voltage profile. Low voltage distribution is done either by three-phase four-wire, three- phase five-wire, single phase three-wire and single phase two-wire low tension lines. This distribution system involves nearly 2:1 ratio of low and high voltage line lengths. This low ratio of HT to LT causes losses.

- **Improper location of distribution transformer:**
  Distribution transformer should be located at load center. In practical situation once the erection of distribution transformer has been completed it is very costly to shift it as per future load that comes in system. Due to this unequal and unpredictable demand of load it is usually not possible to keep the distribution transformer at load center. Due to this unequal expansion losses increases due to the facorI2*R*L.
- **Non – optimal conductor size:**
  Losses in the feeder are inversely proportional to the conductor size. The bigger the size, the lower the resistance and the lower is the losses. While doing expansion of the electricity to new areas , the conductor size is usually selected on the based on the thermal loading limit to curtail the capital investment ,ignoring the cost of losses .With rapid load growth, the conductor size have become inadequate ,causing in high power losses. Investigations on numerous distribution feeder discovered that about 5% of the feeder segments from sources end are responsible approximately for 70 to 80% of the losses in the feeder and loss reduction in the order of 30 to 40% can be achieved by reconductoring of the first few segments of feeders.
- **Inadequate reactive power compensation:**
  The power factors at which the system is operated is an vital pointer of power loss level as the losses are inversely proportional to square of power factor.In urban areas, the lighting load (comprising fluorescent tube lights) is liable for the poor PF .The fluorescent lights have low power factor of 0.5, while in rural areas, the inductive load comprises of the agricultural pump sets with PF of the order 0.7 to 0.75.The investigations made on several distribution feeders indicated that the loss reduction to the extent of 20 to 30% can be achieved by optimal shunt compensation. For a given load if power factor is low the current drawn is high and the losses proportional to the square of the current will be more. Thus the line losses owing to the poor power factor can be reduced by improving the power factor.
- **Inadequate augmentation of transmission and distribution system:**
  Normal load increase of the Indian Utilities is around 8%.This rapid load growth, in turn, calls for the setting up of a large number of substations to meet growing demand. The erection of a new substation requires substantial investment; say Rs. 2.0 to 25 crore s on an average. The incapability of utilities to execute for long range planning and setting up of new distribution substations at most favorable locations has resulted in high power losses.
- **Lengthy distribution lines:**
  The distribution lines in rural areas are largely radial laid. These lines extend over long distances. It results in high resistance losses in the lines.
- **Bad workmanship:**
  Joints are source of power loss. Therefore the number of joints should be kept minimum. Firm connections must have been done by using proper techniques. In LT distribution system joints are used at line terminations, cut-point locations, DTC locations, at drop out fuses, in distribution boxes where cutouts and bus bars are present, in substations and at transformer bushings. These joints should be periodically inspected. Sparking and heating at joints should be eliminated if it has been observed. Replacement of deterioted wires and lines should be done timely to avoid losses of power.
- **Unbalanced load at distribution transformer:**
  The losses in distribution system increases when the load at distribution system is unbalanced. Unequal load distribution among three phases in L.T. system causing high neutral currents, leaking and loss of power.
- **Poor quality of equipments :**
  The losses are due resistance of conductor used for lines and losses in transformers. In transformers two types of losses occurs
  1. ***Fixed losses:*** These are the magnetic losses which consist of hysteresis losses and eddy current losses. These can be kept at minimum by using high quality silicon steel stampings.
  2. ***Variable Losses:*** These are dependent on load and mainly due to winding resistance of transformer. Thus it can be kept at minimum level using high quality copper for winding.

Commercial reasons for high distribution losses:

Commercial losses are near about 18% to 20% .Theses are related to theft of energy, meter reading, faulty meters and error in billing of customer and unmetered supply to customers. 99.95% of these losses occur on LT network.

- **Theft:**
  Theft of power has been done by connecting hooks of wires on L.T. distribution system. This power delivered to customers is not measured by energy meter. This direct and illegal hooking is possible only in L.T. distribution system. If we convert L.T. system in H.T. system people cannot connect illegal hooks on HT lines. Theft of energy is also done by tempering of energy meters by various ways.

Loss reduction techniques:

- **Improving HT/LT ratio:**
  We can improve the HT/LT ratio by converting LT distribution network into HT distribution network.Conveting LT lines to higher voltage consist high initial cost but after some specified time period this system is beneficial.In agricultural sector if we go for HVDS system it connects cluster of 2 to 3 AGR customers employed a small distribution transformer of capacity 6.6 KVA, 15KVA and 25 KVA through almost negligible LT distribution lines. In HVDS there is less distribution losses due to minimum length of distribution line, high quality of power supply with no voltage drop, less burn out of motor. Installation of additional distribution transformers of low capacity at each consumer's premises instead of cluster formation will decrease the losses. We can reduce the losses by installation of single phase transformers to feed residential and commercial customers in rural areas and providing of small distribution transformers with a distribution box attached with its body, having provision for installation of meters.
- **Adopting Arial Bunch Conductor:**
  In HVDS it is not possible to erect high tension lines for each and every consumer. Where LT network cannot be eliminated Arial bunch conductor can be employed to avoid illegal hooking of people. In Agriculture sector more than one customer is connected at a single low capacity transformer. For these customers Arial bunch conductor can be employed to avoid theft of energy.
- **Network reconfiguration:**
  By using higher the cross section area of the conductor the losses will be lower .Reducing the length of LT lines or by relocation of transformer centers at load centers we can go for low distribution losses. Substitution of distribution transformers having higher fixed losses with those having lower no load losses such as amorphous core transformers of shunt capacitors for improvement of power factor.
- **Provision of HT Supply for bulk consumers:**
  Utility must erect distribution system that can provide supply to large commercial and industrial consumers from feeders.
- **By utilizing feeders as per capacity:**
  The higher the load on power lines higher the losses. Distribution losses will increase if the load on distribution feeders crosses its limit.
- **Vigilance activity:**
  By conducting vigilance activity such as mass theft detection drive commercial losses can be reduced. In case of LVDS system vigilance activity should have to carry for both type of theft i.e. hooking on LT network and for tempering of meters but in case of HVDS hooking is near about zero so Vigilance can concentrate on consumers doing theft of energy by tempering of meters.
- **Public Awareness:**
  Utilities can aware public by campaigning regarding save of electrical energy. For this purpose utility can employ energy conservation programmes.
- **Implementation of energy audit schemes:**
  It should be mandatory for all utilities to carry out Energy Audits. Further time bound action for initiating studies for practical evaluation of the total losses into technical and non-technical losses has also to be drawn by the utilities to recognize high loss areas to initiate remedial measure to reduce the losses.

Why LVDS should be replaced by HVDS:

The drawbacks of low voltage distribution are as follows:

- Poor tail end voltage: The percentage voltage regulation in LT distribution system goes beyond 6 % in case of heavy loaded transformers and in case of lengthy distribution lines due to which customers connected at far end of the line always faces low voltage problems in LVDS.

- Motor burn outs almost twice in each cropping period because of working of motors at low voltage which causes winding heating and burning.
- High rate of DTC failure: The rate of DTC failure is higher in LVDS system as compared to HVDS system.
- More resistive loss is present because of low voltage profile.
- Ease of theft of energy: People can easily do theft of electrical energy in agricultural and slim area in LT distribution system by simply connecting hooks of the wires on LT lines whereas it is almost impossible to connect hooks on HT network lines.
- Inappropriate load management results in overloading of conductors and transformers.
- Monitoring of unauthorized hooking or tapping the bare conductors is of LT lines is more difficult.
- No. of consumers that affects due to DTC failure are less in case of HVDS.

High voltage distribution system (HVDS):

To improve quality of supply and reduce losses HVDS is suggested.11 KV lines are extended to as nearer to the loads as possible and erect small size single phase transformers 5, 10 or 15 KVA and release supply with zero or minimum LT line and the unavoidable short LT lengths to be enclosed by insulated wires like ABC (Aerial Bunched Cables). The major advantages of using ABC in HVDS are that the faults on LT lines are totally eliminated, thus improving reliability and also theft by direct tapping is avoided. HVDS project is to reconfigure the existing Low voltage (LT) network as High Voltage Distribution System, wherein the 11kV line is taken as near to the loads as achievable and the LT power supply is fed from small capacity transformer and minimum length of LT line. Existing network consists of large capacity transformers at one point and the connections to each consumer are provided through heavy distance LT lines. This long length of LT lines is causing low voltage condition to the majority of the consumers and high technical losses. In the HVDS plan, LT distribution network is converted into 11 kV mains feeders and thereby installing the small capacity distribution transformer as near as to the load. By converting these LT lines to HVDS, the current flowing through the lines shall reduce by 28 times and will carry down the technical losses in the LT line hugely. The prevailing low voltage in the LT line is also affecting the efficiency of the electric equipments and breakdown is also very high. Also there is a tendency of unauthorized connections to hook to the LT lines which results in over loading of the transformers and failure of the transformers. The scheme consists of converting the existing 3 phase 4 wires lines to 11 kV systems using the existing supports and providing intermediate poles wherever necessary and individual transformers are provided to both agricultural loads and loads other than agriculture. HVDS is most successful method in dropping the technical losses and improving the quality of supply in power distribution system. As the authorized consumers do not allow unauthorized tapping by another as their transformer gets overloaded or may get damaged, resulting in outage of power supply for longer durations. Based on the feedback received from Andhra Pradesh and Gujarat where HVDS schemes have been operational in urban and rural application it is noticed that the investment on conversion from LVDS system to HVDS is recovered by way of loss reduction within a period of 5 to 7 years. There are three types of High Voltage Distribution System namely, Single phase and single neutral , two phase two wire and three phase small rating transformer with three phase HV system.

Analysis of existing LT system and proposed HVDS system and annual saving and payback period:

- Line loss in KW = [{(Cum load in KVA/ (1.732 × voltage in KV × DF)} ^2 × Length in Km × Resistance constant/1000
- Line loss in Units = [{(cum load in KVA/ (1.732 × voltage in KV × DF)} ^2 × Length in Km × Resistance constant × LLF × 8760] /1000
- Where Voltage = 11 KV for HT line
  = 0.4 kV for LT line
  Diversity factor (DF) = 1.5 for HT line = 1.1 for LT line
  Load Factor (LF) = Annual Energy consumption / (Peak × 24 × 0.9 × 365 ×1000)
  = 0.18 for HT line = 0.36 for LT line
- Line Loss Factor (LLF) = (0.2 × LF) + [0.8 × (LF^2)]
  = 0.36 for HT line = 0.18 for LT line
- Reduction in losses = Losses in existing low voltage system - Losses in HVDS
- Annual Savings = Price of a unit × reduction in losses in terms of unit
- Payback Period = (Capital Outlay ÷ Annual Savings)

Examples of *HVDS:*

Different case case studies has been done to find out the superiority of HVDS over LVDS.The results for different case studies are as per below.

1. High voltage distribution system in ANDHRA PRADESH:
   As per ref. paper the study has been carried out for HVDS system at Patnum Substation. It has been found that percentage loss in existing LT system was 16.82%.By converting this LT system into HVDS the loss has been carried out up to 5.30%.The net reduction of losses is 11.52%.Simmillarly the study shows that the voltage profile is improved from340 V to 440 V for the tail end consumer.
2. The case study has also been done for BEHLLA feeder in Punjab state having 100 KVA distribution transformer feeding nine consumers as per paper presentation in IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE) ISSN: 2278-1676 Volume 1, Issue 5 (July-Aug. 2012), PP 39-45. The study clears the facts that Net Losses has been reduced. The details are as follows:

Net Losses for LT Distribution = 19810.404 Units.
Net Losses in HVDS = 4624.55 Units.
Net Reduction in Losses = (Total LT losses-Total HT losses)
= (19810.404-4624.55) = 15185.84 Units.
Power Purchase Price = Rs.5
Annual Savings Annual Savings = 5(Reduction in Losses)
= 5(15185.84) = Rs.75929.24
Capital Outlay = (Total Transformer Cost + Miscellaneous Cost)
= Rs. (2, 15,000+10,000) = Rs.2, 25,000

Payback Period Payback period is the length of time required by the cumulative net cash inflows to cover-up the fixed capital investments.

Payback Period = (Capital Outlay / Annual Savings)

= (225000/75929.24) = 3 Years.

CONCLUSION*:*

It is shown that the substantial amount of generated power is being wasted as losses. Therefore, loss minimization in power system has assumed greater significance.HVDS scheme has led to the formulation of new strategy of energy conservation and minimization of transmission and distribution losses by reducing the power theft. The adoption of HVDS has been indicated as the necessary factor in efficient energy distribution and developing the proper utilization of electricity and efficient distribution of energy in agricultural sector thereby, tackles the problems faced by the farmers. Effective implementation of HVDS scheme has reduced the failure of transformers, burning of agricultural pump sets and curtailment of demand through retrofitting of energy-efficient pumps. This in turn, reduced the wastage of energy and optimization of power intake, thereby promoting the environmental concerns and because of reduced consumption, the farmer gets benefited by the reduction in his monthly expenditure on electricity. It is concluded that the use of distribution transformer of small rating for two or three consumers has reduced the outages, transformer and power losses due to low current and pilferage to a great extent. Also, the accountability of the farmer has increased resulting in moral ownership of the transformer dedicated to single pump. However, initial expenditure on dismantling the existing system is high but it can be compensated in short span of time thus, increasing the annual energy saving. The restructuring of existing LVDS as HVDS in agricultural field presents one of the best technically feasible and financially viable method for providing reliable and quality supply to consumers. Adoption of this innovative measure has been stated to have improved the commercial and technical performance in the particular state. The implementation of this HVDS project opens the avenues for the work in many other related areas. The same work can be extended to commercial, large residential and unbalanced distribution system.

REFERENCES:

[1] Power point presentation on high voltage distribution in Andhra Pradesh State
[2] IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE) ISSN: 2278-1676 Volume 1, Issue 5 (July-Aug. 2012), PP 39-45 www.iosrjournals.org
[3] International Journal of Engineering Research and Reviews ISSN 2348-697X (Online) Vol. 2, Issue 3, pp: (1-8), Month: July - September 2014, Available at: www.researchpublish.com
[4] B.R.Gupta, Power System Analysis and Design (New Delhi: S. Chand & Company Limited).

[5]International Journal of Engineering Technology, Management and Applied Sciences presented on January 2015, Volume 3 Issue 1, ISSN 2349-4476

[6] Robert H.Fletcher and Kai Strunz, Optimal distribution system horizon planning,IEEE Journalof Power system, 22(2), 2007, 791- 799.

[7] Amit Dembra, A.K. Sharma, "High Voltage Distribution System For Agricultural Feeders In Distribution System", International Journal of Engineering Research and Reviews ISSN 2348-697X (Online) Vol. 2, Issue 3, pp no:1-8, Month: July - September 2014.

[8] R. Srinivasa Rao, An Hybrid Approach for Loss Reduction in Distribution Systems using Harmony Search Algorithm, International Journal of Electrical and Electronics Engineering, 2010, 462- 467.

[9] B.L.Theraja, and A.K. Theraja, A textbook of electrical technology, Transmission, distribution and utilization in SI system of units, volume III (New Delhi: S. Chand & Company Limited, 2005)

[10] Anoop Singh, A policy for improving efficiency of agriculture pump sets in India(IIT Kanpur, Climate strategies, 2009).

[11] Punjab State Electricity Board (PSEB) Patiala, Environmental and social review on high voltage distribution project for agriculture consumers in the state of Punjab.

[12] V.K. Mehta and R. Mehta, Principles of Power System (New Delhi: S. Chand & Company Limited, 2008).

[13] SarangPande and Prof. Dr. J.G. Ghodekar, "Computation of Technical Power Loss of Feeders and Transformers in Distribution System using Load Factor and Load Loss Factor", International Journal Of Multidisciplinary Sciences And Engineering , VOL . 3, NO. 6, pp.No: 22-25, JUNE 2012.

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A Review On Power Effective Memristor Based SRAM Using MTCMOS Technique

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Abstract— In recent years demand of low power devices is increasing and the reason behind this is scaling of CMOS technology. Due to the scaling, size of the chip decreases and number of transistor in system on chip (SOC) increases and this phenomenon also apply on memories that are used in SOC. Generally the number of transistors used in chip to store data is more as compared to the number of transistors used for other function. So in future the need of low power memories is increasing and to design low power memories leakage power is attentive parameter to design low power devices because it plays a major role in increasing the total power consumption of the devices.

In this project, MTCMOS (Multi Threshold CMOS) technique is used recently it is very famous in academia and industry. It is a power reducing technique that helps in reducing leakage power in the SRAM by turning of the inactive circuit domains. Designing and calculation of parameters of simple SRAM, Memristor based SRAM and MTCMOS based Memristor SRAM has been done with CMOS Design tool and that will do at 45 nm technology.

Keywords— Low power, Speed, Non Volitle Memory,CMOS, Memristor,MTCMOS,SRAM.

INTRODUCTION

VLSI technology has got enormous in recent years and scaling of chip in VLSI technology decreases very rapidly whose result is that complexity and density of chip has increased. So the low power devices are the first choice of VLSI designers and these low power devices fulfill the goal of the systems. The value of power that can be dissipated from the power supply mathematically is represented as-

$$P_{av} = \left[\left(\frac{1}{T}\right)\int_0^T Idt\right] \times V \quad (1)$$

Where Pav is average power, T is time, I is current and V is voltage. In future demand of battery operated portable systems such as mobile phones, laptops, PDA tools and other handheld devices in electronic field increases. The major concern is that portable systems use power then low power need of low power system in electronic field increases and these systems to store their data use memories. Memory define as it collection of storage cell with proper input and output and one type of these memories is SRAM. In SRAM cell does not need refreshing technique this quality of SRAM indicate by the static word and it is volatile in nature that means when power is plugged in, data is stored and as the power is plugged out data will get lost other qualities of SRAM is it use number of transistors to store a single bit in system on chip (SOC)
and it reduces the delay between the processor and memories. These advantages of SRAM are used to design portable systems that is why low power SRAM is very demand full in handheld devices therefore in this paper designed MTCMOS based Memristor SRAM. Memristor and MTCMOS have been used to designed low power SRAM. Memristor was invented by Leon O. Chua in 1971 and according to Chua Memristor is a fourth missing, two terminal passive elements with variable resistance also called as memristance that give relation between flux (Φm) and charge (q). Memristor is defined as a two terminal non-volatile device in which the magnetic flux (Φm) between the terminals is a function of the amount of electric charge q that has passed through the device and it is denoted by M and its unit is Ω and mathematically represented as-

$$M(q) = \frac{d\varphi m}{dq} \quad (2)$$

Where M is the Memristor, Φm is the magnetic flux and q is the charge. First Memristor was manufactured in HP labs by the R. Stanley Williamsin 2008. Memristor is a new type of device that can be used to design memristive system, devices and memories that can be proved by the mathematical models and that models should be accurate in terms of behavior of physical devices. In this paper also apply MTCMOS technique on Memristor based SRAM it is a power switch technique and use sleep transistors which improves the speed of the devices and decrease the power remarkable.

Literature Review:

Thangamani.V [2] presented by the approach to design memristor based nonvolatile 6-T static random access memory (SRAM) and analysis the circuit performance with conventional 6-T SRAM cell in order to prove the parameter optimizations. Then we address the memristor-based resistive random access memory (MRRAM) which is similar to that of static random access memory (SRAM) cell and we compare the nonvolatile characteristics of MRRAM with SRAM cell.

Uma Nirmal, Geetanjali Sharma, Yogesh Sharma [3] presented by the main objective is to provide new low power solution for Very Large Scale Integration (VLSI) designers. MTCMOS is an effective circuit-level technique that provides a high performance and low-power design by utilizing both low and high-threshold voltage transistors. MTCMOS technique has been proposed in this paper and the proposed technique has small power dissipation as compared to CMOS technique. Simulations based on BSIM 3V3 180nm CMOS technology. It shows 4 bit adders of the proposed technique have low power dissipation as compared CMOS technique.

Nobuaki Kobayashi, Ryusuke Ito and Tadayoshi Enomoto [4] presented by the static random access memories (SRAMs) having high "read" and "write" margins, and a small standby power (*P*ST) are needed for use in low supply voltage battery driven portable systems. The decrease in MOSFET sizes increases not only leakage currents, but also threshold voltage variation that results in smaller margins. To solve these problems a very small circuit called a "Selfcontrollable Voltage Level (SVL)" circuit] was used in the newly developed (dvlp.) SRAM. The dvlp. SRAM succeeded in increasing margins, reducing the standby power and lowering a supply voltage (*V*DD).

Farshad Moradi and Jens K. Madsen [5] presented by a novel 7T-SRAM cell for ultra-low power applications is proposed. The proposed SRAM cell is fully functional at subthreshold voltages down to VDDmin=200mV. In this technique, separate read/write bitlines and wordlines are used that makes read and write operation independent. The 7TSRAM cell proposed in this paper, improves static read noise margin, write margin, and write time by 2.2X, 27%, and 6% in comparison to the standard 6T-SRAM cell. The 7T-SRAM cell proposed in this paper, improves write margin of the conventional 7T-SRAM cell, as well. The proposed 7T-SRAM cell is designed in 65nm CMOS technology**.**

Mika Kutila, Ari Paasio and Teijo Lehtonen [6] presented by the 8T SRAM and 6T SRAMmemory cells are compared in order to establish guidelines for choosing SRAM cell constructions for NTC systems. 8T SRAM is traditionally concerned as a more reliable memory cell, but we have managed to design 6T SRAM which executes read operation with an acceptaple reliability; read being the most vulnerable operation of conventional 6T SRAM cell. Also, our 6T SRAM cell has 31% smaller area and smaller power consumption.

Amit Grover [8] presented by the motivation of reduction of the dynamic power in SRAM memory and focuses on the analysis in terms of power dissipation, delay and area of the 7-transistor SRAM memory cell at 90 nm technologies by using the Tanner tool. The article targets towards short circuit power dissipation as well as switching power dissipation. The circuit is characterized by using the 90 nm technology which is having a supply voltage of 1.0 volts and threshold voltage is 0.3 volts.

Proposed Work :

CMOS technology is used for low power devices. Due to this, size of the chip decreases and number of transistor in system on chip (SOC) increases and this phenomenon also apply on memories that are used in SOC

SRAM (Static Random Access Memory) is a type of memory that provide a link with CPU and designing of SRAM is very critical because it takes large part of power and area therefore to achieve low power SRAM we have designed Memristor based SRAM**.** Memristor is a forth missing non-linear resistor which acts as memory and it improves the power and speed.

MTCMOS (Multi Threshold CMOS) technique is used, recently it is very famous in academia and industry. It is a power reducing technique that helps in reducing leakage power in the SRAM by turning of the inactive circuit domains.

A) Memristor based SRAM

Electrical scheme of the proposed SRAM cell is shown in Fig.1(a). Two memristors are acted as memory element. The arrangement is in such a way that during write cycle, they are connected in parallel but in opposite polarity and during read cycle, they are connected in series. These connections are recognized by two NMOS pass transistors T1 and T2. A third transistor T3 is used to isolate a cell from other cells of the memory array during read and write operations. The gate input of T3 is the Comb signal which is the OR of RD (Read) and WR (Write) signals. RD is set to the LOW state and WR and Comb are set to the HIGH state for write operation. As a result, circuit of Fig.1(b) is formed. The voltage across the memristors here is (*VD-VDD*/4). Depending on the data, it can be either positive (*VD= VDD*) or negative (*VD*= 0 V). Since the polarities of the memristors are opposite, change of memristances

(or resistances) will also occur in the opposite direction. Now RD and Comb are kept in the HIGH state and this forms the circuit shown in Fig.1(c). Voltage at *D* is now:

$$V_D = \left(\frac{V_{DD}}{2} - \frac{V_{DD}}{4}\right) \times \frac{R2}{(R1+R2)} + \frac{V_{DD}}{4}$$

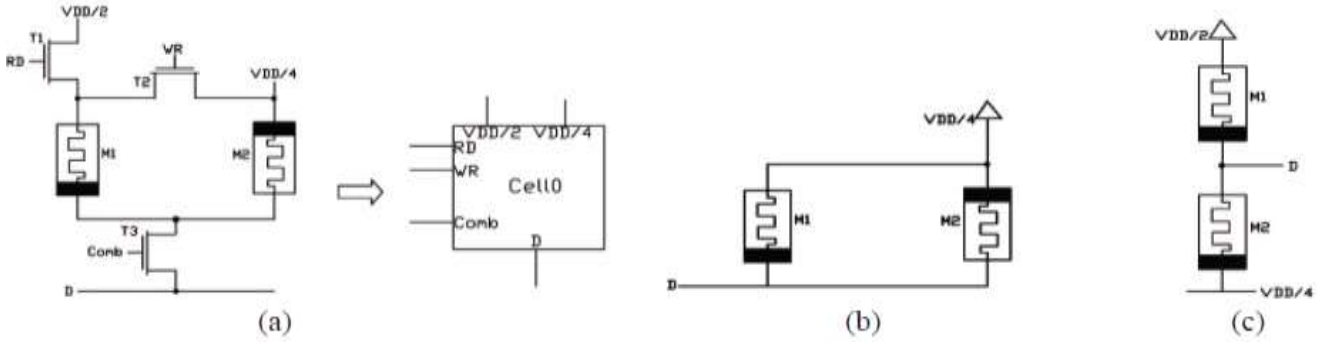

Fig1.
(a) Three transistor-two memristor SRAM cell (b) Circuit when rd=0, wr=1, and comb =1. (c) Circuit when rd=1, wr=0, and Comb=1.

Where, R1 and R2 are the resistances of M1 and M2 respectively. If "1" was written during write cycle, R2 becomes significantly greater than R1 (R2<R1) and then VD is greater than VDD/4 (VD<VDD/4). If "0" was written, *R*1 becomes significantly greater than *R*2 (R1<R2) which makes *VD* to be as close as *VDD*/4. A comparator can be used as a sense amplifier to translate these voltages as HIGH or LOW properly.

B) MTCMOS Technique

Supply and threshold voltages are reduced with the scaling of CMOS technologies. Lowering of threshold voltages leads to an exponential increase in the subthreshold leakage current. In modern high performance integrated circuits (ICs), more than 40% of the total active mode energy can be dissipated due to the leakage currents. With more transistors integrated on-die, leakage currents will soon dominate the total energy consumption of high performance ICs. A popular low leakage circuit technique is the Multithreshold Voltage CMOS (MTCMOS).

The multi threshold CMOS technology has two main features. First, "active" and "sleep" operational modes are associated with MTCMOS technology, for efficient power management. Second, two different threshold voltages are used for N channel and P channel MOSFET in a single chip. This technique based on disconnecting the low threshold voltage (low-Vt) logic gates from the power supply and the ground line via cut-off high threshold voltage (high-Vt) sleep transistors is also known as "power gating". The schematic of power gating technique using MTCMOS is shown in Fig.2 .The transistors having low threshold voltage are used to implement the logic. The transistors having high threshold voltage are used to isolate the low threshold voltage transistors from supply and ground during standby (sleep) mode to prevent leakage dissipation.

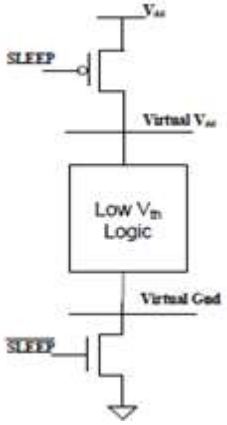

Fig2 .Power Gating Technique using MTCMOS.

In the active mode, sleep transistors are turned on and the logic consisting of low *VT* transistors can operate with high speed and low switching power dissipation. When the circuit is in sleep mode the high *VT* transistors are turned off causing isolation of low *VT* transistor from supply voltage and ground thereby reducing sub-threshold leakage current.

CONCLUSION

In this paper we have proposed Memristor based SRAM with the help of various techniques. It is non volatile in nature because of Memristor and size of Memristor is in nano scale thus it increases the packing density and reduces the power. In this paper we have reviewed on power effective Memristor based SRAM using MTCMOS technique. SRAM takes large part of power & area, therefore to improve power & speed here we are designing Memristor based SRAM. MTCMOS technique is used for reducing leakage power.

REFERENCES:

[1] Vijay Singh Baghel and Shyam Akashe, "Low power Memristor Based 7T SRAM Using MTCMOS Technique," 2015 Fifth International Conference on Advanced Computing & Communication Technologies in MP,India.
.

[2] Thangamani.V, "Memristor-Based Resistive Random Access Memory: Hybrid Architecture for Low Power Compact Memory Design," Control Theory and Informatics ISSN 2224-5774 (Paper) ISSN 2225-0492 (Online) Vol.4, No.7, 2014.

[3] Uma Nirmal, Geetanjali Sharma, Yogesh Sharma, "A Low Power High Speed Adders using MTCMOS Technique," IJCEM International Journal of Computational Engineering & Management, Vol. 13, July 2011.

[4] Nobuaki Kobayashi, Ryusuke Ito and Tadayoshi Enomoto, "A High Stability, Low Supply Voltage and Low Standby Power Six-Transistor CMOS SRAM," 978-1-4799-7792-5/15/$31.00 ©2015 IEEE

[5] Farshad Moradi and Jens K. Madsen, "Robust Subthreshold 7T-SRAM Cell for Low-Power Applications," 978-1-4799-4132-2/14/$31.00 ©2014 IEEE

[6] Mika Kutila, Ari Paasio and Teijo Lehtonen, "Comparison of 130 nm Technology 6T and 8T SRAM Cell Designs for Near-Threshold Operation," 978-1-4799-4132-2/14/$31.00 ©2014 IEEE

[7] G.-F. Wang, W. Kang, Y.-Q. Cheng, J. Nan, J.-O. Klein, Y.-G. Zhang, and W.-S. Zhao, "Low Power Computing Paradigms Based on Emerging Non-Volatile Nanodevices," JOURNAL OF ELECTRONIC SCIENCE AND TECHNOLOGY, VOL. 12, NO. 2, JUNE 2014

[8]Amit Grover, "Low Power 7-T SRAM using 90 NM Technology with Tanner Tool," 2013 First International Conference on Artificial Intelligence, Modelling & Simulation.

[9]U. Supriy, K. Ramana Rao, "Design of Low Power CMOS Circuits using Leakage Control Transistor and Multi-Threshold CMOS Techniques," IJCTA ,July-August 2012.

[10] Bastien Giraud and Amara Amara, Andrei Vladimirescu, "A Comparative Study of 6T and 4T SRAM Cells in Double-Gate CMOS with Statistical Variation," 1-4244-0921-7/07 $25.00 © 2007 IEEE.

[11]Nikhil Raj, Rohit Lorenzo "An effective design technique to reduce leakage power" IEEE Students," Conference on Electrical, Electronics and Computer Science, pp 1-4, March 2012 in Bhopal.

[12]Shyam Akashe, Mayank Shastri, "Read write stability with leakage minimization of 4t SRAM cell for nano CMOS technology,"IEEE Nanoscience engineering and Technology, pp.355-359, 30 November 2011 in Chennai.

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Study the factors affecting road safety using decision tree Algorithms

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Abstract— The purpose of traffic accident analysis is to find the possible causes of accidents. Road accidents cannot be totally prevented but by suitable traffic engineering and management the accident rate can be reduced to a certain extent. This paper discusses the classification techniques C4.5and ID3 using the WEKA Data mining tool. These techniques use on the NH (National highway) dataset. With the C4.5 and ID3 technique it gives best results and high accuracy with less computation time and error rate.

Keywords— Data Mining, Decision Tree Algorithms, C4.5, ID3, Naive Bayes, WEKA, NH(National highway)

I. INTRODUCTION

Data mining is a process that uses a variety of data analysis tools to discover patterns and relationships in data that may be used to make valid predictions. Most commonly used techniques in data mining are: artificial neural networks, genetic algorithms, rule induction, nearest neighbor method and memory based reasoning, logistic regression, discriminate analysis and decision trees. NH provides the efficient mobility and accessibility function. The increasing road accidents have created social problems due to loss of lives and human miseries. Road accidents are essentially caused by interactions of the vehicles, road users and roadway conditions. Each of these basic elements comprises a number of sub elements like pavement characteristics, geometric features, traffic characteristics, road user's behavior, vehicle design, driver's characteristics and environmental aspects. Increase in traffic also brings out extremely severe problem of road accident. The impact of road traffic accident in term of injuries, impairments and fatalities are global social and public health problems. It is now well established that many developing countries face a serious problem of road accidents. Accident fatalities rate in developing countries like India is high in the comparison with those in the developing countries. The population of India has double during the last 30 year while vehicle population has double in the last 5 year. Thus due to increase in the traffic and road accidents certain techniques need to be developed to overcome this problem of accidents. Therefore the factors affecting the traffic accidents have been shared and discussed in this paper.

II. STUDY AREA

The Study has been carried out on the National Highway-1 to reduce the frequency of vehicle accidents passing through NH by using decision tree algorithms.

III. CLASSIFICATION TECHNIQUES

Following are the classification techniques:

C4.5 Technique

Classification algorithms have attracted considerable interest both in the machine learning and in the data mining research areas. Among classification algorithms, the C4.5 system of Quinlan deserves a special mention for several reasons. On the one hand, it represents the result of research in machine learning that traces back to the ID3 system. A decision tree is a tree data structure

consisting of decision nodes and leaves as shown in Figure 1. A leaf species a class value. A decision node species test one of the attributes, which is called the attribute selected at that node.C4.8, implemented in WEKA as J4.8:

Following are the activities of ID3 and C4.5 and also shown in Table 1 and Table 2:

- Permit numeric attributes
- Deal sensibly with missing values
- Pruning to deal with for noisy data

ID3 steps:

- ID3 and C4.5 are algorithms introduced by Quinlan for inducing *Classification Models*, also called *Decision Trees*, from data.
- ID3 works on discrete values only

C4.5 Steps:

- Choose attribute for root node
- Create branch for each value of that attribute
- Split cases according to branches
- Repeat process for each branch until all cases in the branch have the same class

Attributes	Possible values
Age	New, Middle, Old
Competition	Yes, No
Type	Hardware, Software

Table 1: ID3 Uses only Discrete range

Attributes	Possible values
Outlook	Sunny, Overcast, Rain
0Temperature	Continuous
Humidity	Continuous
Windy	True, False

Table 2: C4.5 uses different attribute range

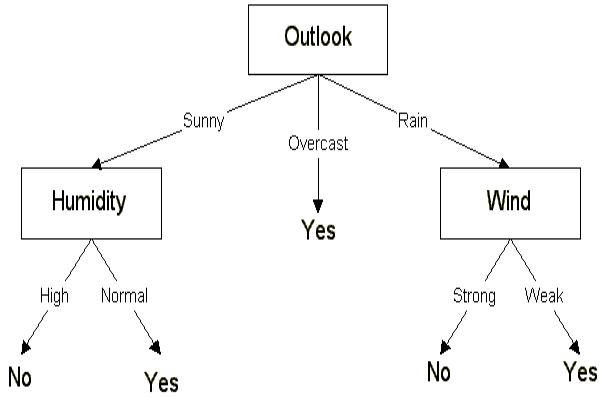

Figure 1: Decision tree

The root node will be that attribute whose gain ratio is maximum. Gain ratio is calculated by the formula.

P(c|x): posterior probability of class (target)

Following example explains the posterior probability:

The posterior probability can be calculated by first, constructing a frequency table for each attribute against the target. Then, transforming the frequency tables to likelihood tables and finally uses the Naive Bayesian equation to calculate the posterior probability for each class. The class with the highest posterior probability is the outcome of prediction as shown in Table 3.

Frequency Table		Play Golf	
		Yes	No
Outlook	Sunny	3	2
	Overcast	4	0
	Rainy	2	3

Table 3: Class with the highest posterior probability

Naïve bayes Classification consider the example given below:

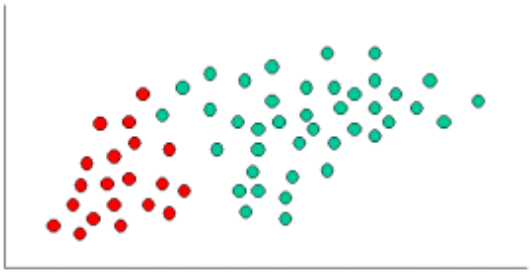

Figure 2: Naive bayes classifier the objects

As indicated, the objects can be classified as either GREEN or RED. Our task is to classify new cases as they arrive, i.e., decide to which class label they belong, based on the currently exiting objects.

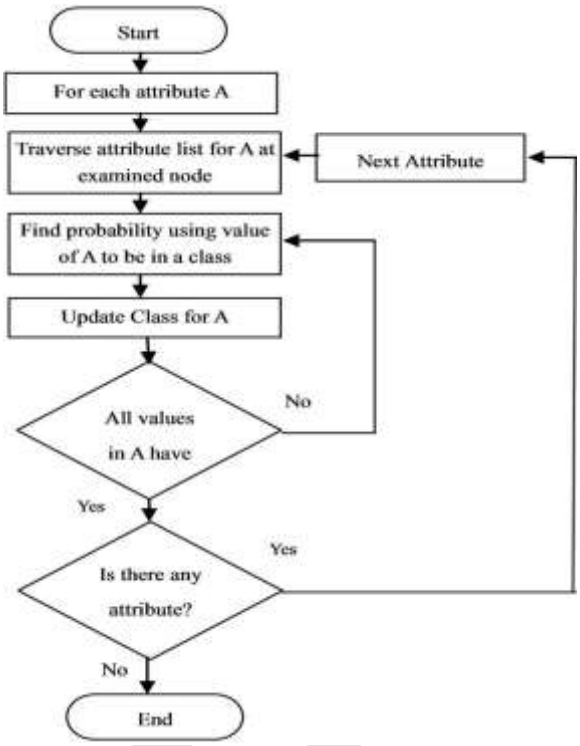

Figure 3: Working of Naive Bayes technique

IV. Experiments

A huge amount of highway accidental data is provided by National Highway Authorities. With this huge scale of data, it is very inefficient or impossible by implementing manual analytical approaches to reach practically meaningful conclusions. In comparing with the conventional statistical methods, decision tree model has shown high efficiency in data analysis and can be used to characterize data and make trend prediction in decision making processes. The decision tree model is therefore chosen to perform the data analysis.

There are major contributing factors for the attributes, which would make the results of decision tree oversize. To get reasonable result, these factors need to be classified into a few groups with losing valuable information. The classified and optimized factors are listed in the following table, which contains 13 distinct groups as shown in Table 4.

1.	**Attention**
2.	**Drink**
3.	**Physical**
4.	**Inexperience**
5.	**Rule**
6.	**Break**
7.	**Mistake**
8.	**Weather**
9.	**Road**
10.	**Sight**
11.	**Age**
12.	**Speed**
13.	**Vehicle**

Table 4: Contributing Factor

V. RESULTS AND DISCUSSIONS

The experiments are conducted through three different aspects with respect to age, season and gender.

7.1 Age group: All the data are categorized into junior, adult and senior according to the drivers' age. By validation, the decision trees generated are tested accurate

7.2 Season: The reasons for accidents in different seasons because of climate conditions. In this section the analysis for two more different groups are presented: winter and non-winter.

7.3 Gender: The experiments were carried out for all the other groups, such as adult, senior, male, female.

VI. EXPERIMENTS RESULTS BY WEKA

Weka is a collection of machine learning algorithms for data mining tasks. The algorithms can either be applied directly to a dataset or called from your own Java code. Weka contains tools for data pre-processing, classification, regression, clustering, association rules, and visualization.

In this section, the commercial software package, Weka, will be employed for the same data presented in previous section to test the accuracy of program developed in this research. Before the utilization of Weka for the data analysis, two problems need to be fixed first. One is the initial data contains a huge amount of information that would make the results less accurate and hard to understand and analyze. The other is that the format of the original data is not acceptable to Weka.

```
Number of Leaves  :     1

Size of the tree :      1


Time taken to build model: 0.44 seconds

=== Evaluation on training set ===
=== Summary ===

Correctly Classified Instances        2183               100      %
Incorrectly Classified Instances         0                 0      %
Kappa statistic                          1
Mean absolute error                      0
Root mean squared error                  0
Relative absolute error                  0.0001 %
Root relative squared error              0.0004 %
Total Number of Instances             2183

=== Detailed Accuracy By Class ===

TP Rate   FP Rate   Precision   Recall  F-Measure   Class
  1         0          1         1         1        NO
  1         0          1         1         1        YES

=== Confusion Matrix ===

    a    b   <-- classified as
 1588    0 |    a = NO
    0  595 |    b = YES
```

Table 5: Results through WEKA

VII. CONCLUSION

A series of studies have been carried out to analyze the causes of National highway accidents in using data mining techniques. The objective of this project was to preprocess highway accidental data from Highway Authority for generating human interpretable decision trees and to show the advantage of using decision tree approach for accidental analysis. C4.5decision tree algorithm whose result is compared with ID3 classification techniques. The analysis is conducted through three different aspects with respect to age, season and gender. The Comparison shows good agreement of the result.

REFERENCES:

[1] X-F Zhang, and L. Fan. "A decision tree approach for traffic accident analysis of Saskatchewan highways", *26th Annual Canadian Conference on IEEE*, 5-8 May, 2013

[2] S. B. Kotsiantis, "Decision trees: a recent overview", *Springer Science and Business Media*, Vol. 39, 2011, pp 261-283

[3] Li, L, Zhang, X., "Study of Data Mining Algorithm based on Decision Tree," *International Conference on Computer Design and Applications*, Vol. 1, 2010, pp. 155-158

[4] Rupali Bhardwaj, Sonia Vatta, "Implementation of ID3 Algorithm", *International Journal of Advanced Research in Computer Science and Software Engineering*, Vol. 3, 2013, pp 845-851

[5] Deyi Sun, Wing Cheong Lau," Social Relationship Classification based on Interaction Data from Smartphones",IEEE 2nd international workshop on hot topics in pervasive computing, 2013.

[6] M. Mayilvaganan, D. Kalpanadevi, "Comparison of Classification Techniques for predicting the performance of Students Academic Environment", *International Conference on Communication and Network Technologies*, 18-19 December, 2014

[7] Syed Tahir Hijazi, S.M.M Raza Naqvi, "Factors affecting Students Performance: A case of private colleges", *Bangladesh e-journal of Sociology*, Vol. 3, 2006

[8] N. Matthew, G. Sajjan, "Comparative Analysis of Serial Decision Tree Classification Algorithms", *International Journal of Computer Science and Security*,Vol. 3, 2009, pp 230-240

[9] J.R Quinlan, "Induction of Decision Trees Machine Learning*", Kluwer Academic Publishers,* Vol.1, 1986, pp 81-106

[10] Duong Van Hieu, Nawaporn Wisitpongphan, Phayung Meesad, "Analysis of Factors which Impact Facebook Users' Attitudes and Behaviors using Decision Tree Techniques", *11TH International Joint Conference on Computer Science and Software Engineering*, 14-16 May, 2014

[11]Bikram Pal Kaur, Himanshu Aggarwal, " Implementation failures of an Information system: A neuro computing approach", *International journal of computer applications*, Vol. 58, 2012, pp 26-33

[12] Bikram Pal Kaur, Himanshu Aggarwal, "Exploration of success factor of Information system", *International Journal of computer science issues*, Vol. 10, 2013, pp 226-235

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PHOTOELECTRIC PROPERTIES OF THIN FILM $Si/Cd_{1-x}Zn_xS$ HETEROJUNCTIONS

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Abstract. Photoelectric properties of thin film $Si/Cd_{1-x}Zn_xS$ heterojunctions have been studied in rather wide range of light wavelength (0.3÷1,4 μm), temperature (100÷500^{0}C) as well as duration (0÷20 min) of thermal processing (TP). In the course of carrying out the experiments it was found that the $Si/Cd_{1-x}Zn_xS$ heterojunctions that were undergo to thermal processing possess higher photosensitivity in the wavelength range of (0,4÷1,25 μm). When these structures are illuminated from the side of semiconductor with wide band gap ($Si/Cd_{1-x}Zn_xS$) is developed the photo electromotive force whose sign does not change in all range of photosensitivity. Chief parameters of the investigated structures were estimated for their illumination by W = 100÷500 mW/sm^2 intensity. It has been found that values of these parameters in addition to other factors depend also on the composition of films.

Keywords: Photoelectric properties, thin film, heterojunctions

1. INTRODUCTION

Wide progress and entrance of semiconductor devices to all spheres of science and engineering often causes their use in conditions of both external and internal ionizing radiation. First of all it belongs to semiconductor emitters [1,2], solar cells [3] and radiation detectors [4]. Radioactive action as a rule causes fast degradation of basic modern semiconductor materials - silicon, germanium [5] and A^2B^6 compounds [6-8] that is revealed in variation (usually to become worst) of characteristics of devices on their basis. The fundamental problem in this sphere becomes finding the regularities of interaction between light and nanoparticles [9]. Interaction of impurities, point and structural defects plays key role in semiconductor materials in both stages; obtaining of single crystals and films with necessary set of properties and management with these properties upon device fabrication [10-12]. Compounds of A^2B^6 group find widespread application in modern optoelectronic facilities due to their unique emitting characteristics and high photosensitivity [13-15]. In reality potential of unique properties of these materials was not perfectly realized in result of weak study and complexity of management the processes of impurity-defect interaction in them. In this connection the question of development of radioactive reliable semiconductor materials keeping functionality of traditional ones becomes actual. An interest to semiconductor materials is not limited with bulk materials and epitaxial films. For series of practice applications (solar cells, matrix electroluminescent screens etc.) are required the small dispersed semicrystalline films of A^2B^6 group compounds. In these materials significance of processes of impurity-defect interactions is multiply increasing. On the other hand complex processes of structural reconstruction occur in semicrystalline films during their TP and device fabrication. Methods of obtaining of thin film semiconductors significantly determine their properties. Therefore the actual becomes not only development of representations on chemistry of solid body but also the techniques allowing to act on synthesized material in the process of its obtaining. In recent years in the obtaining technology of the thin films of metal sulfides dominate the methods based on chemical processes.

2. EXPERIMENT.

Photoelectric properties of thin film $Si/Cd_{1-x}Zn_xS$ heterojunctions have been studied in rather wide range of light wavelength (0,3÷1,4 μm), temperature (100÷500 C) as well as duration time (0÷20 min) of thermal processing (TP).

The studied heterojunctions possessed "sandwich" structure. Upon their creating the Si single crystalline plates of 0.4÷0.5 mm thickness and oriented along the axis (100) were used as the substrate (cathode). Resistivity of p-Si were 8÷20 Ohm sm respectively. As a anode material the molybdenium plate of coal rods have been used. With the aim of dismearing of different mechanical defects, oxide films and other pollutions the silicon substrates were undergo to etching first in HCI and further in KOH+KNO (1:3) mixture at 250-500°C according to preliminary found regime before dipping into operating solution.

The process of electrochemical deposition has been carried out by us on the silicon plates in a special quartz vessel at room temperature. Composition of obtained films was varying in the $0 \leq x \leq 0.5$ range and was controlled by chemical, thermal and X-ray analyses. For different samples their thicknesses were 2 μm. The films possessed n-type conductance which was determined due to sing of thermal e.m.f. Concentration of free charge carriers defined by the value of conductivity and Current-voltage characteristic possessed $(0.2 \div 8)x10^{16}$ sm^{-3} depending on composition percentage of films. Operating areas of obtained heterojunctions were in the $0.04 \div 2$ cm^2 range. Depending on requirements of measurements metallic indium or silver paste were used as materials of ohmic contacts to ohm city of contacts were examined by us according to voltage-current characteristics (VCC) recorded in character graph. Measurement of electro physical characteristics of $Si/Cd_{1-x}Zn_xS$ nanofilms on a glass and estimation the VCC of p-$Si/Cd_{1-x}Zn_xS$ structure alb owed to reveal the optimum composition of chemical width: 1:12:500 ($1,5 \div 2,2x10^{-3}$M Zn $(CH_3OOO)_2$, $1,5 \div 2x10^{-3}$M $Cd(CH_3OOO)_2$, 0,01÷0,02 M $Na_2S_2O_3$, 1,05 M NH_4OH).

The structural characterization of the films has been performed by using X-ray diffractometer in the range of scanning angle 20–70 using Rigaku D/Max-IIIC diffractometer. The surface morphology has been inspected by using ZEISS SUPRA 50VP scanning electron microscope with an attached energy dispersive X-ray analysis (EDAX) analyser to qualitatively measure the sample stoichiometry. The X-ray diffraction patterns (XRD) are analysed to obtain the structural information of thin film. The structural analysis of $Cd_{1-x}Zn_xS$ thin film was carried out by using X-ray diffractometer in the range of scanning angle 20–70. The $Cd_{1-x}Zn_xS$ films were found to have polycrystalline nature and grown in the hexagonal crystal structure with strongly preferred orientation along the (002) plane parallel to the as-revealed from the XRD studies. Fig.1 shows SEM images of as-grown $Si/Cd_{1-x}Zn_xS$ thin films. It is seen that well-crystallized grains in the first image belong to these films. As can be seen in fig.1. the $Cd_{1-x}Zn_xS$ films were dense, uniform and homogeneous without visible pores and covered well with substrate. From the image of $Si/Cd_{1-x}Zn_xS$ thin films, it is clearly seen that the particles forming the films are in nano scale. One of the important applications of the SEM is to obtain the knowledge of the material composition. This microanalysis mode of SEM replied upon the monitoring X-rays emitted by surface of the sample under electron irradiation. These X-rays may be collected and analyzed to give information on the elemental compounds present in the sample. The quantitative analysis of the films was carried out by using the EDAX technique to study stoichiometry of films.

In the course of fulfilled measurements it was known that the $Si/Cd_{1-x}Zn_xS$ heterojunctions that have not been undergo to TP had high photosensitivity in the 0,4÷1,25 μm range of wavelength. When these structures are illuminated from the side of broad band semiconductor $Si/Cd_{1-x}Zn_xS$ is arised the photo electromotive force (e.m.f) whose sign does not change along the range of photosensitivity. Basic parameters (open-circuit voltage (V_{OC}) and $I_{S.C.C.}$ – short circuit current) of these structures were estimated due to their illumation with $W = 100\frac{mW}{cm^2}$ intensities.

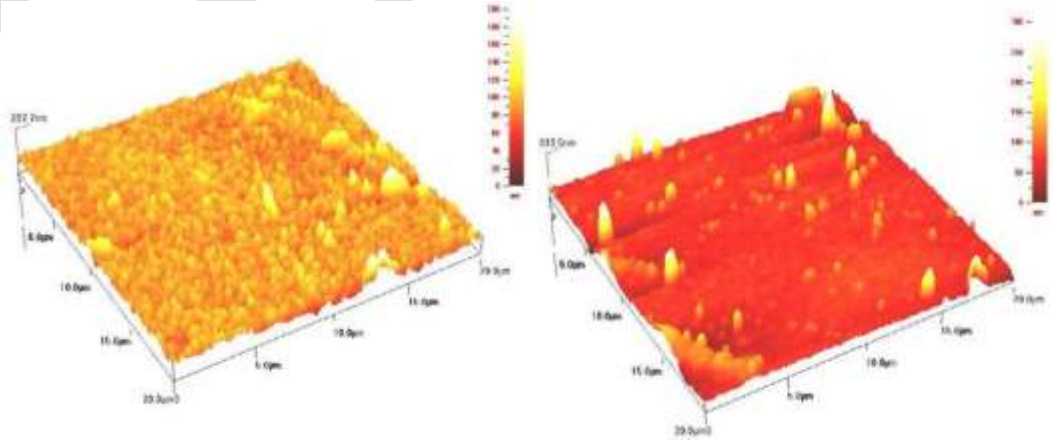

Fig.1. SEM images of as-grown $Si/Cd_{1-x}Zn_xS$ thin films, deposited and annelained at various temperaturs. a- just deposited films, b-after heat-treatment HT in air at 400^0C, for 15 min.

Is found that values of these parameters in addition to other factors are also the function of film composition (value of x) (Fig.1).

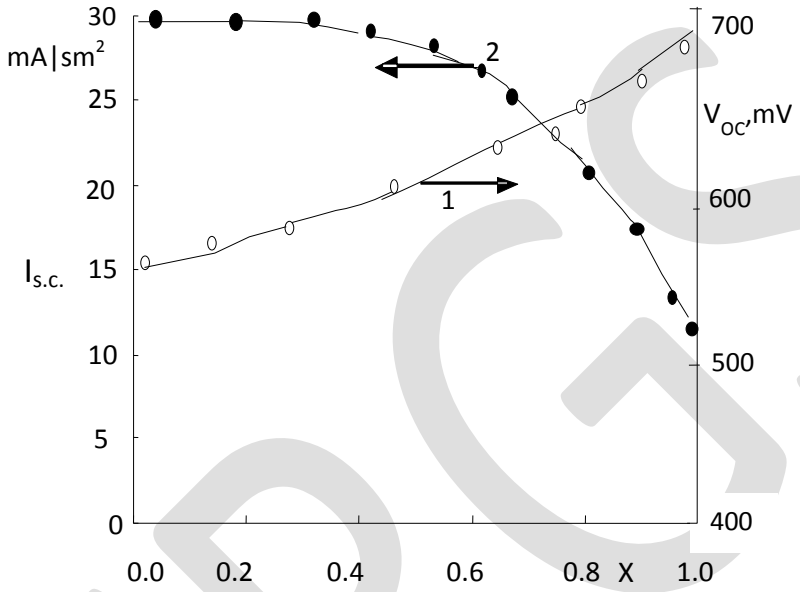

Fig.1. Dependence of open-circuit voltage (1) and short circuit current (2) in p-Si/ $Cd_{1-x}Zn_xS$ versus composition of $Cd_{1-x}Zn_xS$ films: W=100 mW/cm^2

Investigations carried out by us allow to point that the $Cd_{1-x}Zn_xS$ based thin film structures reveal remarkable results under other identic conditions. With the aim of obtaining the photosensitive samples the influence of TP on the photoelectric properties of heterostructures have been studied. The thermal processing has been carried out in the open air at $t=100\div500^0$C with duration time range $\tau=0\div20$ min. It should be noted that under considered conditions the current of short circuit for studied structures was found to be no monotonic not only with temperature but also versus duration period of TP process (Fig.2). For the heterojunctions that passed TP in air at 400^0C $\tau=12$ min values of open-circuit voltage and short circuit current reach $V_{oc}=0,6$ V and $J_{s.c}=23$ mA/sm^2 respectively. With increasing of the percentage of selenium in obtained films with thickness from 0 to 0,2 photoelectrical efficiency for thin film structures considerably increases and it shows enough binding of constants of Si and $Cd_{1-x}Zn_xS$ crystalline lattices. Light current – voltage diagrams of thermally processed heterojunctions are presented in Fig.3.

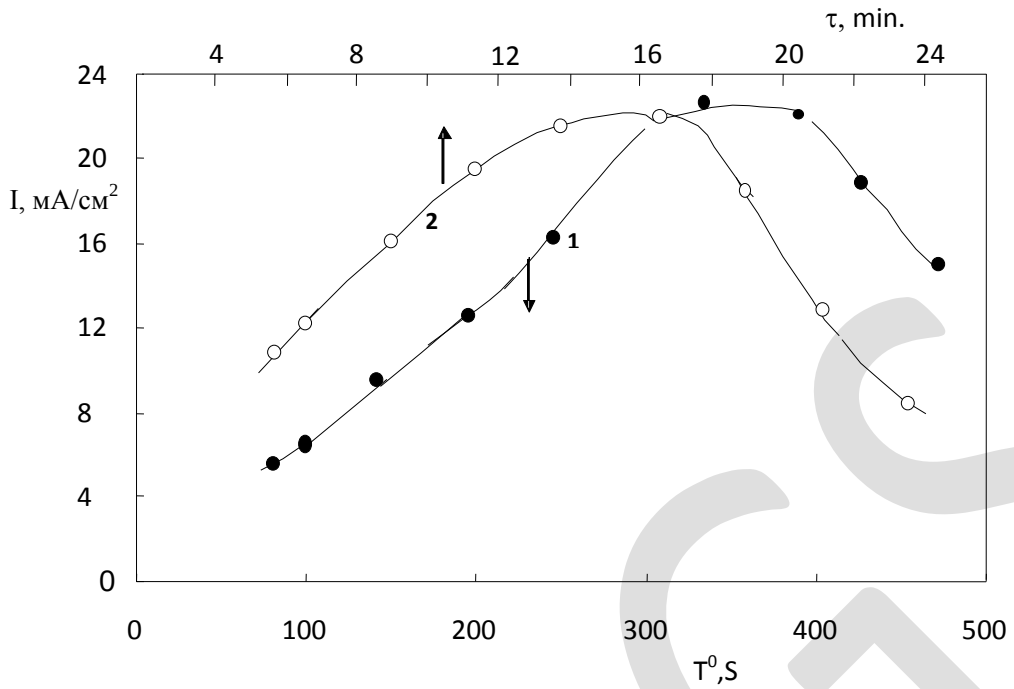

Fig.2. Dependence of short circuit current in p-Si/ $Cd_{1-x}Zn_xS$ heterojunctions versus temperature (1) and duration time(2) of TP; x= 0,5;

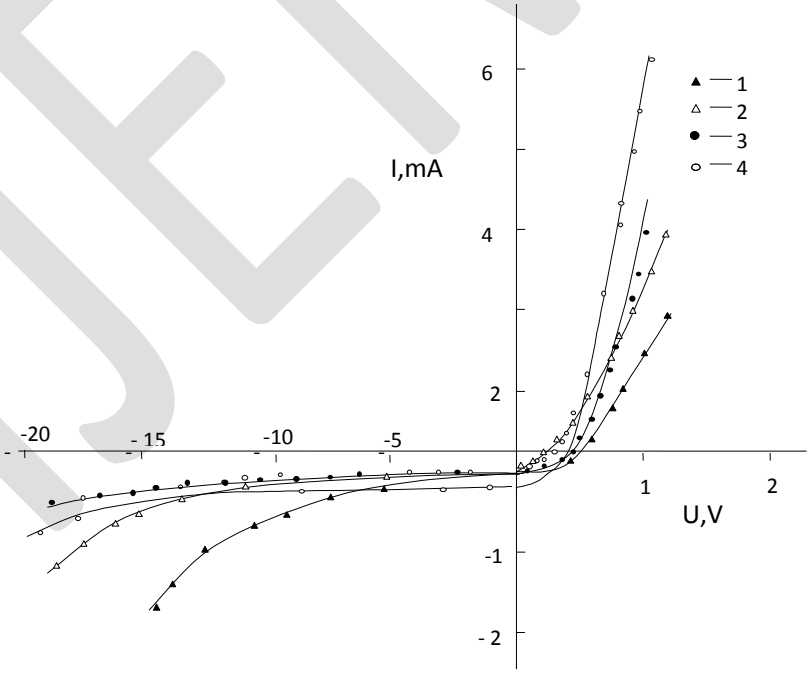

Fig.3. Light CVC of thermally processed p-Si/ $Cd_{1-x}Zn_xS$ heterojunctioıs;

x: 1-0,2; 2-0,3; 3-0,4; 4-0,5; $t=400^0$C, τ=10 min

The photocurrent of p-Si/ $Cd_{1-x}Zn_xS$ heterojunctions (short circuit regime) as a function of power of incident light flux before and after TP is illustrated. For the structures which were not undergo to TP this dependence in the beginning is linear, further has sub linear portions, that tells about presence of recombination centers at intersections. After TP at 400^0S τ=10 min, this dependence becomes linear in absorbed excitation interval.

Fig.4 demonstrates characteristics curves of spectral dependence of short circuit current for the p-Si/$Cd_{1-x}Zn_xS$ heterojunctions obtained by TP under 300^0C temperature. As can be seen from this Figure long wave edge of photosensitivity is defined by their interband transition when heterojunctions are illuminated from the side of substrate (silicon films). In the case of illumination of the studied heterojunctions from the side of Si the spectral dependence of photocurrent process the most intense long wave peak only. For the heterojunctions with x=0 more pronounced short wave peak is observed at 0,450 μm and 1,125 μm related to direct band-to-band transitions in a p, n-Si monocrystal. Illumination the heterojunctions from the side of wideband gap semiconductor ($Cd_{1-x}Zn_xS$ films) leads to change of pattern. With increase in x the displacement of this peak toward more shortwave part of the spectrum is observed. In our option it is related to the change of width of band gap of $Cd_{1-x}Zn_xS$ films. It is assumed, that variation of photosensitivity of heterojunctions dependently on illumination geometry observed by us first of all is related to the features of optical absorption of materials Si and $Cd_{1-x}Zn_xS$ being in contact. Illumination of investigated heterojunctions from the side of $Cd_{1-x}Zn_xS$ films leads to the rise in total width of spectral distribution of short circuit current (Fig.4, curve 2). Most large-strip photosensitivity is reached in heterojunctions obtained by contact with $Cd_{1-x}Zn_xS$ films whose thickness were d=0,5÷1 μm. after TP the spectral distribution of short circuit current in studied heterojunctions considerably varies – the spectrum becomes larger and an increase about 5÷6 times in photocurrent is observed. Increase in annealing temperature up to $350\div380^0$C leads to sharply rise of photosensitivity of heterojunctions in a wide spectral range of 0,8÷1,34 μm (Fig.4, curve 4). At the same time long period annealing ($\tau\geq$15 min) of heterojunctions at temperatures above 450^0C leads to degradation of parameters and finally to destroy of studied structures.

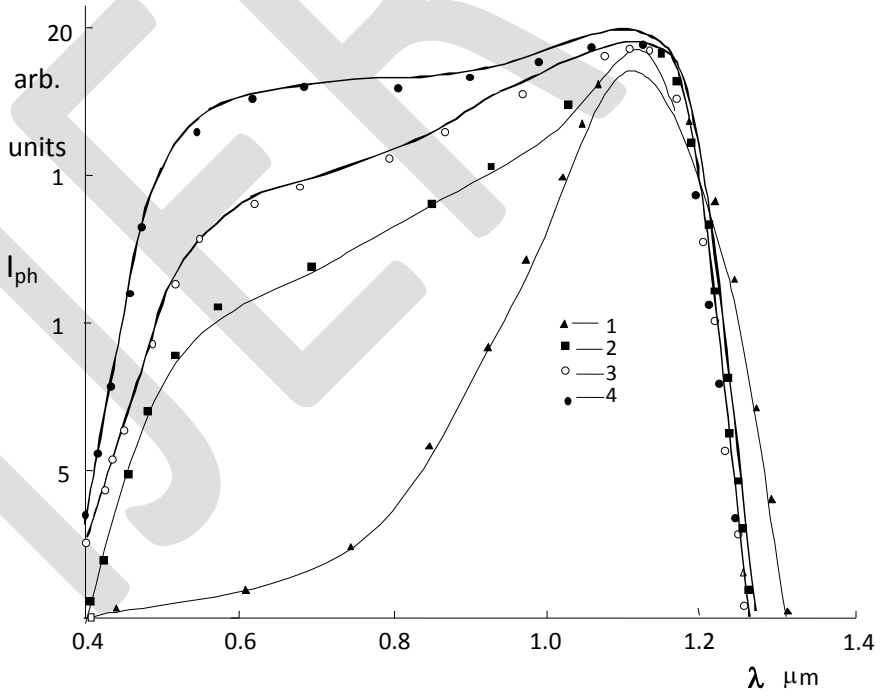

Fig.4. Spectral distribution of photosensitivity of p-Si/$Cd_{1-x}Zn_xS$ heterojunctions after TP, when is illuminated from the side of: 1-Si, 2,3,4- $Cd_{1-x}Zn_xS$, x=0.5; t^0C: 1,2-0, 3-300; 4-420; τ=10 min,

Curves of voltage-capacitance characteristics (VCC) for the structures which were not undergo to TP have been studied. For the isotype structures with x=0,6 the straight line extrapolated up to $C^{-2}=0$ cuts from axis of "voltage" a portion equal 0,59 V, but for unisotype structures with the same composition it becomes 0,65 V. The observed increase in the value of U_d with decrease x in our measurements can be explained with increase of band gap width in films depending on their percentage composition. Character of VCC in investigated p-Si/$Cd_{1-x}Zn_xS$ structures strongly depends on the percentage composition of films (Fig.5).

When a percentage of selenium in $Cd_{1-x}Zn_xS$ solid solutions increases the sharply decrease of divergence between constants of crystals lattices of absorbing and substrate layers causes increase of degree of linearity of curves in $C^{-2}=f(U)$ coordinates. Then a weak dependence of capacitance versus frequency is observed. Note, that capacitance, consequently concentration of surface states are regulated also by regime of TP.

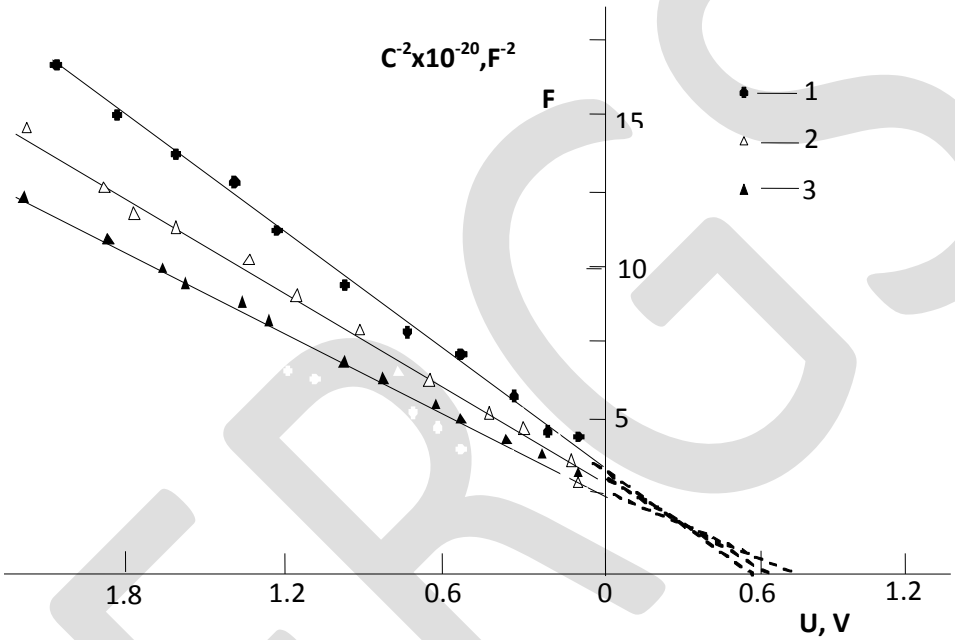

Fig.5. VCC of investigated p-Si/$Cd_{1-x}Zn_xS$ structures:

1-x=0,6; 2-x=0,5; 3-x=0,4

After TP at 380^0C for τ=10 min degree of sharpness for $C^{-2}=f(U)$ dependence strongly increases and then capacitance of structures almost does not depend on the frequency of reference signal. It shows that in the given case concentration of surface states on hetero-boundary, being responsible for frequency dependent contribution to capacitance decreases.

3. DISCUSSION OF RESULTS.

The changes observed in parameters of Si/$Cd_{1-x}Zn_xS$ heterojunctions after TP is explained by us a result of possibility of electronic-molecular interaction between film surfaces and oxygen in considered conditions. In particular, it is assumed, that surface adsorption of oxygen in $Cd_{1-x}Zn_xS$ films just after taking out these films from water solution into opened atmosphere leads to formation of deep acceptor states in boundary layer. Further, through electron capture from the volume these oxygenic centers create interface potential barrier and it in its turn causes low shortwave photosensitivity of created heterojunctions in origin state. Heights of intercrystallite barriers, which mainly are characteristic for semicrystalline films are less in comparison with barriers created by oxygen. Therefore basic properties of p-Si/$Cd_{1-x}Zn_xS$ heterojunctions in a short wave region of spectrum are determined by concentration of oxygen centers only. Values of U_d determined from VAC and CVC do not coincide. In our opinion it can be explained by no optimum fabrication regime as well as zero correspondence of constants of crystalline lattices of materials in contact. Fabrication of heterojunctions by electrochemical method leads to formation of large mumber surface states in interface which are related with inhomogeneouties of semicrystalline films, but this divergence decreases with increase in values of x. It is assumed that increase in percentage of zinc in composition of films leads, first, to enhancement of potential barrier, and, second, to decrease in

discorrespondence between constants of lattices of materials in contact. This in its turn can lead to decrease in concentration of surface states taking part in condition of heterojunction's interface.

4. CONCLUSION.

Photoelectric properties of thin film $Si/Cd_{1-x}Zn_xS$ heterojunctions have been studied in enough wide range of light wavelength, temperature and duration of thermal processing (TP). In measurements was observed that $p\text{-}Si/Cd_{1-x}Zn_xS$ that were undergo to TP process high photosensitivity in the wavelength range of 0,4÷1,28 μm. When these structures are illuminated from the side of semiconductor with large band gap ($Cd_{1-x}Zn_xS$) is developed photo e.m.f., whose sign does not change in all range of photosensitivity. Chief parameters of investigated structures were estimated. It is found that, values of these parameters depend on film composition in addition to other factors.

REFERENCES:

1. Babu, P., M.V., Reddy, N., Revathi, and K.T.R., Reddy, 2011. "Effect of pH on the physical properties of $ZnIn_2Se_4$ thin films grown by chemical bath deposition", *Journal of Nano- and* Electronic Physics 3, pp. 85-91.
2. Bacaksiz, E., S., Aksu, I., Polat, S., Yilmaz, and M., Altunbas, 2009. "The influence of substrate temperature on the morphology, optical and electrical properties of thermal evaporated ZnSe thin films", *Journal of Alloys and Compounds* 487, pp. 280-285.
3. Chen, L.Y., D.L., Zhang, G.M., Zhai, and J.B., Zhang, "Comparative study of ZnSe thin films deposited from modified chemical bath solutions with ammonia-containing and ammonia free precursors", *Materials Chemistry and Physics* 120, pp. 456-460. 2010.
4. J. M. Macak, H. Tsuchiya, A Ghicov, and P. Schmuki, ''DyeSensitized Anodic TiO2 Nanotubes,'' Electrochem. Commun., 7, 1133 (2005).
5. Yang J, Wang G, Liu H, Park J, Chen X (2009) .Controlled synthesis and characterization of ZnSe nanostructures via a solvothermal approach in a mixed solution. Mater. Chem. Phys., 115: 204-208.
6. Choy WCH, Xiong S, Sun Y (2009). A facile synthesis of zinc blende ZnSe Nanocrystals. J. Phys. D: Appl. Phys., 42 :125410(6pp).
7. Deshpande AC, Singh SB, Abyaneh MK, Pasricha R, Kulkarin SK (2008). Low temperature synthesis of ZnSe nanoparticles. Mate.Lett., 62 :3803-3805.
8. Gon H, Huang H, Wang M, Liu K (2007). Characterization and growth mechanism of ZnSe microspheres prepared by hydrothermal synthesis. Ceram. Inl., 33:1381-1384.
9. Cheng CL, Chen YF (2009) . Low temperature synthesis of ZnSe nanowires by self-catalytic liquid-solid growth. Chem. phys., 115:158-160.
10. Choy WCH, Xiong S, Sun Y (2009). A facile synthesis of zinc blende ZnSe Nanocrystals. J. Phys. D: Appl. Phys., 42:125410(6pp).
11. Jana S, Baek IC, Lim MA, Seok SI (2008). ZnSe colloidal nanoparticles synthesized by solvothermal method in the presence of $ZrCl_4$. J. Colloid Interface Sci., 322:437- 477.
12. S. Yang, T. Zhang, L. Zhang, S. Wang, Z. Yang, B. Ding, *Colloids Surf. A: Physicochem. Eng. Aspects*, **296**, №1-3, 37, (2007).
13. Chaudhari, J.B., N.G., Deshpande, Y.G., Gudage, A., Ghosh, V.B., Huse, and R., Sharma, 2008. "Studies on growth and characterization of ternary $CdS_{1-x}Se_x$ alloy thin films deposited by chemical bath deposition technique", *Applied Surface Science* 254, pp. 6810-6816.
14. Dumbrava A. Zinc sulfide fine particles obtained at low temperature, A.Dumbrava, Chalcogenide Letters. 2009. - Vol. 6, №9. - P. 437-443.
15. Yang S., Zhang T., Zhang L., Wang S., Yang Z., Ding B. Continuous synthesis of gold nanoparticles and nanoplates with controlled size and shape under UV irradiation. Colloids Surf. A: Physicochem. Eng. Aspects. 2007. -V. 296. -N 1-3.-P. 37-44

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Secure Multimedia Data using Digital Watermarking: A Review

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Abstract— Due to the excessive use of multimedia application in our daily life it becomes very much crucial for us to secure our multimedia information and copyright protection. Digital watermarking is a technique which is used to protect the information from illegal allocation of audio, video or image. This technique is used in so many applications such as authentication, copyright protection, medical application etc. Various techniques has been developed yet to protect the copyright information and also for authentication like wavelet transform, least significant bit(LSB), SVD and SVD-DWT etc. In this paper we present the literature study about previously work done and also discuss the benefits and drawbacks of the digital watermarking techniques with their explanation.

Keywords— Watermarking, DWT, LSB, Copyright, Authentication, DFT, PSNR

INTRODUCTION

Few year earlier, there have seen an outburst in the make use of digital media. Industry is making noteworthy investments to transport digital audio, image, and video information to consumers and clients. A novel infrastructure of digital audio, image, and video recorders and players, on-line services and electronic business is hastily being deployed. At the same time, major corporations are converting their audio, image, and video library to an electronic form. Digital media suggest numerous different benefits over analog media: the worth of digital audio, image, and video signals is higher than that of their analog counterparts. Editing is simple because one can access the accurate discrete locations that should be changed. Copying is simple with no loss of loyalty. A copy of a digital media is identical to the original. Digital audio, image, and videos are simply transmitted over networked information systems.
These benefits have opened up many novel possibilities. Generally, it is probable to hide data (information) inside digital audio, image, and video files. The information is secreted in the sense that it is perceptually and statistically imperceptible. With many methods, the concealed information can still be improved if the host signal is compressed, edited, or transformed from digital to analog layout and back.

Digital data embedding has many applications. Foremost is submissive and vigorous copyright protection. Most of the inherent advantages of digital signals enhance tribulations associated with copyright enforcement. For this reason, originators and distributors of digital data are hesitant to make available access to their intellectual property. Digital watermarking has been proposed as a means to recognize the owner or distributor of digital data [1]. As per the entrenching domain of the host image, digital image watermarking system can be classified into two domains namely spatial and transform domain. The easiest method in the spatial domain methods is to put in watermark image pixels in the least significant bits of the host image pixels [2]. In capability of data hiding is high in these methods but barely vigorous. Watermarking in transform domain is more protected and vigorous to different attacks. In frequency domain, watermark is not added to the image intensities or pixels, but to the values of its transform coefficients. After that to get the watermarked image, one should carry out the transform inversely. It consists of DCT (Digital Cosine Transform), DFT (Digital Fourier Transform), and DWT (Digital Wavelet Transform). The process of watermarking for digital data is shown in fig. 1.

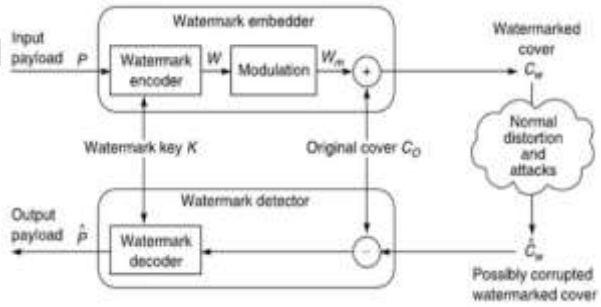

Fig.1 Digital watermarking process

Characteristics of digital watermarking

The watermarking provides different features to protect multimedia data which is describing below:

A. Robustness

A digital watermark is called "fragile" if it be unsuccessful to be noticeable after the slightest alteration. Fragile watermarks are generally used for tamper discovery (integrity confirmation). A digital watermark is called semi-fragile if it contests temperate transformations, except not succeed exposure after malevolent transformations. Semi-fragile watermarks generally used to perceive malevolent transformations.

B. Perceptibility

A digital watermark is called discernible if its presence in the discernible signal is conspicuous (e.g. Digital On-screen graphics like a network logo, content virus codes, opaque images). On videos and images, a few are made apparent/translucent for convince for people due to the actuality that they block segment of the view.

C. Capacity

The length of the embedded message concludes two dissimilar major modules of digital watermarking schemes: The message is theoretically zero-bit long and the system is considered in order to sense the presence or the absence of the watermark in the noticeable object.

D. Embedding method

A digital watermarking method is referred to as spread-spectrum if the marked signal is obtained by an additive amendment. Spread-spectrum watermarks are known to be discreetly robust, although also to have a low information capability due to host interference.
Digital watermarking method is used in different applications such as copyright protection, source tracking, broadcast monitoring, video authentication and software crippling. The objective of this paper is to present the review of literature of previously work done to hide or secure digital data. We also discuss watermarking technique with their advantages and disadvantages. The rest part of the paper, we arrange in this way: In section II literature survey about the previous work done is discussing. In section III explaining different digital watermarking scheme. In section IV discusses the different performance measuring parameter and in last section gives overall conclusion of the paper.

RELATED WORK

Akter et al. [3] anticipated a novel embedding algorithm (NEA) of digital watermarking. The algorithm is executed for digital image as data. The performance is evaluated for NEA and well established Cox's modified embedding algorithm. The watermarking is based on discrete wavelet transforms (DWT) and discrete cosine transforms (DCT). The reception of the novel algorithm is measured by the two necessities of digital watermarking. One is imperceptibility of the watermarked image, measured by peak signal to noise ratio (PSNR) in dB; an additional one is robustness of the mark image, measured by correlation of source mark image and recovering mark image. Now a 512×512 gray scale "Lena" and "Cameraman's" image is taken as host images, and a 128×128 gray scale image is taken as smudge image for 2 level of DWT. The simulation consequences for dissimilar attacking conditions such as salt and pepper attack, Additive White Gaussian Noise (AWGN) attack, jpg compression attack, gamma attack, histogram attack, cropping attack and sharpening attack etc. Subsequent to dissimilar attacks the changing tendency PSNR for both algorithms are comparable. However the mean square error (MSE) value of NEA is forever less than Cox's modified algorithm, which means that after embedding the amendment of the host image property lower for NEA than Cox's algorithm. From the simulation consequences it can be said that NEA will be a replacement of modified Cox's algorithm with better performance ***Singh et al. [4]*** proposed as a novel method to entail ownership verification and defend data from tempering by illegitimate user. To make digital watermarking more proficient digital signature or message authentication code is inserted in the whole message. This paper proposed a method using both Digital Watermarking and Signature so that data reliability can be demonstrated at the receiver end of the network.

Zafar et al. [4] recommended that, the progressing world of digital multimedia communication is faces troubles related to protection and legitimacy of digital data. In the context of multimedia communication, digital images and videos have abundant applications in entertainment world like TV channel broadcasting. Digital watermarking Algorithms used to defend the copyright of digital images and to authenticate multimedia data security. Most watermarking algorithms transform the host image and embedding of the watermark information by vigorous way. ***Roux et al. [8]*** proposed a joint encryption/watermarking system for the purpose of protecting medical images. This system is based on an approach which combines a substitutive watermarking algorithm, the quantization index modulation, with an encryption algorithm: a stream cipher algorithm (e.g., the RC4) or a block cipher algorithm (e.g., the AES in cipher block chaining (CBC) mode of operation) objective is to give access to the outcomes of the image integrity and of its origin even though the image is stored encrypted.

Rehman et al. [5] presented digital images watermarking approach to sustain the ownership and true authentication. To secure intellectual belongings of images, audio and videos, watermark W is converted into a sequence of bits and in order to encrypt the watermark, sequence of size R is selected randomly. Additionally, a pseudo random number is generated to calculate pixels for selection key generation. Finally, 2-level discrete slanlet transform (DST) on the host image is applied to divide it into Red, Green and Blue channels. The results thus produced from proposed methodology exhibit robustness against the existing state of the art. Further, proposed approach effectively extract watermark in the absence of the original images.

Guru et al. [6] adopted the usage of a mixed (hybrid) transformation to fulfill these objectives, The opinion behind applying a hybrid transform or mixed transformation is that the cover image is modified in its singular values rather than on the DWT sub-bands and also PSNR values of both cover image and watermark can be change, therefore the watermark makes it vulnerable to vivid attacks and maintains its original state by checking the robustness. To support the methods and relative study some simulation results are available.

Mishra et al. [9], proposed a novel vigorous watermarking procedure for color images was performed. In this paper, the RGB image is transformed to HSV and watermarked by using discrete wavelet transform. Watermarking embedded phase and extraction phase is designed using an additional low power invisible watermarking algorithm. In this work, the host signal is an image and later than embedding the secret data a watermarked image is obtained and then taken out secret image and original image separately. In future the resulted watermarked image was tested with several attackers to substantiate the robustness and VLSI implementation of invisible watermarking algorithm using VHDL code and also confirm various performances like power, PSNR and tamper detection and area, etc

.

Singh et al. [10] proposed a classification based on their intrinsic features, inserting methods and extraction forms. Many watermarking algorithms are reviewed in the literatures which show advantages in systems using wavelet transforms with SVD. In this paper they also have presented a review of the significant techniques in existence for watermarking those which are employed in copyright protection. Along with these, an introduction to digital watermarking, properties of watermarking and its applications have been presented. In future works, the use of coding and cryptography watermarks will be approached. ***Malipatil et al. [11]*** paper covered, a novel scheme of protecting hidden transmission of biometrics using authentication watermarking. The proposed scheme uses watermark embedding algorithm. Evaluated with traditional personal identification system such as passwords and personal identification number codes, automated biometrics confirmation makes available a well-located and reliable method in diverse application but their validity must be guaranteed. Watermarking technique provides solution to ensure the validity of biometrics; proposed scheme is composed of three parts: watermark embedding, data embedding and data extraction. One of the applications of their proposed method is verifying data integrity for images transferred over the internet.

Ram et al. [12] described a digital image watermarking techniques based on Discrete Wavelet Transform (DWT) and Discrete Cosine Transform (DCT), where the method operates in the frequency domain embedding a pseudo random sequence of a real numbers in a selected set of DCT coefficients and watermark added to this selected DCT coefficients.

DIGITAL WATERMARKING TECHNIQUE

In the area of digital watermarking, digital image watermarking has fascinated a lot of consciousness in the research area for two causes: one is its simple accessibility and the other is it express adequate redundant information that could be used to embed watermarks [13]. Digital watermarking includes different techniques for protecting the digital content. The complete digital image watermarking techniques forever works in two domains either spatial domain or transform domain. The spatial domain approach works directly on pixels. It entrenches the watermark by modifying the pixels value. The most normally used spatial domain approach is LSB. Transform domain approach embed the watermark by transforming the transform domain coefficients. Most generally used transform domain approach is DCT, DWT and DFT.

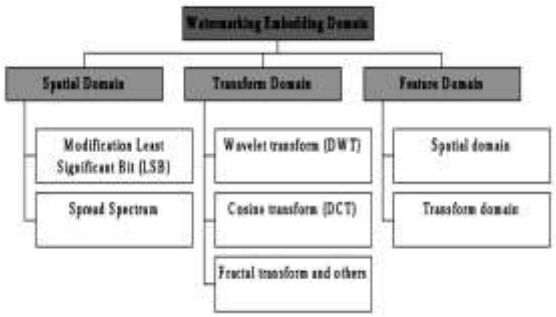

Fig. 2 Classification of Digital Watermarking technique

Spatial Domain Approach

The spatial domain represents the image in the form of pixels. The spatial domain watermarking embeds the watermark by modifying the intensity and the color value of some selected pixels. The strength of the spatial domain watermarking is Simplicity, Very low computational complexity and less time consuming.

Least Significant Bit

Least Significant Bit [14] is a spatial domain technique which is an incredibly unsophisticated and straight forward. It acquires less time to embed image (watermark).The watermark is entrenches into the least significant bits of the original image. This technique has many weaknesses, even uncomplicated attacks can get rid of or annihilate watermark but sometime it may endure beside some of the transformations. Different enhancements on LSB substitution has also been proposed in current times like embed watermark at single bit rate, multi bit rate or by means of a pseudo-random number generator. Pixel can also be preferred with help of key. Whichever addition of noise [15] and performing lossy compression can simply disgrace the image quality or eliminate or obliterate or disrupt watermark. It lacks the basic robustness. In case, if the algorithm is revealed, it becomes simple for attacker to change or eliminate watermark. The advantages of LSB are that it is easy to understand, easy to implement and provide high visual fidelity. Drawback of least significant bit (LSB) is that the transformed pixel is lost, it is less robust to various attacks and cropping or shuffling destroys the coding.

Spread Spectrum

The use of the spread spectrum technique for digital watermarking first appeared in a patent in [16] where the least significant bit of samples of an audio stream are periodically replaced with a random- looking signature, but very little. Since then, increasingly sophisticated algorithms have been developed for embedding messages within digital data in multiple dimensions for audio, image, and video. For the most part the common denominator of these methods has been the use of pseudo-noise (PN) sequences in various forms to embed (or scramble) the message. Advantages of this technique are that it opposes intentional and unintentional interference and can share the same frequency band with other users. It is also able to maintain the privacy, due to the pseudo random code sequence. Drawback of this scheme is that the original audio signal is needed and it is also very susceptible to noise.

Predictive Coding Schemes:

Predictive coding scheme was proposed by Matsui and Tanaka for gray scale images. In this method the correlation between adjacent pixels are exploited. A set of pixels where the watermark has to be embedded is chosen and alternate pixels are replaced by the difference between the adjacent pixels. This can be further improved by adding a constant to all the differences. A cipher key is created which enables the retrieval of the embedded watermark at the receiver. This is much more robust as compared to LSB coding [17].

Patchwork Techniques:

In patchwork watermarking, the image is divided into two subsets. One feature or an operation is chosen and it is applied to these two subsets in the opposite direction. For instance if one subset is increased by a factor k, the other subset will be decreased by the same amount [17]. The advantage of spread spectrum is that it provides High level of robustness against most type of attacks and drawback is that it is not able to hide big amount of information.

Transform or Frequency Domain Approach

The transform domain watermarking is accomplishing extremely much achievement as compared to the spatial domain watermarking. In the transform domain watermarking, the image is represented in the form of frequency. In the transform domain watermarking techniques, initially the original image is converted by a predefined conversion. After that the watermark is embedded in the transform image or in the transformation coefficients. Lastly, the inverse transform is performed to acquire the watermarked image. The example of transform domain of digital marking is DWT, DCT etc.

Discreet Wavelet Transform

Discrete Wavelet transform (DWT) is a mathematical tool for hierarchically decomposing an image [7]. It is useful for processing of non-stationary signals. The transform is based on small waves, called wavelets. Wavelet transform provides both frequency and spatial domain of an image. Unlike conventional Fourier transform, temporal information is retained in this transformation process. Wavelets are created by translations and dilations of a fixed function called mother wavelet. This section analyses suitability of DWT for image watermarking and gives advantages of using DWT as against other transforms. For 2-D images, applying DWT corresponds to processing the image by 2-D filters in each dimension. The filters divide the input image into four sub-bands LL1, LH1, HL1 and HH1. The sub-band LL1 represents the coarse-scale DWT coefficients while the sub-bands LH1, HL1and HH1 represent the fine-

scale of DWT coefficients. To obtain the next scale of wavelet coefficients, the sub-band LL1 is further processed until some final scale N is reached. When N is reached we will have 3N+1 sub-bands consisting of the multi-resolution sub-bands LLN and LHx, HLx and HHx where x ranges from 1 until N. Due to its excellent spatio-frequency localization properties, the DWT is very suitable to identify the areas in the host image where a watermark can be embedded effectively[7]. The advantages of DWT are that it is suitable for localization is time and spatial domain and it also provides high compression strength which is helpful for human discernment. The drawback is that it requires much compression and designing time. It also include blur in the edge of images.

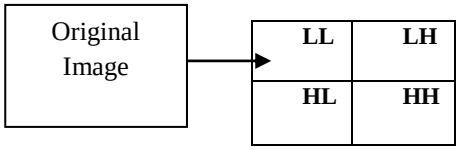

Fig. 3 DWT Decomposition of Image Using 1-Level Pyramid

Discrete Fourier Transform (DFT)

Transforms a continuous function into its frequency components [19]. It provides robustness against geometric attacks like scaling, cropping, rotation, translation etc. DFT of an original image is generally complex valued, which results in the magnitude and phase representation of an image. DFT shows translation invariance. Spatial shifts in the image affects the phase representation of the image but not the magnitude representation, or circular shifts in the spatial domain don't affect the magnitude of the Fourier transform. DFT is resistant to cropping because effect of cropping leads to the blurring of spectrum. If the watermarks are embedded in the magnitude, these are normalized coordinates, there is no synchronization are needed. The advantages of this are that it is very helpful in geometric distortions. Drawback is that it is complex to implement and require much computing time.

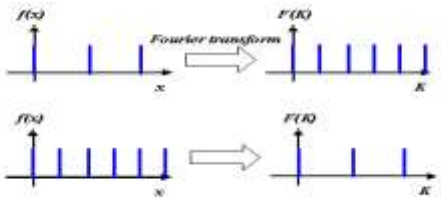

Fig.4 Fourier Transform activity

Discreet Cosine Transform

Discrete Cosine Transform [9] is a very popular transform domain watermarking technique. In this technique, an image is divided into different frequency band as low (FL), medium (FM) and high (FH). It allows selecting the band to embed data or watermark into the image. Figure 5 represents Discrete Cosine Transform Frequency 8X8 block , where low frequency band FL appears at upper left corner, if modification performed here, the watermark can be caught by human eyes. High frequency band FH lies at lower and right edges, if modification performed here, it may lead to local distortion along with edges. Medium frequency band FM is considered best region for modification, it cannot affect the image quality. Thus, a middle frequency band is the best band to embed watermark. DCT is a faster technique [17], with complexity O (n log n). This technique can survive attacks like compression, noising, sharpening and filtering. This technique is considered to be better than spatial domain watermarking technique.

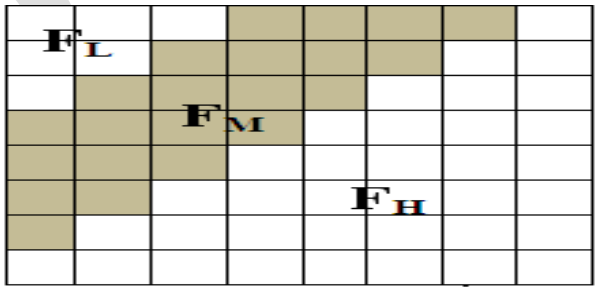

Fig. 5 Discrete Cosine Transform

PERFORMANCE MEASURING PARAMETER

In order to calculate the performance of the watermarked images, there are some performance measures such as ET, NCC, SNR, PSNR, MSE, and BER [20].

Execution Time

It is one of the important parameter to compute the working and performance of the watermarking algorithms in relation with time. It evaluates the amount of time required in embedding process and extraction process of watermark. To measure of execution time CPU cycles are used. General formulae can be used as:

$$Initial\_Time = CPUtime$$
$$Time\_Taken = CPUtime - Initial\_Time$$

Normalized Cross Correlation

It is used to measure the similarity between the cover image and the watermarked image as well as original watermark and recovered watermark. Higher the value of NCC will result in better technique. It is calculated by the formula:

$$NCC = \frac{\sum i \sum j [I(i,j) - Iw(i,j)]}{\sum i \sum j [I(i,j) + Iw(i,j)]}$$

MSE (mean square error)

It is defined as average squared difference between a reference image and a distorted image. It is calculated by the formula given below X and Y is height and width respectively of the image.

$$MSE = \frac{1}{MN} \sum \sum (W_{ij} - H_{ij})^2$$

PSNR (Peak Signal to Noise Ratio)

It is used to find out the degradation in the embedded image with respect to the host image .It is calculated as:

$$PSNR = 10log_{10} L * \frac{L}{MSE}$$

Where L is the peak signal value of the cover image which are equivalent to255 for 8 bit images.

BER (Bit Error Rate)

The **bit error rate** (**BER**) is the amount of **bit** errors per unit time. The **bit error** ratio (also **BER**) is the number of **bit** errors separated by the total number of transferred **bits** during a studied time interval. **BER** is a unitless performance measure, frequently expressed as a percentage.

$$BER = \frac{P}{H * W}$$

Where H and W are height and width of watermarked image is the count number initialized to zero and it incremented by one if there is any bit difference among cover and embedded image.

CONCLUSION

For copyright protection and authentication nowadays watermarking technique is extensively used. In this paper we discusses various digital watermarking technique like spatial and transform domain technique which is very efficient in providing security to our information but some are complex to implement and some included noise or blur in the images. So in future work design the system using the best features of both the technique of watermarking due to which we can provide more security or hide essential information from attacks.

REFERENCES:

[1]. Mitchell D. Swanson, Mei Kobayashi, and Ahmed H. Tewfik "Multimedia Data-Embedding and Watermarking Technologies", Proceedings of IEEE, Vol. 86, No. 6, June 1998.
[2]. C.I. Podilchuk and E. J. Delp, "Digital Watermarking: Algorithms and Applications", IEEE Signal Processing Magazine, pp.33-46, July 2001.
[3]. Afroja Akter, Muhammad Ahsan Ullah, "Digital Watermarking with a New Algorithm", International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
[4]. Shukla, S.S.P. Singh, S.P. , Shah, K. and Kumar A., "Enhancing security & integrity of data using watermarking & digital signature" Recent Advances in Information Technology (RAIT), 2012 1st International Conference on 15-17 March 2012 Page(s):28 - 32 Print ISBN: 978-1-4577-0694-3.
[5]. Myasar Mundher, Dzulkifli Muhamad, Amjad Rehman, Tanzila Saba and Firdous Kausar, "Digital Watermarking for Images Security using Discrete Slantlet Transform", Appl. Math. Inf. Sci. 8, No. 6, 2823-2830 (2014).
[6]. Jaishri Guru, Hemant Dhamecha and Brajesh Patel, "Fusion of DWT and SVD digital watermarking Techniques for robustness", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 9, September 2014 ISSN: 2277 128X.
[7]. Raval, K. and Zafar, S. ―Digital Watermarking with copyright authentication for image Communication‖, in Intelligent Systems and Signal Processing (ISSP), 2013 International Conference on March 2013,pp. 111 - 116 .
[8]. Dalel Bouslimi, Gouenou Coatrieux, Michel Cozic, and Christian Roux―A Joint Encryption/Watermarking System for Verifying the Reliability of Medical Images‖ IEEE Transactions On Information Technology In Biomedicine, Vol.16, No. 5, September 2012 Pp.891-899.
[9]. Manoj Ramaiya Richa Mishra, " Digital Security using Watermarking Techniques via Discrete Wavelet Transform", National Conference on Security Issues in Network Technologies August 11-12, 2012.
[10]. Y. Shantikumar Singh, B. Pushpa Devi, and Kh. Manglem Singh, "A Review of Different Techniques on Digital Image Watermarking Scheme", International Journal of Engineering Research, ISSN:2319-6890, Volume No.2, Issue No.3, pp:193-199, 01 July 2013.
[11]. Shubhangi D.C1, Manikamma Malipatil, "Authentication Watermarking for Transmission of Hidden Data using Biometrics Technique", International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 5, May 2012).
[12]. B Ram, "Digital Image Watermarking Technology Using Discrete Wavelet Transform And Discrete Cosine Transform", International journal of Advancements in Research & technology, Volume 2, Issue 4,April 2013.
[13]. V. M. Potdar, S. Han and E. Chang, "A Survey of Digital Image Watermarking Techniques", 2005 3rd IEEE International Conference on Industrial Informatics (INDIN).
[14]. D. Samanta, A. Basu, T. S. Das, V. H. Mankar, Ankush Ghosh, Manish Das and Subir K Sarkar, SET Based Logic Realization of a Robust Spatial Domain Image Watermarking," Proc. in 5th International Conference on Electrical and Computer Engineering-ICECE 2008, Dhaka, Bangladesh, pp. 986-993, Dec. 2008.
[15]. J. L., Dugelay, S. Roche, C. Rey, G. Doërr, "Still-image watermarking robust to local geometric distortions," IEEE Trans. on Image Proc., vol. 15, no. 9, pp. 2831-2842, 2006.
[16]. L. F. Turner (1989), Digital Data Security System, Patent IPN WO 89/08915.
[17]. Sasmita Mishra, Amitav Mahapatra,Pranati Mishra, "A Survey on Digital Watermarking Techniques", International Journal of Computer Science and Information Technologies, ISSN:0975-9646, Vol. 4 , 2013, 451-456.
[18]. Chaturvedi Navnidhi and Basha S.J, "Comparison of Digital Image watermarking methods DWT and DWT-DCT on the basis of PSNR," International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), ISSN: 2319-8753, Vol. 1, Issue 2, December 2012.
[19]. Jalpa M. Patel, "A brief survey on digital image watermarking techniques" ,International Journal For Technological Research In Engineering Volume 1, Issue 7, March-2014.
[20]. S Sahar Afshan Andrabi, Sheenam, "A Review: Information Hiding Using Watermarking Techniques", International Journal of Computer Science and Engineering (SSRG-IJCSE) – EFES April 2015

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INVESTIGATION ON STRENGTH PROPERTIES OF SELF COMPACTING CONCRETE WITH COPPER SLAG AS FINE AGGREGATE FOR M25 GRADE CONCRETE

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ABSTRACT— Now a days using of industrial waste materials has more in construction sector for the making of concrete because it contributes to reducing the consumption of natural resources. Self – compacting concrete (SCC) is a high performance concrete which can flow under its own weight and it fills the form work perfectly and self-consolidates without any additional vibration devices. This concrete can accelerate the placement and reduce the labour needs for compaction and finishing. Copper slag is one of the waste materials which can have a hopeful expectation in construction industry as partial or full alternative of fine aggregates. The objective of this work is to study the strength properties of self-compacted copper slag concrete. For this purpose M25 grade concrete was used and test were conducted for various proportion of sand replaced by copper slag at 0%, 20%, 40%, 60%, 80%, 100% and silica fume were used as an admixture to the concrete.

Keywords— SCC, Copper slag, Packing factor, Passing ability, Filling ability.

INTRODUCTION

When more quantity of heavy reinforcement is to be placed in a reinforced concrete member, it is too hard to ensure that the formwork is totally filled with concrete that is, completely compacted without any honeycombs. It is not easy to do the compaction by manual Tamping or by mechanical vibrators in this situation. The common methods of compaction, vibration, generates time delays and extra cost in the projects. This difficulty can now be solved with self-compacting concrete. This type of concrete can flow easily around the reinforcement and into all corners of the formwork. Self-compacting concrete (SCC) means a concrete having the ability to compact itself only by means of its own self weight without the usuage of all mechanical vibrations.The exclusion of vibrating machine enhance the environment on and near construction where concrete is being placed, sinking the coverage of labour to noise and vibration. Self-compacting concrete is also known as self-leveling concrete or Self consolidating concrete. Large amount of industrialized waste mounted annually in the emerging countries. Viability and resource effectiveness are escalated by most important issues in our construction industry. Therefore, these days use of alternate materials is commonly used in construction industry. Copper slag is one of the waste materials which possibly will have a hopeful future in construction field as alternative of either cement or fine aggregates.European Federation of National Associations Representing for Concrete established 1989 (EFNARC) has specification and guidelines for SCC to provide a framework for designing SCC and the use of high quality SCC during the year 2002.The design mix of SCC based on M25 is prepared and studied for various replacements of fine aggregates by copper slag and it is evaluated for its strength properties.

MATERIAL PROPERTIES

Cement :

The cement used in this research is 53 grade Ordinary Portland Cement (OPC).The properties of cement used in this research are given in Table 1.

Table 1: Properties of Cement

S. NO	PROPERTIES	RESULT
1	Specific gravity	3.15
2	Initial setting time	34 Min
3	Final setting time	585 Min
4	Normal Consistency	31.3%
5	Fineness	2%

Coarse Aggregate :

Well grade 16 mm size coarse aggregate were selected for present work. The various properties of coarse aggregates were tabulated in table 2.

Table2 : Properties of coarse aggregate

S. NO	PROPERTIES	RESULT
1	Fineness Modulus	3.46
2	Specific Gravity	2.695
3	Bulk Density	1450 kg/m3
4	Moisture Content	0.25 %
5	Water Absorption	0.4 %

Fine Aggregate :

Fine aggregate used in this research was river sand passing through IS sieves 4.75 mm obtained from a local source. Various properties of fine aggregates are tabulated in table 3.

Table 3: Properties of fine aggregate

S. NO	PROPERTIES	RESULT
1	Fineness Modulus	3.18
2	Specific Gravity	2.624
3	Bulk Density	1500Kg/m3
4	Moisture Content	2.4%
5	Water Absorption	0.8%

Copper Slag:

Copper slag was collected from Sterlite Industries India Limited (SIIL) Tuticorin, Tamil Nadu, India and used in this research. Various physical and chemical properties of copper slag are listed in the table below:

Table 4: Chemical properties of Copper Slag

CHEMICAL COMPOSITION	PERCENTAGE OF CHEMICAL COMPONENT
Fe2O3	65.23
SiO2	23.43
CuO	1.22
Al2O3	0.20
TiO2	0.51
K2O	0.28
Mn2O3	0.25
CaO	0.13
SO3	0.16
Na2O	0.52
Insoluble residue	10.22
Sulphide sulphur	0.15

Table 5: Physical properties of Copper Slag.

PROPERTIES	COPPER SLAG
Particle shape	Irregular
Appearance	Black and Glassy
Specific gravity	3.93
Bulk density	1900 Kg/m3
Percentage of voids	34 %
Moisture content	0.13 %
Water absorption	0.18 %
Fineness Modulus	3.28

Silica Fume:

Silica fume can be added to Portland cement concrete to extend its properties; especially it improves better compression and bonding strength, and gives more abrasion resistance. Silica fume is very fine non crystalline silica is produced in electric arc furnace as a derivative of the production of elemental silicon or alloys having silicon. It is usually grey color powder, somewhat similar to Portland cement. Silica fume of specific gravity is 2.2 which is used in this research. Because of its intense fineness and high silica content, silica fume acts as a very effective pozzolanic material.

Super plasticizer:

The use of super-plasticizers in concrete is a mile stone in the advancement of concrete technology. Some high range water reducing admixtures can retard final set by one to five hours and if prolonged setting times are not convenient, the admixture can be combined with an accelerating admixture to reduce the retarding tendencies or even to provide some setting on some acceleration. In this present research super plast 840 super plasticizer is used to make concrete more workable with the self compacting charecteristics.

Water:

Water is an important ingredient in concrete. Practically all natural water that is safe to drink and has no distinct taste or smell which can be used for mixing water in making concrete. Some water which may not fit for drinking may also still be harmless for mixing concrete. Potable water available from the local source was used in the work.

MIX PROCEDURE

By varying the volume of fine aggregate and coarse aggregate several trail mixes are carried out according to the limitation given in the EFNARC guidelines to satisfy fresh properties. Based on this optimum design mix is determined. Mix design calculations are based on several characteristic properties like packing factor, bulk density aggregates, specific gravity, etc. Packing factor is the ratio of mass of aggregates of tightly packed state in SCC to loose state in air. Packing Factor of 1.12 is taken on trial basis. Quantity of cement and water required for cement mixing is calculated as per ACI method. The Quantity of other materials is calculated by Nansu tool for mix design (2001). The percentage of fine aggregate is replaced by 0%, 20%, 40%, 60%, 80%, and 100% in the obtained optimum mix and checked for their fresh and hardened properties. Fresh properties, typical acceptance criteria and mix proportions of the self compacting concrete are tabulated in Table 7,Table 8 and Table 9.

Table 7: Fresh Properties of SCC

Mix	Slump (mm)	Slump 50 (sec)	V funnel (sec)	J Ring (mm)	Remark
0 %	700	2	6	2	Satisfied
20 %	700	2	7	3	Satisfied
40 %	700	2	8	4	Satisfied
60 %	680	3	11	8	Satisfied
80 %	480	Not Satisfied			

Table 8: Typical Acceptance Criteria for SCC

S. No	Method	Unit	Typical Range	
			Minimum	Maximum
1	Slump flow test (Filling ability)	mm	600	800
2	T 50 Cm slump flow (Filling ability)	sec	1	4
3	V- funnel test (Filling ability)	sec	7	11
4	J-ring (Passing ability)	mm	0	10

Table 9: Mix Proportion

Mix	Cement (Kg/m3)	Fine Aggregate (Kg/m3)	Copper Slag (Kg/m3)	Coarse Aggregate (Kg/m3)
0%	295	873	-	547.04
20%	295	681	247	547.04
40%	295	482	493	547.04
60%	295	287	542	547.04
80%	295	97	683	547.04

HARDENED PROPERTIES

Hardened concrete properties are as Compressive strength, Spilt tensile strength and Flexural strength are tested in Universal Testing Machine. For that 3 cubes of size (150*150*150 mm), 3 cylinders of size (300*150 mm) and 3 prisms of size (500*100*100 mm) are cast for each trial mixes of copper slag replacement and tested after 7, 14 and 28 days of curing. Test results are listed in Tables 10, 11 & 12.

Table10: Compressive Strength

Specimen	Compressive Strength (N/mm^2)		
	7th day	14th day	28th day
CS 0	24.78	27.7	30.55
CS 20	26.11	29.5	32.7
CS 40	28.78	32.44	37.8
CS 60	30.56	35	40.3
CS 80	21.67	25.6	28.5

Table11: Split Tensile Strength

Specimen	Split Tensile Strength (N/mm^2)		
	7th day	14th day	28th day
CS 0	1.23	1.25	1.31
CS 20	1.41	1.48	1.52
CS 40	1.59	1.65	1.71
CS 60	1.72	1.75	1.82
CS 80	1.32	1.36	1.4

Table12: Flexural Strength.

Specimen	Flexural Strength (N/mm^2)		
	7th day	14th day	28th day
CS 0	3.43	3.82	4.2
CS 20	3.9	4.26	5.14
CS 40	4.56	4.96	5.86
CS 60	5.2	5.78	6.39
CS 80	3.54	4.08	4.9

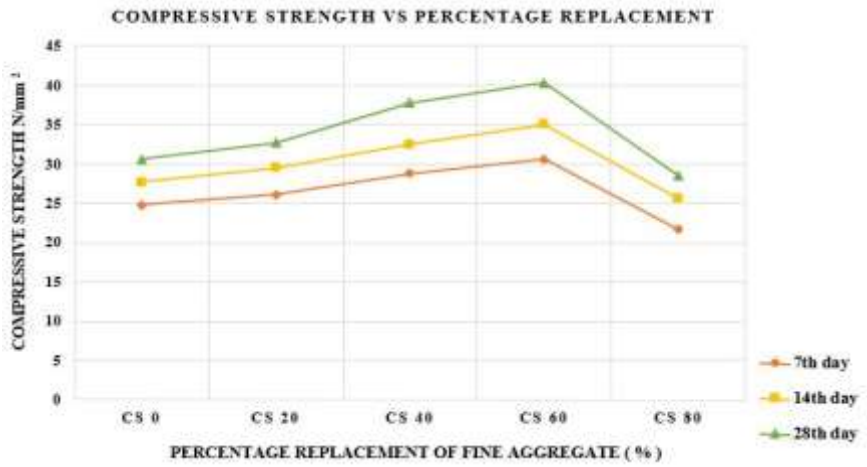

Figure 1 Compressive Strength Vs Percentage Replacement

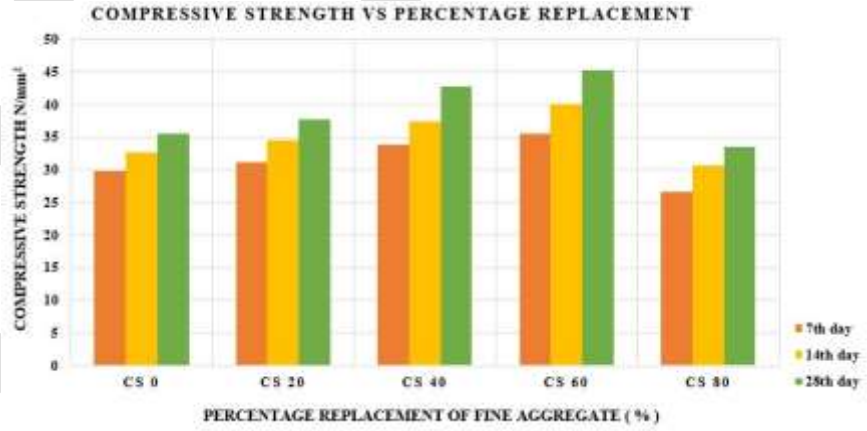

Figure 2 Compressive Strength Vs Percentage Replacement

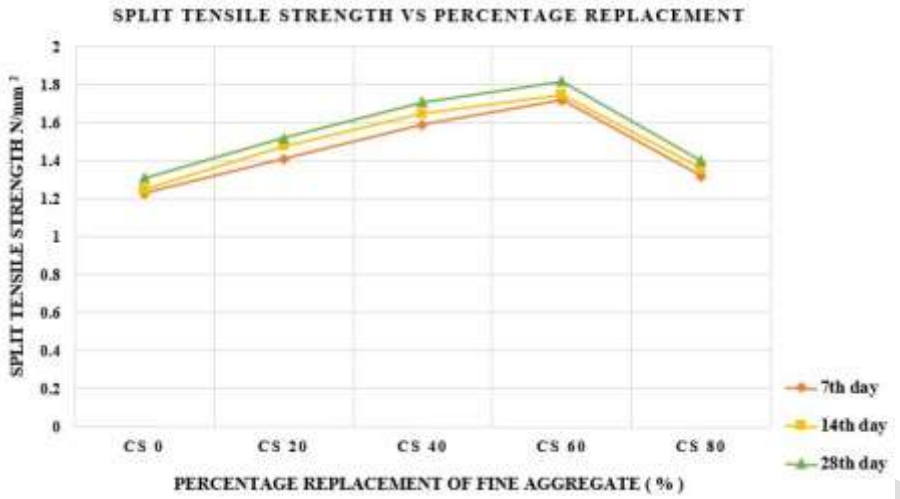

Figure 3 split tensile strength vs percentage replacement

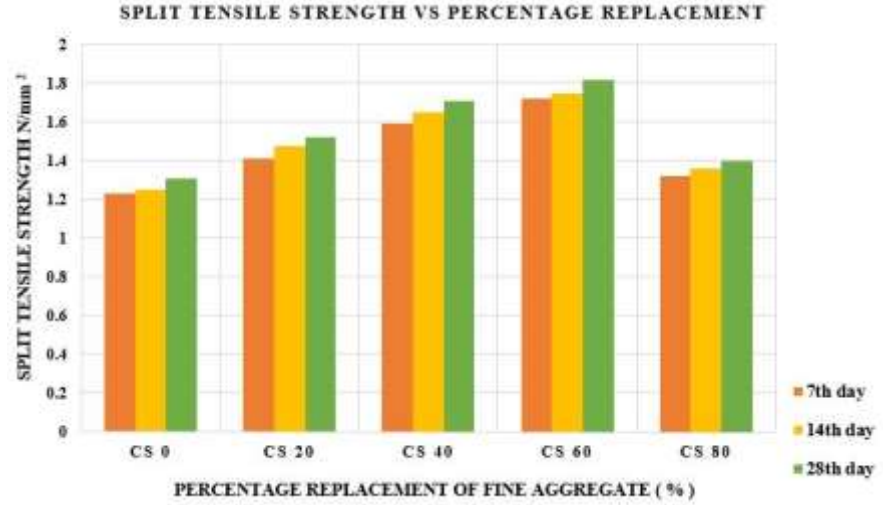

Figure 4 split tensile strength vs percentage replacement

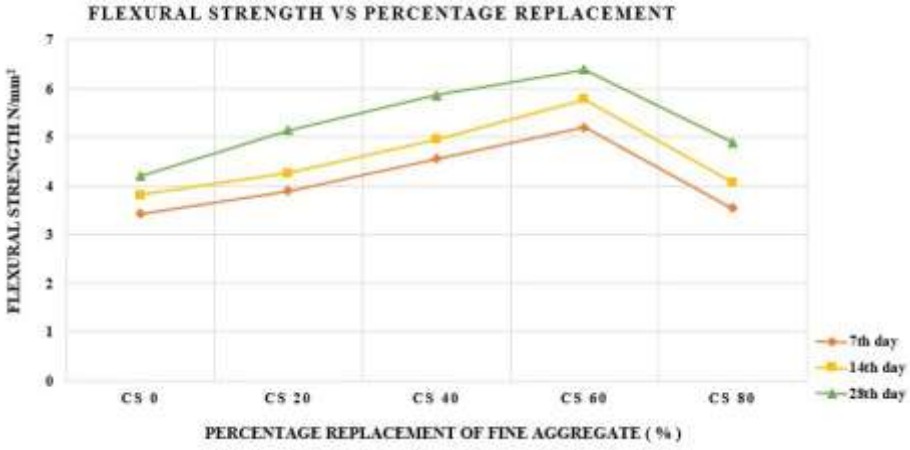

Figure 5 flexural strength vs percentage replacement

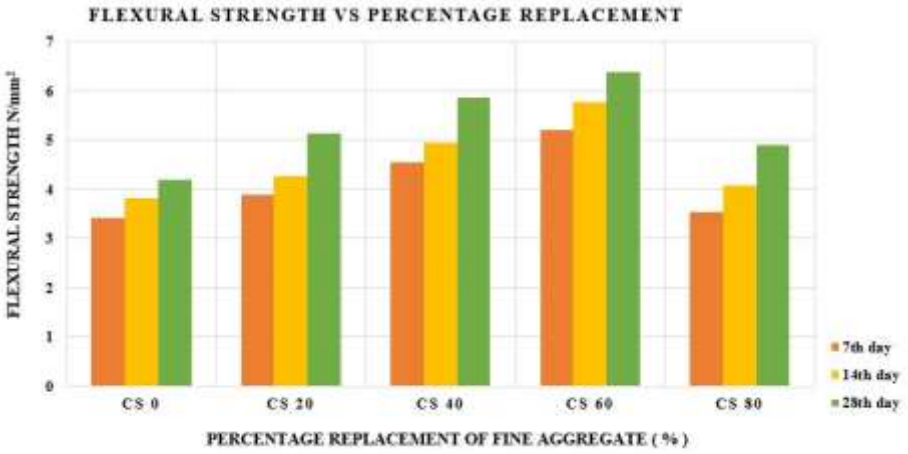

Figure 6 flexural strength vs percentage replacement

From figure 1 to 6, the results clearly show that the self compacting concrete with 60% copper slag is replaced for fine aggregate has optimum results in compressive, split tensile and flexural strength. At 60% Copper slag replacement, the compressive strength, split tensile strength and flexural strength hence an improvement of 24%, 28% and 34% respectively to that of the strengths of control concrete.

CONCLUSION

1. From the experimental results, it was observed that the compressive strength, split tensile strength and flexure strength of concrete can be improved by partial replacement of fine aggregate with copper slag and was found that 60% replacement gives optimum results.

2. The highest compressive strength obtained was 40.3 MPa (60% replacement @ 28 days) which is higher than that of the corresponding strength for control SCC 30.56 MPa.

3. The percentage of increase in the compressive strength is 24.19% after a span of 28 days by replacing 60% of fine aggregate with copper slag.

4. The percentage of increase in the split tensile strength is 28.02% after a span of 28 days by replacing 60% of fine aggregate with copper slag.

5. The percentage of increase in the flexural strength is 34% after a span of 28 days by replacing 60% of fine aggregate with copper slag

6. Further detailed research work is needed to explore the effect of copper slag as fine aggregates.

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REFERENCES:

[1] M.Chockalingam, D.Jayganesh, J.Vijayaraghavan and Dr.J.Jegan, "Scope For Reuse of Copper Slag In Concrete – A Review" International Journal of Civil Engineering & Technology (IJCIET), Volume 4, Issue 6, 2013, pp. 89 - 100, ISSN Print: 0976 – 6308, ISSN Online: 0976 – 6316.

[2] K Tokuhashi, M Shoya, M Aba, S Sugita., "Application of Slag Fine Aggregates to Produce Self-Compacting Concrete" 26thConference on Our World in Concrete & Structures, 27 - 28 August 2001, Singapore

[3] Nagataki, S. and Fujiwara, H., "Self-Compacting Property of Highly-Flowable Concrete, Second Conference on Advances in Concrete Technology", American Concrete Institute, ACI SP-154, June 1995, Pages 301-304.

[4] BertilPersson., "A Comparison Between Mechanical Properties of Self-Compacting Concrete and the Corresponding Properties of Normal Concrete, Cement And Concrete Research", Volume 31, Issue 2, February 2001, Pages 193–198

[5] Najim K.B., Hall M.R., "A Review of the Fresh/Hardened Properties and Applications for Plain- (PRC) and Self-Compacting Rubberised Concrete (SCRC)", Construction and Building Materials 24, 2043–2051, 2010.

[6] P. Ramanathan, I. Baskar, P. Muthupriya, R. Venkatasubramani., "Performance of SelfCompacting Concrete Containing Different Mineral Admixtures", KSCE Journal of Civil Engineering, Volume 17, Issue 2, March 2013, Pages 465-472.

[7] Yogesh, Aggarwal and Paratibha, Aggarwal., "Self compacting concrete-Procedure for mix design, Leonardo Electronic Journal of Practices and Technologies" ISSN 1583-1078, Volume 12, 2008, Pages 15-24.

[8] Sakata,K., Ayao, T. and Ogawa, A., " Mixture Proportioning for Highly Flowable Concrete Incorporating Limestone Powder", ACI, Sp 153-14, Pages 249-268.

[9] Nan su, Kung-chung Hu, His-wen chai., "A Simple Mix Design Method for Self Compacting Concrete, Cement And Concrete Research", Cement and Concrete Research Journal, Volume 3, Issue 2, December 2001, Pages 1799-1807.

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Mathematical Evaluation of Lateral and Torsional Vibrations on Directional Drilling

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Abstract- This research work was carried out to study the dynamics of torsional and lateral vibrations and its impact on directional drilling. Harmonic and modal finite element analyses were adopted for the obvious advantage that it is able to approximate the real structure with a finite number of degrees of freedom. The damping effect of drilling mud and friction between drillstring and the wellbore were also considered. The deductions and findings were used to detect, analyze and mitigate against torsional and lateral drillstring vibrations

1.0. Introduction

The oil and gas industry spends about $20billion annually on drilling activities with 15% of that cost lost to Non Productive Time (NPT). Drillstring vibration is a complex and costly problem that often results in failures of Measurement While Drilling (MWD) tools and Bottom Hole Assembly (BHA) components, poor drilling efficiency and high NPT.

Confronted with the challenges of accessing hitherto unaccessible oil and gas reservoirs spurred the technology advancement in directional drilling with well trajectory ranges from simple 'J' or 'S' paths to complex cased junction with pressure isolation and re-entry capabilities (Fig. 1).

As it is with most technological advancement, directional drilling also came with its attendant challenges. With the increase in inclination of the well, when drilling either in sliding or rotary mode, the risk of drillstring vibration increases.

The primary causes of drillstring vibrations are bit/formation and drillstring/borehole interactions. Large vibration levels cause reduced rates of penetration and catastrophic failures while lower levels may lead to a reduced operating life. The benefits of addressing this problem are obvious and include reduced drilling time and costs, reduced maintenance, and lower equipment turnover.

The drill-string vibrations are induced by the characteristics of the bit-rock interaction and by the impacts that might occur between the column and the borehole. If not controlled, vibrations are harmful to the drilling process causing:

1. Premature wear and consequent damage of the drilling equipment and BHA components - bit, motor / RSS, MWD etc. resulting many times in failures, especially due to fatigue (Fig. 2.)
2. Decrease of the rate of penetration (ROP), increasing the well cost
3. Interferences on the measurements performed during the drilling process and damage of the measurement equipment and even failure to acquire evaluation data
4. Significant waste of energy due to increased Tripping Times and inability to run & set casing, torque and drag

5. BHA instability, reducing the directional control.
6. Wellbore instability occasioned by the fracturing effect on the wellbore due to BHA whirl. (Fig. 3).

Factors that affect torsional and lateral drillstring vibrations

1. Material of the drillstring (shear modulus). For the steel with increasing torque, shear stress increases linearly with shear strain until plastic region is reached.
2. Drilling fluid
3. Well geometry (Hole angle)
4. Difference in friction between the static and dynamic friction of the drill bit and bit face
5. The nature of vibration in drillstrings depends on the type of bit, among other factors. PDC bits work by shearing the rock rather than crush the rock. This results in a bit-rock interaction mechanism characterized by cutting forces and frictional forces. The torque on bit and the weight on bit have both the cutting component and the frictional component when resolved in horizontal and vertical direction.

2.0. **TORSIONAL VIBRATION (STICK-SLIP):** This is the alternate slowing down and speeding up of the bit and BHA. This happens when by any reason the bit (or stabilizer) is slowed down or can eventually stall, but the surface Top Drive or Kelly will continue to rotate at constant speed. When the stalled bit can no longer withstand the increasing torque, the bit or stabilizer breaks free with a higher rotational speed. A torsional wave back down the drillstring to the bit, which again stalls. This cycle repeats unless drilling parameters are adjusted to interrupt it. The period of these oscillations is a function of the length of the drillpipe, the mechanical properties of the drilling system, the drilling parameters (WOB - RPM), the nature and location of the down hole friction.

Stick-slip is caused largely by interaction with the formation and frictional forces between the drillstring, BHA and the wellbore, and this is more pronounced in highly deviated and deep wells. If compressive force F is applied directly along the longitudinal axis of the drillstring, buckling will occur.

TORSIONAL VIBRATION

For torsional vibration, monitor

- Torque on bit
- Bit speed

Surface Measurements or Symptoms

- Topdrive /Rotary table stalling
- Large and erratic surface RPM & torque fluctuations, especially noticeable on a top drive
- Whirling sound form the top drive
- Increased delta surface torque
- Torque or RPM cycling
- Loss of tool face
- Reduced ROP

Downhole measurement

a) Increased delta downhole torque
b) Increased torsional (rotational) acceleration
c) Increased stick/slip indicator
d) Increased bit-stuck percentage (percentage of time < 5rpm)
e) Loss of real-time data or measurement

Postrun Evidence

a) Cutters or inserts damaged typically on nose and taper
b) Over torqued connections
c) BHA failure
d) Damage to the bits with heat checking and dull characteristics
e) Fractured or cracked motor drive line components such as bearing mandrels, driveshafts or drive shaft adapters

Causes of torsional vibration

a) Poor bit selection – overly aggressive PDC bit
b) Improper BHA stabilization – undersize stabilizers
c) Excessive bend in mud motors
d) Tortous hole geometries and high dogleg angles
e) High weight on bit with low rate of penetration
f) Inadequate drill collars mass
g) Inadequate drillpipe and BHA stiffness
h) Poor drilling practices
i) Inadequate lubrication in drilling mud
j) Lithology – interbedded formations, formation interfaces hard and/or abrasive stringers, formations with high friction coefficients
k) Reaming/back-reaming, hole opening, drilling out casing, control drilling.

3.0. **LATERAL VIBRATION (WHIRL AND BENDING):** This is the rotation of the drillstring or any part of the BHA around the hole centre line. This type of vibration occurs when by any means, a bit blade or stabilizer digs into the formation after losing its instantaneous center of rotation. As a result, you may say the bit walks around the hole and produces unusual bottomhole patterns. Hole enlargement may result and leading to premature wear of the BHA components. Also, bit whirl causes significant damage to PDC bits due to high and irregular impact loads and off center wear in roller cone bits. Bit whirl can change the tilt or orientation of the bit and replacing the bit requires the removal of what might be a mile-long drillstring, a costly process.

The main factor influencing whirl is the bit geometry. Longer tapers, more aggressive structures or aggressive gauge cutters all significantly increase a bits tendency to whirl. However, higher back rake, flatter (bit) profiles and smooth gauge will tend to reduce bit whirl.

Surface Measurement or Symptom

a) Increased mean surface torque (indicator of backward whirl)
b) Loss of toolface
c) Reduced ROP

Downhole measurement

a) Increased mean downhole torque
b) Large amplitude, high-rate downhole shocks (indicator of chaotic whirl)
c) Increased lateral shocks
d) Loss of real-time data or measurement
e) Increased shock count

Postrun Evidence

a) Cutters or inserts damaged typically on shoulder or gauge
b) Broken PDC cutters
c) Worn hybrid (equivalents) with minimal cutter wear
d) Overguage hole from calipers
e) BHA failure
f) BHA connection failure due accelerated fatigue (backward, chaotic whirl)
g) Washouts
h) One-sided wear on stabilizers and BHA (forward whirl)

Causes

a) Harmonic resonance of drill string
b) Excessive RPM: stick slip
c) High tortuosity of the well
d) Formations with high coefficients of friction and restitution
e) Inadequate BHA stabilization
f) Low weight on bit and high RPM
g) Poor bit selection

3.1. **TORSIONAL VIBRATIONS: ANDRADE, FOSENCA AND WEBER (2013) MATHEMATICAL FRICTION INDUCED STICK-SLIP MODEL**

The model consist of two degrees of freedom where the surface torque is imposed at the top end

Assumptions:

- The dynamic characteristics of the top drive motor are not considered
- The axial and lateral dynamics of the drilling system are neglected.

- The Bottom Hole Assembly (K_{BHA}) is assumed to be a rigid body since its stiffness is much greater than the stiffness of the drill pipe (K_{DP})
- The two degrees of freedom modeling

The equivalent mass moment of inertia

$J_1 = \rho_{BHA} I_{BHA} L_{BHA}$

The area moments of inertia was given as

$$I_{BHA} = \frac{\pi}{32}(OD_{BHA}^4 - ID_{BHA}^4) \quad 1$$

$$I_{DP} = \frac{\pi}{32}(OD_{DP}^4 - ID_{DP}^4) \quad 2$$

The stiffness is given as

$K = \frac{GI_{DP}}{L_{DP}}$

Where

The shear modulus,

$G = \frac{E}{2(1+v)}$

The mud damping is written in terms of a damping factor of the mud Dr,

$C_1 = D_r L_{DP}$

The structural damping is given by

$Cs = 2\xi \sqrt{K J_1}$

The underlined matrices, A contains the properties of the system

$$q^1 = Aq + T \quad 3$$

They based their work on Pavonne and Desplans (1994) friction model developed from field data using the Televigile measurement device

In their experiment, they observed that the vibration range of surface RPM increases when the WOB value is increased, the amplitude of vibration increasing with WOB also.

The vibration amplitudes when the WOB increases while the surface RPM stays constant were evaluated and also the vibration amplitudes increase when the WOB is increased and the effect of WOB were demonstrated in the bifurcation.

3.2. LATERAL VIBRATION: CRISTIANO AND RODRIGO (2014) MATHEMATICAL MODEL ON LATERAL VIBRATION

The work was based on Jansen, J.D. (1993) model which takes into account the pumping fluid, contact of the stabilizers with the borehole walls, contact of the drillstring with the borehole walls, and excitation due to unbalance. The model was complemented with additional degrees-of-freedom of torsional and longitudinal movement.

Assumptions

- Pumping Fluid: drag in the annular gap between the drillstring and the borehole is proportional to the square of the rotating speed.
- Stabilizers: the hydrodynamic effects in the gap between the stabilizers and the borehole walls are neglected
- Borehole: the cross section of the borehole is circular, and contact between the drillstring and the borehole obey the Coulomb law
- Drillstring Vibration: the adopted rotating speeds are close to the first natural frequency of the drillstring associated to the first bending mode. Hence, lateral vibration of the drillstring will be limited to that of the bending mode of a simply supported beam, which means that both stabilizers will be in contact at the same time;
- Longitudinal Movement: Coulomb friction is considered in the longitudinal direction of movement.
- The weight of the drillstring, and its effects, will not be considered in the model.

Vibration is analyzed in the mid-section of the beam (section A-A Figs. 4). The model has two degrees of freedom to represent the lateral movements of the BHA in directions x_1 and x_2, one degree-of-freedom to represent the torsion of the drillstring, and one degree-of-freedom to represent the longitudinal motion in x. The unbalance of the BHA is represented by an eccentricity, given by the difference between the centre of mass of the BHA and it's the geometric Centre.

The inertia forces due to acceleration of the BHA and of the fluid can be described by

$$F_{mx_1} = -(m_b + m_f)x_1 + m\Omega^2 e_o \cos(\emptyset - \Omega t) \qquad 4$$

$$F_{mx_2} = -(m_b + m_f)x_2 + m\Omega^2 e_o \sin(\emptyset - \Omega t) \qquad 5$$

4.1. HARMONIC FINITE ELEMENT ANALYSIS OF DRILLSTRING LATERAL VIBRATION

Lateral vibration will cause fatigue and failure of drillstring, broaden hole and change bending angle of bit. The major difficulty however encountered in controlling lateral vibration amplitude and impact intensity is the fact that lateral vibration and its consequent drillstring impact cannot be observed at the surface without the expensive MWD apparatus.

Bit whirl is predominant with PDC bits because tricone bits penetrate the bottom of the borehole more and do not allow sideways movement of the bit. Whirl generation is caused by two factors: a centrifugal force generated as a result of the high rotary speed. The added force creates more friction which further reinforces whirl. The second is the center of rotation which is no longer the centre of the bit. This fact however contradicts the basic bit design assumption that the geometric center of the bit is the center of rotation. The impact loads associated with this motion cause PDC cutters to chip, which in turn, accelerates wear.

In this analytical model, we would be able to control lateral vibration by controlling some factors such as under-gauge stabilizer, initial phase angle, initial deformation, WOB and ROP.

The Euler equation for beams will be used to analyze the drillstring vibration. The length of the drillstring AB of length l whose upper end is fixed B and lower end (bit) free to move (Fig. 5).

where P = crippling load that causes the drillstring just to deflect, expressed in N.

The rotation of the cross section as measured by $\theta \approx \frac{dy}{dx}$ is less than 1.0, one radian

At any section XX distant X from the fixed point B, for the curved beam, bending moment is expressed as given as

$$\frac{M}{EI_a} = \frac{d2y}{dx2} \qquad \text{(Leonhard Euler equation)}$$

Recall, M = Force x distance

$$EI_a \frac{d2y}{dx2} = P(\delta - y)$$

$$EI_a \frac{d2y}{dx2} + Py = P\delta$$

$$\therefore \frac{d2y}{dx2} + \frac{P}{EI_a} y = \frac{P\delta}{EI_a}$$

Solving the differential equation,

$$y = C_1 \cos(x \sqrt{\frac{P}{EI_a}}) + C_2 Sin\left(x \sqrt{\frac{P}{EI_a}}\right) + \delta \qquad 6$$

Where

E = Modulus of elasticity for steel expressed in pa (from 200,000 to 220,000MPa)

I_a = Moment of inertia of the straight section of the drillstring expressed in m^4

l = Free buckling length which depends on the actual length of the pipe and the way the end s are fixed, expressed in m

C_1C_2 = Arbitrary constants of integration

At the fixed point, B, the deflection is zero

Boundary conditions:

$y = 0 \ @ \ x = 0$

$y = \delta \ @ \ x = l$

So

$$0 = C_1 + \delta \ or \ \ C_1 = -\delta$$

The slope at any section is given by

$$\frac{dy}{dx} = -C_1\sqrt{\frac{P}{EI_a}}\sin(x\sqrt{\frac{P}{EI_a}}) + -C_2\sqrt{\frac{P}{EI_a}}\cos(x\sqrt{\frac{P}{EI_a}})$$

At the fixed point, B, slope is zero

$$\therefore x = 0, \frac{dy}{dx} = 0$$

So

$$0 = C_2\sqrt{\frac{P}{EI_a}}$$

$$\therefore C_2 = 0$$

At A, the deflection is δ

$$\therefore x = l, y = \delta$$

$$y = C_1\cos(x\sqrt{\frac{P}{EI_a}}) + C_2 Sin\left(x\sqrt{\frac{P}{EI_a}}\right) + \delta$$

$$\therefore \delta = -\delta\cos(l\sqrt{\frac{P}{EI_a}}) + \delta$$

$$\cos(l\sqrt{\frac{P}{EI_a}}) = O$$

$$l\sqrt{\frac{P}{EI_a}} = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}\ldots$$

Where K = 1, 3, 5, …

Considering the first critical value,

$$l\sqrt{\frac{P}{EI_a}} = \frac{\pi}{2}$$

$p = \frac{\pi^2 EI_a}{4l^2}$ (Euler formula)

$$Ia = \frac{\pi}{4}(R_e^4 - R_i^4)$$

Where

R_e: outside radius of the pipe expressed in m

R_i: inside radius of the pipe expressed in m

$$Ia = \frac{\pi}{64}(D_e^4 - D_i^4)$$

D_e: outside diameter of the pipe expressed in m

D_i: inside diameter of the pipe expressed in m

P, the crippling load is the maximum limiting load at which the column tends to have lateral displacement. Buckling occurs about the axis having least moment of inertia.

From above, the factors affecting the vibration/deflection are critical load, length of drillstring, young modulus and moment of inertia.

4.2. HARMONIC ANALYSIS OF NATURAL FREQUENCY OF DRILLSTRING LATERAL VIBRATIONS

To determine the natural frequency of free lateral vibrations, consider a drillstring whose end is fixed and the other end carries a body of weight, W as seen in the figure 6 below

Where

k = stiffness of the drillstring (N/m)

m = mass (Kg)

W = weight of drillstring = mg

δ = static deflection due to weight of the body

x= displacement of the body from the equilibrium position

w_n = circular natural frequency (rad/s)

f_n = natural frequency, Hz

f= frequency of mass body

A = Cross-sectional area

In equilibrium position, the gravitational pull, W = mg and is balanced by force of spring, such that W = k. δ

Since the mass is displaced from its equilibrium position by a distance of x, as shown in Fig 6. Above and is then released, therefore after time t,

Restoring force = $W - k(\delta + x)$

$$= W - k\delta - kx$$

Recall $W = K\delta$

$$\therefore K\delta - k\delta - kx = -kx \ \ (taking\ upward\ force\ as\ negative) \ 7$$

Accelerating force = mass x acceleration $m\frac{d2y}{dt2}(taking\ downward\ force\ as\ positive)$8Equating equation 7 and 8, the equation of motion becomes

$$m\frac{d2y}{dt2} = -kx$$

$$m\frac{d2y}{dt2} + kx = 0$$

$$\frac{d2y}{dt2} + \frac{k}{m}x = 0 \qquad 9$$

Recall that the fundamental equation of simple harmonic equation is

$$\frac{d2y}{dt2} + \mathrm{W}x = 0 \qquad 10$$

Comparing equation 9 and 10, we have,

$$\mathrm{W}^2 = \frac{k}{m}$$

$$\therefore \mathrm{W} = \sqrt{\frac{k}{m}}$$

The periodic time of the vibration is

$$t_p = \frac{2\pi}{\omega_n}$$

And the natural frequency = $\frac{1}{t_p} = \frac{\omega_n}{2\pi}$

$= \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{g}{\delta}}$

Since the static deflection due to gravity,

$$\delta = \frac{mg}{k}$$

Taking the value of g as 9.81m/s^2 and δ in metres

Therefore, the Natural Frequency, f_n

$$f_n = \frac{1}{2\pi}\sqrt{\frac{9.81}{\delta}} = \frac{0.4985}{\sqrt{\delta}}Hz$$

The value of static deflection can be obtained from the relation

$$E = \frac{Stress}{strain} = \frac{W\ x\ L}{A\ X\ \delta}$$

Implication

The external forces causing vibration to the drillstring should not operate at this natural frequency of the drillstring to avoid resonance.

5.0. EFFECT OF THE MUD ON LATERAL VIBRATION

Chen et al (1974) explained that when a structural component vibrates in a viscious fluid, the presence of the fluid gives rise to a fluid reaction force which can be interpreted as an added mass and a damping contribution to the dynamic response of the component.

Added mass and damping are known to be dependent on fluid properties (density and viscosity) as well as the hole geometry and adjacent boundaries.

In general, added mass will decrease the component natural frequencies and can also have a significant effect on the response and the potential for large amplitude motion caused by a resonance. Θ (Fig. 7)

Let r = radius of drillstring oscillating along a diameter in a viscious fluid annulus

The wellbore is stationary

For small aplitude, the equations of state and motion can be linearized.

Damping factor

$$\vartheta n = \frac{Viscious\ damping\ coefficient}{critical\ damping\ coefficient}$$

$$= \frac{C_v}{C_{CR}}$$

But

$$C_{CR} = 2(MC_m + m)w_n$$

When oscillating at the drillstring frequency

$$w_n = w$$

Damping can be measured and calculated by different method including log decrement from auto correlation of response to white noise input of from a “pluck test”, magnification factor (Q) at resonance, bandwith of frequency response function, and measurement

of input power at resonance. The advantages of the bandwith method over the log decrement method and pluck test is that higher modes are not involved and response levels can readily be controlled, if amplitude dependency is suspected. The advantage over the magnification factor method is that only the shape of the curve is involved, calibration factors and the fact that energy may go into different modes is not of concern.

Damping is readily obtained from the transfer function or frequency response curve as

$$\vartheta = \frac{1}{2\sqrt{(N^2 - 1)}} \frac{\Delta f_N}{f_N} \qquad 11$$

Where

$$\Delta f_N = {f_N}^1 - {f_N}^2$$

f_N *is the natural* $(resonant) frequency$

${f_N}^1 \& {f_N}^2$ *are the* $frequencies$ *at which at*

which the response is a $factor$

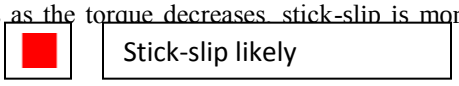
The greater the value of Δf_N, the greater the accuracy of the measurement.

6.0. **STICK-SLIP**

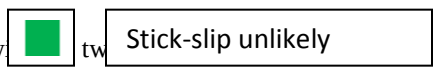
Stick-slip problem starts to become significant with drill strings exceeding a length of about 2000 m (Morten, 2010). In stick-slip situations, from a standstill position, the top drive rotates many times before enough torque is applied to the bit for it to overcome the static friction between the bit and rock. When the bit slips and starts to rotate, it will get a high acceleration. Often the angular velocity of the bit can reach up to three times the velocity of the top drive before the bit speed reduces again and reaches the stick-situation. Then the top drive will 'spin up' the string again until the bit slips, and so it goes on.

To achieve realistic RPM_{bit} and $RPM_{surface}$, the WOB must be reduced to reduce slick-slip effect. The chances of stick-slip are higher in deviated hole sections.

- Stick-slip likely when operating in region of "falling friction" that is as the torque decreases, stick-slip is more likely to occur
- Increase RPM to reduce likelihood of stick-slip



For the stick-slip model, the entire model comprises 3 degrees of freedom: the tw tw



To measure stick-slip downhole, stick-slip index (SSI) is used (SSI is usually encoded in the bits and transmitted to the surface) (Table 1):

$$SSI = \frac{RPM_{\max - RPM_{min}}}{2\ XRPM_{avg}}\ x\ 100 \qquad 12$$

Downhole torsional oscillations and stickslip behavior are visible as periodic torque fluctuations on surface.

CONCLUSION

The results show that

1. Using the harmonic finite element analysis, critical limits for different components of the drillstring and BHA should be determined, beyond which the drillstring will be subjected to lateral and torsional vibrations.
2. Using the Euler equation, the crippling load that causes each drillstring to begin to buckle and the effect of the mud weight and length of drillstring were analyzed
3. It was confirmed that Stick-slip problem starts to become significant with drill strings exceeding a length of about 2000 m (Morten, 2010). As a matter of fact, from this work, Lateral and torsional vibration becomes visible from 1500m.
4. The diameter of the components of the drillstring is inversely proportional to the critical speed of the drillstring.
5. The greater the moment of inertia of the drillstring and BHA when considered in finite terms, the higher the tolerance and therefore the higher the allowable critical speed of the drillstring

REFERENCES:

1. http://www.slb.com/~/media/Files/resources/oilfield_review/ors99/sum99/manage.pdf
2. **Bailey J.J., and Finnie I.**, (1960) "An Analytical Study of Drill-String Vibration", Trans. ASME, May 1960, pp 122-128
3. **Burgess, T.M., MDaniels, G.L. and Das, P.K.**(1987)"Improving BHA Tool Reliability with Drillstring Vibration Models: Field Experience and Limitations" SPE/IADC Drilling conference, New Orleans, LA, Marh 15-18, 1987. SPE Paper 16109.
4. **Black, H. Paul(1961)***Theory of Metal Cutting,* McGraw-Hill Book Company, Inc, NewYork, 1961.
5. **Baryshnikov, A., Calderoni, A., Ligrone, A., Ferrara, P., and Agip, S. P. A.(1998)**, " A New Approach to the Analysis of Drilling String Fatigue Behavior," SPE 30524 presented at the SPE Annual Technical Conference and Exhibition, Dallas, Oct. 22-25, 1998
6. **Besselink B., Van de Wouw N., and Nijmeijer H.** (2010) "A semi-analytical study of stick-slip oscillations in drilling systems", Journal of computational and Nonlinear Dynamics, published by Design Engineering Division of ASME. April 2011, Vol 6.http://www.asme.org/terms/Terms_Use.fm
7. **C. Balci*, M.A. Demircin†, H. Copur*, and H. Tuncdemir*** (2004) "Estimation of optimum specific energy based on rock properties for assessment of roadheader performance", the Journal of the South African Institute of Mining and Metallurgy.
8. **Cristiano E. Agostini and Rodrigo Nicoletti (2014)** "Lateral Vibration of Oilwell Drillstring During Backreaming Operation", Proceedings of the 9th International Conference on Structural Dynamics, EURODYN 2014, Porto, Portugal, 30 June - 2 July 2014.

9. **Coudyzer C., Richard T.,** 2005 "Influence of the back and side rake angles in rock cutting", paper AADE-05-NTCE-75 presented at the 2005 AADE Technical Conference and Exhibition, Houston, April 5-7
10. **Detournay E., Defourny P.,** 1992 "A phenomenological model for the drilling action drag bits" International Journal of Rock Mechanism Mining Science, 1992, pp 13-23.
11. **Duncan, J.J.**(2007) "Challenges and developments in direct measurement of down hole forces affecting drilling efficiency" MSc Thesis, Robert Gordon University, Aberdeen.
12. **Elsayed, M.A., Cherif Aissi and Chaitanya Kancharla** "Analysis of Vibration Characteristics for Drillstrings Using Active Circuits" University of Louisiana at Lafayette, Lafayette, LA, USA 70504
13. **Finnie, I. and J.J. Bailey, (**1960.)"An Experimental Study of Drillstring Vibration" J. Eng for India Trans. AySME, 82: 122 – 135
14. **F.E.Dupriest, J.W. Witt and S.M. Remmert (2007)** "Maximizing ROP with Real-Time Analysis of Digital Data and MSE", International Petroleum Technology Conference, 21-23 November 2005, Doha, Qatar , 2005**IPTC 10607**
15. **Glowka D.A.,** 1989 "Use of Single Cutter Data in the Analysis of PDC Bit Designs: Part 1 – Development of a PDC cutting Force Model", *SPE Journal of Petroleum Technology*, 41 (1989), 797-849.
16. **Ghasemloonia A., Rideout, G. & Butt, S. (**2011) "The Effect of Weight on Bit on the Contact Behavior of Drillstring and Wellbore", Memorial University of Newfoundland, Canada. ISBN: 1-56555-342-X.
17. **Ibrahim, A.A., Musa, T.A. and Fadoul, A.M.** (2004) "Drill mechanics: consequences and relevance of drillstring vibration on wellbore stability", Journal of Appled Sciences 4(1): 106-109, ISSN 1607-8926, Asian Network for scientific information.
18. **L.Gerbaud, S.Menand and H.Sellami** 2006 "PDC Bits: All Comes From the Cutter Rock Interaction" SPE/IADC Drilling Conference, Maimi, United States, 21-23 February 2006. SPE Paper 98988.
19. **Morten Krøtøy Johannessen and Torgeir Myrvold** (2010) "Stick-Slip Prevention of Drill Strings Using Nonlinear Model Reduction and Nonlinear Model Predictive Control" MSc Thesis, Norwegian University of Science and Technology
20. **M.A. Elsayed and Cherif Aissi** (2009) "Analysis of the frequency response function and stability in drillstrings using active circuit model", Journal of Applied Science and Engineering Technology, University of Louisiana, Lafayette.
21. **M. Elsayed, C. Aissi, and A. Yalamanchili,** "Analysis of mode interaction in drillstrings using active circuits," Paper 124, in *Proc. of the Soc. of Experimental Mechanics (SEM) Conf.*, Orlando, FL
22. **MacDonald, K. A. and Bjune, J. V.** (2007) "Failure analysis of drillstrings". Engineering Failure Analysis, 14:1641-1666, 2007.
23. **Paslay, P. R. and D. B. Bogey** (1963). "Drillstring vibrations due to intermittent contact of Bit Teeth". Trans. ASME., 82: 153-165.
24. **R.I. Leine** (1997) "Literature Survey on Torsional Drillstring Vibrations", Internal Report number: WFW 97.069, Division of Computational and Experimental Mechanics, Eindhoven University of Technology, The Netherlands
25. **R. K. Rajput (**2008) "Strength of Materials" published by Rajendra Ravindra Printers, New Delhi, India
26. **Reckmann, Jogi , Herbig,** 2007, "Using Dynamics Measurements While Drilling To Detect Lithology Changes And To Model Drilling Dynamics", paper 29710, OMAE, 26th International Conference
27. **Ramkamal Bhagavatula** (2004) "Analysis of PDC Bit Wobbling And Drilling String Buckling" MSc Thesis In Petroleum Engineering, Texas Tech University
28. **Richard T., Germany C and Detournay E.** 2007 "A simplified Model to Explore the Root cause of Stick-Slip Vibrations in Drilling Systems with Drag Bits" J. Sound Vib., 305, pp432-456

29. **Sellami H., Fairhurst C., Deliac E., Delbast B.,** 1989 "The role of in situ rock stresses and mud pressure on the penetration rate of PDC Bits", presented at the 1989 International Symposium Rock at Great Depth, Pau, France, Vol. 2, pp. 769-777
30. **Teale, R.:** "The Concept of Specific Energy in Rock Drilling", Intl. J. Rock Mech. Mining Sci. (1965) 2, 57-73
31. **Thiago Ritto G** 2010 "Numerical analysis of the nonlinear dynamics of a drill-string with uncertainty modeling", PhD Thesis Université Paris-Est
32. Yigit, A.**S. & Christoferou, P.,** 1996 "Coupled Axial and Transverse Vibrations of Oilwell Drillstring", Journal of Sound and Vibration, 195: 617 – 627
33. http://www.aapg.org/explorer/2012/05may/regsec05.12.cfm

APPENDIX

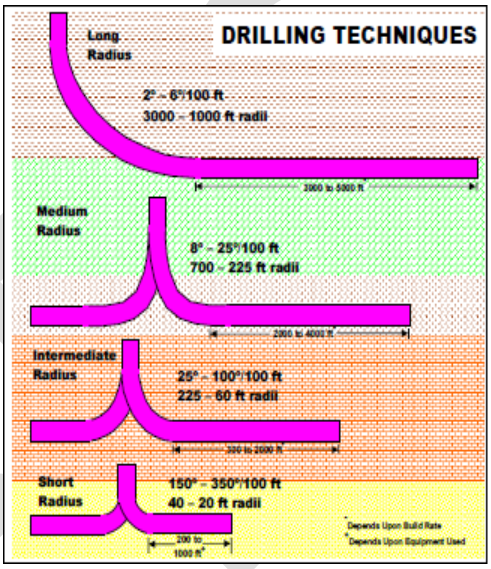


Fig.1. Build curve for short, medium and long range horizontal wells. *Courtesy: Petrolskills, 2013.*

Fig. 2. Drill collars failure in Okono-9 offshore Niger Delta due to PDC Bit Vibration. *Courtesy: NPDC, 2013.*

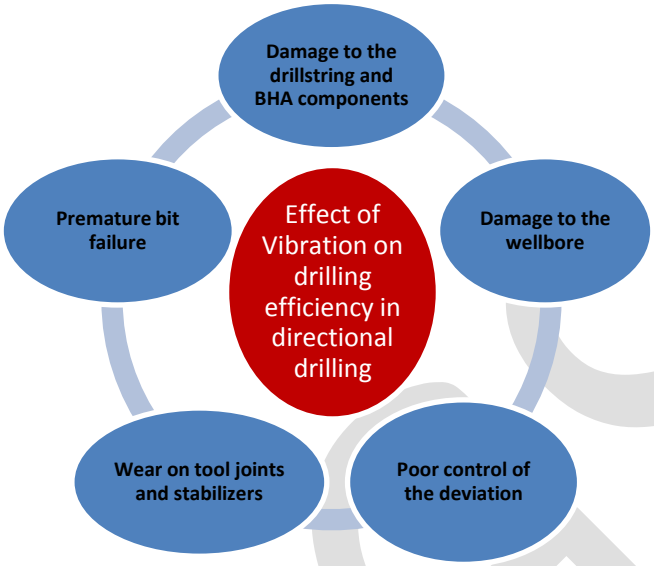


Fig. 3. Effect of vibration on drilling efficiency in directional drilling

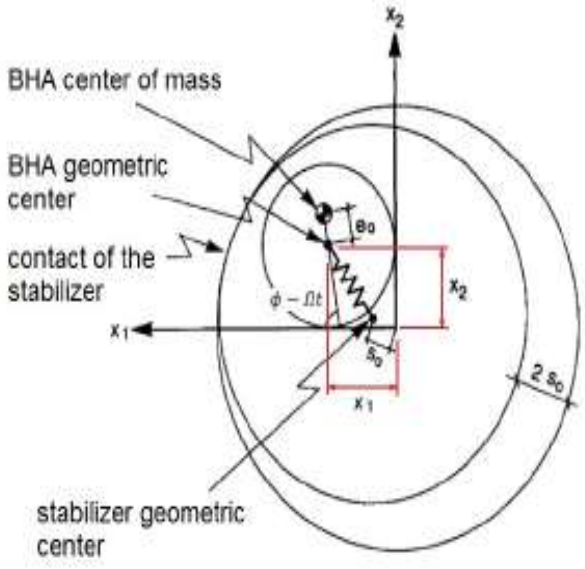


Figure 4. Section A-A with bending of the BHA and contact of the stabilizers with the borehole wall

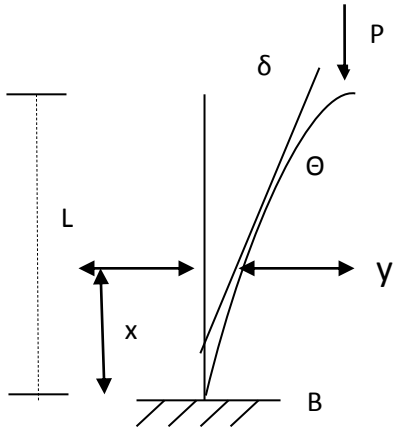
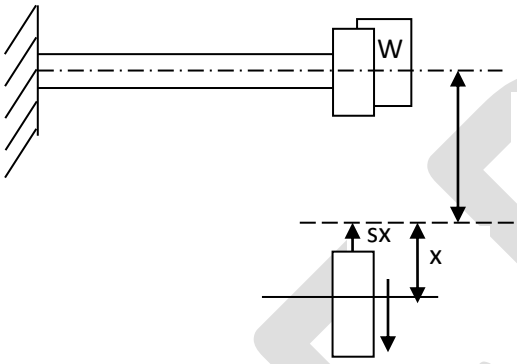


Fig 5. Drillstring deflection



$m\frac{d2y}{dt2}$. Natural frequency of free lateral vibration

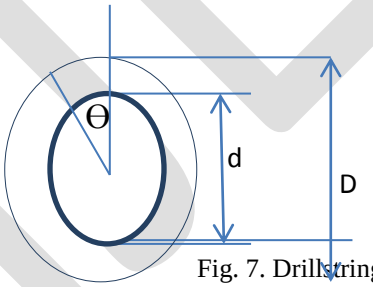


Fig. 7. Drillstring vibration in a wellbore

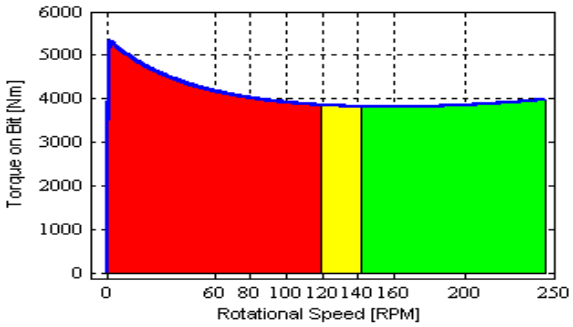


Fig 8. Stick-slip analysis. Source: Reckmann, J. H., 2007.

Table 1. Stick-Slip Index

S/N	SSI	Mode	Risk	Time limit
1.	0-40	None	Low	None
2.	40-60	Torsional oscillations	Medium	None
3	60-80		Medium	Recommended to mitigate
4.	80-100	Stick-slip	High	Onset of full-stall stick slip, mandatory to mitigate
5.	>100	Stick-slip	Severe	30 minutes (formal notification)

SYMBOLS

T_1 = torque on bit

T_2 = surface torque

J_1J_2 = equivalent moment of inertia at bottom end and top end respectively

C_1C_2 = mud damping

C_S = structural damping

Ω_1 = bit speed

Ω_2 = top drive speed (surface RPM)

φ_1 φ_2=rotational displacement (angle) of the bit starting and top drive respectively with zero at time t = 0

k = equivalent stiffness of the drillpipe

The equivalent mass moment of inertia

$J_1 = \rho_{BHA} I_{BHA} L_{BHA}$

ξ = the damping factor

T' =vector with efforts

q = state-space coordinate

m = Mass

k = stiffness

x = displacement of m from the equilibrium position

E = Modulus of elasticity for steel expressed in pa (from 200,000 to 220,000MPa)

I_a = Moment of inertia of the straight section of the drillstring expressed in m^4

l = Free buckling length which depends on the actual length of the pipe and the way the end s are fixed, expressed in m

C_1C_2 = constants of integration

L = length of drillstring in inches

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AUTOMATIC HAND BRAKE SYSTEM

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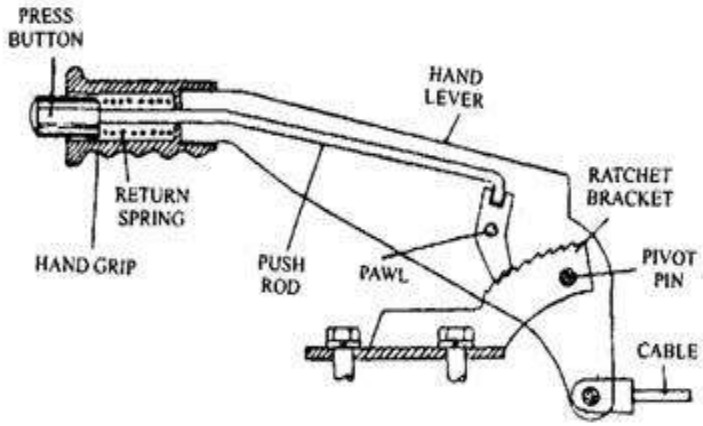
Abstract— Hand brake is one of the most important components in vehicles. In general the hand brake is operated manually in our project, We are developing Automatic Hand Brake System for safety purpose. The hand brake engagement and disengagement is done with the help of proximity sensors and rack & pinion

Keywords— sensors, motor, microcontroller, rack & pinion, IR sensors, relays, hand brake

INTRODUCTION

In cars the hand brake is a latching brake usually used to keep the car stationary. automobiles e-brakes usually consist of a cable directly connected to a brake mechanism on one end and to some type of mechanism that can be actuated by the driver on the other end .the mechanisms is often a hand –operated lever, on the floor on either side of the driver, a pull handle located below and near the steering wheel column, or a pedal located far apart from the other pedals.

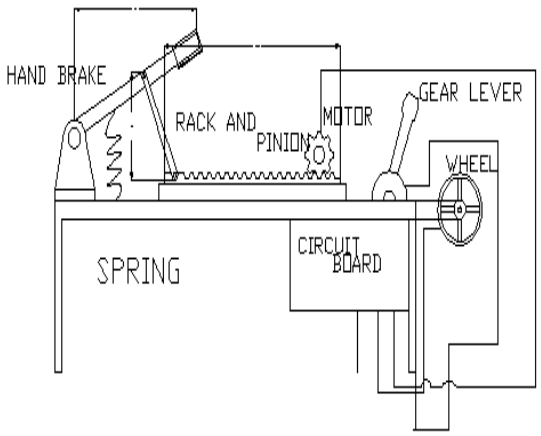


Although sometimes known as an emergency brake, using it in any emergency where the footbrake is still operational is likely to badly upset the brake balance of the car vat increase the likelihood of loss of control of a vehicle for example by initiating the rear –wheel skid. Additionally, the stopping force provided using the hand brake of or in addition to the footbrake is usually small and would not significantly aid in stopping the vehicle, again because it usually operates on rear wheel while braking .the emergency brake is instead intended for use in case of mechanical failure where the regular footbrake is inoperable or compromised, hopefully with opportunity to apply the brake in a controlled manner to bring the vehicle to a safe. If gentle half before seeking service assistance The most common use for an automobile emergency brake is to keep the vehicle motionless when it is parked, thus the alternative name, parking brake .car emergency brake have a ratchet locking mechanism that will keep them engaged until a release button is pressed . on vehicles with automatic transmission, this is usually used in concert with parking pawl in the transmission .automotive safety experts recommended the use of both system is required by laws in some jurisdictions .yet many individuals use only the park position on the automatic transmission and not the parking brake.

WORKING PRINCIPLE:

A rack is a toothed bar or rod that can be thought of as a sector gear with an infinitely large radius of curvature. Torque can be converted to linear force by meshing a rack with a pinion; the pinion turns; the rack moves in a straight line. Such a mechanism is used in automobiles to convert the rotation of the steering wheel into the left-to-right motion of the tie rod(s).Linear actuation is used to engage the hand brake lever and disengagement is done by spring tension.

Line Diagram:



EXPERIMENTAL DETAILS:

There are three proximity sensors used to know the perfect state of vehicle is in rest.

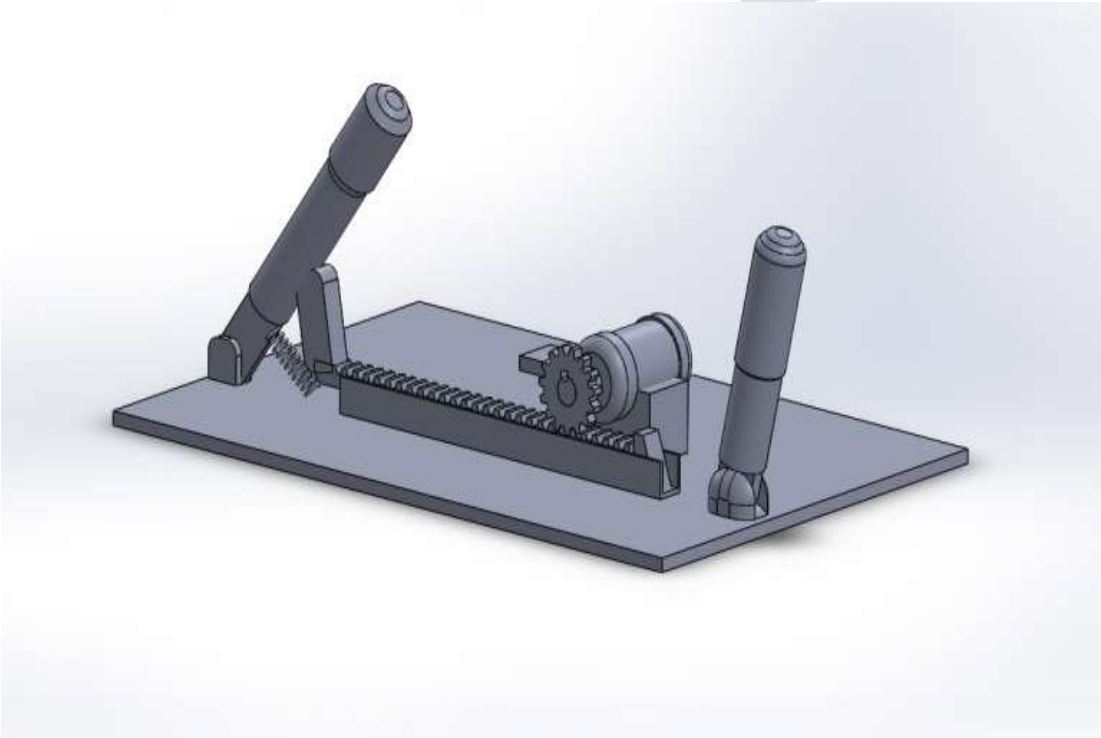
BRAKING CONDITIONS:

WHEEL	GEAR	IGNITION	HAND BRAKE
REST	NEUTRAL	ON OR OFF	ENGAGE
RUNNING	NEUTRAL	ON	DISENGAGE
REST	ON GEAR (ANY)	ON	DISENGAGE
REST	ON GEAR OR NEUTRAL	OFF	ENGAGE

Emergency braking is possible by pressing push button.

AUTOMATIC HAND BRAKE:

The Hand brake lever is coupled with rack and pinion setup. A motor used to apply and release the hand brake through Rack. Motor driven by the control unit (Micro controller) using sensors. Sensors give a signal to control unit when the vehicles is in rest stage. One sensor placed near gear lever to find lever in neutral position and another sensor placed near any one wheel of vehicle to confirm the wheel is not running state the last sensors is used to detect whether the ignition is ON or OFF. Control unit attach the Hand brake when vehicle is in idle stage that is confirmed by the sensors. Also control unit will release the brake when gear lever is changed from neutral.



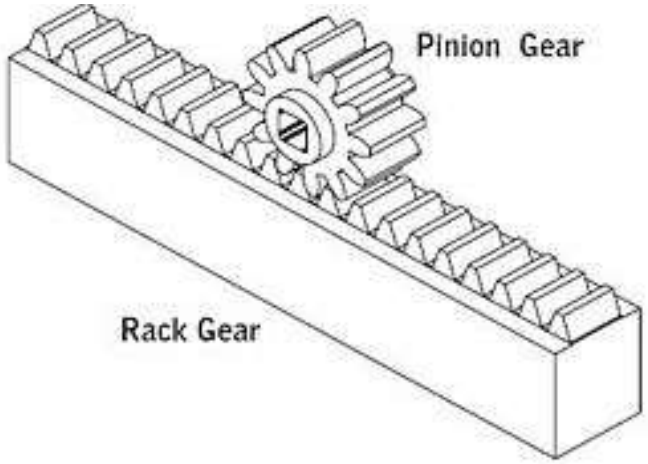
3D DIAGRAM OF AUTOMATIC HAND BRAKE

MAJOR COMPONENTS:

- Rack and pinion setup
- IR Sensors
- Relay
- Microcontroller
- 12V DC motor

RACK AND PINION:

A **rack and pinion** is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of the rack. Thus the linear motion is used to actuate the hand brake with the help of small link.



[Source:www.vexrobotics.com]

MICROCONTROLLER:

A Micro controller consists of a powerful CPU tightly coupled with memory (RAM, ROM or EPROM), various I / O features such as Serial ports, Parallel Ports, Timer/Counters, Interrupt Controller, Data Acquisition interfaces-Analog to Digital Converter (ADC), Digital to Analog Converter (DAC), everything integrated onto a single Silicon Chip.

It does not mean that any micro controller should have all the above said features on chip, Depending on the need and area of application for which it is designed, the on chip features present in it may or may not include all the individual section said above.

Any microcomputer system requires memory to store a sequence of instructions making up a program, parallel port or serial port for communicating with an external system, timer / counter for control purposes like generating time delays, Baud rate for the serial port, apart from the controlling unit called the Central processing unit.

IR SENSOR:

An infrared sensor is a device (usually with supporting circuitry) that can detect infrared light (which is below the optical spectrum) for use to a purpose.

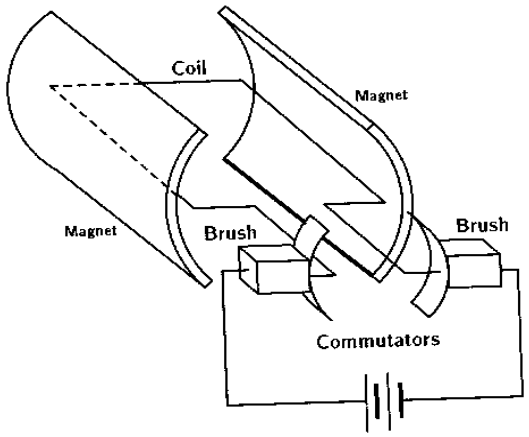
Most of the remote controls for TVs and other entertainment equipment use infrared energy as the transmission medium to carry information between the control unit and the equipment to be operated.

Infrared sensors also have important scientific, military, security and rescue applications since they can "see" the "radiant heat energy" which is infrared radiation. This electromagnetic energy is in the wavelengths from about 750 nm.

There are three infrared sensors are used in wheel, gear lever and engine.

MOTOR:

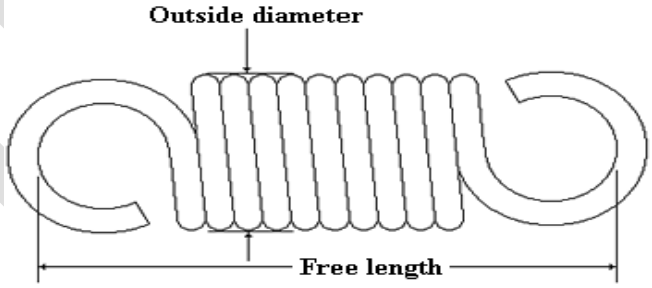
A dc relies on the fact that like magnet poles attract each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. The motor is used to drive the pinion which drives the rack so that circular motion is converted into linear motion. The source of current is obtained from the 12 v dc battery from the car.



[Source:mechatronics.mech.northwestern.edu]

SPRING:

Extension springs are attached at both ends of the components. When these components move apart, the spring tries to bring them together again. Extension spring absorbs and store energy as well as creates a resistance to a pulling force. It is initial tension that determines how tightly together an extension spring is coiled. The spring is interlinked with hand brake lever at center to the base to make the disengagement easier.



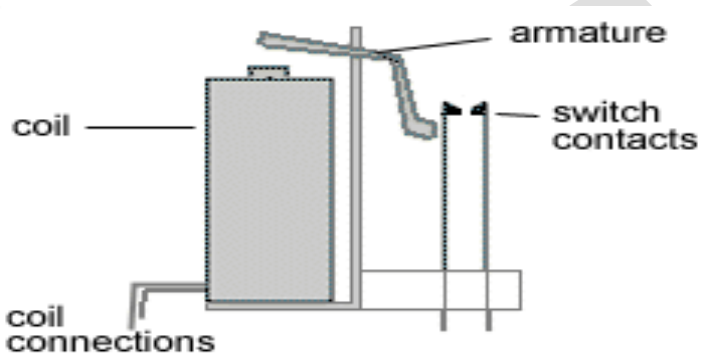
[Source:www.springhouston.com]

LOCK SET:

A lock set is the hardware and the components that make up the locking or latching mechanism that is usually found in doors or other hinged object but can also include sliding doors and drivers. But we are using the lock for arrest the motion of rack at the one end. The push button will be released at the end when the rack exceeds the marked position and prevent the rack from sliding back. This button is directly coupled with gear lever so that when the gear is changed, the push button will be released.

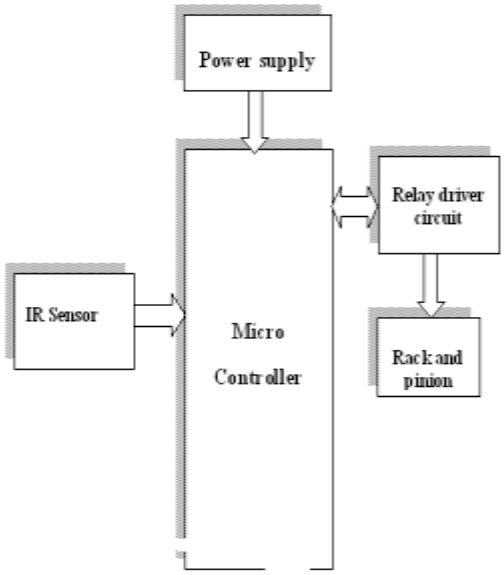
RELAYS:

Relays are the electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principals are also used such as solid state relays. Relays are used where it is necessary to control a circuit by low power signal (with complete electrical isolation between control unit and controlled circuits).We are using the relays for switching the motor ON or OFF. For making **automatic hand brake** system more efficient, these relays should be operated perfectly in all driving and climatic conditions.



[Source:www.glolab.com]

BLOCK DIAGRAM OF CIRCUIT:



ADVANTAGES:

- Low cost.
- Improves parking experience in hills.
- Very compact.
- Emergency stop and start is possible.
- Sensing can be easily done using sensors.
- Reduces the manual interaction.

LITERATURE SURVEY:

A traditional handbrake is very simple by pulling the lever up; you are pulling two cables which run to each of the rear brakes. By adding tension to these cables, this in turn causes the pads (or 'shoes' for cars with drum brakes) to squeeze against the discs (or drums) to hold the rear wheels firmly in place. Some cars with disc brakes have separate handbrake drum-brake shoes or even a separate disc-brake caliper for the handbrake.

Later electronic parking brake replaces this mechanical system with an electrical one. By pressing the switch, motors on each brake caliper squeeze the pads into the disc.

We are trying to make hand brake mechanism even simpler using rack & pinion and proximity sensors.

CONCLUSION:

In our project, hand brake is actuated with the help of rack and pinion and proximity sensor based on some conditions. Sensors sense and provides signal to the circuit board which directly drives the motor. The rack and pinion gets activated and lifts the hand and disengages with the help of push lock and spring tension. In future, this could be developing by adding some of the additional features and also automatic hand brake will be used in all types of automobiles at low cost.

REFERENCES:

[1] Thomas, W., 0000. BIRCH. Automotive braking system, Delmar publishers Nelson ITP

[2] Wikipedia.org

[3] How stuff works.com

[4] Development of Automatic Hand Brake System by R. Anbazhagan, S. Vanangamudi, C. Thamotharan, S. Prabhakar and C. Coomarasamy

[5] Automobile engineering by kirpal Singh

[6] Global.com

[7] *Nice, Karim (2000-08-22).* "How Power Brakes Work". *Howstuffworks.com*. Retrieved 2011-03-12.

[8] Csere, Csaba *(January 1988), "10 Best Engineering Breakthroughs", Car and Driver **33** (7), p. 61*

[9] http://www.cdc.gov/niosh/npg/npgd0272.html

[10] http://www.cdc.gov/niosh/npg/npgd0536.html

[11] "Hydraulic Brakes". *Integrated Publishing*. Retrieved 18 June 2010.

[12] "Effectiveness of ABS and Vehicle Stability Control Systems" *(PDF). Royal Automobile Club of Victoria. April 2004*. Retrieved 2010-12-07.

[13] *Heißing, Bernd (2011)*, Chassis Handbook, *Springer*, ISBN 9783834897893, retrieved February 19, 2013

[14] "Speed With Style", *Cycle World, June 1992*, ISSN 0011-4286, retrieved February 19, 2013

[15] "Non-Skid Braking". *Flight International. 30 October 1953. pp. 587–588.*

[16] "Browse Flight's archive of Historic Aviation". *Flightglobal.com*. Retrieved 2014-08-26.

[17] *Reynolds, Jim (1990). Best of British Bikes. Patrick Stephens Ltd.* ISBN 1-85260-033-0.

[18] "Directory Index: Chrysler_and_Imperial/1972 Chrysler/1972_Imperial_Press_Kit". *Oldcarbrochures.com*. Retrieved 2014-08-26.

[19] "Chrysler Imperial Sure Brake system description". *ImperialClub.org.*

[20] "Directory Index: Lincoln/1970_Lincoln/1970 Lincoln Continental Brochure". *Oldcarbrochures.com*. Retrieved 2014-08-26.

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A Case Study of Radisson Square Indore for Design of Signalized Roundabout

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Abstract— The rate of growth of vehicles is increasing rapidly in developing cities. This situation makes the city to be congested on roads and on intersection. In Indore private vehicles are increasing. As the vehicles are increasing the congestion at roundabout also increases. This study leads to redesign the roundabout or to provide suitable alternative at intersection. We have just study about a site (Radisson square Indore) and concluded that the Radisson square intersection has more traffic than its capacity .therefore it is necessary to redesign it or to provide suitable alternative.

Keywords— Roundabouts, Saturation flow, Cycle Length, Grade intersections.

INTRODUCTION

In recent years, roundabouts have become an increasingly popular traffic management option in urban areas. The ability of a roundabout to reduce vehicle delay under certain conditions is fairly well known within the traffic operations community. Various studies have demonstrated a reduction in congestion and delay after the implementation of a roundabout. However, existing literature is lacking in terms of details regarding under what conditions a roundabout is proposed alternative, and what factors might preclude the implementation of a roundabout. The vast majority of existing literature considers only intersections with four approaches intersecting at right angles. Analytical models have not yet been fully developed to explain roundabout operations. Instead, most models rely on empirical evidence.

Rotary intersections or roundabouts are special form of at-grade intersections laid out for the movement of traffic in one direction around a central traffic island. Essentially all the major conflicts at an intersection namely the collision between through and right-turn movements are converted into milder conflicts namely merging and diverging. The vehicles entering the rotary are gently forced to move in a clockwise direction in orderly fashion. They then weave out of the rotary to the desired direction.

STUDY AREA & METHODOLOGY

For the present study, Radisson Square is selected. The road section is shown in Fig. The traffic on the road consists of the bike, car, three wheeler (Auto rickshaw, loading, tempo), and cycle, heavy vehicle (Multi axle Bus, Truck) etc.

There are two methods used for the analysis of rotary design.

Manual method

In this method a team of surveyors goes to the field and survey in a peak hour. The traffic moving in different directions should be calculated and using this calculations design capacity and other rotary dimensions should be determined.

Advantages of manual method

- Survey for longer period is possible.
- Possible to conduct in bed weathers.

Mechanical method

The devices used in mechanical methods are:

- Magnetic detector
- Ultrasonic device
- Photoelectric cells

Advantages of mechanical method

- Survey for longer period is possible.
- Possible to conduct in bed weathers.

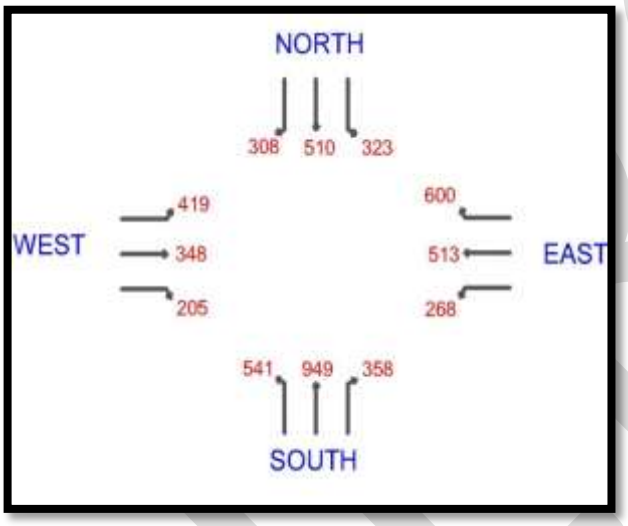
We use manual method at the Radisson square for the rotary design

DATA COLLECTION

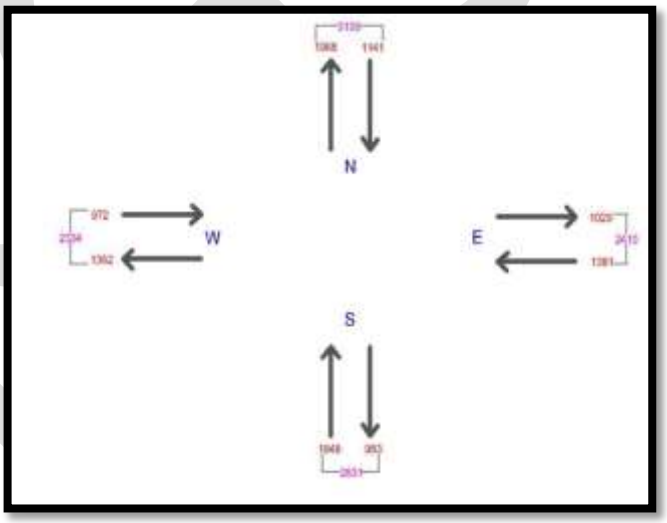
The data collection includes the vehicle count, Cycle length. The data is collected for the time period of one hour in the peak time. The data collections at section are shown in Table.

Traffic Count by Manual Method at Radisson Square:-

APPROCH	LEFT TURNING			STRAIGHT			RIGHT TURNING		
	CARS	HEAVY VEH	TWO WHEE-LER	CARS	HEAVY VEH	TWO WHEE-LER	CARS	HEAVY VEH	TWO WHEE-LER
NORTH	33	81	84	210	45	231	78	33	183
SOUTH	183	57	264	420	69	447	126	48	129
EAST	75	27	156	189	24	342	66	156	129
WEST	144	51	178	118	48	127	81	36	163



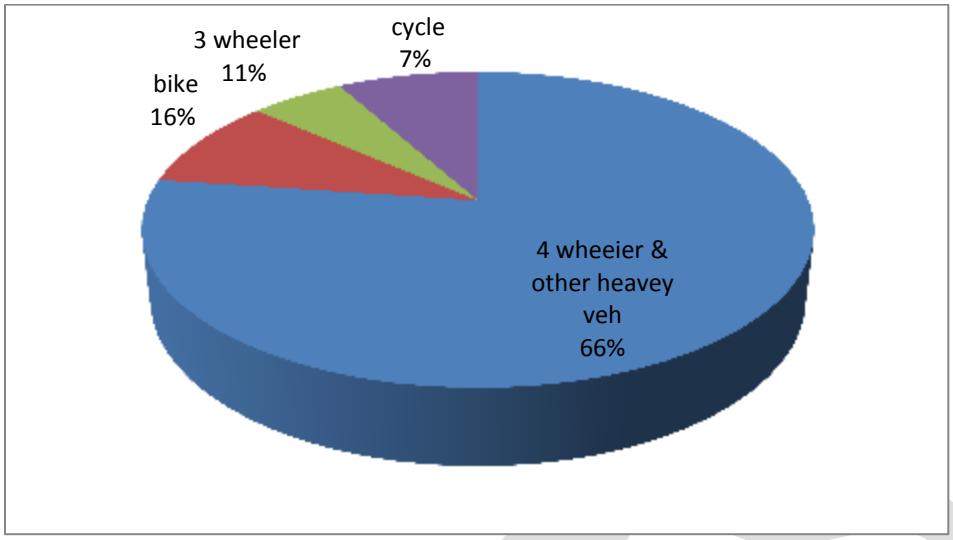
TRAFFIC APPROACHING ON ROTARY



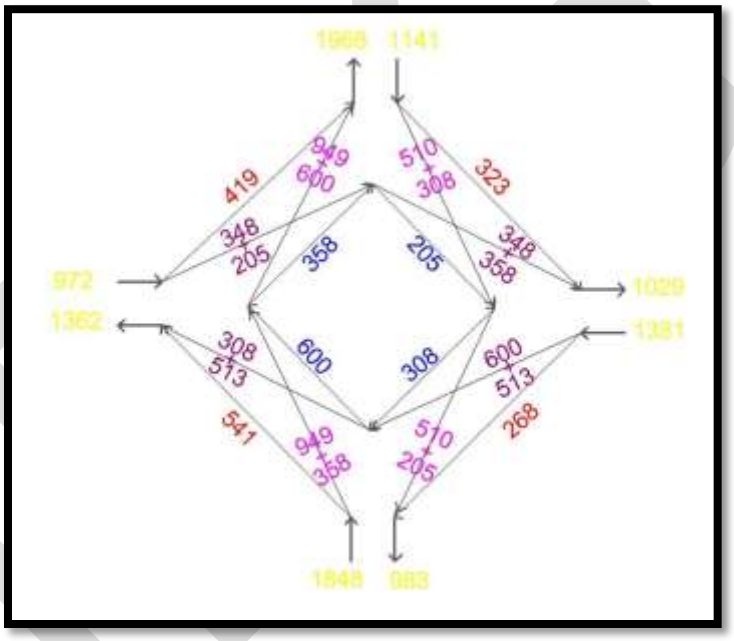
TOTAL TRAFFIC LEAVING & ENTERING THE APPROACHES

COMPOSITION OF VEHICLES

The compositions of the vehicles are shown by using pie chart as shown in Fig.. The percentage of four wheeler is very high means the four wheeler are forced the other vehicle to flow in slower speed, therefore the traffic congestion is depends upon the number of four wheeler.



Traffic Negotiating on Rotary



SIGNAL DESIGN

Signal design should be carried out as per IRC: 93-1985. The Webster method is adopted for signal design. Saturation flow (S) is measured using formulas as described Ravel et al. The value of y of each phase is calculated using formula y = q/s. For signal design the first alternative is taken as 4-phase signal design in which vehicles movement for all four phase is taken as straight and right direction.

PHASE	Q	S	Y = Q/S
PHASE – 1	1968	5512	0.35
PHASE – 2	1848	5512	0.33
PHASE – 3	1381	5512	0.25
PHASE – 4	1362	5512	0.24

The ΣY is come out equal to 1.17 which is greater than 1. Hence traffic is oversaturated, so signal design cannot be done, and 4-phase signal design is not possible.

The flow of vehicles at intersection is very much high. It cannot be maintained smoothly by providing traffic signals. In4-phase signal design i.e. the condition is oversaturated.

CONCLUSION

- The Capacity At Radisson Square Is 3570 PCU / Hour Which Shows That The Traffic Count at Radisson Square Is Very High.
- The summation of saturation flow is come out equal to 1.17 which is greater than 1. Hence traffic is oversaturated, so signal design cannot be done, and 4-phase signal design is not possible.
- The percentage of four wheeler and heavy vehicle is very high and forced the other vehicle to flow in slower speed, therefore the traffic congestion increase on signal.

PROPOSAL

- The traffic count at Radisson square is very much high as calculated. That`s why there must be a need of traffic signal with rotary intersection.
- To provide diversion for left turners before entering the roundabout.
- To provide flyover at cross section in MR – 10 Road over the Ring Road in order to reduce the traffic.

REFERENCES:

1. Harshad C Prajapati, Subhaskumar C Singh, "Provision of Suitable Alternative in Place of a Roundabout: A Case Study of Anjali Roundabout." International Journal of Engineering and Technical Research [ISSN: 2321-0869, Volume-2, Issue-2, February 2014]
2. Rahane, S. K. and Saharkar, U. R., "Traffic Congestion – cause and solution : A study of TalegaonDabhade City." Journal of information knowledge and research in civil engineering, ISSN: 0975 – 6744, Volume 3, Issue 1, Page 1. OCT. 2014
3. Yamuna, S., "Study of traffic flow characteristic for Heterogeneous Traffic." IOSR journal of engineering, volume 4. (May 2014)
4. Schoon, C., and J. Van Minnen. "The Safety of Roundabouts in the Netherlands." Traffic Engineering and Control 33 (1994): 142-148.
5. Shawaly, E.A.A., C.W.W. Li, and R. Ashworth. "Effects of entry signals on the capacity of roundabout entries." Traffic Engineering and Control 33, no. 6 (1992): 354-363.
6. Stanek, David, and Ronald Milam. "High-Capacity Intersection Analysis: Going Around in Circles." National Roundabout Conference. 2005.
7. Toledo, T., et al. "Calibration and Validation of Microscopic Traffic Simulation Tools:Stockholm Case Study." Transportation Research Record (1831), 2003: 65-75.
8. Akcelik, R., and R. Troutbeck. "Implementation of the Australian Roundabout Analysis Method in SIDRA." Proceedings of the International Symposium on Highway Capacity. Karlsruhe, Germany: Balkema Publisher, 1991. 17-34.
9. Al-Masaeid, H.R., and M.Z. Faddah. "Capacity of Roundabouts in Jordan." Transportation Research Record 1572, 1997: 76-85.
10. Al-Omari, H., H.R. Al-Masaeid, and Y.S. Al-Shawabkah. "Development of a Delay Model for Roundabouts in Jordan." Journal of Transportation Engineering 130, no. 1 (January2004): 76-82.
11. IRC 65-1975, — "Recommended Practice for Traffic Rotaries", Indian Road Congress, New Delhi.
12. IRC: 106-1990 — "Guidelines for capacity of urban roads in plan areas", Indian Road Congress New Delhi.
13. IRC 93-1985, — "Guidelines on Design and Installation of Road Traffic Signals", Indian Road Congress, New Delhi.

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Data Hiding In Encrypted Images

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Abstract—Recently more attention is paid to reversible data hiding in encrypted images, since it maintains the excellent property that the original cover can be losslessly recovered after the embedded data is extracted while protecting the image content confidentiality. All previous methods embed data by reversibly vacating room from the encrypted images, which may be subject to some errors on data extraction and image restoration. Here propose a novel method by reserving room before encryption with a traditional algorithm and thus it is easy for the data hider to reversibly embed the data in the encrypted image. The proposed method can achieve real reversibility that is data extraction and image recovery are free of any error.

Keywords— reversible data hiding (RDH), image encryption, encryption key, data hiding ke, image decryption, privacy protection , rationale rhombus, LSB replacement, vacating room after encryption (VRAE), reserving room before encryption (RRBE).

INTRODUCTION

The amount of digital images has been increased rapidly, therefore the protection of multimedia data is very important for many applications, such as confidential transmission, video surveillance, military and medical field applications. To decrease the transmission time, the data compression is necessary. The protection of multimedia data can be done with the compression, encryption and data hiding. Two main groups of technologies have been developed for this purpose. The first one is based on content protection through encryption. The second group bases the protection on data hiding, aimed at secretly embedding a message into the data. These two technologies can be used complementary and mutually commutative. Major objective of the work is reserving room before encryption with a traditional RDH algorithm, and thus it is easy for the data hider to reversibly embed data in the encrypted image. Thus it achieves real reversibility, that is data extraction and image recovery are free of any error. Thus the data hider can benefit from the extra space emptied out in previous stage to make data hiding process effortless. Previous work proposed to embed data in an encrypted image by using an irreversible approach of data hiding. But the possibility of noise contained in the decrypted image. Now the challenge was to find an encryption method robust to noise. This problem can be resolved by the proposed method, reversible data hiding in encrypted images by reserving room before encryption. An adaptive median filter is also applied at the final stage of decryption to remove the impulse noise contents in the image.

SYSTEM DESIGN AND IMPLEMENTATION

Data Hiding is the technique of hiding the data into cover media. The data hiding process involve two sets of data, first one is a set of embedded data and another is a set of the cover media data. As when data is embedded into the image then the quality of image get disturbed. So it is expected that after the data extraction the image quality should be maintained just like the original image. But that image contains some distortions. RDH in images is a technique, due to which the original cover can be loss less recovered after the embedded message is extracted. The previous methods can be summarized as the framework, vacating room after encryption (VRAE). Vacating room from the encrypted images losslessly is relatively difficult and also sometimes inefficient. Thus, reverse the order of encryption and vacating room, that is reserving room prior to image encryption at content owner side, the RDH tasks in encrypted images would be more natural and are much easier which leads to the framework, reserving room before encryption (RRBE). As shown in Figure 1, the content owner first reserves enough space on original image and then convert the image into its encrypted version with the encryption key. The data embedding process in encrypted images is inherently reversible for the data hider only needs to accommodate data into the spare space previous emptied out. The data extraction and image recovery are performed by the receiver. The double encrypted image containing data is first decrypted by using the data hiding key and extracts the data stored in the image. Then it is decrypted by using the encryption key and recovers the original image. At the decryption side there is a possibility of noise that is any undesirable signal. Noise gets introduced into the data via any electrical system used for storage, transmission, or any other processing. In order to remove the noise content in the decrypted image an adaptive median filter is used at the final stage. The adaptive median filter performs spatial processing to determine which pixels in an image have been affected by impulse noise. It helps

to remove impulse noise and smooth other noise, which in turn reduce distortion, like excessive thinning or thickening of object boundaries.

Figure 1. Block diagram of data hiding in encrypted image.

Elaborate a practical method based on this Framework, which primarily consists of four stages: generation of encrypted image, data hiding in encrypted image, data extraction and image recovery.

a) Generation of encrypted image

To construct the encrypted image, the first stage can be divided into three steps: image partition, self reversible embedding followed by image encryption. At the beginning, image partition step divides original image into two parts A and B; then, the LSBs of A are reversibly embedded into B using rationale rhombus algorithm so that LSBs of A can be used for accommodating messages.

1.Image Partition

The operator here for reserving room before encryption is a standard reversible data hiding technique, so the goal of image partition is to construct a smoother area on which rationale rhombus algorithms can be used to achieve better performance. To do that, without loss of generality assume the original image is an 8 bits gray scale image with its size M×N and pixels Ci,j ϵ [0,255],1 ≤ i ≤ M ≤ j ≤ N. First, the content owner extracts from the original image, along the rows, several overlapping blocks whose number is determined by the size of embedded messages. In detail, every block consists of m rows, where, m = [l/N] and the number of blocks can be computed through n= M-m+1. An important point here is that each block is overlapped by pervious or sub sequential blocks along the rows. For each block define a function to measure its first order smoothness. $f = \sum_{u=2}^{m} \sum_{v=2}^{N-1} \left| C_{u,v} - \frac{C_{u-1,v} + C_{u+1,v} + C_{u,v-1} + C_{u,v+1}}{4} \right|$ Higher relates to blocks which contain relatively more complex textures. The content owner, selects the particular block with the highest to be A, and puts it to the front of the image concatenated by the rest part with fewer textured areas, as shown in Figure 2.

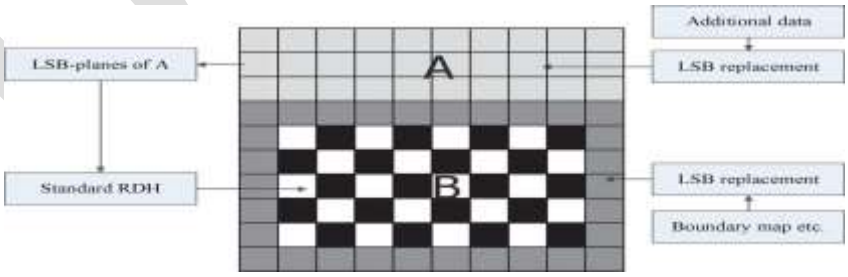

Figure 2. Illustration of image partitioning and embedding process.

2. Self-Reversible Embedding

The goal of self reversible embedding is to embed the LSB planes of A into B by employing traditional RDH algorithms. For illustration, simplify the method in to demonstrate the process of self embedding. This step does not rely on any specific RDH

algorithm. Pixels in the rest of image B are first categorized into two sets: white pixels with its indices i and j satisfying (i + j) mod2= 0 and black pixels whose indices meet (i + j) mod2 = 1, as shown in Figure. 2. Then, each white pixel $B_{i,j}$ is estimated by the interpolation value obtained with the four black pixels surrounding it is $\mathbf{B'_{i,j} = \omega_1 B'_{i-1,j} + \omega_2 B'_{i+1,j} + \omega_3 B'_{i,j-1} + \omega_4 B'_{i,j+1}}$ Where the weight ω_i $1 \leq i \leq 4$, the estimating error is calculated via $e_{i,j} = B_{i,j} - B'_{i,j.}$ and then some data can be embedded into the estimating error sequence. Further calculate the estimating errors of black pixels with the help of surrounding white pixels that may have been modified. Then another estimating error sequence is generated which can accommodate messages and can also implement multilayer embedding scheme by considering the modified B as original one when needed. In summary, to exploit all pixels of B, two estimating error sequences are constructed for embedding messages in every single layer embedding process.

3. Image Encryption

After rearranged self embedded image and reserving rooms, denoted by X , is generated. Then encrypt X to construct the encrypted image, denoted by E. Encryption key is an 8 bit key. In this the encryption is done by XORing the image with the key. With a stream cipher, the encryption version of X is easily obtained. For example, a gray value ranging from 0 to 255 can be represented by 8 bits, $X_{i,j}(0)$, $X_{i,j}(1)$, $X_{i,j}(2)$..... $X_{i,j}(7)$ Such that $X_{i,j}(k) = \frac{X_{i,j}}{2^k} \bmod 2$, $k = 0,1, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.7.$

The encrypted bits can be calculated through exclusive or operation, $E_{i,j(k)} = X_{i,j} \oplus r_{i,j}$.

Finally, embed 10 bits information into LSBs of first 10 pixels in encrypted version of to tell data hider the number of rows and the number of bit planes that can embed information into encrypted image. Note that after image encryption, the data hider or a third party cannot access the content of original image without the encryption key, thus privacy of the content owner being protected. After all this steps the content owner sends the locations where the data can be embedded along with the encrypted image.

b) Data hiding in encrypted image

Once the data hider acquires the encrypted image can embed some data into it, although he does not get access to the original image. The embedding process starts with locating pixels in which the data can embed in the encrypted version of image. Since the data hider has the locations where the data can be embedded it is effortless for the data hider to read bits information in LSBs of encrypted pixels. After knowing how many bit planes and rows of pixels he can modify, the data hider simply adopts LSB replacement to substitute the available bit planes with additional data. Finally, the data hider encrypts according to the data hiding key to formulate encrypted image containing data.

c) Data extraction and image recovery

In this case the two keys that is the encryption key and the data hiding key, both are used to extract the data and then the image. Since the image is encrypted two times, the image can be restored only after the data extraction. Hence first using the data hiding key the image is decoded and the data stored in the LSBs of the pixels in the image is extracted. Then the decoded image once again decoded with the encryption key. Then by applying the rationale rhombus algorithm for data extraction the LSB values are restored and placed it in its own position using LSB replacement algorithm. Finally the extracted image is passed through the adaptive median filter that helps to reduce the impulse noise and also smooth all other types of noise. The adaptive median filter preserves detail and smooth non impulsive noise. Hence it provide noiseless decrypted output image.

ALGORITHM

i. Rationale Rhombus Algorithm

Rationale rhombus method used to store the LSB values of the pixel of the portion of the image. Rationale rhombus method is implemented here to effectively hide and make is available in the decoding time. In an image the adjacent pixels have the pixel value in less difference. So while considering a rhombus in the pixels the pixel cantered by the four pixels has the average value of the four pixels. This technique is used to develop the rationale rhombus algorithm. These pixels are classified as Cross and Dot. Dots are the four pixels used to find the average value and its value is not changed in this method. Cross is the pixel where the data is hiding and is modified with the following algorithm. Henceforth, this scheme will be called the Cross embedding scheme.

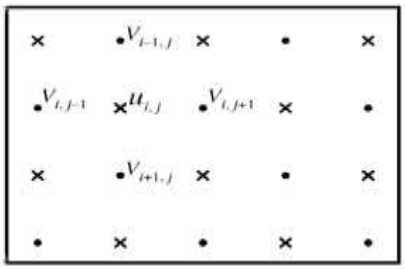

Figure 3. Prediction pattern

In order to predict pixel value of position ui, j in Fig.3, four neighbouring pixels "Dots" are used. Vi, j−1, vi+1, j, vi, j+1, and vi−1, j. Ui,j is used as the Cross to store the data. The five pixels including ui, j comprises a cell which is used to hide one bit of data.

The encoder of the Cross embedding scheme for a single cell is as follows. Centre pixel ui, j of the cell can be predicted from the four neighbouring pixels vi, j−1, vi+1, j, vi, j+1, and vi−1, j.

The predicted value u'i, j is computed as $u'i,j = [vi,j-1 + vi+1,j + vi,j+1 + vi-1,j / 4]$.

Based on the predicted value u'i, j and original value ui, j, the prediction error "E" is computed as E = ui, j – u'i, j and M = 2E.

Prediction error can be expanded to hide information as H = M + bit Where H is the prediction error after expansion called modified prediction error. The bit is the hiding data. After data hiding, the original pixel value ui, j is changed to Ui, j as Ui, j = H + u'i, j.

The decoding procedure for the Cross embedding scheme for a single cell is an inverse of the encoding scheme. During data hiding, pixels from the Dot set are not modified, so the predicted values u'i, j is also not changed. Using the predicted value u'i, j and the modified pixel value Ui, j, and the decoder can exactly recover the embedded bit and original pixel value.

The modified prediction error is computed as H = Ui, j – u'i, j.

The embedded bit value is computed as bit = H mod 2.

The original prediction error is computed as M = H – bit and E = M / 2.

The original pixel's value is computed as ui, j = u'i, j + E Note that the two sets (the Cross set and Dot set) are independent of each other. Independence means changes in one set do not affect the other set, and vice versa. Pixels from the Dot set are used for computing predicted values u'i, j, whereas pixels from the Cross set ui, j are used for embedding data. The order of hiding data in cells is not important and can be changed. Sorting reorders cells according to the magnitudes of local variance and enables hiding data in cells with small prediction errors. Thus, sorting can significantly improve the data embedding scheme.

ii. LSB Replacement Algorithm

In this algorithm embed the each bit of the data in the least significant bits places of the original image. The embedding of the data is performed choosing a subset of image pixels and substituting the least significant bit of each of the chosen pixels with embedding bits. The extraction of the data is performed by extracting the least significant bit of each of the selected image pixels. If extracted bits match the inserted bits, then the stored is detected. The extracted bits do not have to exactly match with the inserted bits. A correlation measure of both bit vectors can be calculated. If the correlation of extracted bits and inserted bits is above a certain threshold, then the extraction algorithm can decide that the data is detected.

Step 1. Load the original image.

Step 2. Load the embedding data.

Step 3. Determine the value of the embedding factor

Step 4. Call the embedding function to embed the bits in the least significant bits of the original image.

Step 5. Use the extraction function to extract the watermark.

iii. Adaptive Median Filtering Algorithm

The Adaptive Median Filter performs spatial processing to determine which pixels in an image have been affected by impulse noise. The Adaptive Median Filter classifies pixels as noise by comparing each pixel in the image to its surrounding neighbor pixels. The size of neighborhood is adjustable, as well as the threshold for the comparison. A pixel that is different from a majority of its neighbors, as well as being not structurally aligned with those pixels to which it is similar, is labeled as impulse noise. These noise pixels are then replaced by the median pixel value of the pixels in the neighborhood that have passed the noise labeling test. Adaptive median filter changes size of Sxy (the size of the neighborhood) during operation.

● Notation

Zmin = minimum gray level value in Sxy
Zmax = maximum gray level value in Sxy
Zmed = median of gray levels in Sxy
Zxy = gray level at coordinates (x, y)
Smax = maximum allowed size of Sxy

● Algorithm

Level A : A1 = Zmed – Zmin
A2 = Zmed – Zmax
if A1 > 0 AND A2 < 0, go to level B
else increase the window size
if window size < Smax, repeat level A
else output Zxy
Level B: B1 = Zxy - Zmin

B2 = Zxy – Zmax
if B1 > 0 AND B2 < 0, output Zxy
else output Zmed

● Explanation

Level A: IF Zmin < Zmed < Zmax, then
• Zmed is not an impulse
(1) go to level B to test if Zxy is an impulse .
ELSE
• Zmed is an impulse
(1) the size of the window is increased and
(2) level A is repeated until .
(a) Zmed is not an impulse and go to level B or
(b) Smax reached: output is Zxy

Level B: IF Zmin < Zxy < Zmax, then
• Zxy is not an impulse
(1) output is Zxy (distortion reduced)
ELSE
• either Zxy = Zmin or Zxy = Zmax
(2) output is Zmed (standard median filter)
• Zmed is not an impulse (from level A)

HARDWARE AND SOFTWARE REQUIREMENTS

1. Software requirements

a) MATLAB

Matlab is a high performance language for technical computing. It integrates computation, visualization, and programming in an easy to use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

•Math and computation
•Algorithm development
•Modeling, simulation, and prototyping
•Data analysis, exploration, and visualization
•Scientific and engineering graphics
•Application development, including graphical user interface building

Matlab is an interactive system whose basic data element is an array that does not require dimensioning. This allows to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non interactive language such as C or Fortran. The name Matlab stands for matrix laboratory. Matlab was originally written to provide easy access to matrix software developed by the Linpack and Eispack projects. Today, Matlab uses software developed by the Lapack and Arpack projects, which together represent the state of the art in software for matrix computation. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, Matlab is the tool of choice for high productivity research, development, and analysis. Matlab features a family of application specific solutions called toolboxes.

b) MODELSIM

ModelSim is a multi language HDL simulation environment by Mentor Graphics for simulation of hardware description languages such as VHDL, Verilog and System C and includes a built in C debugger. Overview of the ModelSim simulation environment is divided into four: Basic simulation flow , Project flow ,Multiple library flow and Debugging tools.

c) ISE Design Suit

The ISE Design Suite: Embedded Edition includes Xilinx platform studio , software development kit large repository of plug and play IP including micro blaze and peripherals, and a complete RTL to bit stream design flow. Embedded Edition provides the fundamental tools, technologies and familiar design flow to achieve optimal design results.The ISE Design Suite: System Edition builds on top of the Embedded Edition by adding on System Generator for DSP™. System Generator for DSP is the industry's leading high-level tool for designing high-performance DSP systems using Xilinx all programmable devices, providing system modeling and automatic code

generation from Simulink and matlab ISE WebPACK delivers a complete, front-to-back design flow providing instant access to the ISE features and functionality at no cost. To learn more, please visit ISE WebPACK Design Software landing page.

d) DIGILENT ADEPT

The Digilent Communications Interface DLL, dpcutil.dll, provides a set of API functions for applications programs running on a Microsoft Windows based computer to exchange data with logic implemented in a Digilent system board. Various Digilent applications programs, such as Transport component of the Adept Suite, depend on the data interchange API functions in dpcutil. The operation of these functions depends on the presence of a Digilent communications subsystem component running the appropriate firmware and the implementation of the appropriate interface logic in the gate array. This include functional requirements of the communications interface logic and provides a sample implementation. The logic implements are set of registers in the gate array. An application on the host PC exchanges data with the design in the gate array by reading or writing these registers. Digilent Communications Interface modules implement the interface described in this document to control the reading and writing of these registers. Signals sourced by the host are generated by the Digilent communication interface and are inputs to the logic in the gate array. The term peripheral refers to the logic implemented in the gate array of the system board. Signals sourced by the peripheral are outputs from the logic implemented in the gate array.

2. Hardware requirements

a) Nexys3 Spartan 6

The Nexys3 is a complete, ready to use digital circuit development platform based on the Xilinx Spartan 6 LX16 FPGA. The Spartan 6 is optimized for high performance logic, and offers more than 50% higher capacity, higher performance, and more resources as compared to the Nexys2's Spartan-3 500E FPGA. Spartan 6 LX16 features include:

- GPIO includes 8 LEDs, 5 buttons,8 slide switches and 4-digit seven-segment display
- 2,278 slices each containing four 6 input LUTs and eight flip flops
- 576Kbits of fast block RAM
- two clock tiles (four DCMs & two PLLs)
- 32 DSP slices
- 500MHz+ clock speeds
- Xilinx Spartan 6 LX16 FPGA in a 324 pin BGA package
- 16Mbyte Cellular RAM (x16)
- 16Mbytes SPI (quad mode) PCM non volatile memory
- 16Mbytes parallel PCM non-volatile memory
- 10/100 Ethernet PHY
- On-board USB2 port for programming & data xfer
- USB-UART and USB HID port (for mouse/keyboard)
- 8 bit VGA port
- 100MHz CMOS oscillator
- 72 I/O's routed to expansion connectors
- USB2 programming cable included

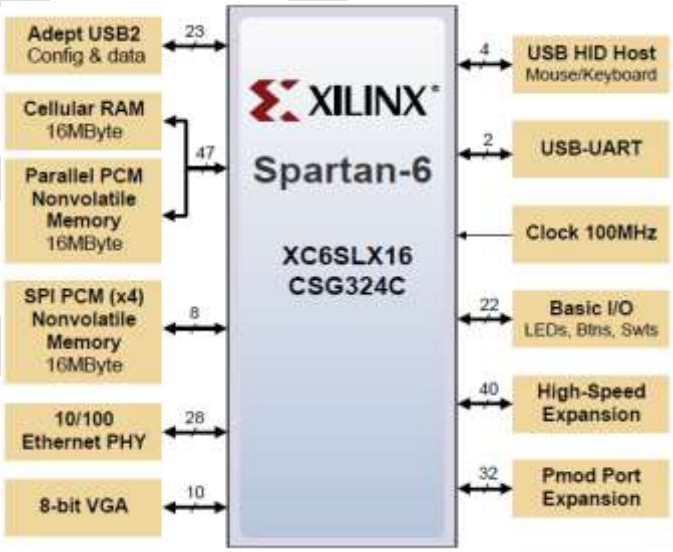

Figure 4. Nexys3 spartan 6

b) Memory Card

A memory card or flash card is an electronic flash memory data storage device used for storing digital information. These are commonly used in many electronic devices, including digital cameras, mobile phones, laptop computers, MP3 players and video game consoles, Tablets. Most of these can be diminutive, re-recordable, and can retain data without power.

c) USB cable

The Universal Serial Bus (USB) is an industry standard developed in the mid 1990s that defines the cables, connectors and communications protocols used in a bus for connection, communication, and power supply between computers and electronic devices.

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CONCLUSION

Reversible data hiding in encrypted images is a advanced topic provides the privacy preserving requirements from cloud data management. Reserving room before encryption shows the excellent property that the original cover is recovered without any loss after the embedded data is extracted out while protecting the image content's confidentiality. This method can take advantage of all traditional RDH techniques for plain images and achieve excellent performance without loss of perfect secrecy.. All previous methods embed data by reversibly vacating room from the encrypted images, which subject to some errors on data extraction and image restoration. Reversible data hiding is a novel method by reserving room before encryption with a traditional Reversible data hiding algorithm, and thus it is easy for the data hider to reversibly embed data in the encrypted image. Also it achieve real reversibility, that is data extraction and image recovery are free of any error. This novel Method achieve real reversibility by the use of Rationale Rhombus algorithm, and provide great improvement on the quality of marked decrypted images while retrieving the image.

REFERENCES:

[1] Kede Ma, Weiming Zhang, Xianfeng Zhao, Member, IEEE, Nenghai Yu, and Fenghua Li "Reversible Data Hiding in Encrypted Images by Reserving Room Before Encryption".

[2] Vasiliy Sachnev, Hyoung Joong Kim, Member, IEEE, Jeho Nam Senior Member, IEEE,Sundaram Suresh, and Yun Qing Shi, Fellow, IEEE "Reversible Watermarking Algorithm Using Sorting and Prediction.

[3] Lixin Luo, Zhenyong Chen, Ming Chen, Xiao Zeng, and Zhang Xiong "Reversible Image Watermarking Using Interpolation Technique".

[4] Mona M. El-Ghoneimy, Associate Professor, Elect. & Comm. Dept.,Faculty of Engineering, Cairo University, Post code 12316"Comparison Between Two Watermarking Algorithms Using Dct Coefficient, And Lsb Replacement.

[5] Deepshikha Chopra, Preeti Gupta, Gaur Sanjay B.C, Anil Gupta "Lsb Based Digital Image Watermarking For Gray Scale Image".

[6] Masoud Nosrati Ronak Karimi Mehdi Hariri "Reversible Data Hiding: Principles, Techniques, and Recent Studies".

[7] Yun Q. Shi, Department of Electrical and Computer Engineering,New Jersey Institute of Technology, Newark, NJ 07102, USA0"Reversible DataHiding".

[8] W. Zhang, B. Chen, and N. Yu, "Improving various reversible data hiding schemes via optimal codes for binary covers," IEEE Trans. Image Process., vol. 21, no. 6, pp. 2991–3003, Jun. 2012.

[9] J. Fridrich and M. Goljan, "Lossless data embedding for all image formats," in Proc. SPIE Proc. Photonics West, Electronic Imaging, Security and Watermarking of Multimedia Contents, San Jose, CA, USA, Jan. 2002, vol. 4675, pp. 572–583.

[10] M. Johnson, P. Ishwar, V. M. Prabhakaran, D. Schonberg, and K. Ramchandran, "On compressing encrypted data," IEEE Trans. Signal Process., vol. 52, no. 10, pp. 2992–3006, Oct. 2004.

[11] M. Goljan, J. Fridrich, and R. Du, "Distortion-free data embedding for images," in Proc. Inform. Hiding Workshop, Pittsburgh, PA, 2001, pp. 27–41.

[12] R.Gonzalez and R.Woods, "Digital Image Processing", 1998.

[13] B Surekha, Dr GN Swamy, "A Spatial Domain Public Image Watermarking", International Journal of Security and Its Applications Vol. 5 No. 1, January, 2011.

[14] W. Zeng, "Digital watermarking and data hiding: technologies and applications," in Proc. Int. Conf. Inf. Syst., Anal. Synth., vol. 3, 1998, pp. 223–229.

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Impact of Leachate on Soil Properties in the Dumpsite

(A Case study of Greater Visakhapatnam)

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Abstract - Soil pollution is one of the grave consequences of the inevitable municipal solid waste dumping especially in a country like India which is one among the densely populated. The developing trend of industrialization and modernization is generating tons of solid waste of different categories posing severe environmental threat. The activities of both the developed and developing countries are equally affecting the soil fertility. Though there are many factors affecting the soil characteristics the unscientific disposal and dumping of solid waste has become one of the major concerns due to the irreversible leachate affect. In this context a comprehensive knowledge on the soil fertility and the extent of soil contamination is very much awaited aspect. The present paper is an attempt to analyze the impact of leaching on the soil physico-chemical properties of an active dumpsite in Visakhapatnam.

Key words - Dumpsite, MSW, leachate, soil pollution, soil physico-chemical properties, soil macro-nutrients, comparative study, etc;

INTRODUCTION

Open and unscientific dumping of municipal solid waste is one of the most common methods adopted since years in almost all the cities. Municipal solid waste generally constitutes of both the degradable and non-degradable substances which find their way into the under groundwater resources and soil strata. Though all natural resources have their own importance in the environment, soil has a major role to play. Ever since life existed soil played a vital role in the growth of microbes useful for the nutrient cycling to make available all the essential nutrients required for the plant growth and nourishment. Micro-organisms in waste dumpsites use waste constituents as source of nutrients thereby detoxifying the materials as their digestive processes breakdown complex organic molecules into simpler less toxic molecules [1]. In addition the soil organic matter helps in maintaining soil quality [2]. Soil provide a suitable natural environment for biodegradation of wastes and therefore serve as a sink for the adsorption and absorption of ions and as a medium for the restoration of vegetation and normal land use [3].Though there are different ways how a soil is defined by different experts, for agriculturalists it is a part of earth's crust or a layer useful for the plant growth. Misuse of the soil by various anthropogenic activities will result in drastic impacts in the near future that are damaging to the ecosystem and the environment on the whole. Although solid waste can be an asset when properly managed, it poses the greatest threat to life and health due to its potential of contaminating terrestrial, aquatic and aerial environments [4]. This contamination of surface water, groundwater, soil and air is associated with wide range of human health and ecological impacts thereby contributing to the degradation of vital natural resources [5]. The dumpsites in most developing countries are usually unlined shallow hollow excavations arising from abandoned burrow-pits and quarry-sites without any environmental impact assessment studies [6]. Eventually these waste dumpsites with waste heaps become a potential threat to the soil and the underground water resources due to the leachate percolation in course of time. The leachate from

open dumps and landfills contain both chemical and biological constituents [7]. Million tons of solid wastes from different sources like industrial, agricultural, commercial, residential, etc; pave their way onto the soil interfering with the natural activity of the soil. While the proliferating population and demand of food is making the farmers to use high yielding fertilizer varieties which are expensive yet yield farmers the intended production percentage. In this context the economically meager farmers are compelled to use the soils from the dump yards as the soils are rich in organic matter required for the crop growth unnoticed of the future problems. Several wastes from different sources find the way into the environment and finally end up in the dump sites posing severe contamination of soil due to the heterogeneity. Soils serve as a natural sink for the pollutants released from both natural and man-made sources. Though the municipal solid waste in developing countries like India is mostly food wastage, the decomposition of the organic matter will change the physico-chemical properties of the soil affecting the underlying groundwater sources through leachate percolation. Assessment of soil pollution becomes difficult when contaminants belong to different sources and their products are variably distributed [8]. Solid waste pollutants serve as an external force affecting the physico-chemical characteristics of soil ultimately contributing towards the poor production of vegetation [9].The disturbances of higher intensity sometimes endanger the survival of some species and yield to low richness [10].Therefore it is utmost important to understand the soil geology and chemistry to assess the impact of the pollutants released onto the fertile layer. Many works were carried throughout the world to interlink and establish the connection between the soil quality to microbial, plant, animal, and human health. The efforts made by the authorities in the study site still need some expertise to solve the problems arising out of the municipal solid waste disposal.

The present paper is an attempt to analyze the physico-chemical parameters of the soil samples collected from the dump yard of the Visakhapatnam city.

METHODOLOGY:

STUDY AREA

Visakhapatnam the urban agglomeration covers an area of 545 km^2 and is one of the fast growing metropolitan in the state of Andhra Pradesh with an estimated population of 20 lakhs. The city is nestled between Eastern Ghats and Bay of Bengal. Greater Visakhapatnam city stands for its natural beauty and often known as the "***City of Destiny***". Geologically the study area has a variety of soil forms like sandy, clayey, alluvial etc; but most predominantly dominated by the Khondalites group. The city generates a total of 1000 MT/day of municipal solid waste which is unscientifically managed since 20 yrs. The municipal dump yard lies between latitude $17^0$50'45 26"N and longitude 83^0 22' 03 27'E in Kapuluppada village located in Bheemunipatnam of Visakhapatnam district, Andhra Pradesh. The dump yard is located 25 kms away from the city in about 100 acres. The dump yard has a thick coppice and is in close propinquity to the Bay of Bengal on one side and bounded by agricultural villages on the other side which is a basis for the selection of this site. Though Visakhapatnam is one of the major industrial zones still lacks in few service deliveries like sewerage systems, medical facilities and sanitation which makes it a rationale for selection of this area for the study.

Fig 1 – Location of the Andhra Pradesh state

Fig 2 – Location of district

Fig 3 - Satellite imagery of the dump yard

SAMPLE COLLECTION:

Approximately 1kg of composite soil samples were collected at a depth of 15cms from the waste disposal site at different distances into clean polythene air-tight bags to prevent any further changes in moisture and volatile matter. The soil samples were brought to the laboratory air- dried and the lumps of the air dried samples were broken down in a porcelain motor. The soil samples were sieved using a 2mm sieve as per standard methods. The soil samples were later analyzed for pH, EC, moisture, N, P and K. A comparative study has been made between the control soil collected far from the activity of municipal solid waste dumping and the soils collected from the dump yard within huge heaps.

RESULTS:

Physico- chemical properties of soil samples at the dump yard

Parameter	**S1** Close proximity to MSW activity	**S2** 1km distance	**S3** 2km distance	**S4** 3km distance	**S5** Control sample away from dumpsite
pH	6.18	7.63	7.84	7.86	8.34
EC (mmhos/cm)	1.24	1.18	1.14	1.09	1.03
Moisture (%)	36.04	31.12	28.03	24.02	18.10
Organic Carbon	3.04	2.13	2.04	1.42	0.8
Nitrogen(Available) Kg/acre	262	187	144	115	62
P_2O kg/acre	91	84	76	73	34
K_2O kg/acre	363	235	179	157	15

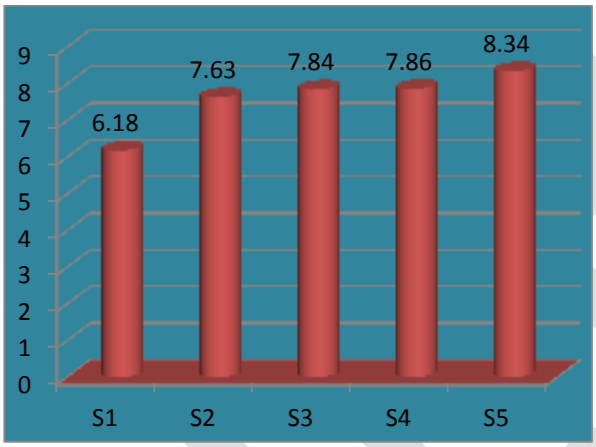

Fig 4 – pH

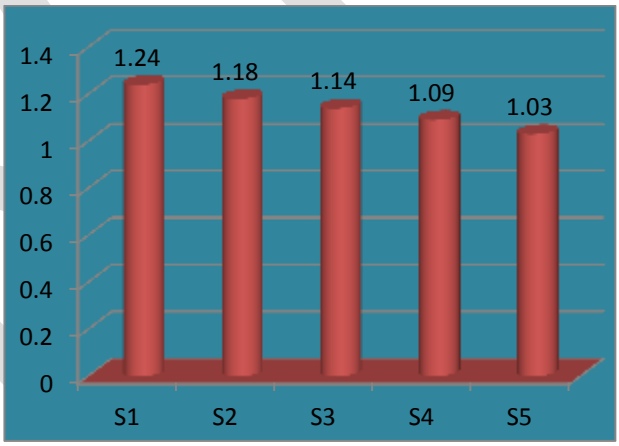

Fig 5 – EC

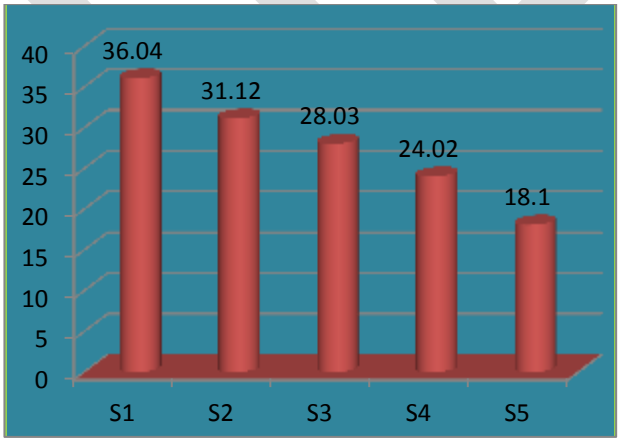

Fig 6 – Moisture

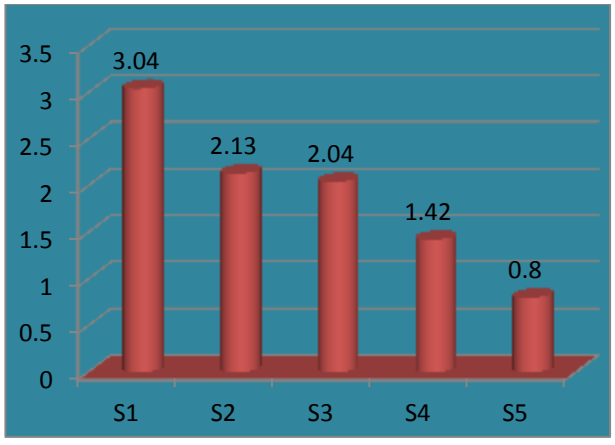

Fig 7 - Organic Carbon

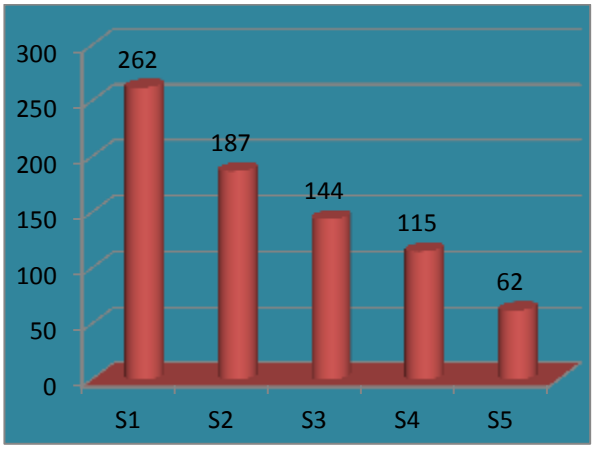

Fig 8 - Available Nitrogen

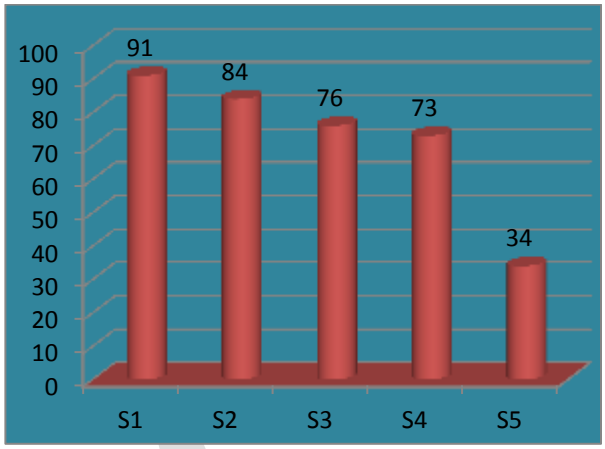

Fig 9- Available Phosphorus

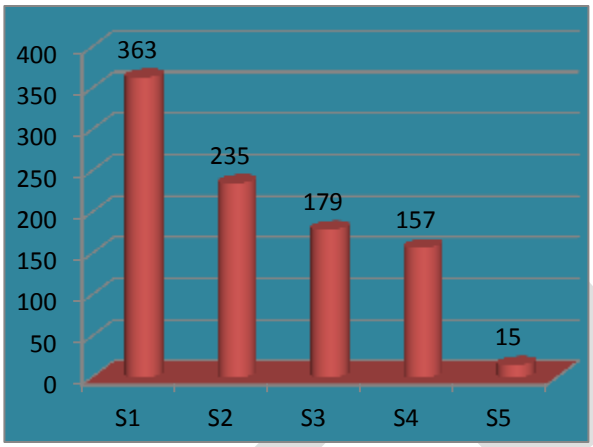

Fig 10 - Available Potassium

Fig 11 - View of dump yard

DISCUSSION:

The soil samples collected from the dump yard showed variation in physico-chemical parameters. The pH is a basic measure for identification of the chemical nature of the soil. The sample collected close to the MSW activity showed pH of 6.18 due to the decomposition of organic matter leading to the formation of organic acids which indicated slightly acidic soils. In general, leachate generated from young acidogenic landfills are characterized by high concentrations of organic and inorganic pollutants [11].The acidification of soils could possibly affect the nutrient supply to the plants and increase in soil micro-nutrients toxic for the growth of crops. While the samples collected at regular distances in the dump yard showed alkaline pH with increasing trend which usually depends on soil texture, porosity and infiltration capacity of the water in the dump yard. The alkaline nature of the soil samples collected slightly away from the dumping activity showed increasing pH level which is very often encountered at landfills aging 10 years after disposal [12]. However the increase in soil pH decreases the soil micro-nutrient availability to the plants. While either of the extreme pH conditions can affect the survival of plants which has to be modified for specific crops. The electrical conductivity of the soils close to the dumpsite was high compared to the soil sample at the control site. The high EC is due to the increase in the salts and ions. Conductivity value of less than 0.5milliScm^{-1} is perfectly safe and it doesn't have any negative effect on plant growth. The study identified that the soil samples both at the dump yard and the control site are above the permissible range which is toxic to plants and may prevent them from obtaining water from soil [13]. Moisture content was high in the soils close to the activity of MSW due to

high organic matter and soil microbial activity [14], which showed a considerable decrease within the dump yard at specific distances and at the control site. The result obtained agree with the findings of [15], who reported decrease in moisture content with increase in distance from the refuse dump site. The percentage organic carbon ranged from 1.42 to 3.04% with the highest value at the functional area due to decomposition of organic matter and lowest organic carbon percentage at the control site. The soils were found to be highly enriched with the nitrogen levels which ranged between 115kg/acre to 262kg/acre with the lowest value of 62kg/acre in the control soil sample. The phosphorus content in the dump yard soils ranged between 73 to 91kg/acre with the lowest value of 34kg/acre at the control site. The high nitrogen and phosphorus content recorded in dump site soil could be attributed to high organic matter found in dump soil [16]. Potassium content in the dump site soils ranged between 157 kg/acre to 363 kg/acre while lowest of 15 kg/acre at the control site. Though potassium is a soil nutrient helpful for the plant growth the anthropogenic activities could result in increase in the potassium levels which is source of groundwater contamination.

CONCLUSION

The indiscriminate dumping of municipal solid waste revealed a considerable change on the soil qualities in the dump yard. The study showed that all the parameters are in high concentration as per the Indian Agricultural Standards which could be deteriorated further by dumping of municipal solid waste thereby increasing the toxic substances in the dump yard soils. The study also revealed that the fertility of the soil in dumpsite has been altered and thus show both positive and negative aspects which have to be further investigated.

REFERENCES:

[1]. Pavoni JL, Heer Jr. JE, Hagerty DL. 1975. Handbook of Solid Waste Disposal, Materials and Energy Recovery. New York: Van Nostrand Reinhold Company.

[2]. Pedra, F., Polo, A., Ribeiro, A., and Domingues, H. (2007). Effects of municipal solid waste compost and sewage sludge on mineralization of soil organic matter. *Soil Biology Biochemstry*, 39: 1375-1382.

[3]. Ekundayo, EO (2003). Suitability of waste disposal sites for refuse disposal in Benin city, Nigeria.

[4]. Bishop, P.L., 2000. Pollution prevention: Fundamentals and Practice. McGraw-Hill, Companies Inc., USA, pp: 98.

[5]. USEPA, 2002. Environmental and Economic Benefit Analysis of Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations.

[6]. Amadi, A. N., Ameh, M. I., & Jisa, J. (2010). The impact of dumpsites on groundwater quality in Markurdi Metropolis, Benue State. Natur. *Appl. Sci. J., 11*(1), 90-102.

[7]. W. J. Schneider, "Hydrological implications of solid waste disposal", US Geological Survey p.12 (1970).

[8]. Partha, V., Murthya, N.N., Saxena, P.R., 2011. Assessment of heavy metal contamination in soil around hazardous waste disposal sites in Hyderabad city (India): natural and anthropogenic implications. E3. J. Environ. Res. Manage. 2 (2), 027–034

[9]. Papageorgiou, M., 2006. Public community partnerships for waste collection in three Indian cities, an exercise in world making – best student essays of 2005–06. Inst. Soc. Studies 24, 104–117.

[10]. Hussain, M., Palmer, M.W., 2006. Effect of clipping, fertilization and water stress on species composition of experimental plant communities along a simulated soil gradient. Proc. Okla. Acad. Sci. 86, 53–63.

[11]. Calli B, Mertoglu B, Inanc B (2005) Landfill leachate management in Istanbul: applications and alternatives. Chemosphere 59:819–829.

[12]. El-Fadel M, Bou-Zeid E, Chahine W, Alayli B (2002) Temporal variation of leachate quality from pre-sorted and baled municipal solid waste with high organic and moisture content. Waste Manag (Oxford) 22:269–282.

[13]. Goswami U, Sarma HP (2008). Study of the impact of municipal solid waste dumping on soil quality in Guwahati city, Poll. Res., 27(2), 2008, 327-330.

[14]. Zhang S, Lövdahl L, Grip H, Jansson P, Tong Y (2007). Modelling the effects of mulching and fallow cropping on water balance in the Chinese Loess Plateau, 210 (Article in Journal) Soil and Tillage Research, Elsevier Science BV 2007-11-05. 000244850400006.

[15]. Ibitoye AA, Ipinmoroti KO and Amoo IA (2005). Effects of municipal refuse dump on the Pysico-chemical Properties of soil and water. Nig. J. Soil Sci. 15(2):122-128.

[16]. Soheil, R.I., Hossien, M.H., Gholamreza, S., and Hassan, E. (2012). Effects of composted municipal waste and its leachate on some soil chemical properties and corn plant responses. 2(6):801-814.

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Design and comparison of 1x2 inverted diamond shaped microstrip antenna array with T and I slot having defected ground

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Abstract— The aim of this paper is to design an inverted diamond shaped microstrip antenna array with T and I slot. The defected ground structure is taken here. The results of the T slot array with defected ground and I slot with defected ground is studied and the comparison of the results is made. Both proposed antennas operate at 7GHz frequency. The structure is simulated on HFSSv10 software.

Keywords— HFSS (high frequency structure simulator), UWB (ultra-wide band), DGS (defected ground structure), MSA (microstrip antenna array), 3-D (3-dimenssion), Leff (effective length), GHz (giga hertz)

INTRODUCTION

There has been a flourishing prospect of UWB technology in recent years in both communication and other purposes like microwave imaging and radar application. Recent studies of UWB antenna structures are specially concentrated on microstrip slot [1] and planar monopole antennas [1].Among the different miniaturizing techniques such as cutting slots in patch [2], using shorting walls [3] or shorting pins [4] and folding the microstrip patch to create 3-D structures [5], the slots with various shapes and structures becomes a potential for candidate [6-8].

The effect of reduced ground plane and DGS improves the antenna radiation characteristics and they are used for effective antenna matching for better control on the radiation pattern for optimum performance [9-10].

The paper presents an inverted diamond shaped 1x2 MSA array with reduced ground. The reduced ground is further shaped to steps shape for better results.

ANTENNA DESIGN

The array is designed on a FR4 substrate placed 1mm above the ground.

Width of antenna is given by:-

$W = c/2f\sqrt{(\epsilon r + 1)/2}$ where f is operating frequency

And

ϵr is dielectric constant of substrate.

The effective dielectric constant:-

$\epsilon reff = (\epsilon r + 1)/2 + (\epsilon r - 1)/2(1+ 12h/W)^{-0.5}$

The actual L, in meters is calculated using:-

$L= Leff -2\Delta l$ where $Leff = c/2f\sqrt{(\epsilon reff/2)}$ and Δl is length extension

From the above equations the dimensions of the rectangular patch are calculated and rectangular patch is created. From this rectangular patch an inverted diamond patch is cut and an array is made with corporate feeding as shown in figures below.

The length of the ground plane is 3mm and width is 18mm.

The array feed by a 50Ω microstrip line.

Two designs are shown in the figures below. One is the inverted diamond 1x2 array with T slot and other with I slot. The figures below show the structure of the above mentioned designs.

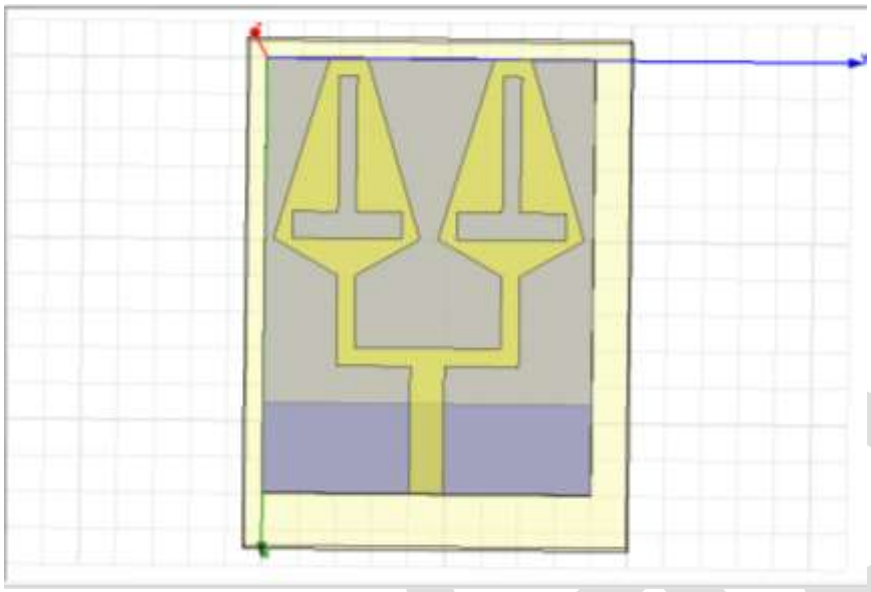

Figure 1 1x2 Inverted diamond array with T slot

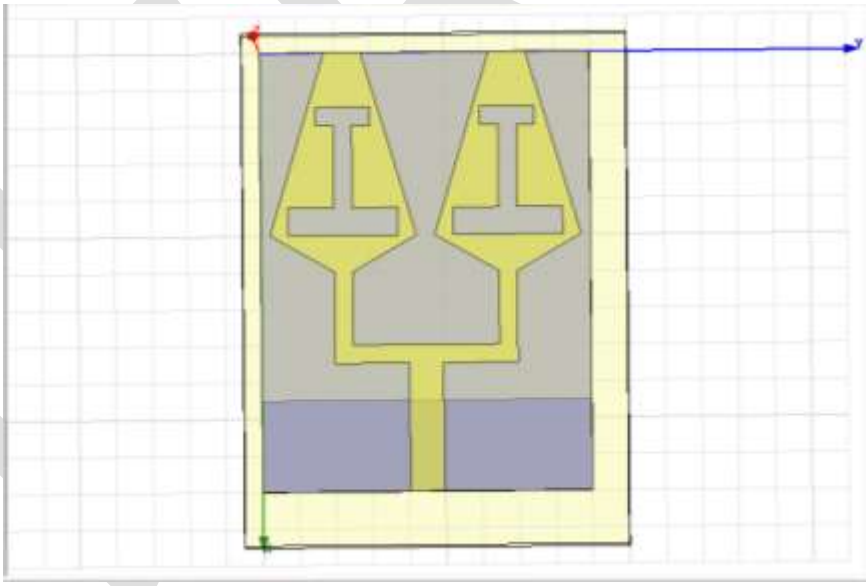

Figure 2 1x2 inverted diamond array with I slot

The above two designs are simulated using hfssv2 software. The results of these designs are as below. Both the designs are operated on 7GHz frequency.

SIMULATION AND RESULTS

The below figures, figure 3 and figure 4 shows the s-parameter of the two structures. The s parameter curve of both the designs shows that the design with T slot has -23.14 dB and for I slot is -21.81dB for the UWB range.

From the vswr curve of the two designs we can see that the antenna with T slot has 1.38dB and sharp peak is not obtained while the antenna with I slot has 1.44dB with sharp tip. These are shown in figures 5 and 6.

The figure 7 and 8 reflects the radiation pattern of both the designs. All these results are shown in the following figures.

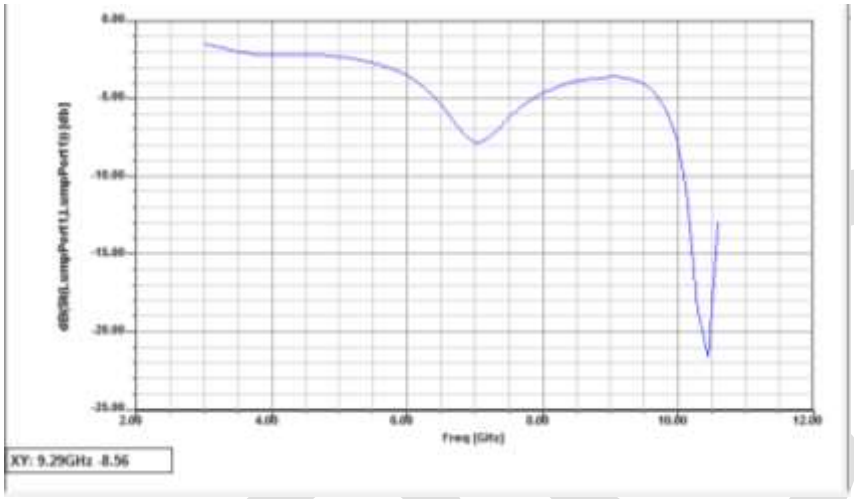

Figure 3 s parameter 1x2 inverted diamond array with T slot

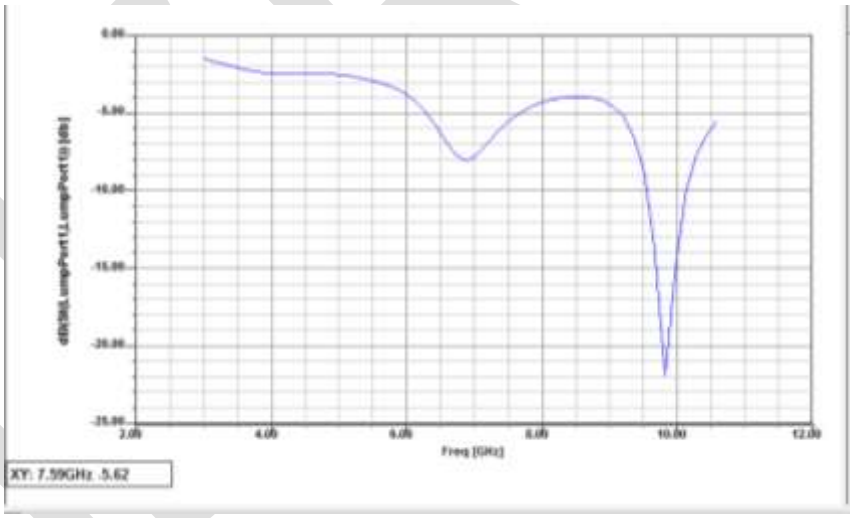

Figure 4 s parameter 1x2 inverted diamond array with I slot

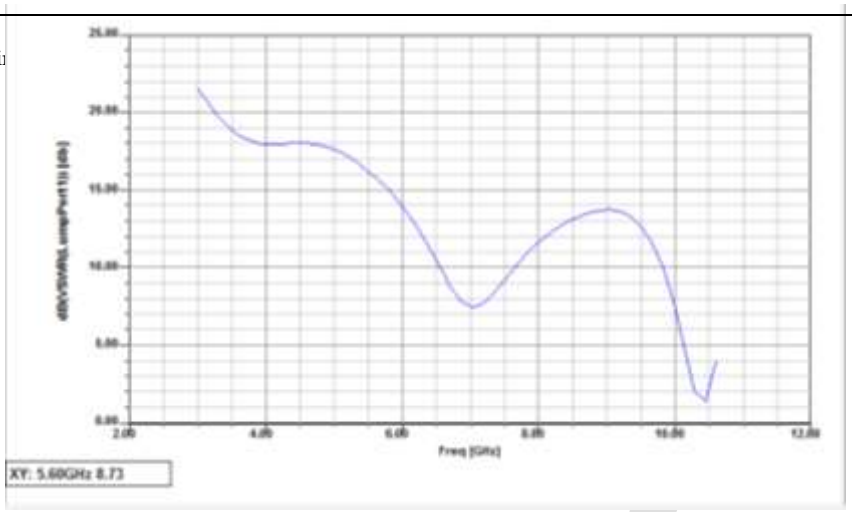

Figure 5 vswr 1x2 inverted diamond array with T slot

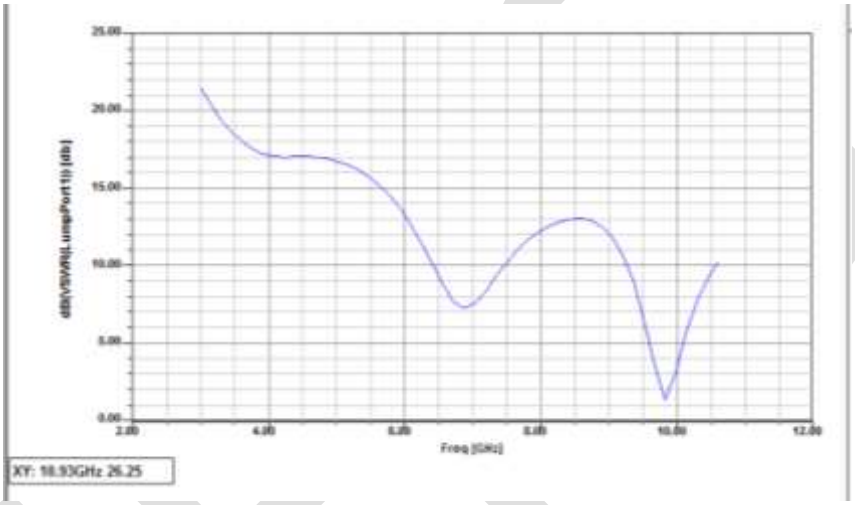

Figure 6 vswr 1x2 inverted diamond array with I slot

Figure 7 radiation pattern 1x2 inverted diamond array with T slot

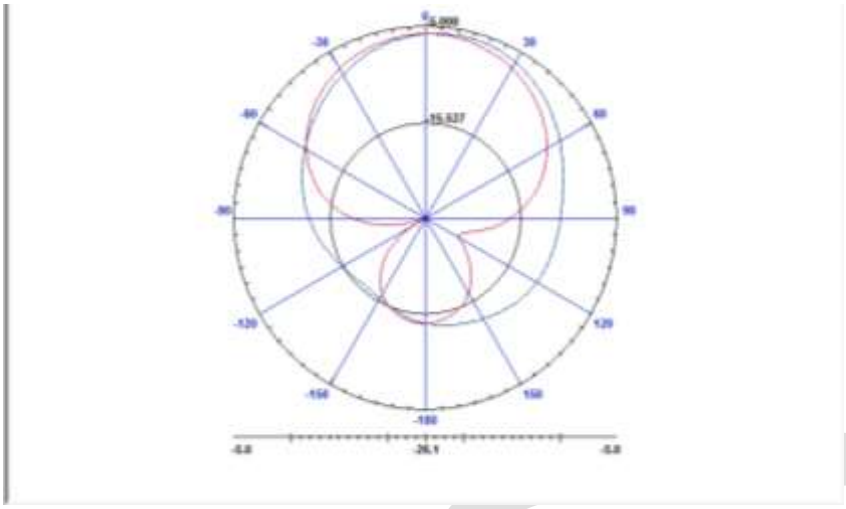

Figure 8 radiation pattern 1x2 inverted diamond array with I slot

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Here, I would like to thank the IJERGS team for selecting my paper and promptly responding to my emails and giving me proper suggestions timely.

CONCLUSION

From the above results we can conclude that 1x2 inverted diamond array with I slot has better response over T slot structure for the ultra-wide band frequency range.

REFERENCES:

[1] C A Balanis ,"Antenna Theory Analysis And Design".

[2] R.Garg,P.Bhartia,I.Bahl,AIttipipiboon,"Microstrip Antenna Design Handbook".

[3] C.Y Chin,C.H Chan,K.M Luk,"Study of a small wideband patch antenna with double shorting walls", IEEE Antennas on wireless propagation letters;vol.3,pp230-231,2004.

[4] K.Shackelford,K.F Lee,K.M Luk,R Chair,"U-Slot patch antenna with shorting pin",Electron letters,vol.37,no-12,pp729-730,2001.

[5] K.L Lau,K.C Kong,K.M Luk,"A miniaturized folded shorted path antenna for dual-band operations",IEEE transactions on antenna & propagation;vol.55,no.8. 2007.

[6] A.Beno,D.S Emmanual,"Diamond shaped symmetrical slotted miniaturized microstrip patch antenna for wireless applications",JATIT, vol.47,no.3,2013.

[7] Ziani Kerarti Djalal,Meriah Sidi Mouhamed,"New diamond antenna for UWB applications",IJCSI;vol.9,issue 4,no.1 2012.

[8] Farah Nadia,Mohd.Isa,Paul B Brennan,"Design of high gain and UWB microstrip array antenna for avalanche radar',AP-S/URSI 2011

[9] P.V Lokhander,B.T Saloke,"Design and simulation of circular MSA with DGS for WLAN applications',IOSR-JECE,ISSN:2278-2834,ISBN-2278-8735,pp46-50.

[10] Kushwala Nagendra,K Raj;"Design of slotted ground hexagonal MSA and gain improvement with FSS screen",Progress In Electromagnetics Research B,vol.51,177-199,2013

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A Survey Paper on Data Security in Cloud Computing using Threshold Cryptography and User Revocation

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Abstract-Cloud computing is extremely well known in associations and foundations on the grounds that it gives stockpiling and computing administrations at low cost. Nonetheless, it additionally presents new difficulties for guaranteeing the confidentiality, integrity and access control of the information. Some methodologies are given to guarantee these security prerequisites however they are needed in a few routes, for example, infringement of information confidentiality because of plot assault and substantial calculation (because of substantial no keys). To address these issues we propose a plan that uses threshold cryptography in which information proprietor partitions clients in gatherings and gives single key to each client bunch for decoding of information and, every client in the gathering shares parts of the key. In this paper, we utilize ability rundown to control the access. This plan not just gives the solid information confidentiality additionally lessens the quantity of keys.

Keywords- Outsourced data, malicious outsiders, access control, authentication, capability list, threshold cryptography, user revocation.

INTRODUCTION:

Cloud computing is another and fast developing innovation in field of computation and storage of data. It gives storage and computing as a service at exceptionally attractive expense. It gives services according to three fundamental service models infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS). Storage as a service is basically a platform as a service. The five characteristics of cloud computing are: on-demand service, self service, location autonomous, rapid elasticity and measured scale service [1]. These characteristics make cloud significant. Commercial enterprises and establishments are misusing these characteristics of cloud computing and increasing their benefit and income. That is why, commercial enterprises are moving their organizations towards cloud computing. Notwithstanding, data security is a major obstacle in the way of cloud computing. Individuals are as yet fearing to abuse the cloud computing. A few individuals trust that cloud is unsafe place and once you send your data to the cloud, you lose complete control over it. They are pretty much right[2][3]. Data of data proprietors are prepared and put away at external servers. Along these lines, confidentiality, integrity and access of data turn out to be more vulnerable. Since, external servers are operated by commercial service providers, data proprietor can't trust on them as they can utilize data for their advantages and can ruin organizations of data proprietor[4]. Data proprietor even can't trust on users as they may be malicious. Data confidentiality may violet through plot attack of malicious users and service providers.

To accomplish fine-grained information access control, the methodology has utilized capacity list [5]. It is fundamentally line based decay of access framework. In ability rundown approved information and operations for a client are indicated. It is preferable suit over Access Control List (ACL) [6][7][8] in light of the fact that ACL determines clients and their allowed operation for every information and record. It is essentially wasteful that two clients require same information and have same operations on it. In this paper, the methodology has utilized the altered Diffie-Hellman calculation to create one time shared session-key in the middle of CSP and client to secure the information from pariahs. To guarantee information honesty the methodology has utilized MD5 [4].

LITERATURE SURVEY

1) Attribute based Proxy Re-Encryption for Data Confidentiality in Cloud Computing Environments

AUTHORS: Jeong-Min Do

Key Policy-Attribute Based Encryption (KP-ABE) and Proxy Re-Encryption(PRE) are proposed to ensure data confidentiality and access control in cloud computing. But, these technologies affect the confidentiality of data through collusion attack of new user in system and cloud server. To recover this problem, a new system has been proposed that store and divide data file into header, body. In addition, this scheme selectively delegates decryption right using Type-based Proxy re-encryption..

2) How to share a secret

AUTHORS: Adi Shamir

This paper proposes a schema which shows how to partition data into fragments in such way that it becomes easy to reconstruct the original data from any partition, but even complete knowledge of k-1 fragments cannot help to get the whole information about D. This technique helps in construction of key management schemes which are robust for cryptographic system can function securely and reliably even when misfortunes destroy half the pieces and security breaches expose all but one of the remaining pieces.

3) Secure Data Access in Cloud Computing.

AUTHORS: Sunil Sanka

Cloud computing is used by cloud users to outsource their sensitive and confidential data to cloud service providers which leads to carry out research work on data security and access control of that data. Some existing solutions that are proposed makes use cryptographic techniques to provide data security and access control problems but they increase the computational overhead on the data owner as well as the cloud service provider as they need to manage the keys as well as their distribution. In this paper, capability based access control technique is been proposed which ensures only authorized users will access the data stored on cloud. This work also designs a modified version Diffie-Hellman key exchange protocol which is used between cloud service provider and the user for sharing a symmetric key secretly so as to provide authorized data access that will solve the problem of key management and its distribution at cloud service provider. The proposed approach is efficient and secure under existing security models.

4) Improved Proxy Re-encryption Schemes with Applications to Secure Distributed Storage

AUTHORS: GIUSEPPE ATENIESE

Blaze, Bleumer, and Strauss (BBS) proposed an application, in 1998, known as atomic proxy re-encryption. This application converts a cipher-text for Alice into a cipher-text for Bob without considering the plaintext using a semi-trusted proxy. It can be predicted that use of rapid and efficient re-encryption will become tremendously popular as a solution for dealing with encrypted file systems. The technique known as BBS re-encryption is mostly in use but, it has many security risks. Recent work done by Dodis and Ivan, present a new schemes for re-encryption that deals with a efficient way to provide security and also delivers the a way of providing access control to a file system security.

5) Capability-based Cryptographic Data Access Control in Cloud Computing

AUTHORS: Chittaranjan Hota

Cloud computing supports large data storage by using clusters of computers which has made it as a popular idea in computing world. It delivers the newest method for making computing resources work as a service. It describes not only a platform but also a type of application. It uses dynamic technique for configuring, allocating and de-allocating servers whenever they are needed. Cloud computing is used by cloud users to outsource their sensitive and confidential data to cloud service providers which leads to carry out research work on data security and access control of that data. There are many solutions that are available which make use of cryptographic techniques to solve these security and access control problems but they increase the overhead of the data owner as well as the cloud service provider as they need to manage the key as well as their distribution among the users. In this paper, capability based access control technique is been proposed which ensures only authorized users will access the data stored on cloud. This work also designs a modified version Diffie-Hellman key exchange protocol which is used between cloud service provider and the user for sharing a symmetric key secretly so as to provide authorized data access that will solve the problem of key management and its distribution at cloud service provider. The proposed approach is efficient and secure under existing security models.

EXISTING SYSTEM:

The existing scheme uses threshold cryptography in which data owner divides users in groups and gives single key to each user group for decryption of data and, each user in the group shares parts of the key. In this paper, they use capability list to control the access. This scheme not only provides the strong data confidentiality but also reduces the number of keys.

PROPOSED SYSTEM:

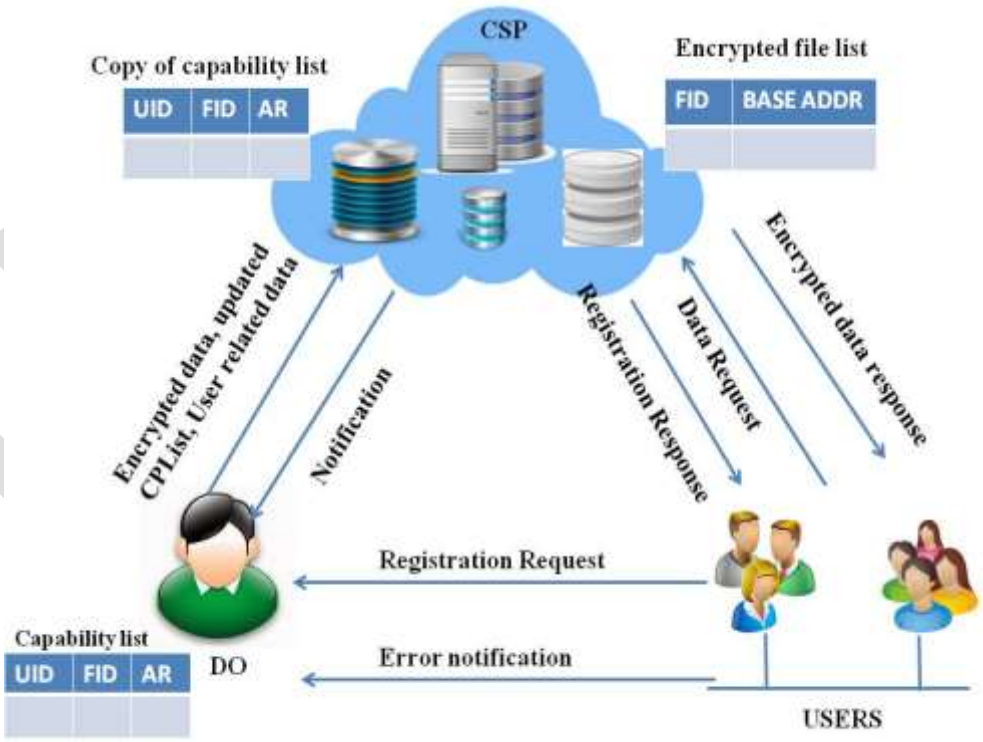
1. **User Revocation:**

   User revocation is the main challenge in previous scheme then we consider forward secrecy & backward secrecy. Forward secrecy is redefined in secure cloud sharing, which means that newly joining group members can decrypt and read all the shared files now and before. When a member leaves the group, he/ she will lose the ability to download and read the shared data ever again, which is called backward secrecy in cloud based group sharing.

2. **Data Dynamic Operation:**

   Data dynamics are most general forms of data operation, such as block modification, insertion, and deletion.

SYSTEM ARCHITECTURE:



CONCLUSION and FUTURE SCOPE:

We introduced another methodology which gives security for information outsourced at CSP. Some methodologies are given to secure outsourced information yet they are experiencing having huge number of keys and intrigue assault. By utilizing the threshold cryptography at the client side, we shield outsourced information from agreement assault. Since, DO stores its information at CSP in scrambled frame and, keys are known just to DO and regarded clients bunch, information confidentiality is guaranteed. To guarantee fine-grained access control of outsourced information, the plan has utilized ability list. Open key cryptography and MD5 guarantee the element verification and information integrity individually. Open key cryptography and D-H trade shielded the information from untouchables in our methodology. No of keys (on the grounds that in threshold cryptography, there is a single key comparing to every gathering) have decreased in the proposed plan.

REFERENCES:

[1] J. Do, Y. Song, and N. Park, "*Attribute Based Proxy Re-encryption for Data Confidentiality in Cloud Computing Environments*," Computers, Networks, Systems and Industrial Engineering (CNSI), 2011 FirstACIS/JNU International Conference on, vol., no., pp.248-251, 23-25 May 2011.

[2] T. Mather, S. Kumaraswamy, and S. Latif, "*Cloud Security and Privacy*," O'Reilly Media, Sep. 2009.

[3] A. T. Velte, T. J. Velte, and R. Elsenpeter, "*Cloud computing a practical approach*," Tata McGraw-Hill Edition, 2010, ISBN-13:978-0-07-068351-8.

[4] S. Sanka, C. Hota, and M. Rajarajan, "*Secure data access in cloud computing,"* Internet Multimedia Services Architecture and application (IMSAA), 2010 IEEE 4th International Conference on, vol., no., pp.1-6, 15-17 Dec. 2010.

[5] C. Hota, S. Sanka, M. Rajarajan, and S. Nair, "*Capability-Based Cryptographic Data Access Control in Cloud Computing*," Int. J.Advanced Networking and Applications Volume: 01 Issue: 01 Page:(2011).

[6] G. Ateniese, K. Fu, M. Green, and S. Hohenberger, "*Improved proxy re-encryption schemes with applications to secure distributed storage*," in Proc. of NDSS'05, 2005.

[7] W. Stallings, "*Cryptography and network security*," LPE Forth Edition, ISBN- 978-81-7758-774-6.

[8] S. D. C. di Vimercati, S. Foresti, S. Jajodia, S. Paraboschi, and P. Samarati, "*Over-encryption: Management of access control evolution on outsourced data*," in Proc. of VLDB'07, 2007.207

[9] Sushil Kr Saroj, Sanjeev Kr Chauhan, Aravendra Kr Sharma, Sundaram Vats, "*Threshold Cryptography Based Data Security in Cloud Computing*", 2015 IEEE International Conference on Computational Intelligence & Communication Technology.

[10] R. S. Fabry, "*Capability-Based Addressing*," in Communications of the ACM, 17(7), July 1974, pp. 403-412.

[11] V. Goyal, O. Pandey, A. Sahai, and B. Waters, "*Attribute-based encryption for fine-grained access control of encrypted data*," Association for Computing Machinery, in Proc. of CCS'06, 2006.

[12] N. Bennani, E. Damiani, and S. Cimato, "*Toward Cloud-Based Key Management for Outsourced Databases*," Computer Software and Applications Conference Workshops (COMPSACW), 2010 IEEE 34th Annual, vol., no., pp.232-236, 19-23 July 2010.

[13] A. Shamir, "*How to share a secret*," Communications of the ACM, v.22 n.11, p.612-613, Nov. 1979. [Online].

Available:http://portal.acm.org/citation.cfm?id=359168.359176.

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A Survey Paper on Secure Auditing and Maintaining Block Level Integrity with Reliability of Data in Cloud

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Abstract-- As the cloud computing innovation creates amid the most recent decade, outsourcing information to cloud administration for capacity turns into an alluring pattern, which benefits in saving endeavours on substantial information upkeep and administration, In any case, following the outsourced cloud stockpiling is not completely reliable, it raises security worries on the most proficient method to acknowledge information deduplication in cloud while accomplishing uprightness examining. In this work, we ponder the issue of honesty examining and secure deduplication on cloud information. Specifically, going for accomplishing both information uprightness and deduplication in cloud, we propose two protected frameworks, to be specific SecCloud and SecCloud+. SecCloud presents an examining substance with an upkeep of a MapReduce cloud, which assists customers with producing information labels before transferring and in addition review the honesty of information having been put away in cloud. Contrasted and past work, the calculation by client in SecCloud is enormously lessened amid the file transferring and reviewing stages. SecCloud+ is composed propelled by the way that clients constantly need to scramble their information before transferring, and empowers honesty evaluating and secure deduplication on encoded information.

Keywords— Secure auditing, Deduplication, Reliability, Cloud computing, Third Party Auditor, Diffie-Hellman Key Exchange,

INTRODUCTION

Despite the fact that cloud stockpiling framework has been generally embraced, it neglects to oblige some critical emerging needs, for example, the capacities of auditing integrity of cloud files by cloud customers and detecting copied files by cloud servers. We show both issues underneath. The first issue is integrity auditing. The cloud server has the capacity alleviate customers from the substantial weight of capacity administration and maintenance. The most distinction of cloud stockpiling from customary in-house stockpiling is that the data is exchanged by means of Internet and put away in an uncertain domain, not under control of the customers by any stretch of the imagination, which inevitably raises customers extraordinary worries on the integrity of their data. These worries originate from the way that the cloud stockpiling is defenseless to security dangers from both outside and inside of the cloud, and the uncontrolled cloud servers might inactively conceal some data misfortune incidents from the customers to maintain their notoriety.

In addition genuine is that for saving cash and space, the cloud servers may even effectively and purposely dispose of once in a while got to data files belonging to an ordinary customer. Considering the substantial size of the outsourced data files and the customers' constrained asset abilities, the first issue is summed up as in what manner can the customer efficiently perform periodical integrity verifications even without the neighborhood duplicate of data files.

The cloud storage is powerless to security dangers from both outside and inside of the cloud [1], and the uncontrolled cloud servers might inactively conceal some information misfortune episodes from the customers to keep up their notoriety. Deduplication would prompt various dangers conceivably influencing the stockpiling framework [3][2], for instance, a server telling a customer that it (i.e., the customer) does not require to send the record uncovers that some other customer has the precise same record, which could be touchy sometimes.customers dependably need to encrypt their information before transferring, for reasons extending from individual protection to corporate strategy, we bring a key server into SecCloud as with [4] and propose the SecCloud+ pattern.

LITERATURE SURVEY

1) Enabling Public Verifiability and Data Dynamics for Storage Security in Cloud Computing:

Cloud Computing has been envisioned as the next-generation architecture of IT Enterprise. It moves the database and application software to the centralized large data centers, where the management of the data and services may not be fully trustworthy. This unique factor brings about many new security challenges, which have not been well understood yet. This work studies the problem of ensuring the data integrity of the storage in Cloud Computing. In particular, we can consider the task of allowing a third party auditor (TPA), on behalf of the cloud client, to verify the integrity of the data stored in the cloud storage but dynamic data. The introduction of TPA eliminates the involvement of client through the auditing of whether his data stored in the cloud is indeed intact, which can be important in achieving economies of scale for Cloud Computing as well. The support for data dynamics via the most general forms of data operation, such as block modification, deletion , insertion is also a significant step towards practicality, since services in the Cloud Computing are not limited to archive or backup data. While prior work on ensure remote data integrity often lack the supports of either public verifiability or dynamic data operation.

2) Proofs of Ownership in Remote Storage Systems:

Cloud storage systems are becoming increasingly popular and popular. A promising technology that keeps their cost down is removing duplication of file , which stores only a single copy of the data repeating. Client side deduplication attempts to identify the deduplication opportunities already present at the client and save the bandwidth of uploading copies of existing files to the server which is harmful. In this work we identify attacks that exploit client-side deduplication, allowing an attacker to gain access to arbitrary size files of other users based on a very small hash signature of these files. More specifically, an attacker if he knows the hash signature of a file can convince the storage service that it owns that file, hence that server lets the attacker download the entire file.

3) DupLESS: Server-Aided Encryption for Deduplicated Storage :

Cloud storage service providers such as Dropbox and others perform the deduplication to save space by only storing one copy of each file uploaded on it. Should clients conventionally encrypt their files, however their savings are lost. Message locked encryption (the prominent manifestation of which is convergent encryption) resolves this all the tension. However it is inherently subject to the brute force attack that can recover files falling into some known set. We propose an architecture which provides secure de-duplicated storage resisting brute-force attacks too, and realize it in a system called DupLESS . In DupLESS, client encrypt under message based keys obtained from key server via an oblivious PRF protocol. It enables the client for storing encrypted data with an existing service,that have the service perform deduplication on their behalf, and yet achieves strong confidentiality guarantees. We show that encryption for the de-duplicated storage can achieve the performance and the space savings close to that of using all the storage service with plaintext data.

4) Provable Data Possession at Untrusted Stores :

Introduce a model for provable data possession that is PDP which allows a client that has stored data at an untrusted server for the verification of the server possesses the original data without retrieving. The model generates the probabilistic proofs of the possession by sampling some random sets of blocks from the server, which drastically reduces I/O costs. The client maintains some constant amount of the metadata to verify the proof. The challenge or the response protocol transmits small and constant amount of the data, which minimizes the network communication. Thus, the PDP model for the remote data checking supports large data sets in widely-distributed storage systems.

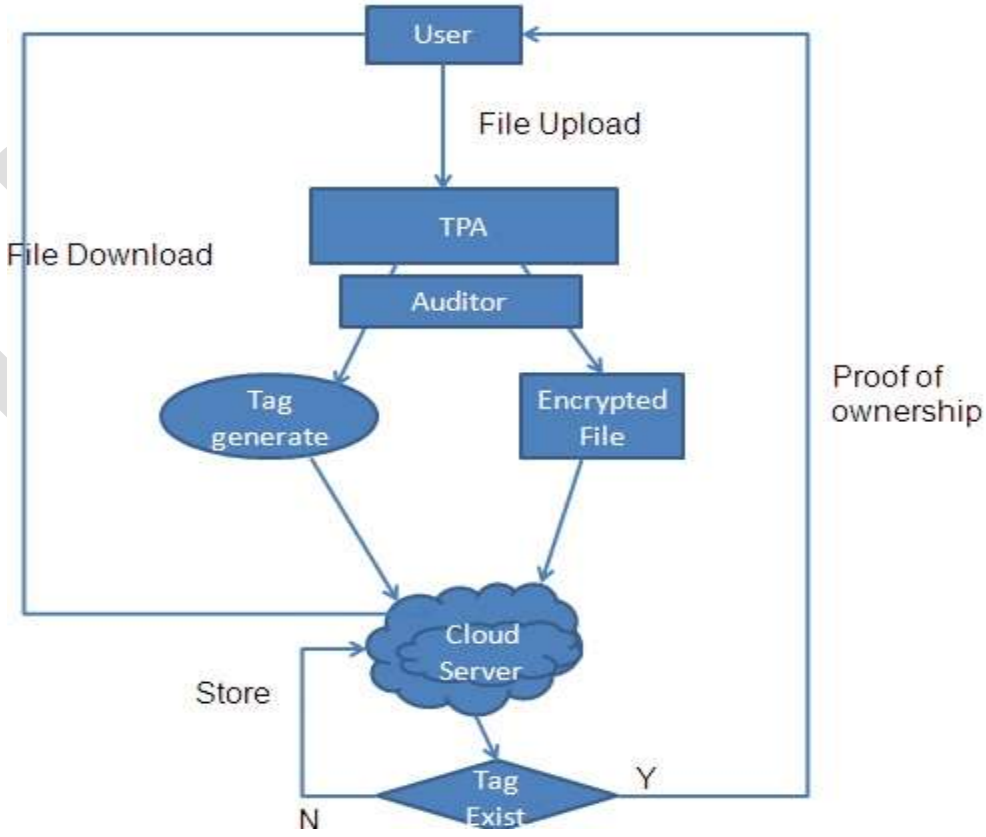
5) Remote Data Checking Using Provable Data Possession :

Introduce a model for provable data possession PDP and that can be used for remote data checking: A client that has stored the data at an untrusted server which can verify that the server possesses the original data without retrieving it. The model generates some probabilistic proofs of the possession by sampling the random sets of the blocks from the server, which drastically reduces the cost of I/O . The client maintains a constant amount of all metadata to verify proof. The challenge/response protocol transmits a small and constant amount of data and which minimizes the network communication. And thus, the PDP model for remote data checking is lightweight and supports large datasets in the distributed storage systems. The model is also robust in that it incorporates mechanisms for the mitigating arbitrary amounts of data corruption.

EXISTING SYSTEM:

We determine that SecCloud framework has accomplished both integrity auditing and file deduplication. Be that as it may, it can't keep the cloud servers from knowing the substance of files having been put away. In other words, the functionalities of integrity auditing and secure deduplication are just forced on plain files. In this area, we propose SecCloud+, which takes into account integrity auditing and deduplication on scrambled files. Framework Model Compared with SecCloud, our proposed SecCloud+ involves an extra trusted element, to be specific key server, which is in charge of assigning customers with mystery key (according to the file content) for encrypting files. This construction modeling is in line with the late work. However, our work is distinguished with the past work by allowing for integrity auditing on encoded data. SecCloud+ takes after the same three protocols (i.e., the file uploading protocol, the integrity auditing protocol and the proof of proprietorship protocol) as with SecCloud. The main distinction is the file uploading protocol in SecCloud+ involves an extra stage for correspondence between cloud customer and key server. That is, the customer needs to speak with the key server to get the merged key for encrypting the uploading file before the phase in SeeCloud.

SYSTEM ARCHITECTURE:



Achievement of integrity and avoiding duplication is the main task we are focusing, we are going enhance it by adding block level deduplication and providing reliability of data also. That is,

1. Improve Reliability:

In this we consider deduplication system improves storage utilization while reducing reliability hence we formalize the notion of distributed reliable deduplication system. A new distributed deduplication systems which are with the higher reliability in which the data chunks are distributed across multiple cloud servers such as block.

2. Block-level deduplication:

We consider block level deduplication in that file is divided into block and check deduplication for block.

For encryption we are going to use Asymmetric Encryption Key Algorithm RSA.

CONCLUSION

Aiming to achieving both data integrity and deduplication in cloud, we propose SecCloud and SecCloud+. SecCloud introduces an auditing substance with maintenance of a MapReduce cloud, which assists customers with generating data labels before uploading and additionally reviews the integrity of data having been put away in cloud. Furthermore, SecCoud empowers secure deduplication through introducing a Proof of Ownership protocol and preventing the leakage of the side channel information in the data deduplication. Contrasted and past work, the calculation by client in SecCloud is incredibly diminished during the file uploading and auditing stages. SecCloud+ is a propelled development persuaded by the way that clients constantly need to encode their data before uploading, and takes into account integrity auditing and secure deduplication straightforwardly on scrambled data.And we are providing block level deduplication and reliability as well.

REFERENCES:

1] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and M. Zaharia, "A view of cloud computing," Communication of the ACM, vol. 53, no. 4, pp. 50–58, 2010.

[2] J. Yuan and S. Yu, "Secure and constant cost public cloud storage auditing with deduplication," in IEEE Conference on Communications and Network Security (CNS), 2013, pp. 145–153.

[3] S. Halevi, D. Harnik, B. Pinkas, and A. Shulman-Peleg, "Proofs of ownership in remote storage systems," in Proceedings of the 18th ACM Conference on Computer and Communications Security. ACM, 2011, pp. 491–500.

[4] S. Keelveedhi, M. Bellare, and T. Ristenpart, "Dupless: Server- aided encryption for deduplicated storage," in Proceedings of the 22Nd USENIX Conference on Security, ser. SEC'13. Washington, D.C.: USENIX Association, 2013,pp.179194.[Online].Available:https://www.usenix.org/conference/usenixsecurity13/technicalsessions/presentation/bellare

[5] G. Ateniese, R. Burns, R. Curtmola, J. Herring, L. Kissner, Z. Peterson, and D. Song, "Provable data possession at untrusted stores," in Proceed- ings of the 14th ACM Conference on Computer and Communications Security, ser. CCS '07. New York, NY, USA: ACM, 2007, pp. 598– 609

[6] M. Bellare, S. Keelveedhi, and T. Ristenpart, "Message-locked encryption and secure deduplication," in *Advances in Cryptology – EUROCRYPT 2013*, ser. Lecture Notes in Computer Science, T. Johansson and P. Nguyen, Eds. Springer Berlin Heidelberg, 2013, vol. 7881, pp.296–312.

[7] J. Li, X. Chen, M. Li, J. Li, P. Lee, and W. Lou, "Secure deduplication with efficient and reliable convergent key management," *IEEE Transactions on Parallel and Distributed Systems*, vol. 25, no. 6, pp.1615–1625, June 2014.

[8] Jingwei Li, Jin Li, Dongqing Xie and Zhang Cai , "Secure Auditing and Deduplicating Data in Cloud" IEEE TRANSACTIONS

ON COMPUTERS VOL: PP NO: 99 YEAR 2015.

[9] Y. Zhu, H. Hu, G.-J. Ahn, and M. Yu, "Cooperative provable data possession for integrity verification in multicloud storage," IEEE
Transactions on Parallel and Distributed Systems, vol. 23, no. 12, pp. 2231–2244, 2012.

[10] Q. Wang, C. Wang, J. Li, K. Ren, and W. Lou, "Enabling public verifiability and data dynamics for storage security in cloud computing," in *Computer Security – ESORICS 2009*, M. Backes and P. Ning, Eds., vol. 5789. Springer Berlin Heidelberg, 2009, pp. 355–370.

[11] J. Douceur, A. Adya, W. Bolosky, P. Simon, and M. Theimer, "Reclaiming space from duplicate files in a serverless distributed file system," in *22nd International Conference on Distributed Computing Systems*, 2002, pp. 617–624.

[12] Huaqun Wang "Proxy Provable Data Possession in Public Clouds" IEEE TRANSACTIONS ON SERVICES COMPUTING, VOL. 6, NO. 4, OCTOBER-DECEMBER 2013, 551-559

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Image Segmentation using Hybrid Particle Swarm Optimization & Penalized Fuzzy C-Mean Clustering

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Abstract- In this work image segmentation is used to find the region of interest (ROI). In this process image is divided into different segments. The segments have to be divided on the basis of the similarity. The images used for this has to be segmented in a proper way so that hidden information from medical images can be extracted. The main problem in segmentation is that after segmentation the edges and the logical information from images get dispersed. To overcome the issue of the image segmentation the penalty based fuzzy c-mean clustering has been implement which segment the regions of the image on the basis of penalty value defined in the algorithm. For increase the performance of a particular algorithm artificial intelligence approaches have to be implement that optimize the results of the purposed algorithm by using fitness evaluation for each value of the image.

Keyword: Medical Image Segmentation, Types of segmentation, PFCM, PSO, GA, PSNR etc,.

1. INTRODUCTION

1.1 Image Segmentation: Picture division assumes an imperative part in picture investigation, showing up in numerous applications including example distinguishment, object discovery, and restorative imaging. Picture division intends to parcel a picture into important district as for a specific application and comparing to individual surfaces, articles, or characteristic parts of articles. All in all, picture division is the first stage in picture examination which looks to streamline the information into its essential part components or protests inside the scene.

1.2 Types of Image Segmentation

1.2.1 Colored Image: Shade Image Segmentation calculation The human eyes have customizability for the shine, which we can just recognized handfuls of ash scale anytime of complex picture, yet can recognize a huge number of shades. Much of the time, just use ash Level data cannot extricate the focus from foundation; we should by method for shade data. Likewise, with the quickly change of PC handling capacities, the shade picture transforming is being more concerned by individuals.

1.2.2. Gray-scale Image Segmentation: The segmentation of image raster data into connected regions of common gray-scale has long been seen as a basic operation in image analysis. In texture analysis, just this type of segmentation is possible after individual pixels in an image have been labeled with a numeric classifier.

1.2.3. Text Segmentation:: It is remarkable that content extraction, including content identification, limitation, division and distinguishment is essential for feature auto-understanding. Content division, that is to discrete content pixels from complex foundation in the sub-pictures from features. Content division in feature pictures is significantly more troublesome than that in filtering pictures..

1.3 Techniques Used

1.3.1 PFCM- Penalized Fuzzy C-Means (PFCM) algorithm for clustering gene expression data is introduced in this paper, which modified Fuzzy C-Means (FCM) algorithm to produce more meaningful fuzzy clusters. Genes are assigned a membership degree to a cluster indicating its percentage association with that cluster. The two algorithms differ in the weighting scheme used for the contribution of a gene to the mean of the cluster. FCM membership values for a gene are divided among clusters in proportion to similarity with that clusters mean. The contribution of each gene to the mean of a cluster is weighted, based on its membership grade. Membership values are adjusted iteratively until the variance of the system falls below a threshold. PFCM algorithm helps in identifying hidden pattern and providing enhanced understanding of the functional genomics in a better way.

1.3.2 Hybrid PSO: To overcome the limitations of PSO, hybrid algorithms with GA are proposed. The basis behind this is that such a hybrid approach is expected to have merits of PSO with those of GA. One advantage of PSO over GA is its algorithmic simplicity. Another clear difference between PSO and GA is the ability to control convergence. Crossover and mutation rates can subtly affect the convergence of GA, but these cannot be analogous to the level of control achieved through manipulating of the inertia weight. In fact, the decrease of inertia weight dramatically increases the swarm's convergence. The main problem with PSO is that it prematurely converges to stable point, which is not necessarily maximum. To prevent the occurrence, position update of the global best particles is changed. The position update is done through some hybrid mechanism of GA.

GA: Genetic Algorithms are a family of computational models inspired by evolution. These algorithms encode a potential solution to a specific problem on a simple chromosome-like data structure and apply recombination and mutation operators to these structures so as to preserve critical information. An implementation of a genetic algorithm begins with a population of chromosomes. One then evaluates these structures and allocates reproductive opportunities in such a way that those chromosomes which represent a better solution to the target problem are given more chances to reproduce than those chromosomes which are poorer solutions. The goodness of a solution is typically defined with respect to the current population.

2. PURPOSE OF THESIS WORK

Medical images are very difficult to process because in medical field minute details of image are also matter a lot that's why they need to be divided in such a manner so that their minute details can be easily examined. To divide the image into parts or we can say that segments the technique is called as segmentation. In this work image segmentation is used to find the region of interest (ROI). In this process image is divided into different segments. The segments have to be divided on the basis of the similarity. The images used for this has to be segmented in a proper way so that hidden information from medical images can be extracted. The main problem in segmentation is that after segmentation the edges and the logical information from images get dispersed. To overcome the issue of the image segmentation the penalty based fuzzy c-mean clustering has been implement which segment the regions of the image on the basis of penalty value defined in the algorithm. For increase the performance of a particular algorithm artificial intelligence approaches have to be implement that optimize the results of the purposed algorithm by using fitness evaluation for each value of the image.

3. OVERVIEW OF FINAL APPROACH

In proposed work the image segmentation is done to divide image into various segments to exact hidden information and logical data from the input image. In this process various approaches has been used. In this research work main motive is to use medical images for segmentation purposes. To process segmentation the different steps has been carried out. In these steps the statically histogram of the image has to be find out for extraction of intensity level of particular image at each and every pixel set. in second step the clusters has been form on the basis on histogram using k-mean clustering approach which computers neighbor pixel values and develop different pixels into different clusters. When clustering is done image has been used for segmentation process using penalized fuzzy c mean clustering (PFCM) approach for segmentation. To achieve better results of segmentation the coefficients extracted by PFCM has been optimized using Genetic Algorithm (GA). PSO is faster in finding quality solutions. It faces some difficulty in obtaining better quality solutions while exploring complex function. The drawback of PSO is that the swarm may prematurely converge. To overcome the limitations of PSO hybrid algorithms with GA are used. Advantage of PSO over GA is its algorithmic simplicity and ability to control convergence. After this parameter analysis has been done by computing PSNR and MSE from the input and segmented image.

4. RESULTS AND DISCUSSIONS

In the proposed work different medical images has been used for image segmentation process. In these MRI medical images of different body parts have been captured for image segmentation process. These are 300 images of different body parts have been available. These images are of heart, lungs, head, brain, and knee. These image have been segmented by using the Fuzzy C-mean clustering approach that use the gray lever pixel values for finding the centre value on the basis of objective function. FCM approach is much sensitive to noise. So to reduce the affect of noise the image segmentation has been done by using the PFCM approach that utilizes the penalty factor that is based on the NEM algorithm.

Fig 4.1 GUI

Fig 4.1 represents graphical user interface of the proposed work. This figure represents the graphic user interface designed for image segmentation system. In this various graphic user interface control buttons have been used for image segmentation. These buttons performs various tasks for image segmentation. In this various axes and edit boxes have been used for handling the various operations of image segmentation.

Fig. 4.2 represents the input image

Fig 4.2 represents the input image which is selected on clicking on the browse button. This figure represents the input image that has been selected for image segmentation process. This image has been preprocessed and undergoes the operation of image segmentation process.

Fig 4.3 Conversion of input image to gray scale image

Fig 4.3 represents the conversion of input image to gray scale image. Input image is of RGB form and it has to be converted into gray scale. This figure represents the image that has been converted from true color image to gray scale image. The luminance of the image has been converted by using three true colors of the image that are red, green and blue.

Fig 4.4 represents that the FCM segmentation is applied on gray scale image.

This figure represents the image segmented by using the FCM approach. This approach computes the objective function value for image segmentation process. The objective function of FCM uses the gray level pixel values intensity for image segmentation process. On the basis of the objective function and the clusters the centre values have been computed that helps for image segmentation.

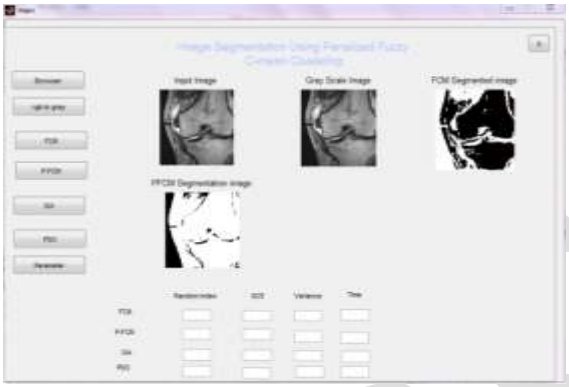


Fig 4.5 image Segmentation using PFCM approach

This figure represents the image segmentation using PFCM approach. The FCM approach is very much noise sensitive. In the PFCM approach different parameters and NEM algorithm is used for maximizing the spatial domain features. In this figure the penalty factor is computed and added to objective function of PFCM.

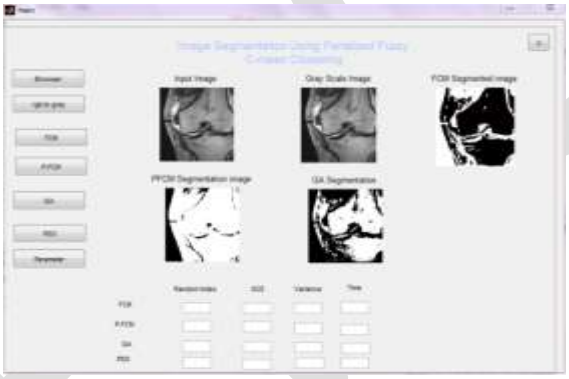


Fig 4.6 optimization of image Segmentation using hybrid PSO approach

This figure represents the image that has been segmented by using PFCM approach that has been optimized by using the different hybrid PSO approach. In the hybrid PSO approach the fitness function has been used that computes the particle best and global best for whole image. The global best value is best value for image segmentation approach

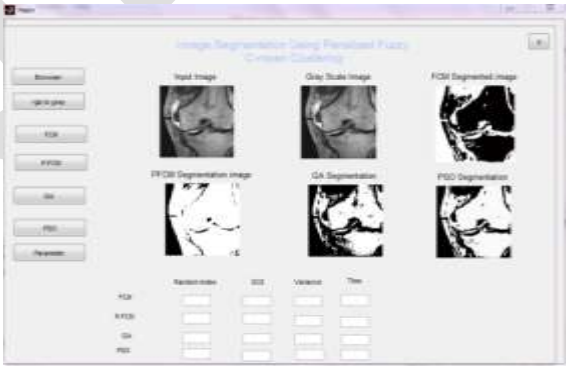
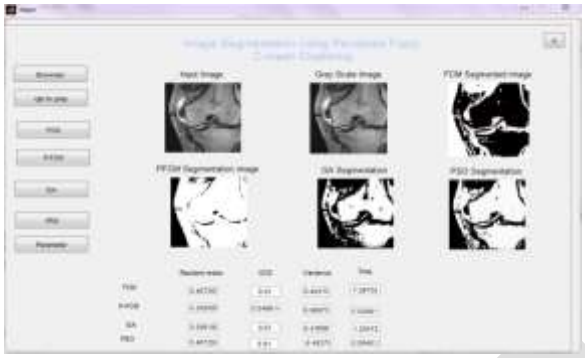


Fig 4.7 Parameter analysis for different approaches

This figure represents various parameters for image segmentation. In this image various parameters have been evaluated for performance evaluation of purposed work. The parameter random index, GCE, and variance have been computed. These parameters have been essential for image segmentation process.



5. PARAMERERS

PSNR: PSNR stands for peak signal to noise ratio. The term peak signal-to-noise ratio (PSNR) is an expression for the ratio between the maximum possible value of a signal and the power of distorting noise that affects the quality of its representation. PSNR is usually expressed in terms of the logarithmic decimal scale. PSNR is used to measure the quality of image (stego-image). The signal or input in this case is the original data, and the noise is the error introduced by compression. The PSNR is defined as:

$$\mathrm{PSNR} = 10.\log_{10}\left(\frac{\mathrm{MAX}_1^2}{\mathrm{MSE}}\right)$$

$$= 20.\log_{10}\left(\frac{\mathrm{MAX}_1}{\sqrt{\mathrm{MSE}}}\right)$$

$$= 20.\log_{10}(\mathrm{MAX}_1) - 10.\log_{10}(\mathrm{MSE})$$

Although a higher PSNR generally indicates that the good quality of image. PSNR is most easily defined via the mean squared error (MSE). Here, MAX_I is the maximum possible pixel value of the image. When the pixels are represented using 8 bits per sample, this is 255. In this expression, PSNR is inversely proportional to the MSE, if the PSNR is high then MSE is low and if the PSNR is low then MSE is high.

MEAN SQUARED ERROR: Mean squared error (MSE) of an estimator measures the average of the squares of the "errors", that is, the difference between the estimator and what is estimated. It is basically a difference between the cover image and stego image. If the value of MSE is low, then the quality of the stego image is better. In an analogy to standard deviation, taking the square root of MSE yields the root-mean-square error or root-mean-square deviation (RMSE or RMSD), which has the same units as the quantity being estimated; for an unbiased estimator.
The MSE is defined as:

$$\mathrm{MSE} = \frac{1}{\mathrm{mn}}\sum_{\mathrm{i}=0}^{\mathrm{m}-1}\sum_{\mathrm{j}=0}^{\mathrm{n}-1}[\mathrm{I}(\mathrm{i},\mathrm{j}) - \mathrm{K}(\mathrm{i},\mathrm{j})]^2$$

6. CONCLUSION

The Goal of our research is to use medical images for segmentation purposes. To process segmentation the different steps has been carried out. In these steps the statically histogram of the image has to be find out for extraction of intensity level of particular image at each and every pixel set. in second step the clusters has been form on the basis on histogram using k-mean clustering approach which computers neighbor pixel values and develop different pixels into different clusters. When clustering is done image has been used for segmentation process using penalized fuzzy c mean clustering (PFCM) approach for segmentation. To achieve better results of segmentation the coefficients extracted by PFCM has been optimized using Genetic Algorithm (GA). In GA it evaluated fitness function on the basis of chromosomes and genes. PSO is faster in finding quality solutions. It faces some difficulty in obtaining better quality solutions while exploring complex function. The drawback of PSO is that the swarm may prematurely converge. To overcome the limitations of PSO hybrid algorithms with GA are used. Advantage of PSO over GA is its algorithmic simplicity and ability to control convergence. On the basis of this we evaluate various parameters like PSNR, MSE & on the basis of these parameters it concludes our system gives us better results.

REFERENCES:

1. Abishek Gupta, Ajesh Nag, Jaten Savani "Evolutionary Approach and Spline Interpolation for Contrast Enhancement" IEEE Second International Conference on Image Information Processing, pp. 181-186,2013.
2. Peng Fengb "Enhancing retinal image by the Contourlet transform", IEEE Conf. on Counterlet transform, 2007, pp 516–522.
3. Alejandro F. Frangi "Multiscale vessel enhancement filtering", IEEE Conf. on enhancement, 1998, pp 130-137.
4. Muneer Ahmad "An Integrated Approach for Medical Image Enhancement using Wavelet Transforms and Image Filtering", IEEE Conf. on Life Science Journal, 2014, pp 6-11.
5. Alex F. de Araujo "New artificial life model for image enhancement", IEEE Conf. on image enhancement, 2013, pp 6-16.
6. Swagatam Das1, "Bacterial Foraging Optimization Algorithm: Theoretical Foundations, Analysis, and Applications", IEEE Conf. on BFOA, 2014, PP 31-40.
7. Nik Shahidah Afifi Bt Md Taujuddin " Enhancement of Medical Image Compression by using Threshold Predicting Wavelet-Based Algorithm", IEEE Conf. on Medical Imahges, 2011, pp 43-52.
8. Janani, V. ; Dinakaran, M. "Infrared image enhancement techniques- A review", in Current Trends in Engineering and Technology (ICCTET), 2014, ISBN 978-1-4799-7986-8, pp 167-173.
9. Bhattacharya, S; Gupta, S.; Subramanian, V.K. "Localized image enhancement", 2014, pp 1-6.
10. Suprijanto; Gianto ; Juliastuti, E. ; Azhari "Image contrast enhancement for film-based dental panoramic radiography", IEEE International Conference on System Engineering and Technology, 2012, pp 1-5.
11. Hasikin, K, Isa, N.A.M. "Enhancement of the Low Contrast Image Using Fuzzy Set Theory" IEEE 14th International Conference on Computer Modelling and Simulation, pp. 371-376, 2012.
12. Wang Xianghong, Yang Shi-e, Xu Xinsheng "An Effective Method to Colour Medical Image Enhancement" IEEE International Conference on Complex Medical Engineering, pp. 874-877, 2007

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Using Median Filter Systems for Removal of High Density Noise From Images

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Abstract— An Efficient algorithm for median filter for removal or improvement of gray scale images that square measure highly corrupted salt and pepper noise is proposed during this paper. Noise in image square measure represent by the pixel value 0's and 255's that square measure shows that black and white dot in image. In proposed algorithm take an image and choose 3x3 size window and 5x5 size window and processing or center pixel value check if its value is 0's or 255's then image is corrupted otherwise noise free image. If image is noisy and processing pixels neighboring pixel value is between 0's and 255's then we tend to replace pixel value with the median value and if processing pixels neighboring pixel value is 0's or 255's then we tend to replace pixel value with the mean value. Further increased the window of size 5x5 and once more repeat given process until image is denoised. The proposed filter algorithm with 3x3 and 5x5 patch shows higher parametric values as compared to the standard median filter with 3x3 and 5x5 patch for Lena image. The simulation result shows higher and efficient performance of Peak signal to noise ratio and Mean Square Error and Image enhancement factor.

Keywords— Standard median filter, Salt and Pepper Noise, Unsymmetric trimmed median filter, Peak signal to noise ratio, Mean square error, Image enhancement factor.

I. Introduction

Images area unit corrupted by noise chiefly throughout image acquisition and/or transmission. Impulse noise is one amongst those noises, that is generated throughout imaging because of faulty shift wherever fast transients area unit gift. Impulse noise denoising is a critical issue in case of digital image processing [1]. The appearance of image is considerably affected even at density of impulse noise. There are 2 kinds of impulse noise, they're salt and pepper noise and random valued noise. Noise removal is achieved by using a number of existing linear filtering techniques which are mathematically simple. A significant category of linear filters minimizes the mean square error (MSE) criterion. These linear filtering techniques work well once noise is additive. These techniques fail when noise is non additive and are not effective in removing impulse noise. Non-linear filtering techniques area unit enforced wide as a result of their superior performance in removing salt and pepper noise and conjointly conserving fine details of image. There are many works on the restoration of images corrupted by salt and pepper noise. The median filter was once the foremost common non-linear filter for removing impulse noise, due to its smart denoising power and procedure potency. Median filters are known for their capability to remove impulse noise as well as preserve the edges.

Images are often corrupted by impulse noise Image noise is any degradation in an image signal while an image is being sent from one place to another place via satellite, wireless and network cable etc. error occurs in image signal while an image is being sent electronically from one place to another place, for example an image transmitted using a wireless network might be corrupted as a result of lighting or other atmospheric disturbance[2].Impulse noise are classified into two categories: fixed valued impulse noise and random valued impulse noise. Impulse noise the pixel value of a noisy pixel takes either maximum or minimum gray level [3]. Gray scale images are distinct from one –bit black and white images, which in the context of computer imaging are images with only the two colors, black and white (also known as binary images). Gray scale images have many shades of gray in between 0 and 255. In random value impulse noise, noisy pixel value is in the range of [0,255] for gray scale images. In this paper we focus only on removing fixed value impulse noise.

II. LITERATURE SURVEY

Removing impulse noise there are many linear and nonlinear filtering techniques.
In Median filter (MF) [4] is used to reducing noise. It is used to remove noise in image for only low noise density. This filter performance is poor. The Standard Median Filter (SMF) is used to remove only low noise densities but high noise densities its performance is poor and image is not cleared.
In Adaptive Median Filter (AMF) [5] [6] "Salt & Pepper Impulse Detection and Median based Regularization using Adaptive Median Filter". New Adaptive 2D spatial filter operators for the restoration of salt & pepper impulse noise are corrupted digital images. Its performance is better as compare to SMF but high noise densities the window size has to be increased, so images are blurring.
Weighted Median Filter (WMF) [7] is also used to removal salt and pepper noise and its performance is good for low density noise but high density noise images are not clear.
In Center Weighted Median Filter (CWMF) [8] weights are assigned to selected pixels in the filtering window in order to control the filtering behavior but at high noise density filters fails to reproduce the original image with edge details. Centre weighted median filter and Recursive Weighted Median Filter (RWMF) are used to improve the performance of the median filter. It also give more weight to some selected pixel in window and exhibits blurring of filtered images [9].To overcome this problem in Adaptive Center Weighted Median Filter (ACWMF) but in this filter we need some threshold values [4].
To remove the threshold problem in Tri-State Median Filter (TSMF) [10].In this filter images noise detection by an impulse detector, this takes the outputs from the SMF and CWMF and compare with the center pixel value and origin value in order to make a tri-state decision. The switching logic is controlled by a threshold T and the output of TSM filter.
Directional Weighted Median Filter (DWMF), are used to remove impulse noise and this filter is also used to identify noisy pixel using all four directional information of the selected pixel to calculate the median. In this method, two major steps: Detect noisy pixel using new impulse detector and Utilize weighted directional calculate the median for removing impulse noise and preserve details [11].
Decision Based Algorithm (DBA) is also known as Switching Median Filter (SMF) [11]. In this filter is used to minimize the undesired alteration of uncorrupted pixels by the filter. Overcome this problem, switching median filter checks each input pixel whether it has been corrupted by impulse noise or not. Then it will be change only the intensity of noisy pixel candidates, while left the other pixels unchanged the decision is based on a threshold value. This filter repeated replacement of neighboring pixel produces streaking effect [12].
In Decision Based Unsymmetrical Trimmed Median Filter (DBUTMF) is used to overcome streaking effect problems, but the trimmed median of the 3x3 window will not provide the best result for the noisy pixel [13].
In Modified Decision Based Unsymmetrical Trimmed Filter (MDBUTMF) is used to remove image details such as thin lines and corners while problem of DBUTMF, But in this filter performance is not best [14].
In Decision-based Average or Median filter (DAM) [15] Combine the advantages of the [16] and adaptive median filter in order to achieve better result. DAM has a good trade-off between quantitative and qualitative properties of the recovered image and computation time. And this method noisy pixel values are replaced by average and median of the neighbor's value.
Modified Non-Linear Filter (MNLF) is also used to remove impulse noise. In this method the noisy pixel are replaced by trimmed median value when other pixel are not all 0's or 255's. But if the all the pixel value are 0 or 255 then this method increases the window size and then trimmed median value is calculated and noisy pixel is replaced [17].
All this filters fail at low and high noise density. The proposed filter achieves best performance value of Peak Signal to noise ratio (PSNR) and MSE values.

III. PROPOSED FILTER

The proposed algorithm is divided into two parts first is addition of noise and second is filtering operation. The projected Median filter can be a easy and powerful non-linear filter. Median filter is employed for reducing the number of intensity change between one pixel and therefore the other different pixel. During this filter, if image is noisy and processing pixels surrounding pixel value is lies between 0's and 255's then we tend to exchange pixel value with the median of it. The median of selected window from given pixel value is calculated by arranging all the pixel values into increasing order and then replace the pixel being calculated with the processing pixel value. And if processing pixels neighboring pixels value in the selected window contains all 0's or 255's then we tend to replace pixel value with the mean value which can be calculated by arranging all the pixel values into increasing order and then replace the pixel which is calculated with the processing pixel value. Further Increased the window of size 5x5 and once more repeat the given process until image is Denoised.

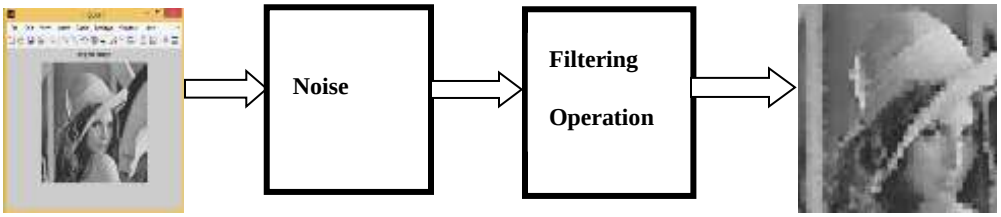

Figure 1: Block diagram of proposed system

IV. Proposed Filter Algorithm-

Step 1): Initially Read Noisy Image.

Step 2): Noise Detection Condition

If 0<P (i, j) < 255 / Noise free

Then, Send to de-noised or restore

Step 3): Choose window of size 3x3 with center element as processing pixel. Assume that the pixel being processed is P (i, j).Check the pixel value.

Step 4): If P(i,j) = 0 or P(i,j) = 255, then P(i,j) is a corrupted pixel.

Step 5): Apply Conditions

Case i): If target pixel P (i, j) neighboring all pixels are 0's or 255's then go to step 6 for Noise Removal

Case ii): if target pixel Y (i, j) neighboring all pixels are combinations of 0's and 255's then Go to step 7 for Removal of Noise.

Step 6): If all the elements in the selected window are 0"s and 255"s, then take all surrounding pixel P (i, j) after that arrange in increasing order and calculate the mean of the elements in the window. This mean value is replace by processing pixel P (i.j) and go to step 8.

Step 7): If processing pixel and neighboring pixel value contains some combination of 0's and 255's then eliminate 0's and 255's from the selected window and find the median value of the remaining elements. Replace P (i, j) with the median value and go to step 8.

Step 8): Image is restored.

Step 9: Repeat a process for every pixel for 5x5 window.

V. Methodology Of Proposed Work

In our proposed system we had implemented decision based filter and unsymmetric trimmed median filter, for every test image initially we had applied noise addition technique, then we had performed filtering algorithms using decision based filter and unsymmetric trimmed median filter and image is restored. This restored image we had compared with Peak signal to noise ratio, mean square error, image enhancement factor, our system has more efficient than other existing methods such as median filter. The proposed Median Filter Algorithm was processes to detect noise and remove 90% noise in given image as compare to previous algorithm.
Ex: - Case i): If target pixel P(i, j) value is maximum (i.e.255) gray level and its neighboring pixel are also maximum value or salt noise.

To remove the salt noise there are two phases

1) If we take median value it will be 255, which is again noisy pixel.

2) If we take mean value it will be 255, which is also noisy pixel again.

To solve this problem the target pixel is replace by the pepper noise mean value.

255 255 255

255 255 255

255 255 255

Case ii):- If target pixel P (i, j) value is minimum (i.e.0) gray level and its neighboring pixel are also minimum value or salt noise.

To remove the salt noise there are two phases

1) If we take median value it will be 0, which is again noisy pixel.

2) If we take mean value it will be 0, which is also noisy pixel again.

To solve this problem the target pixel is replace by the salt noise mean value.

0 0 0

0 0 0

0 0 0

Case iii):- if target pixel value in selected window is max/min gray level (0/255) and neighboring pixel contains all that adds 0 and 255 to the image.

To remove noise use following steps:

1) Take the selected window 3x3 all pixel value instead of target pixel in1-D array.

[255, 255, 255, 0, 255, 255, 0, 255]

2) Now this array element is sorting in ascending order.

[0, 0, 255, 255, 255, 255, 255, 255]

3) Now we find the mean value of this array is 159.

4) Hence replace the target pixel value by 159.

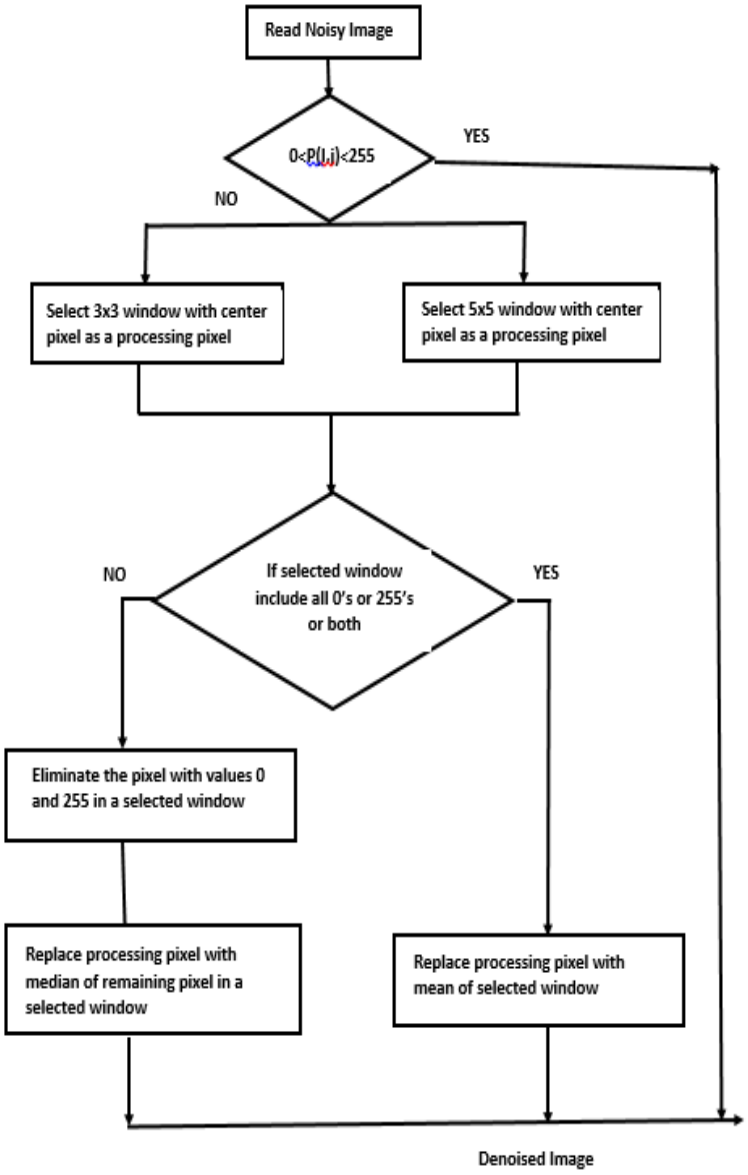

Figure 2: Flow Chart of Proposed System

Case iv):-If target pixel value is maximum (i.e.255) or minimum (i.e.0) gray level and its neighbor some pixel contains salt and pepper noise to the image.

In this case to remove noise use following steps:

1) Take the selected window 3x3 all pixel value instead of target pixel in1-D array.

[90, 80, 85, 40, 0, 255, 50, 255]

2) Now these array elements is sorting in ascending order and also remove salt and pepper value.

[40, 50, 80, 85, 90]

3) Now we find the median value of this array is 70.

4) Hence replace the target pixel value by 70.

70	80	85
40	255	0
255	50	255

Case v):-If the target pixel value in selected window is noise free value, so it does not require for processing.

50	70	90
10	80	40
60	30	20

VI. SIMULATION RESULT

The performance of the implemented algorithm for 3x3 and 5x5 window size is tested with lenna.jpg grayscale image. We have used Matlab R2010 as the simulation tool. The noise density (intensity) is varied from 10% to 90% and performances are quantitatively measured by the Peak-Signal-to-Noise Ratio (PSNR), Mean Square Error (MSE) and Image Enhancement Factor (IEF).

Performance parameter: - For comparing original image and filtered image, we calculate following parameters:

1) Peak-Signal-to-Noise-Ratio (PSNR): PSNR could be a mathematical term to estimate the standard of reconstructed image as compared to that of original image. It is outlined as magnitude relation between most maximum power of signal (original data) and power of corrupting noise (error in reconstruction). Peak signal to noise magnitude relation is often calculated in terms of index decibel scale. Higher PSNR shows that image reconstruction is of upper quality.

$$PSNR\ in\ db = 10\log_{10}\left(\frac{255^2}{MSE}\right) \quad \text{.....(1)}$$

2) Mean Square Error (MSE): The two major error metrics that are used to compare the various image compression methods are the PSNR (Peak Signal to Noise Ratio) and the MSE (Mean Square Error). MSE is the accumulative squared error between compressed image and original image.

$$MSE = \frac{\sum\sum(Y(x,y)-(\hat{Y}(x,y))2}{MN} \quad \text{..... (2)}$$

Where MSE stands for mean square error, M x N, is size of the image, Y represents the original image and Ŷ denotes the Denoised image.

3) Image Enhancement Factors (IEF): The image enhancement factor is the statistical approach used to measure the effectiveness of the process used in the restoration of images. The higher the value of IEF better the process of conversion.

$$IEF = \frac{\sum\sum(\in(x,y)-(Y(x,y))2}{\sum\sum\widetilde{(Y(x,y)-Y(x,y))2}} \quad \text{..... (3)}$$

The simulation results for PSNR (Peak Signal to Noise Ratio) are show in table 1 for standard median filter and implemented algorithm with 3x3 and 5x5 patch for high (95%) level noise density for Lena image.

PSNR (db)				
% of Noise	Median filter		Proposed Filter	
	3x3	5x5	3x3	5x5
50	15.081	20.975	27.568	25.675
60	12.343	17.805	25.848	24.858
70	10.027	13.901	23.345	23.965
75	8.893	11.733	21.326	23.412
80	8.159	10.271	18.629	23.105
85	7.379	8.844	17.805	22.239
90	6.655	7.500	15.837	20.507
95	6.007	6.355	13.878	17.667

Table 1: Comparison result for PSNR value with different Noise Densities for Lena image.

The simulation results for MSE (Mean square error) are show in table 2 for standard median filter and implemented algorithm with 3x3 and 5x5 patch for high (95%) level noise density for Lena image.

MSE				
% of Noise	Median filter		Proposed filter	
	3x3	5x5	3x3	5x5
50	2018.13	519.41	118.82	176.02
60	3791.21	1077.80	169.13	212.41
70	6462.09	2647.90	301.01	260.95
75	8389.94	4362.99	479.06	296.33
80	9934.63	6108.67	708.21	318.07
85	11888.8	8484.54	1077.80	388.27
90	14046.7	11562.7	1695.54	578.50
95	16303.7	15049.5	2661.9	1112.4

Table2: Comparison result for MSE value with different Noise Densities for Lena image.

The simulation results for IEF (Image enhancement factor) are show in table 3 for standard median filter and implemented algorithm with 3x3 and 5x5 patch for high (95%) level noise density for Lena image.

IEF				
% of Noise	Median filter		Proposed Filter	
	3x3	5x5	3x3	5x5
50	4.57	17.77	81.12	52.46
60	2.91	10.25	65.34	52.02
70	2.00	4.88	42.94	49.53
75	1.66	3.20	29.16	47.14
80	1.48	2.41	20.81	46.33
85	1.31	1.84	14.51	40.28
90	1.18	1.43	9.80	20.75
95	1.07	1.16	6.60	15.80

Table 3: Comparison result for IEF value with different Noise Densities for Lena image.

The comparison chart of PSNR value of standard median filter and implemented algorithm with 3x3 and 5x5 patch for different noise density with Lena image are shown in figure 3.

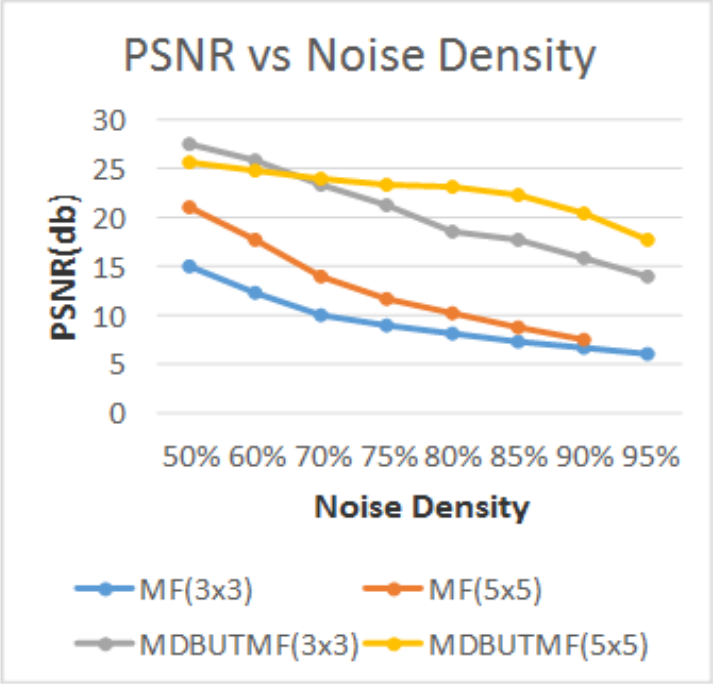

Figure 3: Comparison chart of PSNR and Noise density

The comparison chart of MSE value of standard median filter and implemented algorithm with 3x3 and 5x5 patch for different noise density with Lena image are shown in figure 4.

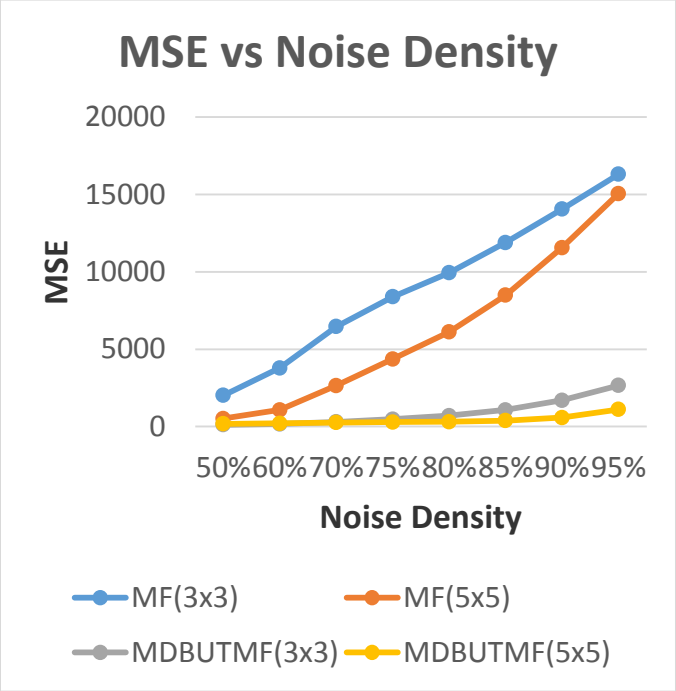

Figure 4: Comparison chart of MSE and Noise density

The comparison chart of IEF value of standard median filter and implemented algorithm with 3x3 and 5x5 patch for different noise density with Lena image are shown in figure 5.

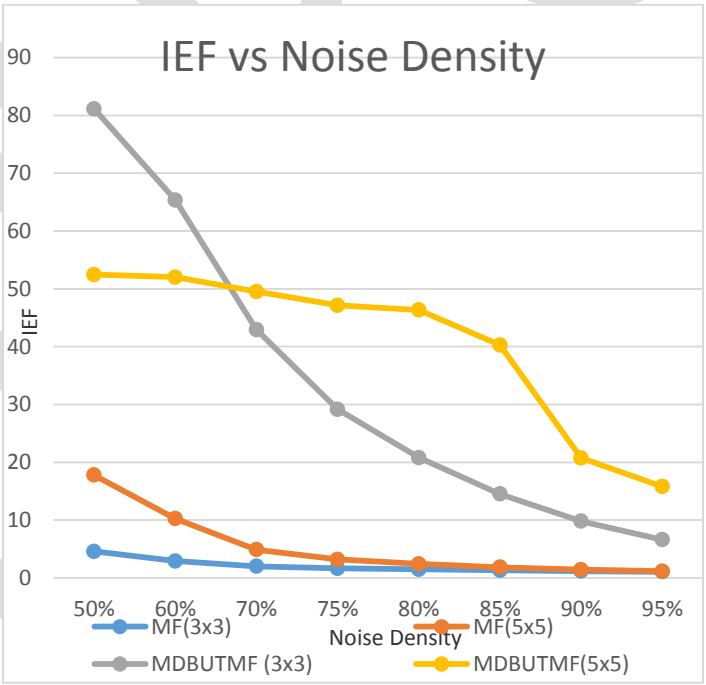

Figure 5: Comparison chart of IEF and Noise density

The performance of restored results of standard median filter and implemented algorithm with 3x3 and 5x5 patch for Lena image which is corrupted by 75% and 80% noise density as show in figure 7:

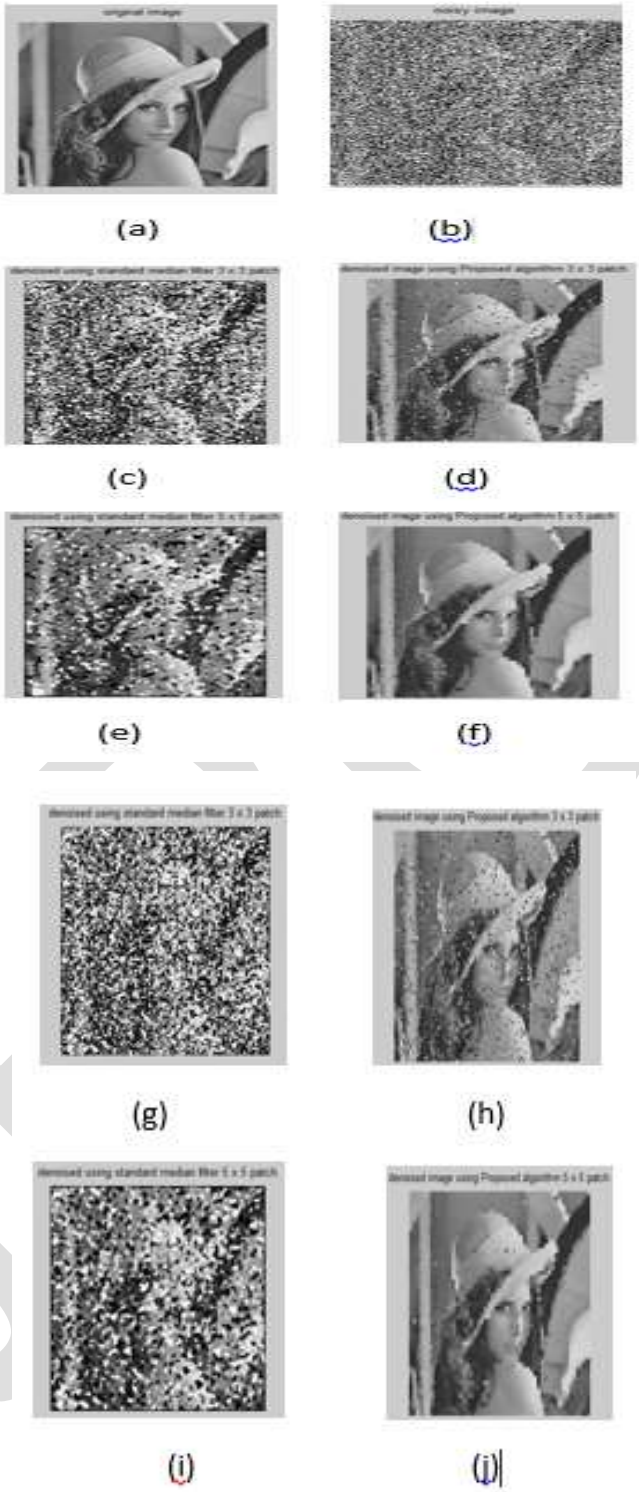

Figure 7: Result of the proposed filter and median filter for Lena image at 75% and 80% noise density. Column (a) original image (b) Corrupted image and (c) restored image using the standard median filter and implemented algorithm

CONCLUSION

In this paper we implemented new algorithm using median filter for removal of high density salt and pepper noise for gray scale image. The implemented filter algorithm with 3x3 and 5x5 patch shows higher parametric values as compared to the standard median filter with 3x3 and 5x5 patch for Lena image. The simulation result shows higher and efficient performance of Peak signal to noise ratio and Mean Square Error and Image enhancement factor.

REFERENCES:

[1] Castleman Kenneth R, Digital Image Processing, Prentice Hall, New Jersey, 1979.

[2] Reginald L. Lagendijk, Jan Biemond, Iterative Identification and Restoration of Images, Kulwer Academic, Boston, 1991.

[3] Scott E Umbaugh, Computer Vision and Image Processing, Prentice HallPTR, New Jersey, 1998.

[4] A.K.Jain, Fundamentals of digital image processing.Prentice-Hall, 1989

[5] Z. Wang and D. Zhang, "Progressive switching median filter for the removal of impulse noise from highly corrupted images," IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing, 1999, vol. 46, no. 1, pp.78-80.

[6] H. Ibrahim, "Adaptive switching median filter utilizing quantized window size to remove impulse noise from digital images," Asian Transactions on Fundamentals of Electronics, Communication and Multimedia, 2012, vol. 2, no. 1, pp. 1-6.

[7] T. Chen and H. R. Wu, "Adaptive impulse detection using center weighted median filters," IEEE Signal Process.Lett., vol. 8, no. 1, pp. 1–3, Jan.2001

[8] Review of Impulse Noise Reduction Techniques Manohar Annappa Koli Research Scholar, Department of Computer Science Tumkur university.1/fnoise,"BrownianNoise,"http://classes.yale.e du/9900/math190a/OneOverF.html, 1999.

[9] Arce G. and Paredes J., "Recursive Weighted Median Filters Admitting Negative Weights and Their Optimization", IEEE Trans. on Signal Processing, 48**,** No. 3, pp. 768-779, 2000

[10] Tao Chen, Kai-Kuang Ma, Li-Hui Chen "TriSstate Median Filter for Image Denoising" IEEE Transactions on Image Processing, Vol. 8, No. 12, December 1999, pp 1834-1838

[11] K.S. Srinivasan and D. Ebenezer, "A new fast and efficient decision based algorithm for removal of high density impulse noise," IEEE signal process, Lett. vol.14, no.3, pp.189-192, March 2007.

[12] Kaveri A.P. and K.J.Amrutkar, "Median filtering frameworks and their application to image enhancement", IJAIEM, volume 3, issue 3, March 2014.

[13] K. Aiswarya, V. Jayaraj, and D. Ebenezer, "A new and efficient algorithm for the removal of high density salt and pepper noise.

[14] Dr. G. Ramachandra Reddy, A. Srinivas, M. Eswar Reddy and, T.Sunilkumar "Removal of high density impulse noise through modified non linear filter"2013.

[15] A Jourabloo, AH Feghahati, M Jamzad, New algorithms for recovering highly corrupted images with impulse noise. Scientia Iranica 19(6), (2012). doi:10.1016/j.scient.2012.07.016

[16] Majid, A. and Tariq Mahmood, M. ''A novel technique for removal of high density impulse noise from digital images'', IEEE International Conference on Emerging Technologies, ICET, Islamabad, Pakistan, pp. 139–143 (2010).

[17] S. Esakkirajan, T. VeeraKumar, Adabala N. Subramanyam and C.H.Premchand,"Removal of high density salt and pepper noise through modified based asymmetric trimmed median filter", IEEE Signal processing letter,vol.18,no.5,may 2011.

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A Survey on an Optimal Data Compression Scheme & Enhanced Security techniques in Clustered Wireless Sensor Network

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Abstract: One of the main issues with the wireless sensor network is its data transmission rate. Latest technology of compressive sensing (CS) is a main research area under development. Compressive Sensing (CS) will reduce the rate of data transmissions and it can balance the traffic load along the whole networks. After all, while using the pure compressive sensing the total number of transmissions for data collection will be high. Inorder to cut short the rate of transmissions in sensor networks, hybrid method of Compressive Sensing (CS) is used. A light weight Enhanced Lossless Entropy Compression algorithm is used minimizing the amount data in sensor network. The major concern is security in WSN, So an advanced SET-IBS protocol is used to make the data efficient and more secure. This light weight algorithm will consumes less energy during the encryption and decryption of the data. This encryption takes less energy and therefore it is helpful to make the WSN efficient. In this survey, main focus is on optimization of energy in terms of lightweight security and compression techniques which reduces the complexity of Wireless Sensor network.

Keywords: Compressive Sensing, Lossless entropy Compression, Wireless Sensor Network ,Cluster Head, Base Station, SET-IBS protocol, Bit Error Rate

INTRODUCTION

Wireless Sensor Network mainly focus on monitoring the physical conditions with a number of sensor nodes. The sensors/actor nodes which are present have limited resources with respect to power, processing and computing, also the size must be small as possible so that the nodes can have enough number of applications. This sensors is basically used to observe many physical conditions like temperature, sound, pressure and motion, etc. The main activities of those sensors nodes can be summarize as follows: Sense the environment as well as collect the information of environment. The focus of the research is around the improved quality of communication through Wireless Sensor Networks. The major goal is to achieve the minimum consumption of energy and its optimal use. The WSN has got much attention from various applications, because, it can work on its own without any of the human interventions. The sensor nodes can communicate around a small distance via a wireless medium and collaborate to achieve a common task, for example, environment monitoring, military surveillance, industrial process control, warehouses, malls, tunnels etc.The sensor have different initial energy depending on the power levels. Wireless sensor networks present a series of serious issues that still need research effort. Challenges faced by WSNs are Network lifetime, Scalability, Interconnectivity, Reliability, Heterogeneity, Privacy and Security. To balance the traffic load and reduces the number of data transmissions throughout networks Compressive Sensing CS plays major role(1) (2). However, by using pure compressive sensing the total number of transmissions for data is large. To minimize the number of transmissions in sensor networks the hybrid method of using Compressive Sensing CS is used.

In the proposed research (1) a Hybrid Compressive Sensing which is a clustering method for sensor networks is intervend. The cluster is formed with the combination of sensor nodes, in each cluster, sensor nodes transmit sensed data to the cluster head CH.

A data collection is made as a tree structure and it sends data to CHs and will transmit the data to the sink by using the Compressive Sensing CS. To conclude how much the big cluster size should be is an important problem for the hybrid method. Suppose if the cluster size is too big then the number of transmissions required to collect data from sensor nodes in a cluster to the Cluster Head will be high.

Data compression (6) is a very important and useful technique in the wireless sensor network for conservation of energy. The Data compression technique was considere as a useful approach for reducing the power consumptions of WSN nodes. The advancement in Lossless temporal compression include compression algorithms that is Sequential-Lossless Entropy Compression S-LEC (6) which is used in compressing the sensed data which will improve the Efficient data transmission for WSNs. The Advance Secure and efficient data transmission (7) Advance SET-IBS is mainly focusing on the secured data transmission as well as efficiency in efficient in sensor network communication. By applying the ID-based cryptosystem and the orphan node problem is solved in the secure transmission protocols with the symmetric key management systems in the WSNs.

RELATED WORK

Ruitao Xie and Xiaohua Jia, "Transmission-Efficient Clustering Method for Wireless Sensor Networks Using Compressive Sensing" authors present the analysis on the optimal value of the edge length D of cluster-square and discussions on determining the parameter H in this paper distributed implementations. Finally, provided an additional performance evaluation. It includes the comparison between analytical results and simulation results, the simulations on the non-homogenous networks, and iteration times to converge of the iterative algorithm in our method.

In (2) the Compressive sensing (CS)-based in-network data processing is a promising approach to reduce packet transmission in wireless sensor networks. Existing CS-based data gathering methods require a large number of sensors involved in each CS measurement gathering, leading to the relatively high data transmission cost. In this paper, authors propose a sparsest random scheduling for compressive data gathering scheme, which decreases each measurement transmission cost from O(N) to O(log(N)) without increasing the number of CS measurements as well. In this papers scheme, authors present a sparsest measurement matrix, where each row has only one nonzero entry. To satisfy the restricted isometric property, authors propose a design method for representation basis, which is properly generated according to the sparsest measurement matrix and sensory data. With extensive experiments over real sensory data of CitySee, we demonstrate that our scheme can recover the real sensory data accurately. Surprisingly, our scheme outperforms the dense measurement matrix with a discrete cosine transformation basis over 5 dB on data recovery quality.

Ruobing Jiang, Yanmin Zhu, "Compressive Detection and Localization of Multiple Heterogeneous Events with Sensor Networks" considers the crucial problem of event detection and localization with sensor networks, which not only needs to detect occurrences but also to determine the locations of detected events and event source signals. It is highly challenging when taking several unique characteristics of real-world events into consideration, such as simultaneous emergence of multiple events, overlapping events, event heterogeneity and stringent requirement on energy efficiency. Most of existing studies either assume the oversimplified binary detection model or need to collect all sensor readings, incurring high transmission overhead. Inspired by spatially sparse event occurrences within the monitoring area, authors propose a compressive sensing based approach called CED, targeting at multiple heterogeneous events that may overlap with each other. With a fully distributed measurement construction process, authors approach

enables the collection of a sufficient number of measurements for compressive sensing based data recovery. The distinguishing feature of this approach is that it requires no knowledge of, and is adaptive to, the number of occurred events which is changing over time.

In (4) it investigates and compares the performance of wireless sensor networks where sensors operate on the principles of cooperative communications. Authors consider a scenario where the source transmits signals to the destination with the help of L sensors. As the destination has the capacity of processing only U out of these L signals, the strongest U signals are selected, while the remaining (L - U) signals are suppressed. A preprocessing block similar to channel shortening (CS) is proposed in this paper. However, this preprocessing block employs a rank-reduction technique instead of CS. By employing this preprocessing, we are able to decrease the computational complexity of the system without affecting the bit-error-rate (BER) performance. From Authors simulations, it can be shown that these schemes outperform the CS schemes in terms of computational complexity. In addition, the proposed schemes have a superior BER performance as compared with CS schemes when sensors employ fixed-gain amplification. However, for sensors that employ variable-gain amplification, a tradeoff exists in terms of BER performance between the CS scheme and these schemes. These schemes outperform the CS scheme for a lower signal-to-noise ratio.

Megumi Kaneko and Khaldoun Al Agha, "Compressed Sensing Based Protocol for Interfering Data Recovery in Multi-Hop Sensor Networks"consider a multi-hop wireless sensor network that measures sparse events and propose a novel protocol based on Compressed Sensing (CS) as an alternative to traditional Media Access Control (MAC) scheduling and routing protocol. Instead of avoiding collisions, our CS-based protocol exploits interferences by superimposing the data measurements "over-the-air", simultaneously received at any node. Thanks to Author's protocol design, each node is able to recover and forward only new data towards the sink. Author's protocol achieves near zero reconstruction errors at the sink, while greatly reducing overhead and delays compared to conventional methods. These results reveal a new and promising approach to protocol design through CS.

In (7) Secure data transmission is a critical issue for wireless sensor networks (WSNs). Clustering is an effective and practical way to enhance the system performance of WSNs. In this paper, authors study a secure data transmission for cluster-based WSNs (CWSNs), where the clusters are formed dynamically and periodically. Authors propose two Secure and Efficient data Transmission (SET) protocols for CWSNs, called SET-IBS and SET-IBOOS, by using the Identity-Based digital Signature (IBS) scheme and the Identity-Based Online/Offline digital Signature (IBOOS) scheme, respectively. In SET-IBS, security relies on the hardness of the Diffie-Hellman problem in the pairing domain. SET-IBOOS further reduces the computation overhead for protocol security, which is crucial for WSNs, while its security relies on the hardness of the discrete logarithm problem. Authors show the feasibility of the SET-IBS and SET-IBOOS protocols with respect to the security requirements and security analysis against various attacks.

METHODOLOGY

For reducing the number of data transmission,a hybrid compressive sensing CS is used.In this approach the sensors are divided into clusters, each and every cluster is having a cluster head CH which is elected according to the maximum energy present in the batteries of sensor nodes and also the second maximum node is ready for further Cluster Head Selection. The sensed data is retrieved via the sensor nodes, every sensor sends will send the sensed data to the cluster head in the form of tree topology and gather all the data to the cluster Head.

A.Cluster Head Election:

The central point of a cluster area is determined and the sensor node comes closest to this central area will be made as the cluster head. Here the major issue is that the sensor nodes do not know who is the closest to the central point of a cluster area, and do not know if there is a sensor node falling into the close range of the central point, so all the nodes within the range of from the center is considered to be the CH candidates of the cluster where R is the transmission range of sensors. The value of H is determined such that there is at least one node within H hops from the central point of a cluster. To elect the CH, each node broadcasts a CH election message that possess

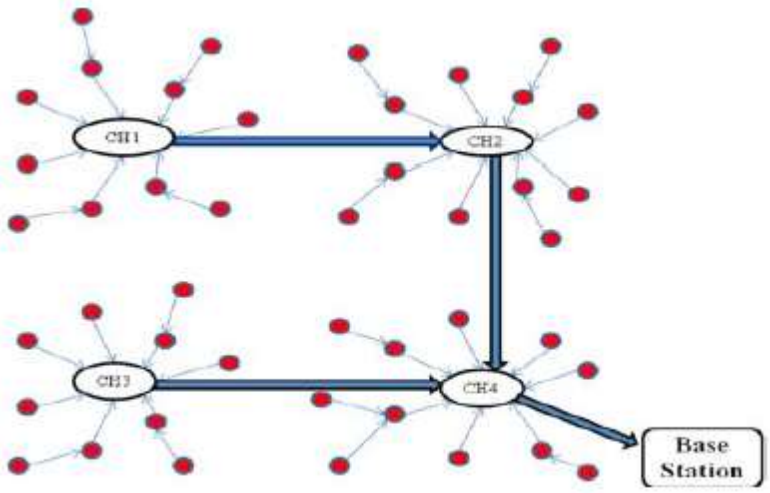

Figure 1: Hybrid Compressive Sensing

its identifier, its location and the identifier of its cluster. Later on the CH election message is propagated not more than 2H hops. After a timeout, the node that has the smallest distance to the centre of the cluster among the other nodes will becomes the CH of the cluster. In the particular case that no sensor node falls within H hops from the central point so that there is no CH for this cluster-area, the nodes in this cluster-area accepts the invitation from neighbouring CHs and will the become members of other clusters. Thus no node will be left out of the network.

B. Sensor Node Clustering

Once the CH is elected, CH will broadcasts an advertisement message to all the other sensor nodes in the sensor field, inorder to invite the sensor nodes to join the cluster. This particular advertisement message consists of the information such as: the identifier and location of the CH, and the number of hop that the message has travelled. The hop count is first set as 0. When a sensor node receives an advertisement message, if the hop count of message is smaller than that recorded from the same CH, it updates the information in its record including the node of previous hop and the number of hop to the CH, and then will broadcasts the message to its neighbouring nodes; otherwise, the message will be discarded. The routing from a sensor node to its CH follows the reverse path in forwarding the advertisement message. The data of sensor nodes within a cluster is collected by this routing tree.

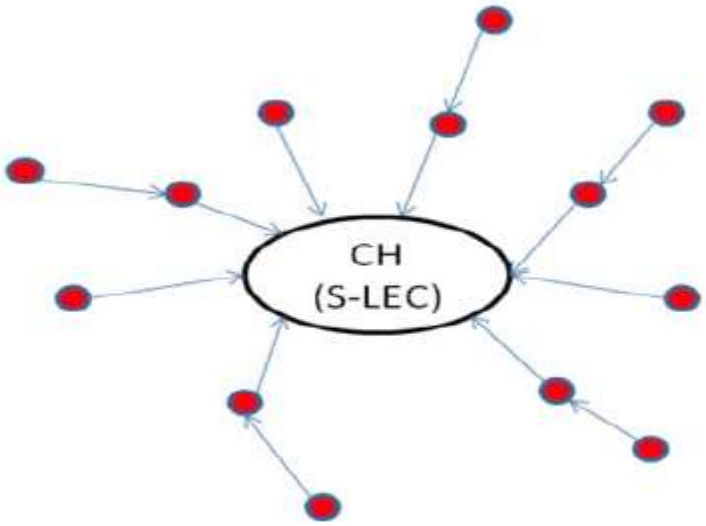

Figure 2:Sequential Lossless Compression

THEORITICAL ANALYSIS

In research (1) the simulations shows that this method can reduce the number of transmissions. When the number of measurements is 10th of the number of nodes in the network, the simulation results show that Hybrid CS method can reduce the number of transmissions by about 60 percent compared with clustering method without using CS. Even for the non-homogenous networks in the irregular sensor field, the Hybrid Compressive Sensing method can significantly reduce the data transmissions compared with the other data collection methods.

In (2) Experiment results shows that the CS based data gathering scheme can recover the sensory data without any errors. The Simulation results also shown this scheme can significantly save energy consumption while comparing with the existing compressive sensing data collection methods.

In research paper (3) presented a compressive sensing based approach inorder for the detection as well as localization of heterogeneous events with the sensor networks. And the distributed measurement construction process has been developed to produce a sufficient number of measurements.

In (4) the performance and complexity of the proposed reduced-rank techniques are superior to the CS technique when deploying the fixed gain amplification factor. However, a trade off can be observed between the complexity and BER performance when the sensors utilize the variable-gain amplification factor.

In (5) to techniques to exploit ”over-the-air” data aggregation which is a routing based on a simple flooding procedure is considered whereby upon packet reception every node broadcasts this packet locally until it reaches the sink. Unlike the single-hop case, there are major issues to be resolved in this multi-hop setting. If each node simply forwards all received packets, the number of superimposed measurements will drastically improve to the poor CS recovery due to loss of sparsity in each packet.

In (6) this comparison results on two different WSN data sets it is interesting fact to know that LEC can perform extremely different depending on the characteristics of WSN data sets. In other case LEC could perform well on Sensor scope WSN relative humidity and temperature measurements that are quite smooth and it performs rather poorly on WSN volcanic data that are very dynamic in nature. Smooth WSN data at Sensor Scope largely satisfy this assumption that LEC can lead to good compression performance. In contrast proposed S-LEC can perform good both in smooth WSN data and dynamic WSN data because of its capability of a high degree of robustness.

In (7) presents the SET protocols are designed for CWSNs with higher efficiency. The SET-IBOOS operates similarly to the previous SET-IBS that operates in rounds during communication and protocol initialization prior to the network deployment.

REFERENCES:

[1] Ruitao Xie and Xiaohua Jia, "Transmission-Efficient Clustering Method for Wireless Sensor Networks Using Compressive Sensing"IEEE Transactions On Parallel And Distributed Systems, Vol. 25, No. 3, March,2014

[2] Xuangou Wu, Yan Xiong, Panlong Yang, Member, IEEE, Shouhong Wan, and Wenchao Huang, "Sparsest Random Scheduling for Compressive Data Gathering in Wireless Sensor Networks" IEEE Transactions On Wireless Communications, Vol. 13, No. 10, October, 2014

[3] Ruobing Jiang, Yanmin Zhu, "Compressive Detection and Localization of Multiple Heterogeneous Events with Sensor Networks" 2014 IEEE 22nd International Symposium of Quality of Service (IWQoS)

[4] Qasim Zeeshan Ahmed, Ki-Hong Park, Member, IEEE, Mohamed-Slim Alouini, Fellow, IEEE, And Sonia Aïssa, Senior Member, IEEE, "Compression And Combining Based On Channel Shortening And Reduced-Rank Techniques For Cooperative Wireless Sensor Networks" IEEE Transactions On Vehicular Technology, Vol. 63, No. 1, January, 2014.

[5] Megumi Kaneko and Khaldoun Al Agha, "Compressed Sensing Based Protocol for Interfering Data Recovery in Multi-Hop Sensor Networks" IEEE Communications Letters, Vol. 18, No. 1, January, 2014.

[6] Yao Liang, Senior Member, IEEE, and Yimei Li, "An Efficient and Robust Data Compression Algorithm in Wireless Sensor Networks" IEEE Communications Letters, Vol. 18, No. 3, March 2014.

[7] Huang Lu, Jie Li and Mohsen Guizani, Member IEEE, "Secure and Efficient Data Transmission for Cluster-Based Wireless Sensor Networks" IEEE Transactions On Parallel And Distributed Systems, Vol. 25, No. 3, March, 2014.

[8] Adil Bashir, Ajaz Hussain Mir, "An Energy Efficient and DynamicSecurity Protocol for Wireless Sensor Network" 2013 International Conference on Advanced Electronic Systems (ICAES)

[9] Muni Venkateswarlu K, A. Kandasamy, K. Chandrasekaran, "EnergyEfficient Edge-Based Network Partitioning Scheme for Wireless Sensor Networks" 2013 International Conference on Advances in Computing, Communications and Informatics (ICACCI)

[10] Laye Hadji Diakite and Li Yu, "Energy and Bandwidth Efficient Wireless Sensor Communications for Improving the Energy Efficiency of the Air Interface for Wireless Sensor Networks" Third International Conference on Information Science and Technology March 23-25, 2013; Yangzhou, Jiangsu, China

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Green Computing: Eco Friendly Technology

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Abstract— Green computing is the study and practice of efficient and eco-friendly computing. Green computing is also called as green technology. The principle behind energy efficient coding is to save power by getting software to make less use of the hardware, rather than continuing to run the same code on hardware that uses less power. Green computing is the environmentally responsible use of computers and related resources. Such practices include the implementation of energy-efficient central processing units (CPUs), servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste).Green computing is also necessary for the future generation also. This work includes the use of green computing in today's world and how the environment problems can reduced using green computing and how to protect the future by using the green technology.

Keywords— green computing, energy star, approaches towards green computing, implementation of green computing and future of green computing.

INTRODUCTION

Green computing is also known as green information technology (green IT).Green computing is the environmentally responsible and eco-friendly use of computers and their resources [1].In broader terms, it is also defined as the study of designing, manufacturing/engineering, using and disposing of computing devices in a way that reduces their environmental impact. It is the study and practice of environmentally sustainable computing or IT [2]. San Murugesan states that this can include "designing, manufacturing, using, and disposing of computers, servers, and associated subsystems—such as monitors, printers, storage devices, networking and communications systems — efficiently and effectively with minimal or no impact on the environment. The goals of green computing are similar to green chemistry: reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste. It was primarily addressed by enhanced research and development efforts to reduce power usage, heat transmission, cooling needs of hardware devices, in particular processor chips using extensive hardware controls. Green computing is important for all classes of systems, ranging from handheld systems to large-scale data centers.

ORIGIN

In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labelling program that is designed to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies [10]. This resulted in the widespread adoption of sleep mode among consumer electronics. Concurrently, the Swedish organization, TCO Development launched the TCO Certification Program to promote low magnetic and electrical emissions from CRT-Based computer displays; this program was later expanded to include criteria on energy consumption, ergonomics and the use of hazardous materials in construction.

WHY GREEN COMPUTING?

Green computing whose goals are to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste. We use Green Computing for following benefits:-

1) Using ENERGY STAR qualified products help in energy conservation.
2) The Climate Savers Computing Initiative (CSCI) catalogue can be used for choosing green products.
3) Organic light-emitting diodes should be used instead of the regular monitors [5].
4) Surge protectors offer the benefit of green computing by cutting off the power supply to peripheral devices when the computer is turned off.
5) Donating your old computers and other peripherals can reduce the rate of e-waste creation [8].
6) It was expected that computers would help reduce paper wastage. However, even today wastage of paper is a serious issue in industries [10].
7) Use the device only if it is necessary.
8) The manufacturing of disks and boxes needed for video games takes up a lot of resources. Video game manufacturers can offer their games online for download, leading to reduction in e-waste. This move can cut down on the transportation/ shipping cost.
9) Use of 'Local Cooling' software can help in monitoring and thereby, bringing down the energy consumed by computer. This 'Windows' program makes adjustments to the power options of computer and helps in minimizing energy consumption [12].

APPROACHES TOWARDS GREEN COMPUTING

I. Virtualizing

Computer virtualization refers to the abstraction of computer resources, such as the process of running two or more logical computer systems on one set of physical hardware. The concept originated with the IBM mainframe operating systems of the 1960s, but was commercialized for x86-compatible computers only in the 1990s [3]. With virtualization, a system administrator could combine several physical systems into virtual machines on one single, powerful system, thereby unplugging the original hardware and reducing power and cooling consumption. Virtualization can assist in distributing work, so that servers are either busy or put in a low-power sleep state.

II. Terminal Servers

Terminal servers have also been used in green computing. When using the system, users at a terminal connect to a central server; all of the actual computing is done on the server, but the end user experiences the operating system on the terminal. These can be combined with thin clients, which use up to 1/8 the amount of energy of a normal workstation, resulting in decrease of energy cost and consumption.

III. Power Supply

Desktop computer power supplies (PSUs) are in general 70–75% efficient, dissipating the remaining energy as heat. A certification program called 80 plus certifies PSUs that are at least 80% efficient; typically these models are drop-in replacements for older, less efficient PSUs of the same form factor. As of July 20, 2007, all new Energy Star 4.0-certified desktop PSUs must be at least 80% efficient.

IV. Video Card

A fast GPU may be the largest power consumer in a computer.

Energy-efficient display options include:

- No video card - use a shared terminal, shared thin client, or desktop sharing software if display required.
- Use motherboard video output - typically low 3D performance and low power.
- Select a GPU based on low idle power, average wattage, or performance per watt.

V. Display

CRT monitors typically use more power than LCD monitors. They also contain significant amounts of lead. LCD monitors typically use a cold-cathode fluorescent bulb to provide light for the display. Some newer displays use an array of light-emitting diodes (LEDs) in place of the fluorescent bulb, which reduces the amount of electricity used by the display. Fluorescent back-lights also contain mercury, whereas LED back-lights do not.

VI. Cloud Computing

Cloud computing addresses two major ICT challenges related to Green Computing – energy usage and resource consumption. Virtualization, Dynamic provisioning environment, multi-tenancy, green data center approaches are enabling cloud computing to lower carbon emissions and energy usage up to a great extent [14]. Large enterprises and small businesses can reduce their direct energy consumption and carbon emissions by up to 30% and 90% respectively by moving certain on-premises applications to cloud.

IMPLEMENTATION OF GREEN COMPUTING

i. Blackle

Blackle is a search-engine site powered by Google Search. Blackle came into being based on the concept that when a computer screen is white, presenting an empty word or the Google home your computer consumes 74W [9]. When the screen is black it consumes only 59W. Based on this theory, if everyone switched from Google to Blackle, mother earth would save750MW each year. This was a really good implementation of Green Computing. The principle behind Blackle is based on the fact that the display of different colours consumes different amounts of energy on computer monitors.

ii. Zonbu Computer

The Zonbu is a new, very energy efficient PC. The Zonbu consumes just one third of the power of a typical light bulb. The device runs the Linux operating system using a 1.2 gigahertz processor and 512 MB of RAM. It also contains no moving parts, and does even contain a fan [13].

iii. Sunray Thin Client

Sun Microsystems is reporting increased customer interest in its Sun Ray, a thin desktop client, as electricity prices climb. Thin clients like the Sun Ray consume far less electricity than conventional desktops.

Future of Green Computing

As 21st century belongs to computers, gizmos and electronic items, energy issues will get a serious ring in the coming days, as the public debate on carbon emissions, global warming and climate change gets hotter [6]. The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings. Companies are laying emphasis on moving towards eco-friendly components in computers. The use of eco-friendly sustainable components will become the norm rather than the exception in future [7]. Taking into consideration the popular use of information technology industry, it has to lead a revolution of sorts by turning green in a manner, no industry has ever done before. Opportunities in green technology lie like never before in history and organizations are seeing it as a way to create new profit centers while trying to help the environmental cause. The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings [4]. Faster processors historically use more power. Power supplies are notoriously bad, generally as little as 47% efficient. And since everything in a computer runs off the power supply, nothing can be efficient without a good power supply. Recent inventions of power supply are helping fix this by running at 80% efficiency or more.

CONCLUSION

The green technology doesn't include green computing only but also focuses on the components used in the computer. As, energy star is used nowadays focuses on the computer does not affect the environment. Sustainable computing should be considered. Green computing represents a responsible way to address the issue of global warming. By adopting green computing practices, business leaders can contribute positively to environmental stewardship and protect the environment while also reducing energy and paper costs. Nowadays, every computer manufacturing company is focusing on the green IT concept. It can be seen that people are moving towards the green technology day by day. New green materials are developed every year and many toxic ones are already being replaced by them. Environmentally it is not a good thing that most PCs -- especially in companies -- have typically entered a landfill after only a few years of service. However, this reality does at least mean that a widespread mind set already exists for both adapting to and paying money for new computer hardware on a regular basis.

REFERENCES:

[1] http://en.wikipedia.org/wiki/Green_computing
[2] http://www.green-compute.com/green_computing.html.
[3] http://www.scribd.com/doc/91046429/green-computing-Report
[4] http://thefutureofthings.com/articles /1003 /green-computing.html
[5] http://www8.hp.com/us/en/hpinformation/index.html
[6] http://timesofindia.indiatimes.com/topic/Green-computing
[7] http://www.studyhelpline.net/hot_it_topics/green_computing/future.aspx
[8] http://www.wisegeek.com/what-is-green-computing.html
[9] http://ito.hkbu.edu.hk/eng/user/if_energy-saving-green.html
[10] http://greencomputingisgood.blogspot.in/2011/03/benefits-of-green-computing.html
[11] http://www.epa.gov/
[12] http://www.ncomputing.com/company/green-computing/
[13] Green Computing: Tools and Techniques for Saving Energy, Money, and Resources by Bud E. Smith
[14] The Green Computing Book: Tackling Energy Efficiency at Large Scale by Wu-chun Feng

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ECG Signal De-Noising Techniques: A Review

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Abstract— Nowadays for de-noising the cardiac syndrome electrocardiogram (ECG) technique is used which record the result in form of waves or signal by using ECG tool but this includes various artifacts (motion) , noise and baseline wander which becomes very essential for us to extract or remove for better clinical result which helps in treatment of the patient. There are various techniques has been proposed or implemented for de-noising the signal for medical purpose such as wavelet transform, and neural network etc. In this we present the literature study of the previously developed technique and algorithm with their advantages and disadvantages. We also discuss the different performance measuring parameter of electrocardiogram.

Keywords— ECG, Wavelet transform, Neural Network, De-noising, Baseline Wander

INTRODUCTION

Heart disease is the major problem in human being nowadays which is the important part of the body and the cure of this is the major issue. The primary step for the patient of heart disease is the ECG (electrocardiogram). ECG and EKG are one and the same and used interchangeably for taping of the electrical commotion of the heart. "EKG" is from the original term "electrocardiogram," which is introduced by the well-known Dutch physiologist Willem Einthoven in the 1890s and early on 1900s. ECG is based on the English version of the word, "electrocardiogram", and is the version used most frequently today. EKG, conversely, is still regularly used and preferred by some populace, partly for historical causes, perhaps because that is basically the way they learned it, and/or somewhat to circumvent confusion with the analogous sounding EEG (from the brain) and EGG (from the reproductive system). I will typically use "ECG" from here on, with some "EKG" or together, as is usually done by others and in the literature (and you'll need to get used to it).

The heart itself is a multifarious organ and the electrical patterns coming from it can seem exceptionally complex, puzzling, and even overwhelming. ECGs are usually run in a medical/quantifiable environment involving abnormalities and tribulations. Most training and knowledge of ECGs and the associated terminology and jargon engrosses medically-related persons. On the other hand, most of the billions of hearts in the world keep ticking away day in and day out with their everyday standard patterns. Numerous biologists, biology teachers and students, and other people uncover the standard heart and its outputs to be interesting.

We recently switched to standard (clinical type) 12-lead and Holter PC-based units for pre-professional students who will eventually encounter the standard ECG machines as well as other students who might either be just plain interested or else encounter problems with their own hearts and end up getting 12-lead ECGs run on themselves in a clinical environment [2]. The range value for normal resting EKG is show in table.1

Standard ECGs, however, have a fairly steep learning curve, with most of the training and educational material focused on the medical student. It is possible, however, to introduce the subject to virtually anyone who is interested or needs to understand it to whatever degree. The main, typical waves of an ECG are identified as P, Q, R, S, and T (the symbols A, B, C, and X, Y, Z etc. had already been used for other physiologically-related items at the time when the system was first developed). Note: all of the waves do not appear on all recordings and there are also some other waves (with other names) that sometimes show up. The following recording, for example, does not show a "Q" wave, a downward wave just before the R wave, although the position of a Q wave (when present) is shown in fig.1.

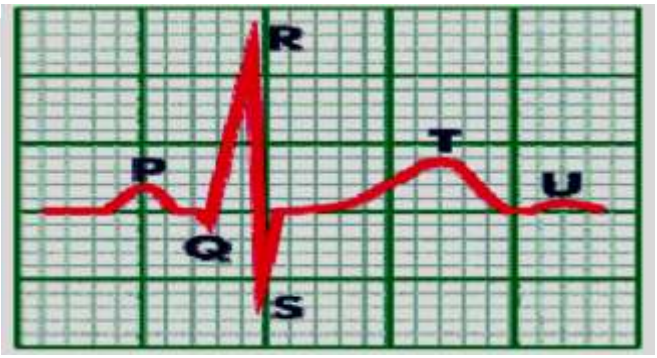

Fig.1 Different Signals of ECG

The signals obtained from the ECG tools sometime do not appear clear which can be the harmful for the patient. This can be happen due to the injection of different types of noise such as electromyography noise, electrode contact noise and motion artifacts etc. The basicprinciple of it to get clear or visible results from the ECG tool by eliminating such noise and artifacts. To de-noising the signal of ECG a lots of techniques has been proposed or implemented such as DCT, DWT, DFT, Neural network, fuzzy set etc. In this paper we are presenting the literature study about the technique of de-noising the signal with their benefits and limitation. An organization of remaining section of the paper is done as follows: Section second of the paper present the different types of waves & Noise found in ECG. In section third present the literature work for de-noising the signal. In section fourth various techniques and algorithm of ECG signal de-noising is discussed with their advantages and disadvantages and last but not least this section gives overall conclusion about the paper.

ECG WAVES & TYPES OF ARTIFACTS

An ECG is performed by placing electrodes on the skin overlying the heart. As the electrical impulse moves from the atria, which are the top two chambers, to the ventricles down below, the voltage measurement between the electrodes varies, and this produces a graph of how your heart is performing. This provides the person running the test with valuable information based on the intensity of the heart's contractions and the time intervals between those contractions.

FIG.2 PLACEMENT OF ELECTRODES ON THE CHEST READ THE ELECTRICAL CURRENTS PRODUCED BY THE HEART

Types of Waves in ECG

In a normal ECG, there are three distinct waves: P-wave,QRS-wave and T-wave.

P-Wave

This is the primary wave or P wave [3] of the ECG which issimilar the salad course - it gets to the table hurriedly, and isn't predominantly bad for you. The primary wave moves quicker and arrives first. It's a longitudinal wave, meaning it throbs the ground parallel to the direction of motion - it basically shakes the ground up and down or side to side. In spite of having the highest frequency (the number of vibrations per second), P-waves cause comparatively minor damage.

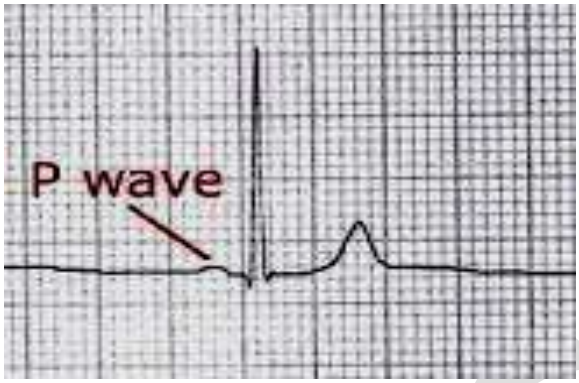

FIG.3 REPRESENTATION OF P WAVE

QRS Complex

A small dip followed by a large spike and another dip. This series is usually considered together, and it's called the QRS wave[3] and this puts the waves in alphabetical order. The QRS wave is sometimes called the QRS complex, and it represents the depolarization of the ventricles. This quickly leads to the contraction of the ventricles and ejection of blood out of the heart and into the large arteries exiting the heart.

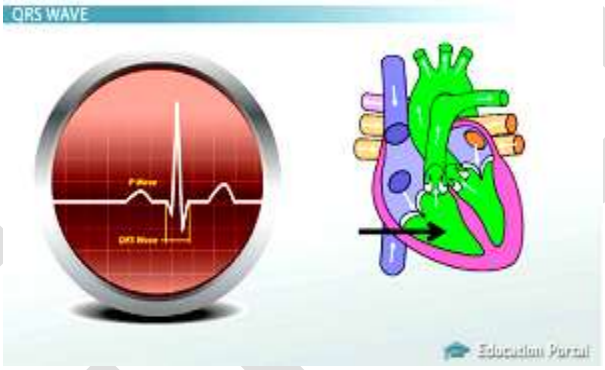

FIG.4 REPRESENTATION OF QRS COMPLEX

T-Wave

The T wave is the furthermost labile wave in the ECG [4]. T wave deviations including low-amplitude T waves and abnormally inverted T waves may be the result of many cardiac and non-cardiac conditions. The normal T wave is typically in the similar direction as the QRS except in the right pre-cordial leads (see V2 below). Likewise, the normal T wave is asymmetric with the first half moving more gradually than the second half. In the normal ECG (see below) the T wave is always upright in leads I, II, V3-6, and continually inverted in lead aVR. The other leads are inconstant depending on the direction of the QRS and the age of the patient.

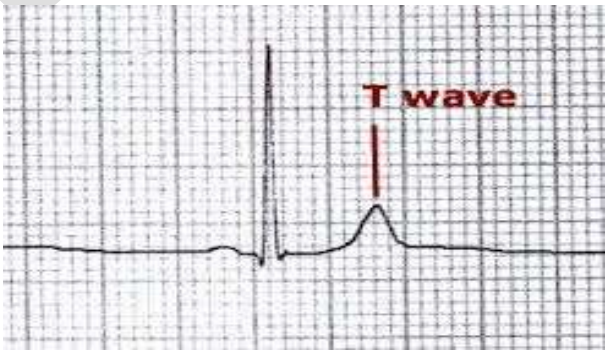

Fig. 4 Representation of T wave

Artifacts in ECG signal

The objectives of acquisition of ECG signal and signal processing system is to acquire the noise free signal. The major sources of noise are: power line interference, muscle contractions, motion artifacts, baseline wandering, high frequency noise in ECG, noise generated by electronics devices, high frequency noise in the ECG and breath, lung or bowel sounds tainting the heart sounds (PCG) and misplaced electrode, etc in which some artifacts is describing below [5]:

Baseline Wandering

In wandering baseline, the isoelectric line variations position. One probable cause is the cables moving during the reading. Patient movement, unclean lead wires/electrodes, loose electrodes, and a diversity of other things can source this as well.

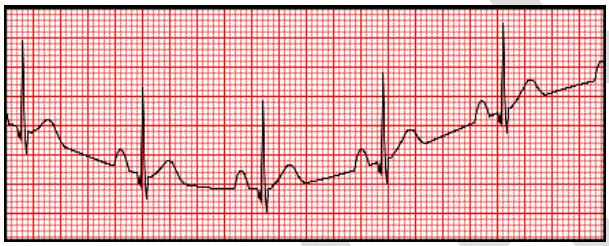

Fig. 5Baseline Wandering Artifacts

Muscle Artifacts

The heart is not the simply thing in the body that produces quantifiable electricity. When your skeletal muscles undergo tremors, the ECG is bombarded with seemingly haphazard activity. The term noise does not denote to sound but rather to electrical interference. Stumpy amplitude muscle tremor noise can imitator the baseline seen in atrial fibrillation. Muscle tremors are frequently a lot more understated than that shown in figure 6.

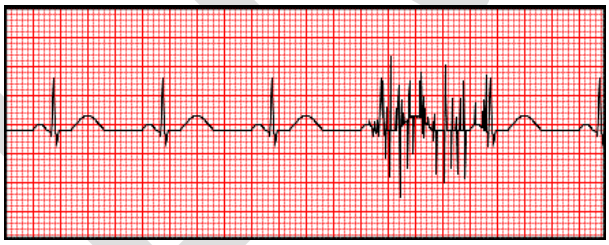

Fig. 6 Muscle Artifacts

Power line Interference

The power line interference is caused by using AC current which pronounces the type of electricity that we get from the wall. In the United States, the electricity "fluctuations direction" 60 times per second (i.e. 60 hertz). (Several places in Europe use 50 Hz AC electricity.) When an ECG machine is ailing grounded or not equipped to filter out this interference, you can get a profuse looking ECG line (as shown in figure 7). If one were to aspect at this ECG line narrowly, he would see 60 up-and-down wave patterns in a given second (25 squares).

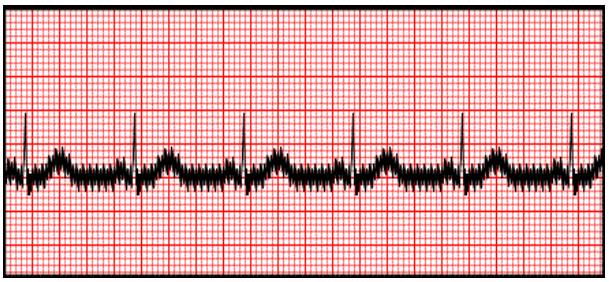

Fig.7 Power line Interference

RELATED WORK

CUOMO ET AL. [6] proposed a novel algorithm for ECG signal de-noising, pertinent in the contest of the real-time health supervising using mobile devices, where the signal processing effectiveness is theaustere requirement. The proposed algorithm is computationally inexpensive because it related to the class of Infinite Impulse Response (IIR) noise diminution algorithms. The major contribution of the proposed system is that confiscate the noise's frequencies exclusive of the implementation of the Fast Fourier Transform that would entail the use of special optimized libraries. It is composed by simply few code lines and thereforesuggests the prospect of implementation on mobile computing devices in an easy way. Additionally, the methodconsents to the local de-noising and therefore a real time visualization of the de-noised signal. The experiments on real datasets have been carried out in order to test the algorithm from correctness and computational point of vision.

KOWARET AL. [7] proposed an effectivealgorithm and its implementation details for de-noising ECG signals along with perfect detection of R peaks andhence the QRS complex of ECG signals using DWT .Main noises under consideration were the wide band EMG noise, PLI noise and low frequency BLD. When ECG signal is de-noised at level three, five and eight using DWT it was observed that at level three EMG, PLI noises areremoved and the signal has P, QRS, T waves and BLD. Inde-noised signal at level five the ECG signal has onlyrelatively slow P, T waves and BLD. The de-noised signalat level eight has only low frequency BLD. Noises suchas EMG, PLI and BLD were removed by subtracting thede-noised signal at level eight from de-noised signal atlevel three. When de-noised signal at level five issubtracted from the de-noised signal at level three, it wasobserved that the resulting signal has only QRS complex. Proposed method efficiently removed the different noisesembedded in the ECG signal and provided R-wavedetection sensitivity of more than 99%.**J**

AGTAP ET AL. [8] implemented the Chebyshev Type II digital filter to surmountdeprivation by improving ECG signal superiority for eminence clinical diagnosis. Dissimilar artifacts are the motive in corruption of the ECG signal. Eliminating noise from the biomedical signal is still challenging and a quickly expanding field with anextensive range of applications in ECG noise reduction. Presented paper deals with the design of Chebyshev Type II filters including low pass, high pass, notch filters. In addition the performance is tested using cascading of filters. For real time application 1711 add on card is used. Dissimilar ECG signals from MIT/BIH arrhythmia database are used for substantiation and compared with real time ECG signals. Finally consequences indicated noise reduction in the ECG.

MITRAET AL. [9] presented algorithm for de-noisingan ECG signal along with precise detection of Rpeaks and hence QRS complex using DWT where db6wavelet was selected as mother wavelet. Decomposition and selective reconstruction is used to de-noise the ECG signal. Thresholding together with slope inversion method isused for detection of QRS complex. Wavelet decomposition of ECG wave up to level 10 usingorthogonal daubechis 6 wavelet generates 10 scales ofapproximation coefficients. The baseline drift is obtainedas the lowest frequency signal and can be easily corrected. The detection of relatively high frequency QRS complexregion has become much easier because of thedecomposition of the signal. The enactment of thesystem is validated using the 12-lead ECG recordingscomposed from physionet PTB diagnostic database givingsensitivity of 99.4 %. The algorithm is evaluatedwith only two class of patient.

SUFI ET AL. [10] formulated a new ECG obfuscation technique for feature extraction and corruption detection. They described a new ECG obfuscation method which uses cross correlation based template matching scheme to differentiate all ECG features followed by corruption of those features with added noises. It is enormously complicated to restructure the obfuscated features without the knowledge of the templates used for feature matching and the noise. Therefore they measured three templates and three noises for P wave, QRS Complex and T wave includes the key which is only 0.4%-0.9% of the original ECG file size. The key allocation amid the authorized doctors is proficient and fast because of its small size. To finish off the experiments carried on with extremely high number of noise combinations the security influence of the presented method was very high.

SAWANTET AL. [11] wavelet de-noising method hasbeen examined to abolish noise from the ECG signal. Diverse thresholding algorithms are investigated boththeoretically and empirically. Ideal ECG signal and noisecorrupted ECG signal are evaluated using MATLAB.Elimination of noise because of muscle activity is intricate tohandle because of the substantial spectral overlieamongthe ECG and muscle noise. Averaging methods have beenprofitably applied to ECG signal for diminution of baselinewander noise. DWT has good capability to decompose the signaland wavelet thresholding is good in removing noise fromdecomposed signal. They applied wavelet transform on theinput vector, thresholded it, inverse transformed it to finallyaccomplish a signal with extremely low EMG noise. The analysis ofthresholding techniques has been compared based on signalto noise ratio. It is observed that "rigrsure" system

givesoptimum performance.

TOSHNIWAL ET AL. [12] used the discrete wavelet transform at level 8 was functional to noisy ECG signals and decomposition of these ECG signals was accomplished. Subsequently removal of noise component using thresholdingmethod, decomposed signal is again reconstructed using Inverse discrete wavelet transform (IDWT). Now for de-noising the ECG signal, bi-orthogonal wavelet transform is used and the most effective idea for noise removal process is concluded with this wavelet transform. The simulation has been done in MATLAB toolbox with the help of SIMULINK. The experiments were carried out on MIT-BIH database. Performance analysis was performed by evaluating Mean Square Error (MSE), Signal-to-noise ratio (SNR), Peak Signal-to-noise ratio (PSNR) and visual inspection over the de-noised signal from each algorithm.

NOISE REMOVAL TECHNIQUE OF ECG

Discrete Wavelet Transform (DWT)

The DWT of a signal "x" is calculated by transient itthrough a series of filters i.e. low pass and high pass filters [13, 14]. The inner product of the signal x(t) and the waveletfunction ψm,k provides a set of coefficients XDWT(m,k)for m and k by applying DWT on signal x(t). DWT can beconsidered as one of the multi-rate signal processingsystems that use multiple sampling rates in the processingof discrete time signals. The DWT of a signal x(t) is givenby:

$$X_{DWT_k}=\int_{-\infty}^{\infty} x(t)2^{m/2}\varphi(2^m t-k)dt$$

Where, ψm,k is the wavelet function. The discrete wavelet transform of a signal is consideredby passing it through a series of filters specifically low passfilter and high pass filter. The coefficients associated withlow pass filter is called approximation coefficients andhigh pass filtered coefficients are called meticulouscoefficients. This decomposition process is carried outuntil the required frequency response is accomplished from thegiven input signal.

Advantages:

- It is superior in conserving the energy in the presence of noise and in reconstructing the original ECG signal with a improved time resolution
- Increase the de-noising performance due to shift invariance property of SWT
- EMD and DWT domain will offer cleaner ECG signals

Disadvantages:

- It is not a shift1-invariant transform
- Lack of direction selectivity.

Empirical Mode Decomposition (EMD)

In this method the noisy ECG signal is decomposed in to different intrinsic mode functions (IMFs) .Then we must find the width of the QRS complex, to preserve it. Therefore sum of first 3 IMFs were taken and their sum is calculated. With the help of this and R point location QRS width is calculated. Then an adaptive window (Tapered cosine window) of size equal to width of the QRS complex is designed to preserve the QRS complex from the noisy IMFs. Mainly lower order IMFs are noisy. Then the signal can be reconstructed by adding these windowed IMFs and the remaining IMFs [15]
An enhancement to this method can be done by using a moving average filter for the smoothening of windowed
IMFs. Thus we have to increase the QRS complex quality. Here residue got after empirical mode decomposition is also considered. EMD is an adaptive and data driven technique, thus suitable for any non stationary signal [16].And the de-noised ECG signal is very much similar to the original clean ECG signal. The ECG signal with high frequency Additive white Gaussian noise can be reduced using this technique.

Advantages:

- EMD is especially suitable for analyzing periodic signals like ECG that consists of both high and low frequency components.
- EMD and DWT domain will provide cleaner ECG signals

Disadvantages:

- It is not superior in preserving the energy in the presence of noise and in reconstructing the original ECG signal with a better time resolution

Soft and Hard Thresholding

A kind of signal estimation technique called wavelet thresholding have signal de-noising capabilities. Wavelet shrinkage operation is categorized in to two thresholding methods hard and soft. Performance of thresholding purely depends on the type of thresholding method and the thresholding rule used for the given application. In hard thresholding, the coefficients that are lesser than the threshold are vanished and the others are kept unchanged. However, the soft thresholding makes a continuous distribution of the remaining coefficients centered on zero by scaling them. Soft thresholding [17] is given as follows:

$$\hat{X} = \begin{cases} y, -sgn(y)T & if|y| \geq T \\ 0, & if|y| < T \end{cases}$$

Hard thresholding is given as following:

$$\hat{X} = \begin{cases} y, - & if|y| \geq T \\ 0, & if|y| < T \end{cases}$$

Advantages:

- It has the ability to perform local analysis
- Soft thresholding is best in preserving noise while not in good for edge vise-versa for hard thresholding.

Disadvantages:

- The hard threshold is not continuous at threshold whereas the soft threshold is not differentiable at this value; a pre-requisite for any optimization problem

Adaptive Filtering

An adaptive filter uses iterative computations to minimize the error "in modeling the relationship between two signals in real time" [18]. Fig. 4 shows a basic diagram of an adaptive filter. Here, the input S1 represents the ECG which is observed with the additive noiseS1. The reference signal n is either a pure noise generator or a signal relatedto n. Since the n and S1 are uncorrelated, then

$$E[e^e = E[(n-y)^2] + E[s_1^2]$$

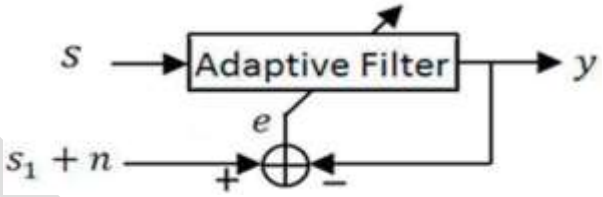

Fig. 8 Adaptive filter Process

Let the N coefficients of the filter at the Kth iteration denoted as $W_k = [W_1(k), W_2(k), \ldots..W_n(k)]^T$ vector $X_k = [x(k), x(k-1), \ldots..x(k-N)]^T$, the output will be given as in Equation :

$$y(k) = \sum_{i=0}^{N} w_i(k)s(k-i) = W_k^T X_k$$

Advantages:

- Filtering response is fast
- Residual errors are small
- When working in time varying environment it has excellent performance

Disadvantages:

- This method necessitates reference signal (either signal or noise characteristics) information for the operational filtering process.[19]
- When RLS algorithm is used it has high computational complexity and stability problems.

CONCLUSION

The removal or extraction of noise from the biomedical signal is very essential for disease diagnosis which may contaminated by different artifacts like motion, power line, electrode movement during the recording etc. due to which bad result is generating. To de-

noising the ECG signal from such artifacts various techniques has been implemented. In this paper, we discuss the literature about various proposed approach and techniques together with their benefits and drawbacks. After analyzing these techniques is it found that some are efficient in de-noising but they and good not for edge and lack of direction selectivity. So in future work need to develop such technique which can overcome all these limitations.

REFERENCES:

[1] Prajakta S. Gokhala, "ECG signal de-noising using Discrete Wavelet Transform for the removal of 50 Hz PLI noise", IJETAE, vol.2, issue 5, March 2012.
[2] T.B. Garcia and N.E. Holtz."12-lead ECG: The Art of Interpretation", Jones & Bartlett Publication Sudbury in 2001, MA.236 pp. ISBN 0-7637-1284-1.
[3] Dr. Gillaspy "Electrocardiogram (ECG): Definition & Wave Types".
[4] http://ecg.utah.edu/lesson/11.
[5] RangayyanRangaraj M., "Biomedical Signal Analysis: A case study approach", Wiley-IEEE press, December 2001.
[6] S. Cuomo, G. De Pietro, R. Farina, A. Galletti, and G. Sannino "A Novel O(n) Numerical Scheme for ECG Signal De-noising", ICCS 2015 International Conference On Computational Science. Procedia Computer Science Volume 51, 2015, Pages 775–784.
[7] Dewangan Naveen Kumar, Manoj K Kowar and KiranDewangan, 2011, "A Comparative Study of Denoising of ECG Signals using Wavelet Transform", Global Journal of Modern Biology and Technology, 1(3): 1-3.
[8] Sonal K. Jagtap, M. D. Uplane, "A Real Time Approach: ECG Noise Reduction in Chebyshev Type II Digital Filter", International Journal of Computer Applications (0975 – 8887) Volume 49– No.9, July 2012.
[9] Banerjee Swati and MadhuchhandaMitra, 2010, "ECG Signal Denoising and QRS Complex Detection by Wavelet Transform Based Thresholding", Sensors & Transducers Journal, 119(8): 207-214.
[10] F. Sufi, S. Mahmoud, I. Khalil, "A new ECG obfuscation method: A joint feature extraction & corruption approach," International Conference on Information Technology and Applications in Biomedicine, 2008. ITAB 2008, pp. 334-337, May 2008.
[11] ChitrangiSawant, Harishchandra T. Patil, "ECG Signal De-noising using Discrete Wavelet Transform", International Journal of Electronics Communication and Computer Engineering Volume 5, Issue (4) July, Technovision-2014, ISSN 2249–071X.
[12] Arpit Sharma, Richa Sharma, Toshniwal "Efficient Use of Bi-orthogonal Wavelet Transform for Cardiac Signals", International Journal of Computer Applications (0975 – 8887) Volume 89 – No 8, March 2014
[13] S. Mallat. "A Wavelet Tour of Signal Processing" Academic Press, San Diego, USA, 1998.
[14] K. Borries R.V., Pierluissi J. H., and Nazeran H., Redundant Discrete Wavelet Transform for ECG Signal Processing, Biomedical Soft Computing and Human Sciences, (2009),Vol.14,No.2,pp.69-80.
[15] B. Weng, M. B. Velasco, and K. E. Barner, "ECG denoising based on the empirical mode decomposition," in Proceedings of the 28th IEEE EMBS Annual International Conference New York City, USA, pp. 1–4, Sept.2006,.
[16] Sonali, Omkar Singh, Ramesh Kumar Sunkaria-" ECG Signal Denoising Based on Empirical Mode Decomposition and Moving Average Filter", 2013 IEEE.
[17]Soman& K. I. Ramachandran "Insight Into Wavelets –From Theory to Practice", Prentice H Donoho, D.L. (1995), "Denoising by soft-thresholding," IEEE Trans. on Inf. Theory, 41, 3,pp. 613-627.
[18] S. C. Douglas, "Introduction to Adaptive Filters," in Digital Signal Processing Handbook, V. K. Madisetti and D. B. Williams, Eds. CRC Press LLC, 1999.
[19] V. Prasad, T. S. Latha, and M. Suresh, "Denoising of Biological Signals using Wavelets," Int. J. Curr. Eng. Technol., vol. 3, no. 3, pp. 863–866, 2013.

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Solving Fuzzy Differential Equations using Runge-Kutta third order method with modified contra-harmonic mean weights

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Abstract— In this paper an attempt has been made to determine a numerical solution for the first order fuzzy differential equations by using Runge-kutta third order method with modified contra-harmonic mean weights.The accuracy of the proposed method is illustrated by a numerical example with a fuzzy initial value problem using trapezoidal fuzzy number.

Keywords— Fuzzy Differential Equations, Third order Runge-kutta method, Modified contra-harmonic mean, Trapezoidal fuzzy number

1.INTRODUCTION

The fuzzy differential equation concept has been most popular and rapidly growing in the last few years. First order linear fuzzy differential equation is one of the simplest fuzzy differential equation,which appear in many applications. The concept of fuzzy derivative was first introduced by S.L.Chang and L.A.Zadeh in[6]. D.Dubois and Prade [7] defined and used the extension principle.Other methods have been discussed by M.L.puri and D.A.Ralescu[23] and R.Goetschel and W.Voxman[10] contributed towards the differential of fuzzy functions.The fuzzy differential equation and initial value problems were extensively studied by O.Kaleva [15,16] and by S.Seikkala[24].Recently many research papers are focused on numerical solution of fuzzy initial value problems (FIVPS).Numerical Solution of fuzzy differential equation has been introduced by M.Ma, M.Friedman, A.Kandel [18] through euler method and by S.Abbasbandy and T.Allahviranloo [1] by taylor method.Runge–Kutta methods have also been studied by authors [2,21].V.Nirmala,N.Saveetha,S.Chenthurpandiyan discussed on numerical solution of fuzzy differential equation by Runge-Kutta method with higher order derivative approximations[20].R.Gethsi sharmila and E.C.Henry Amirtharaj discussed on numerical solutions of first order fuzzy initial value problems by non-linear trapezoidal formulae based on variety of means[13].Runge-kutta third order method with contra-harmonic mean for stiff problems was discussed by Osama Yusuf Ababneh,Rokiah Rozita[17].Following by the introduction this paper is organised as follows :In section 2, some basic results of fuzzy numbers and definitions of fuzzy derivative are given. In section 3, the fuzzy initial value problem is discussed. Section 4 describes the Runge-kutta third order method with modified contra-harmonic mean .In section 5, the Runge-kutta third order with modified contra-harmonic mean method was proposed for solving fuzzy initial value problem and the numerical examples are provided to illustrate the validity and applicability of the new method. Finally the conclusion is given for the proposed method.

2.PRELIMINARIES

Fuzzy number

An arbitrary fuzzy number is represented by an ordered pair of functions $(\underline{u}(r), \bar{u}(r))$ for all $r \in [0,1]$ which satisfy the following conditions.

i) $\underline{u}(r)$ is a bounded left continuous non-decreasing function over $[0,1]$ with respect to any r.

ii) $\bar{u}(r)$ is a bounded right continuous non-decreasing function over $[0,1]$ with respect to any r.

iii) $(\underline{u}(r) \le \bar{u}(r))$ for all $r \in [0,1]$ then the r-level set is $[u]_r = \{x \setminus u(x) \ge r\ \}; 0 \le r \le 1$

Clearly, $[u]_0 = \{x \setminus u(x) \ge 0\}$ *is compact*, which is a closed bounded interval and we denote by $[u]_r = (\underline{u}(r), \bar{u}(r))$

Trapezoidal Fuzzy Number

A trapezoidal fuzzy number *u* is defined by four real numbers $k < l < m < n$, where the base of the trapezoidal is the interval [*k, n*] and its vertices at *x = l, x = m*. Trapezoidal fuzzy number will be written as *u = (k, l, m , n).* The membership function for the trapezoidal fuzzy number *u* = (*k , l , m , n)* is defined as the following :

$$u(x) = \begin{cases} \dfrac{x-k}{l-k} & k \le x \le l \\ 1 & l \le x \le m \\ \dfrac{x-n}{m-n} & m \le x \le n \end{cases}$$

we have :

(1) $u > 0$ *if* $k > 0$

(2) $u > 0$ *if* $l > 0$

(3) $u > 0$ *if* $m > 0$ and

(4) $u > 0$ *if* $n > 0$

Definition: (α - Level Set)

Let I be the real interval. A mapping $y : I \to E$ is called a fuzzy process and its α - *level Set* is denoted by $[y(t)]_\alpha = [\underline{y}(t;\alpha), \bar{y}(t;\alpha)\ ],\ t \in I\ , 0 < \alpha < 1$

Definition: (Seikkala Derivative)

The Seikkala derivative $y'(t)$ of a fuzzy process is defined by $[y'(t)]_\alpha = [\underline{y}'(t;\alpha), \bar{y}'(t;\alpha)\ ]\ t \in I\ , 0 < \alpha \le 1$ provided that this equation defines a fuzzy number, as in [24].

Lemma:

If the sequence of non-negative number $\{W_n\}_{n=0}^{m}$ satisfy $|Wn+1| \le A|Wn| + B\ , 0 \le n \le N-1$ for the given positive constants *A* and *B*, then $|Wn| \le A^n |W_0| + B\dfrac{A^n - 1}{A-1}\ , 0 \le n \le N$

Lemma:

If the sequence of non-negative numbers $\{W_n\}_{n=0}^{m}, \{V_n\}_{n=0}^{N}$ satisfy $|W_{n+1}| \le |W_n| + A\ max\{|W_n|, |V_n|\} + B,$

$|V_{n+1}| \le |V_n| + A\ max\{|W_n|, |V_n|\} + B$ for the given positive constants *A* and *B*, then $U_n = |W_n| + |V_n|\ ,\ 0 \le n \le N$

we have, $U_n \le \overline{A^n} U_0 + B\dfrac{\overline{A^n}-1}{A-1}$ $0 \le n \le N$ where $\overline{\mathrm{A}} = 1 + 2\mathrm{A}$ and $\overline{B} = 2B$.

Lemma

Let $F(t,u,v)$ and $G(t,u,v)$ belong to $C'(R_F)$ and the partial derivatives of *F* and *G* be bounded over R_F .Then for arbitrarily fixed r, $0 \le r \le 1$, $D(y(t_{n+1}), y^0(t_{n+1})) \le h^2 L(1+2C)$ where *L* is a bound of partial derivatives of *F* and *G*, and

$$C = Max\left\{\left\|G\left[t_N, \underline{y}(t_N;r), \overline{y}(t_{N-1};r)\right]\right\|, r \in [0,1]\right\} < \infty$$

Theorem

Let $F(t,u,v)$ and $G(t,u,v)$ belong to $C'(R_F)$ and the partial derivatives of *F* and *G* be bounded over R_F .Then for arbitrarily fixed *r*, $0 \le r \le 1$, the numerical solutions of $\underline{y}(t_{n+1};r)$ and $\overline{y}(t_{n+1};r)$ converge to the exact solutions $\underline{Y}(t_{n+1};r)$ and $\overline{Y}(t_{n+1};r)$ uniformly in *t.*

Theorem

Let $F(t,u,v)$ and $G(t,u,v)$ belong to $C'(R_F)$ and the partial derivatives of *F* and *G* be bounded over R_F and $2Lh < 1$. Then for arbitrarily fixed $0 \le r \le 1$,the iterative numerical solutions of $\underline{y}^{(j)}(t_n;r)$ and $\overline{y}^{(j)}(t_n;r)$ converge to the numerical solutions $\underline{y}(t_n;r)$ and $\overline{y}(t_n;r)$ in $t_0 \le t_n \le t_N$, when $j \to \infty$.

3.FUZZY INITIAL VALUE PROBLEM

Consider a first-order fuzzy initial value problem

$$\begin{cases} y'(t) = f(t, y(t)), t \in [t_0, T] \\ y(t_0) = y_0 \end{cases} \tag{3.1}$$

where *y* is a fuzzy function of t, $f(t,y)$ is a fuzzy function of the crisp variable $'t'$ and the fuzzy variable y, y' is the fuzzy derivative of *y* and $y(t_0) = y_0$ is a trapezoidal or a trapezoidal shaped fuzzy number.

We denote the fuzzy function '*y*' by $y = [\underline{y}, \overline{y}]$ .It means that the r-level set of $y(t)$ for $t \in [t_0, T]$ is $[y(t)]_r = [\underline{y}(t;r), \overline{y}(t;r)]$, $\left[y(t_0)\right]_r = [\underline{y}(t_0;\ r), \overline{y}(t_0;\ r)]$, $r \in (0,1]$,

we write $f(t,y) = [\underline{f}(t,y), \overline{f}(t,y)]$ and

$$\underline{f}\ (t,y) = F[t, \underline{y}, \overline{y}] \quad , \quad \overline{f}(t,y) = G[t, \underline{y}, \overline{y}],$$

because of $y' = f(t,y)$ we have

$$\underline{f}\left(t, y(t); r\right) = F[t, \underline{y}(t;r), \overline{y}(t;r)], \tag{3.2}$$

$$\overline{f}(t, y(t); r) = G[t, \underline{y}(t; r), \overline{y}(t; r)] \quad (3.3)$$

by using the extension principle, we have the membership function

$$f(t, y(t))(s) = sup\{y(t)(\tau) \setminus s = f(t, \tau)\}, \ s \in R \quad (3.4)$$

so the fuzzy number $f(t, y(t))$ follows that

$$[f(t, y(t))]_r = [\underline{f}(t, y(t); r), \overline{f}(t, y(t); r)], \ r \in (0,1] \quad (3.5)$$

where $\underline{f}(t, y(t); r) = min\{f(t,u) \mid u[y(t)]_r\}$ (3.6)

$$\overline{f}(t, y(t); r) = max\{f(t,u) \mid u[y(t)]_r\} \quad (3.7)$$

Definition 3.1: A function $f : R \to R_F$ is said to be fuzzy continuous function, if for an arbitrary fixed $t_0 \in R$ and $\varepsilon > 0$, $\delta > 0$ such that $|t - to| < \delta \Rightarrow D[f(t), f(t_0)] < \varepsilon$ exists.

The fuzzy function considered are continuous in metric D and the continuity of $f(t, y(t); r)$ guarantees the existence of the definition of $f(t, y(t); r)$ for $t \in [t_0, T]$ and $r \in [0,1]$ [10]. Therefore, the functions *G* and *F* can be definite too.

4.THIRD ORDER RUNGE-KUTTA METHOD WITH MODIFIED CONTRA-HARMONIC MEAN

The third order Runge-kutta method with modified contra-harmonic mean was proposed for approximating the solution of first order fuzzy initial value problem $y'(t) = f(t, y(t))$ $y(t_0) = y_0$.

The basis of all Runge-Kutta methods is to express the difference between the value of 'y' at t_{n+1} and t_n as $y_{n+1} - y_n = \sum_{i=0}^{m} w_i k_i$ (4.1)

where w_i's are constant for all i and $k_i = hf(t_n + a_i h, y_n + \sum_{j=1}^{i-1} c_{ij} k_j)$ (4.2)

Increasing of the order of accuracy of the Runge-Kutta methods have been accomplished by increasing the number of taylor's series terms used and thus the number of functional evaluations required[5].The method proposed by Goeken.D and Johnson.O[9] introduces new terms involving higher order derivatives of 'f' in the Runge-Kutta k_i terms (i > 0) to obtain a higher order of accuracy without a corresponding increase in evaluations of 'f ', but with the addition of evaluations of f'.

Runge-kutta third order method with modified contra-harmonic mean was discussed by Osama Yusuf Ababneh, and Rokiah Rozita [17].

Consider $y(t_{n+1}) = y(t_n) + \frac{h}{4}\left[\frac{k_1^2 + k_2^2}{k_1 + k_2} + \frac{3(k_2^2 + k_3^2)}{k_2 + k_3}\right]$ (4.3)

where $k_1 = hf(t_n, y(t_n))$ (4.4)

$$k_2 = hf\left(t_n + a_1 h, y(t_n) + a_1 k_1\right) \tag{4.5}$$

$$k_3 = hf\left(t_n + a_2 h, y(t_n) + a_2 k_2\right) \tag{4.6}$$

and the parameters a_1, a_2 are chosen to make y_{n+1} closer to $y(t_{n+1})$ .The value of parameters are $a_1 = \frac{2}{3}$, $a_2 = \frac{4}{21}(3+\sqrt{2})$

5.THIRD ORDER RUNGE-KUTTA METHOD WITH MODIFIED CONTRA-HARMONIC MEAN FOR SOLVING FUZZY DIFFERENTIAL EQUATIONS

Let the exact solution $[Y(t)]_r = [\underline{Y}(t;r), \overline{Y}(t;r)]$,is approximated by some $[y(t)]_r = [\underline{y}(t;r), \overline{y}(t;r)]$ .The grid points at which the solutions is calculated are $h = \frac{T - t_0}{N}$, $t_i = t_0 + ih; 0 \le i \le N$

From 4.3to 4.6 we define

$$\underline{y}(t_{n+1}, r) - \underline{y}(t_n, r) = \frac{h}{4}\left[\frac{\underline{k_1}^2(t_n, y(t_n, r)) + \underline{k_2}^2(t_n, y(t_n, r))}{\underline{k_1}(t_n, y(t_n, r)) + \underline{k_2}(t_n, y(t_n, r))} + \frac{3(\underline{k_2}^2(t_n, y(t_n, r)) + \underline{k_3}^2(t_n, y(t_n, r)))}{\underline{k_2}(t_n, y(t_n, r)) + \underline{k_3}(t_n, y(t_n, r))}\right] \tag{5.1}$$

where $k_1 = hF[t_n, \underline{y}(t_n, r), \overline{y}(t_n, r)]$ (5.2)

$$k_2 = hF[t_n + \frac{2}{3}, \underline{y}(t_n, r) + \frac{2}{3}\underline{k_1}(t_n, y(t_n, r)), \overline{y}(t_n, r) + \frac{2}{3}\overline{k_1}(t_n, y(t_n, r))] \tag{5.3}$$

$$k_3 = hF[t_n + \frac{4}{21}(3+\sqrt{2}), \underline{y}(t_n, r) + \frac{4}{21}(3+\sqrt{2})\underline{k_2}(t_n, y(t_n, r)), \overline{y}(t_n, r) + \frac{4}{21}(3+\sqrt{2})\overline{k_2}(t_n, y(t_n, r))] \tag{5.4}$$

and

$$\overline{y}(t_{n+1}, r) - \overline{y}(t_n, r) = \frac{h}{4}\left[\frac{\overline{k_1}^2(t_n, y(t_n, r)) + \overline{k_2}^2(t_n, y(t_n, r))}{\overline{k_1}(t_n, y(t_n, r)) + \overline{k_2}(t_n, y(t_n, r))} + \frac{3(\overline{k_2}^2(t_n, y(t_n, r)) + \overline{k_3}^2(t_n, y(t_n, r)))}{\overline{k_2}(t_n, y(t_n, r)) + \overline{k_3}(t_n, y(t_n, r))}\right] \tag{5.5}$$

where $k_1 = hG[t_n, \underline{y}(t_n, r), \overline{y}(t_n, r)]$ (5.6)

$$k_2 = hG[t_n + \frac{2}{3}, \underline{y}(t_n, r) + \frac{2}{3}\underline{k_1}(t_n, y(t_n, r)), \overline{y}(t_n, r) + \frac{2}{3}\overline{k_1}(t_n, y(t_n, r))] \tag{5.7}$$

$$k_3 = hG[t_n + \frac{4}{21}(3+\sqrt{2}), \underline{y}(t_n, r) + \frac{4}{21}(3+\sqrt{2})\underline{k_2}(t_n, y(t_n, r)), \overline{y}(t_n, r) + \frac{4}{21}(3+\sqrt{2})\overline{k_2}(t_n, y(t_n, r))] \tag{5.8}$$

we define $F(t_n, y(t_n, r)) = \frac{h}{4}\left[\frac{\underline{k_1}^2(t_n, y(t_n, r)) + \underline{k_2}^2(t_n, y(t_n, r))}{\underline{k_1}(t_n, y(t_n, r)) + \underline{k_2}(t_n, y(t_n, r))} + \frac{3(\underline{k_2}^2(t_n, y(t_n, r)) + \underline{k_3}^2(t_n, y(t_n, r)))}{\underline{k_2}(t_n, y(t_n, r)) + \underline{k_3}(t_n, y(t_n, r))}\right]$ (5.9)

$$G(t_n, y(t_n,r)) = \frac{h}{4}\left[\frac{\overline{k_1}^2(t_n, y(t_n,r)) + \overline{k_2}^2(t_n, y(t_n,r))}{\overline{k_1}(t_n, y(t_n,r)) + \overline{k_2}(t_n, y(t_n,r))} + \frac{3(\overline{k_2}^2(t_n, y(t_n,r)) + \overline{k_3}^2(t_n, y(t_n,r)))}{\overline{k_2}(t_n, y(t_n,r)) + \overline{k_3}(t_n, y(t_n,r))}\right] \quad (5.10)$$

Therefore we have

$$\underline{Y}(t_{n+1}, r) = \underline{Y}(t_n, r) + F[t_n, Y(t_n, r)]$$

$$\overline{Y}(t_{n+1}, r) = \overline{Y}(t_n, r) + G[t_n, Y(t_n, r)] \quad (5.11)$$

and

$$\underline{y}(t_{n+1}, r) = \underline{y}(t_n, r) + F[t_n, y(t_n, r)]\,] \quad (5.12)$$

$$\overline{y}(t_{n+1}, r) = \overline{y}(t_n, r) + G[t_n, y(t_n, r)]$$

Clearly $\underline{y}(t;r)$ and $\overline{y}(t;r)$ converge to $\underline{Y}(t;r)$ and $\overline{Y}(t;r)$ whenever $h \to 0$

6.NUMERICAL EXAMPLE

Consider fuzzy initial value problem

$$\begin{cases} y'(t) = y(t), & t \geq 0 \\ y(0) = (0.8 + 0.125r, 1.1 - 0.1r) \end{cases} \quad (6.1)$$

The exact solution is given by

$$Y(t,r) = [(0.8 + 0.125r)e^t, (1.1 - 0.1r)e^t]$$

At t=1we get

$$Y(1,r) = [(0.8 + 0.125r)e, (1.1 - 0.1r)e], \; 0 \leq r \leq 1$$

The values of exact and approximate solution with h= 0.1 is given in Table : 1. The exact and approximate solutions obtained by the proposed method is plotted in Fig:1.The estimation of Error 1 and Error 2 is plotted in Fig:2.

Table:1

r	Exact Solution t=1	Approximate Solution (h=0.1)	Error 1	Error 2
	$\underline{Y}(t;r)$ $\overline{Y}(t;r)$	$\underline{y}(t;r)$ $\overline{y}(t;r)$		
0.0	2.174625 , 2.990110	2.205551 , 3.032633	3.092588e-002	4.252308e-002
0.1	2.208604 , 2.962927	2.240013 , 3.005064	3.140910e-002	4.213651e-002
0.2	2.242583 , 2.935744	2.274475 , 2.977494	3.189231e-002	4.174994e-002
0.3	2.276561 , 2.908562	2.308937 , 2.949925	3.237553e-002	4.136336e-002
0.4	2.310540 , 2.881379	2.343398 , 2.922356	3.285875e-002	4.097679e-002
0.5	2.344518 , 2.854196	2.377860 , 2.894786	3.334196e-002	4.059022e-002

0.6	2.378497 , 2.827013	2.412322 , 2.867217		3.382518e-002	4.020364e-002
0.7	2.412475 , 2.799830	2.446784 , 2.839647		3.430840e-002	3.981707e-002
0.8	2.446454 , 2.772647	2.481245 , 2.812078		3.479161e-002	3.943050e-002
0.9	2.480432 , 2.745465	2.515707 , 2.784509		3.527483e-002	3.904392e-002
1.0	2.514411 , 2.718282	2.550169 , 2.756939		3.575805e-002	3.865735e-002

Fig-1 (Approximate & Exact)

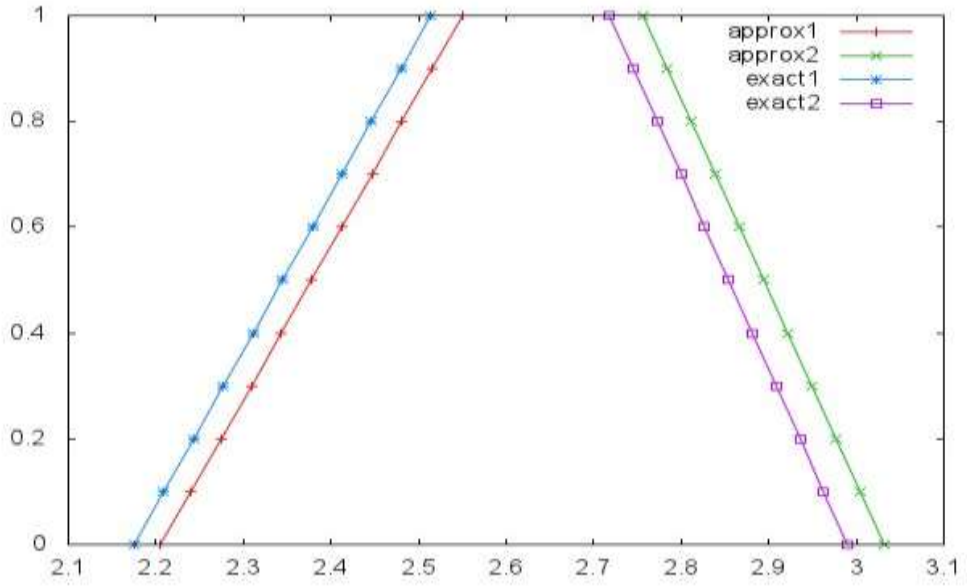
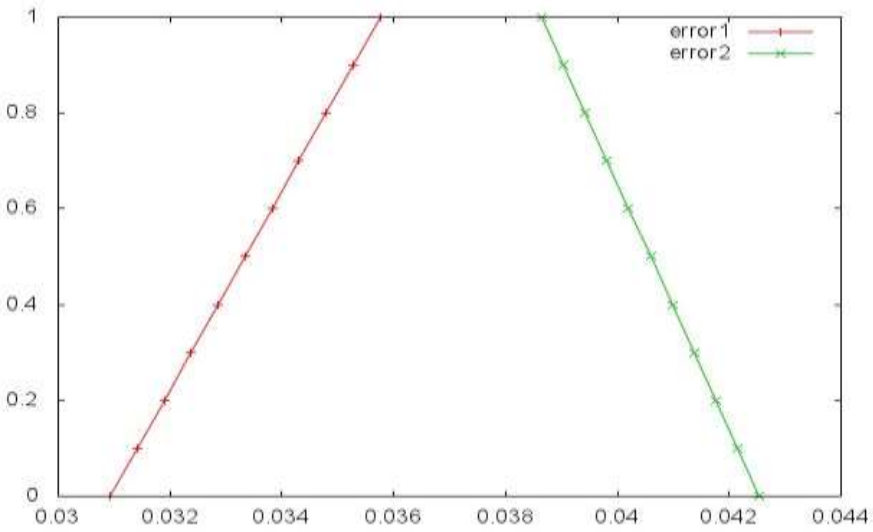


Fig-2 (Error-1 & Error-2)



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CONCLUSION

In this paper the runge-kutta third order method with modified contra-harmonic mean has been applied for finding the numerical solution of first order fuzzy differential equations using trapezoidal fuzzy number.The efficiency and the accuracy of the proposed method have been illustrated by a suitable example. From the numerical example it has been observed that the discreet solutions by the proposed method almost coincide with the exact solutions.

REFERENCES:

[1] S.Abbasbandy,T AllahViranloo,"Numerical Solution of fuzzy differential equations by Taylor method", *Journal of Computational Methods in Applied Mathematics*2(2),pp.113-124(2002).

[2] S.Abbasbandy,T.Allah Viranloo, "Numerical solution of fuzzy differential equations by Runge-Kutta method", *Nonlinear studies* .11(1),pp. 117-129(2004).

[3] J.J.Buckley and E.Eslami, Introduction to Fuzzy Logic and Fuzzy Sets, Physica-Verlag, Heidelberg,Germany. 2001.

[4] J.J.Buckley and E.Eslami and T.Feuring, Fuzzy Mathematics in Economics and Engineering,Physica-Verlag, Heidelberg, Germany.2002.

[5] J.C Butcher, "The Numerical Analysis of Ordinary Differential equations Runge-Kutta and General Linear Methods", New York: Wiley (1987).

[6] S.L.Chang and L.A.Zadeh, On Fuzzy Mapping and Control, IEEE Trans. Systems Man Cybernet., 2 (1972) 30-34.

[7] D.Dubois,H.Prade,"Towards fuzzy differential calculus:Part3, Differentiation",*Fuzzy sets and systems* 8, pp.2 25-233(1982).

[8]C.Duraisamy and B.Usha"Another approach to solution of Fuzzy Differential Equations"*Applied Mathematical sciences* Vol.4, no.16,777-790(2010).

[9] D.Goeken, Johnson, "Runge–Kutta with higher order derivative Approximations" *Applied. Numerical Mathematics* 34, pp.207-218(2000).

[10] R Goetschel and W.Voxman, Elementary Calculus,Fuzzy sets and systems,18 (1986) 31-43.

[11]R,Gethsi sharmila & E.C,Henry Amirtharaj,"Numerical Solutions of N^{th} order fuzzy initial value problems by Non-linear Trapezoidal method based on lograthimic mean with step size control"*International Journal of applied Mathematics & Statistical Sciences* Vol 3,Issue 3 july 2014,11-24

[12] R,Gethsi sharmila & E.C,Henry Amirtharaj" Numerical Solutions of N^{th} order fuzzy initial value problems by fourth order Runge-kutta Method based on Centroidal mean"*IOSR journal of Mathematics* 'Vol 6,Issue 3(May-jun 2013),pp 47-63

[13] R,Gethsi sharmila & E.C,Henry Amirtharaj,"Numerical Solutions of first order fuzzy initial value problems by Non-linear Trapezoidal formulae based on variety of Means"*Indian journal of Research*,Vol 3,Issue-5 May 2014.

[14] R,Gethsi sharmila & E.C,Henry Amirtharaj" Numerical Solutions of N^{th} order fuzzy initial value problems by fourth order Runge-kutta Method based on Contra-harmonic Mean"*International journal on recent and innovation trends in computing and communications*,Vol 2 Issue:8,ISSN:2321-8169.

[15] O.Kaleva , "Fuzzy differential equations", *Fuzzy sets and systems* 24 pp.301-317(1987).

[16] O.Kaleva, "The Cauchy problem for Fuzzy differential equations", *Fuzzy sets and systems* 35,pp 389-396(1990).

[17] Osama Yusuf Ababneh and Rokiah Rozita"New third order Runge-kutta Based contraharmonic Mean for stiff Problems", *Applied Mathematics Sciences*,Vol 3 ,no.8,365-376(2009).

[18] K.Kanagaraj and M.Sambath"Numerical solution of Fuzzy Differential equations by Third order Runge-Kutta Method", *International journal of Applied Mathematics and Computation"*Volume.2(4),pp 1-8(2010).

[19] M.Ma,M. Friedman, Kandel. A,"Numerical solutions of fuzzy differential equations", *Fuzzy sets and System* 105, pp. 133-138(1999).

[20] V.Nirmala and S.Chenthurpandian,"New Multi-Step Runge Kutta Method for solving Fuzzy Differential equations", *Mathematical Theory and Modeling* ISSN 2224-5804(Paper),ISSN 2225-0522 (online)Vol.1, No.3,2011.

[21]V.Nirmala,N.Saveetha,S.Chenthurpandiyan,"Numerical Solution of Fuzzy Differential Equations by Runge-Kutta Method with Higher order Derivative Approximations",*Proceedings of the International conference on Emerging Trends in Mathematics and Computer Applications*,India:MEPCO schlenk Engineering College,Sivakasi Tamilnadu,pp.131-134(ISBN:978-81-8424-649-0) (2010)

[22] Palligkinis,S.Ch.,G.Papageorgiou,Famelis,I.TH.,"Runge-Kutta methods for fuzzy differential equations",*Applied Mathematics Computation*, 209,pp.97-105(2009).

[23] M. L. Puri and D. A. Ralescu, Differentials of Fuzzy Functions, J. Math. Anal. Appl., 91 pp- 321-325(1983).

[24] S.Seikkala , "On the Fuzzy initial value problem", *Fuzzy sets and systems* 24, pp.319-330(1987).

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Review paper on VLSI Design of modulo 2^n □1 Adder using Residue Number System

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Abstract— Modular adder is one of the key components for the application of residue number system (RNS). Moduli set with the form of 2^n +1 can offer excellent balance among the RNS channels for multi-channels RNS processing. As one of the processor's ALU performance issues, the carry propagation during the addition operation limits the speed of arithmetic operation. In this paper review on 2^n +1 addition in the residue number system. The architecture design of CCS modular adder is simple and regular for various bit-width inputs. The review modulo adder in the aforementioned paper consists of a dual-sum carry look-ahead (DS-CLA) adder, a circular carry generator, and a multiplexer, which can reduce both number of slice and maximum combination path delay (MCPD).

Keywords: -Modulo Adder, Residue Number System (RNS), and VLSI design

I. INTRODUCTION

Residue number systems (RNS) [1]-[2] reduces the delay of carries propagation, thus suitable for the implementation of high-speed digital signal processing devices. Some arithmetic operations, such as addition and multiplication, can be carried out more efficiently in RNS than in conventional two's complement systems. RNS has been adopted in the design of Digital Signal Processors (DSP) [3]-[4], Finite Impulse Response (FIR) filters [5], image processing units [6], Discrete Cosine Transform (DCT) processors [7], communication components [8], cryptography [9], and other DSP applications. In recent years, efficient schemes for modulo multipliers have
been studied intensively. Generally, modulo 2^n □1 adder can
be divided into three categories, depending on the type of operands that they accept and output:

i. the result and both inputs use weighted representation;
ii. the result and both inputs use diminished-1 representation;
iii. the result and one input use weighted representation, while the other input uses diminished-1.

For the first category, Zimmermann et al. [8] used Booth

encoding to realize, but depart from the diminished-arithmetic, which leads to a complex architecture with large
area and delay requirements. For the second category, Wang *et al.* [9] proposed diminished-1 multipliers with -bit input operands. The multipliers use a non-Booth recoding and a zero partial-product counting circuit. The main drawback in this architecture was handling of zero inputs and results were not considered.

P. Rajender , R.Srinivas published a research with title " Design of Novel Digital Adder Design Based On Residue Number System" They proposed in their research that Modular adder is one of the key components for the application of residue number system (RNS). Module set with the form can offer excellent balance among the RNS channels for multi-channels RNS processing. A novel algorithm and its VLSI implementation structure were proposed for modulo 2^n - 2^k-1 adder. In the proposed algorithm, parallel prefix operation and carry correction techniques are adopted to eliminate the re-computation of carries. Any existing parallel prefix structure can be used in the proposed structure. Thus, we can get flexible tradeoff between area and delay with the proposed structure. Compared with same type modular adder with traditional structures, the proposed modulo 2^n -2^k-1 adder offers better performance in delay and area.

In a recent paper by Lin and Sheu, the authors have proposed a new circular-carry-selection technique that is applied in the design of an efficient diminished-one modulo 2*n* + 1 adder. The proposed modulo adder in the aforementioned paper consists of a dual-sum carry look-ahead (DS-CLA) adder, a circular carry generator, and a multiplexer, which can reduce both area–time (AT) and time–power (TP) products compared with previous modulo adders. However, in our investigation, there will be incorrect results on the calculation of modulo addition because the carry-in of the DS-CLA adder is equal to zero. To remedy this drawback, we propose the corrected architecture of the DS-CLA adder based on the equations proposed in the aforementioned paper, which can perform correct modulo addition. The complexity of the corrected architecture is almost the same as the one proposed by Lin and Sheu but with less area cost, which can also have the same merits of both AT and TP products.

Curiger et al. [10] proposed new modulo multipliers by using the third category. This architecture use ROM based look-up methods are competitive. The main drawback in this architecture increasing n-bit, they become infeasible due to excessive memory requirements. Also proposed for the third category architecture and reduce the memory requirement and speed up. The new architecture is based on n-bit addition and radix-4 booth algorithm, which is efficient and regular. We are replaced diminished-1 modulo 2^n □1 adder by inverted n-bit adder.

The remainder of the paper is organized as follows: mathematical formulation of Diminished-1 number representation computation of modulo multiplier is presented in Section II. The proposed structures are presented in Section III. Hardware and time complexity of the proposed structures are discussed and compared with the existing structures in Section IV. Conclusion is presented in Section V.

II. DIMINISHED -1 NUMBER REPRESENTATION

The modulo $2^n + 1$ arithmetic operations require (n+1) bit operands. To avoid (n+1)-bit circuits, the diminished-1 number system [15] has been adopted. Let $d[A]$ be the diminished-1 representation of the normal binary number $A \in [0, 2^n$, namely

$$d[A] = |A - 1|_{2^n+1} \quad \text{(i)}$$

In (i), when, $A \neq 0, d[A] \in [0, 2^n - 1$ is an n -bit number, therefore (n+1) -bit circuits can be avoided in this case. However,

$$A = 0, d[A] = d[0] = |-1|_{2^n+1} = 2^n \quad \text{(ii)}$$

is an (n+1) -bit number. This leads to special treatment for d [0]. The diminished-1 arithmetic operations [15] are defined as

$$d[-A] = \overline{d[A]}, if\ d[A] \in [0, 2^n - 1] \quad \text{(iii)}$$

$$d[A + B] = |d[A] + d[B] + 1|_{2^n+1} \quad \text{(iv)}$$

$$d[A - B] = \left|d[A] + \overline{d[B]} + 1\right|_{2^n+1} \quad \text{(v)}$$

$$d[AB] = |d[A] \times d[B] + d[A] + d[B]|_{2^n+1} = |d[A] \times B + B - 1|_{2^n+1} \quad \text{(vi)}$$

$$d[2^k, A] = iCLS(d[A], k) \quad \text{(vii)}$$

$$d[-2^k, A] = iCLS(\overline{d[A]}, k) \quad \text{(viii)}$$

Where $\overline{d[A]}$ represents the one's complement of d [A]. In (vii) and (viii) iCLS (d[a], k) is the k -bit left-circular shift of in which the bits circulated into the LSB are complemented.

III. VARIOUS MODULO ADDER

A proposed architecture consists of the partial products generator (PPG), the correction tern generator (CTG), the inverted end-around-carry carry save adder (EAC CSA) and 2-stage inverted n-bit adder. Based on this architecture, a solution which is more effective is proposed. The encoding scheme accordant with the radix-4 Booth recoding [15], the partial product generator (PPG) can be constructed with the well-known Booth encoder (BE) and Booth selector (BS). The different blocks used in PPG and EAC CSA are taken from [15].

In this paper, we modified BE block which take successive overlapping triplets ($b_{2i-1} b_{2i} b_{2i+1}$) and encodes each as an element of the set {-2,-1, 0, 1 2}. Each BE block produces 3 bits: 1x, 2x and Sign. The 3 bits along with the multiplicand are used to form partial products.

The CTG produces which has the form ($.....0x_{i+1} 0x_i .....0x_1\ 0x_0$) with $x_i \in \{0,1\}$. Since the 2i-th bit x_i is 1 when the BE_i block encodes 0, otherwise x_i is 0, one XNOR gate accepting the 1x and 2x bits of the block can generate the 2i-th bit x_i .

The inverted EAC CSA tree can reduce the Partial Products to two numbers. The CSA tree is usually constructed with full adders (FA).Then the final two numbers from the tree is passed through the 2 -stage inverted n-bit adder. The 2-stage inverted n-bit adder is consisting of two rows of adders. First row consist of n-bit ripple carry adder of one half adder and (n-1) full adders and the second row consist of n-bit ripple carry adder of n half adders, as shown in fig.(3).

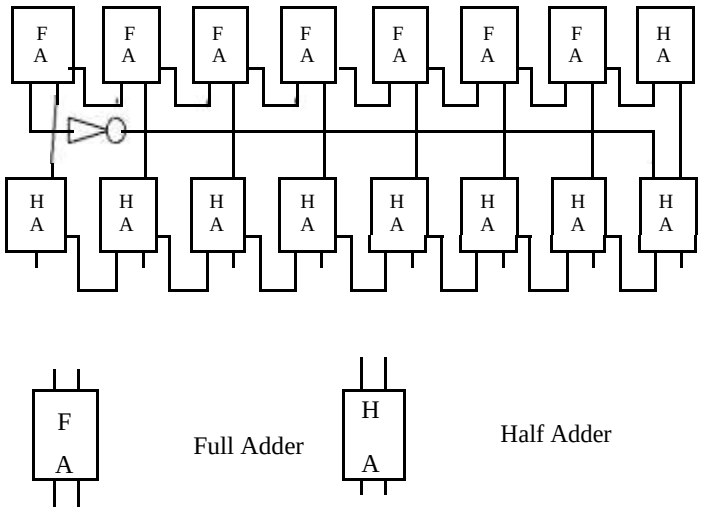

Fig.3. 2-Stage Inverted n-bit Adder

In othertechniques the modulo $2^n - 2^k$ -1 adder is s composed of four modules, pre-processing unit, carry generation unit, carry correction unit, and sum computation unit.

B. Carry Generation Unit

In carry generation unit, the carries C_i^T (i= 1, 2, 3…n) of can be obtained with the carry generation and carry propagation bits from the pre-processing unit. Any existing prefix structure can be used to get the carries.

It is worth pointing out that the carry-out bit of SCSA in the pre-processing unit, is not involved in the prefix computation. Instead, C_{SCSA} combined with the carry-out bit of the prefix tree is required to determine the carry-out bit of A+B+T (denoted as C_{out})

$$C_{out} = C_{SCSA} \cdot C_n^T$$

C. Carry Correction Unit

The carry correction unit is used to get the real carries for each bit needed in the final sum computation stage. In order to reduce the area, we get the carries of A+B by correcting the carries of A+B+T in the carry correction unit.

We first derive the relation of C_i^0 and C_i^1 (i=0, 1, 2, 3 …n) in binary addition. Where and arethecarry outputs of prefix tree when the lowest carry in is ―0‖ and ―1‖, respectively.

D. The Sum Computation

Generally, the sum computation is as same as that in prefix based binary adder. However, is the correction result when C_{out} is taken into account. That is, if C_{out}=0, is the carry bit of A+B. Otherwise, it is the carry bit of A+B+T. Thus, the partial sum bits of A+B and A+B+T are both required in the final sum computation.

IV. RESULT AND SIMULATION

The architecture has very low hardware complexity compared to [5], which consist of modulo $2^n + 1$ adder. In the architecture, we use the 2-stage inverted n-bit adder. And calculate the output for 8, 12bit.

We compare the CCS diminished-one modulo adder against two previous designs of parallel-prefix modular adder [10] and select-prefix modular adder [11], which are regarded as the fastest and the most AT efficient designs among the existing solutions.

In order to get more accurate performance evaluation, we design the existing modulo $2^n - 2^k$ - 1 adder with Sklansky prefix tree and the other modulo adders mentioned in Table I with VHDL

AREA OF MODULO 2^n-2^k-1 ADDER BASED ON UNIT-GATE MODEL

Modules	AND	OR	XOR
Pre-processing	2n-k-2	1	2n-k-1
Carry generation	$2N_P$-n+k-1	N_P+1	0
Carry Correction	n-1	n-1	0
Sum Computation	0		N+1

V. CONCLUSION

The aspire behind the system is to design a high speed adder with low power consumption and low surface area. The structure will be consisted of four units, the pre-processing, the carry computation, the carry correction and the sum computation unit. The tradeoff property between area and delay is proposed in this scheme. The synthesis results will be check on Xilix Software. Although 2^n +1 is proposed in this synopsis but we can change the scheme if result will not match our expectations. This work aims to build an Efficient Hardware Design for an Adder based on Residual Numbering System (RNS), with a pre-specified special set of moduli to simplify the implementation for the purpose of proving the feasibility of its usage.

REFERENCES:

[1] P. V. Ananda Mohan, *Residue Number Systems: Algorithms and Architectures*, Kluwer, Academic Publishers, 2002.

[2] Omondi, and B.Premkumar,Residue Number System: Theory and Implementation,*Imperial College Press*,2007

[3] R. Chaves, L. Sousa, "RDSP: a RISC DSP based residue number system", *in Proc. Euromicro Symposium on Digital System Design (DSD)*, pp. 128–135, Sept. 2003.

[4] J. Ramirez, A. Garcia, S. Lopez-Buedo, and A. Lloris, "RNS-enabled digital signal processor design", *Electronics Letters*, vol. 38, no. 6, pp. 266–268, March 2002.

[5] G. L. Bernocchi, G. C. Cardarilli, A. D. Re, A. Nannarelli, M. Re,"Low-power adaptive filter based on RNS components", *in Proc. ofthe Int. Symposium on Circuits and Systems (ISCAS)*, pp. 3211–3214, 2007.

[6] F. Marino, E. Stella, A. Branca, N. Veneziani, and A. Distante, "Specialized Hardware for Real-Time Navigation", *Real-Time Imaging*, vol. 7, no. 1, pp. 91-108, Feb. 2001.

[7] P. G. Fernandez, and A. Lloris, "RNS-based implementation of 8x8 point 2D-DCT over field-programmable devices", *Electronics Letters*, vol. 39, no. 1, pp. 21-23, Jan. 2003.

[8] U. Meyer-Baese,A. Garcia, and F. Taylor, "Implementation of a communications channelizer using FPGAs and RNS arithmetic", *Journal of VLSI Signal Processing*, vol. 28, no. 1-2, pp. 115-128, June 2001.

[9] J. C. Bajard, and L. Imbert, "A full RNS implementation of RSA", *IEEE Trans. Comput*., vol. 53, no 6, pp. 769–774, June 2004.

[10] Y. Liu, and E.M.-K Lai, "Design and implementation of an RNSbased 2-D DWT processor", *IEEE Trans. on Consumer Electronics*, vol. 50, no. 1, pp. 376-385, Feb. 2004.

[11] R. Zimmermann,―Efficient VLSI implementation of modulo (2^n □1) addition and multiplication,‖ in *Proc. 14th IEEE Symp. Comput. Arithm.*, Adelaide, Australia, Apr. 1999, pp. 158–167.

[12] Z.Wang, G. A. Jullien, andW. C.Miller, ―An efficient tree architecture for modulo (2^n □1) multiplication,‖ *J. VLSI Signal Process. Syst.*, vol.14, no. 3, pp. 241–248, Dec. 1996.

[13] A. Curiger, H. Bonnenberg, and H. Kaeslin, ―Regular VLSI architectures for multiplication modulo (2^n □1) ,‖ *IEEE J. Solid-State Circuits*,vol. 26, no. 7, pp. 990–994, Jul. 1991.

[14] L. Leibowitz,―A simplified binary arithmetic for the fermat number transform,‖ *IEEE Trans. Acoust., Speech, Signal Process.*, vol. ASSP-24, pp. 356–359, May 1976.

[15] J.W.Chen, R.H.Yao and W.J.Wu,Efficient ―modulo (2^n □1) multipliers,‖ *IEEE Trans. VLSI systems*., vol. 19, no 12, pp. 2149–2157, Dec. 2011

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AN OVERVIEW OF HANDWRITTEN GURMUKHI CHARACTER RECOGNITION

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Abstract :-This paper represent Handwritten Gurmukhi feature Recognition system using some statistical characteristics like zone density, projection histograms , 8 directional zone density characteristics in combination with some geometric characteristics like area, perimeter, eccentricity, etc. The image text is first pre-processed by using many methods like binarization, morphological operations (erosion and dilation) applied to delete noise and then segmented into isolated characters. The highest accuracy obtained by using these characteristics and back propagation classifier is 98%.

Keywords: Handwritten character recognition, Feature extraction, Diagonal features, Intersection and open end points features, SVM.

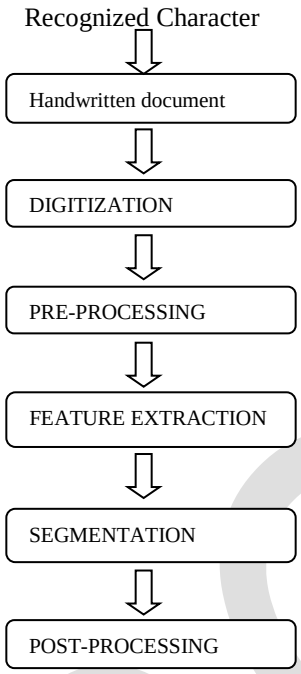
Introduction: Nowadays, computers have a great effect on us and we process almost all the important job of our lives electronically. Keeping in mind the usage of computers these days, we must to develop efficient, easy and fast ways for information transfer within human beings and computers. DAR systems play a major role in data transfer between human beings and computers.OCR system is an essential part of a DAR system. OCR systems have been developed to identified printed texts as well as handwritten texts. Handwritten text recognition systems essentially given an link for improving communication between users and computers. These empower computers to read and process handwritten texts. These systems shall further help significantly in bridging the gap between man and machine. Although, many researchers have worked to identify the features of Indian scripts, the problem of data exchanging within people and machines is still a problem in these scripts. The work carried out in this thesis focused the problem of handwritten characteristics identification for Gurmukhi script. Gurmukhi script is used to write Punjabi language. This language is one from the official languages of India. Gurmukhi script is the tenth most widely used script in the world.

The proposed recognition system

. A typical offline handwritten feature identification system include activities, namely, digitization, pre-processing, segmentation, character extraction, classification and post processing. The series of these activities is shown in Figure 1.2.

1.2.1 **Digitization** Converting a paper based handwritten text into an electronic form is referred as digitization. The electronic conversion is carried out by forming the bitmap image after checking the text. Digitization yields the digital picture which is then fed to the pre-action phase.

Figure 1.2: Block diagram of offline HCR system



1.2.2 PRE-PROCESSING

PRE-PROCESSING is the initial stage of character recognition. It encompasses skew detection and correction, skeletonize, and noise reduction/removal. Skewness means the tilt of the bit mapped picture of the scanned text. It usually surfaces when the text is wrong fed to the scanner. Skeletonization is applied in way to decrease the line width of the text from many pixels to a single pixel. Noise elimination is carried out to delete those unnecessary bits that do not play a substantial role in the document. After pre-processing, we have the digital text that is inputted to the Segmentation phase.

1.2.3 **Segmentation** In feature recognition, the process of segmentation plays a very important role. division is used to break the text into lines, words and akhars. For the work of division, an algorithm is used to find the division points in a handwritten data. Gurmukhi script data can be segmented into paragraphs, lines, words and characters. The challenge of a division method lies in the detection of the best division point for lines, words and characters in isolation. wrong segmentation can lead to the wrong recognition. Segmentation of a handwritten text is a difficult task owing to a variety of writing styles.

1.2.4 Feature extraction

Feature extraction is an important task of the recognition process which is used to calculate the applicable shape contained in the character. In the feature extraction stage, one can extract the characteristics of the character. The performance of the identification system depends on characteristics which are being extracted. In OCR applications, it is important to extract those characteristics that will make easy the system which can differentiate within all the character classes that exist. The extracted characteristics may be structural or statistical based. Structural characteristics depict a pattern in ways of its topology and geometry by provide it local and global Offline Handwritten Gurmukhi Script identification 8 properties. Characteristics of the distribution of pixel values on the bitmap image are taking as statistical characteristics.

1.2.5 **Classification**

Classification stage is the stage of an OCR system wherein one makes the decisions. It uses the characteristics extracted in the characteristics extraction stage, for making class membership in the identification system. The preliminary aim of the classification stage of an OCR system is to develop a constraint that can help to reduce the classifications issue relevant to characteristics extraction. Effectiveness of any character identification system is highly dependent on the capability of identify the rare characteristics of a character and the capability of the classifier to relate characteristics of a character to its class. different classification methods, namely, k-NN, HMM, SVM and Bayesian etc. exist in literature.

1.2.6 Post-processing

OCR results, in general, contain mistake since classification phase does not ever give one hundred percent correct results. To further refine the results of classification, post action applied. There are two most commonly used post-processing methods for mistake correction. These are (i) dictionary lookup and (ii) statistical way .

Gurmukhi script is the script used for writing *Punjabi* language and is derived from the old *Punjabi* term "*Guramukhi*", which means "from the mouth of the Guru". *Gurmukhi* script is the 10th most widely used script in the world [Source: Growth of Scheduled Languages: 1971, 1981, 1991, 2001 and 2011, Census of India, Ministry of Home Affairs, Government of India]. The writing style of the *Gurmukhi* script is from top to bottom and left to right. *Gurmukhi* script has three vowel bearers, thirty two consonants, six additional consonants, nine vowel modifiers, three auxiliary signs, and three half characters. In *Gurmukhi* script, there is no case sensitivity.

Objectives of this work

The objectives of the proposed reading are outlined as :

1. To reading and implement existing algorithms and ways like Bengal Engineering and Science University Shibpur algorithm, Democritus University of Thrace- Adaptive Run Length Smearing Algorithm , Institute of Language and Speech Processing-Line and Word division algorithm, and University of Athens-Hough conversion for line and word division of a handwritten document. A new algorithm will be proposed for division of lines for the offline handwritten Gurmukhi script data.

2. To explore existing characteristics (structural and statistical) and to suggest innovative character for offline handwritten Gurmukhi script identification.

3. To explore HMM, ANN, k-NN and SVM classifiers and to suggest efficient combinations of these in the form of many classifiers. In order to achieve these aims, a detailed survey of literature on different steps of a HCR system has been done. Statistical characteristic have been used for constructing a feature vector for identification purpose. many classifiers such as k-NN, HMM, SVM, Bayesian and MLP have been employed for identification purpose. Combinations of these classifiers have also been used for offline handwritten Gurmukhi character indentification in the thing carried out for this thesis.

Assumptions

We have considered this constraints while performing experiments in this thesis.

1. The handwritten documents have been checked at 300 dpi resolution.

2. The information considered in this work is free from noise.

3. The data considered in this work does not contain any non-text items such as images, characteristics etc.

4)Recognition of equations, line drawings, and gestural symbols.

5)Noisy tablet data.

REFERENCES:

[1] Lorigo, L. M., and Govindaraju, V.: Offline Arabic handwriting recognition: a survey. IEEE Transactions on PAMI, 28, 5 (2006) 712-724

[2] Plamondon, R. and Srihari, S. N.: On-line and off- line handwritten character recognition: A comprehensive survey, IEEE Transactions on PAMI, 22, 1 (2000), 63-84

[3] Lehal, G. S. and Singh, C.: A Gurmukhi script recognition system, In Proceedings of 15th ICPR, 2 (2000), 557-560

[4] Wen, Y., Lu, Y. and Shi, P.: Handwritten Bangla numeral recognition system and its application to postal automation, Pattern Recognition, 40 (2007), 99-107

[5] Swethalakshmi, H., Jayaraman, A., Chakravarthy, V. S. and Sekhar, C. C.: Online handwritten character recognition of Devanagari and Telugu characters using support vector machine, In Proceedings of 10th IWFHR, (2006), 367-372

[6] Pal, U., Wakabayashi, T. and Kimura, F.: A system for off-line Oriya handwritten character recognition using curvature feature, In Proceedings of 10th ICIT, (2007), 227-229

[7] Hanmandlu, M., Grover, J., Madasu, V. K. and Vasikarla, S.: Input fuzzy for the recognition of handwritten Hindi numeral, In Proceedings of ITNG, (2007), 208-213

[8] Rajashekararadhya, S. V. and Ranjan, S. V.: Zone based Feature Extraction algorithm for Handwritten Numeral Recognition of Kannada Script, In Proceedings of IACC, (2009), 525-528

[9] Tripathy, J.: Reconstruction of Oriya alphabets using Zernike Moments, International Journal of Computer Applications, 8,8 (2010), 26-32

[10] Jindal, M. K.: Degraded Text Recognition of Gurmukhi Script", PhD Thesis, Thapar University, Patiala, India, 2008

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REDUCTION IN THE IMPACT FORCE ON A VEHICLE USING SPRING DAMPER SYSTEM

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Abstract—In the design of an automobile, the most important task is to minimize the occurrence and consequences of automobile accidents. Too many passengers die or injure every year because of accidents. Most of the vehicle manufacturing companies are unable to control these accidents. We are coming across the many accidents which were the result of poor designing and maintenance. The vehicles should have active safety system which will avoid the accidents as much as possible and passive safety system which will reduce the damage and loss of lives. The spring damper system is a passive safety system which will decrease the impact of accident. In this systems spring will store the energy and damper will dissipate the energy. This spring damper system reduces the impact of accident by increasing the time of collision as the spring needs some time to compress it totally. In this to check the amount of reduction in impact force when two bodies collide is analyzed with the spring damper system and without the spring damper system. The Impact force is significantly reduced with the spring damper system.

Keywords— Impact, Accident, Spring, Damper, Collision, Force, Crash, Safety.

INTRODUCTION

From the beginning of human life in order to move from one place to another we are using different Transportation systems, at the early stage people used horses, Carts but after inventing the engines people are ready to use vehicles like bikes, cars and buses. But today there is no guarantee that we will reach the destination safely. It is important to know the risk factors associated with vehicular transportation. It is very important to know various factors that will influence the impact of an accident. In present most of the vehicles are manufactured with the bumper which will break under the load. Now the world is looking for the spring damper system which will dissipate the energy without causing damage for a specified range of speeds.

A cushioning model is made to test the impact force was explored using a metal ball and varying thicknesses of polyster, it is found that the collision time is increasing with thickness of sponge up to some thickness and which makes less force on the metal ball[1]. A friction element was introduced into the bumper to improve on the impact and kinetic energy absorption capacity. The simulation revealed that the energy absorption capacity of the bumper was improved with the addition of a friction element. To validate these results experiments were conducted[2]. To mitigate the degree of damage to passengers caused by automobile collisions, a friction damper was built and used in experimental tests to test its effectiveness in impact energy attenuation. The study revealed that energy absorption capacity of a bumper can be improved with the addition of a friction damper [4].

MATHEMATICAL MODEL OF SPRING DAMPER SYSTEM

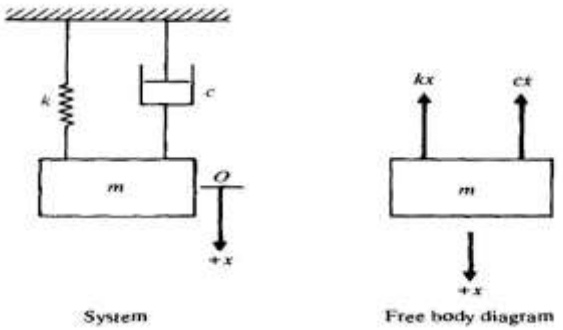

Fig. 1 Basic Spring Damper System

$$m\frac{d^2x}{dt^2} + c\frac{dx}{dt} + kx = 0$$

Where m = mass, c = damping coefficient, k = stiffness, x = displacement, t = time

Effect of the Spring Damper Parameters on the Dynamic Behavior of the System:

MATLAB is used to solve the ordinary differential governing equation. The fixed parameters for the analysis are Mass= 5000kg and Initial velocity=30m/s.

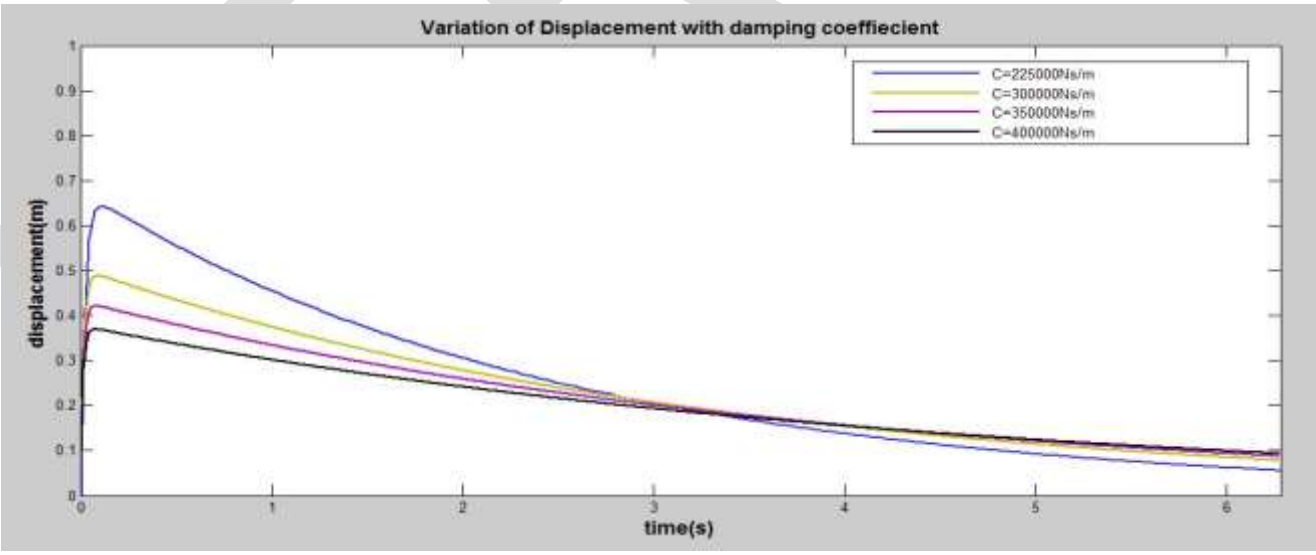

Fig. 2 Displacement variation with damping coefficient

Above graph we can indicates that with increase in damping coefficient, maximum displacement is decreasing and the peak is shifting towards the Y-axis. So it will help us in determining the spring parameters.

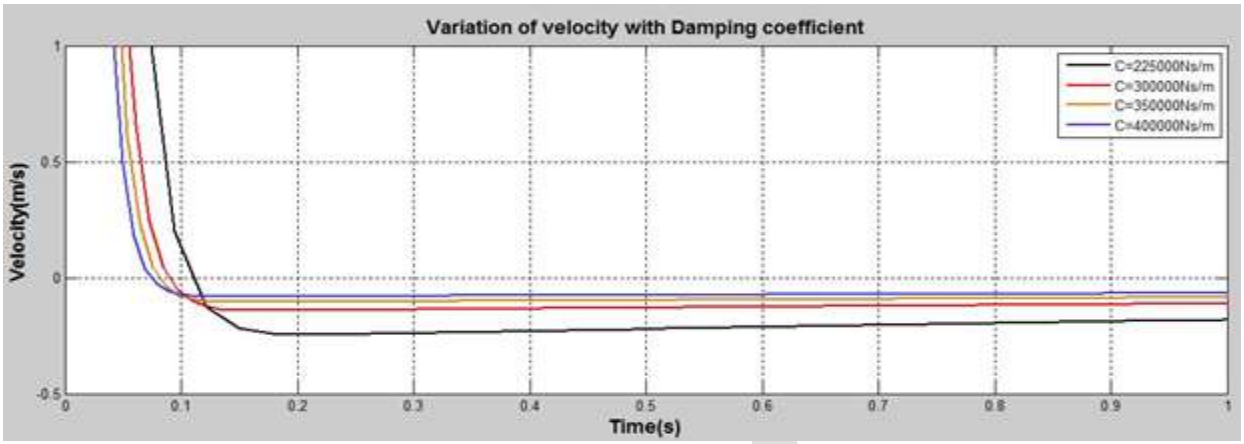

Fig. 3 Velocity variation with damping coefficient

Above graph we can indicates that with increasing damping coefficient the zero velocity is shifting towards the Y-axis and high negative velocity is with the less damping coefficient, it is indicating the less time to come to rest.

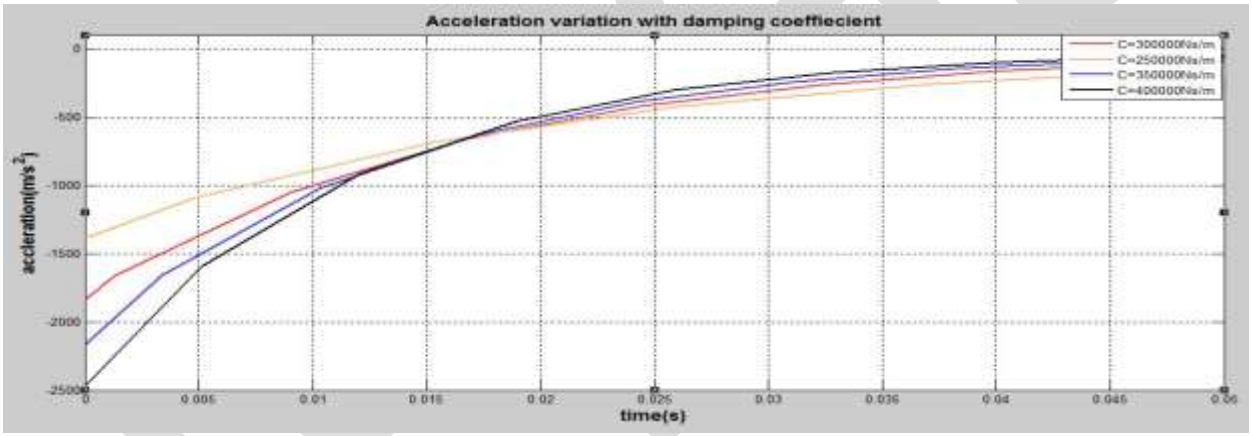

Fig. 4 Acceleration variation with damping coefficient

This graph indicates with high damping, high acceleration is occurs. It implies that spring attains maximum displacement in less time.

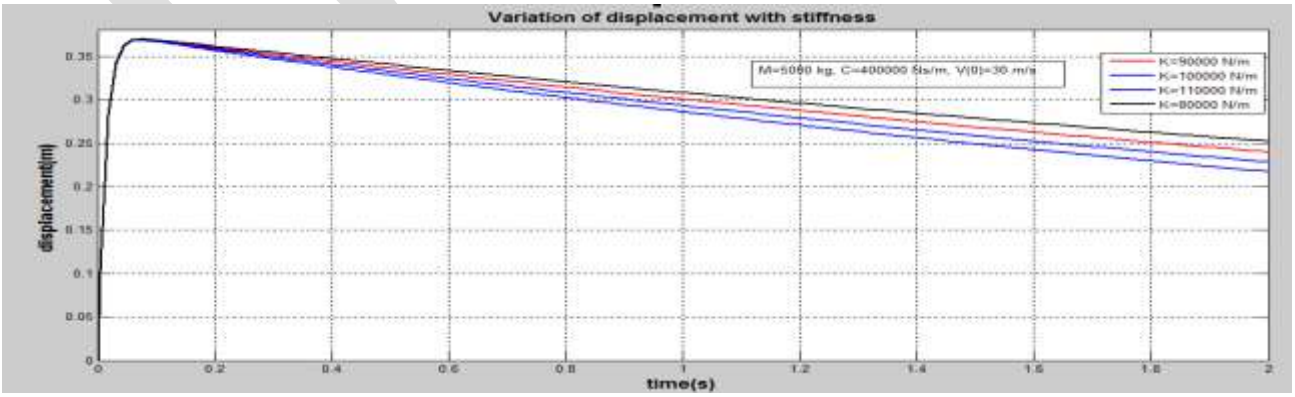

Fig. 5 Displacement variation with stiffness

This graph indicates that variation in stiffness is having negligible effect on the maximum displacement and with increase in stiffness the spring is coming to rest within less time.

ANALYSIS OF IMPACT FORCES WITH TWO BOXES USING IMPACT FUNCTION MODEL IN HYPERWORKS

Common Assumptions made during the analysis

- Contact between the bodies and the ground is frictionless.
- Impact function model is considered for the analysis.
- Geometry of the bodies is assumed as cubical.
- Bodies are made of hard metals, so force exponent is assumed as 2.
- Joint between the bodies and ground is Translational joint.
- The spring used is Coil spring.
- Mass of the boxes is 5000 kg.
- Initial speed of translating boxes is 30000 mm/s.
- Spring stiffness is 90 N/mm, Damping coefficient is 300 Ns/mm for the spring damper system
- Contact properties for the IMPACT function model are stiffness coefficient 10^7 N/mm and maximum damping coefficient is 50 Ns/mm, depth of penetration is assumed as 2 mm.

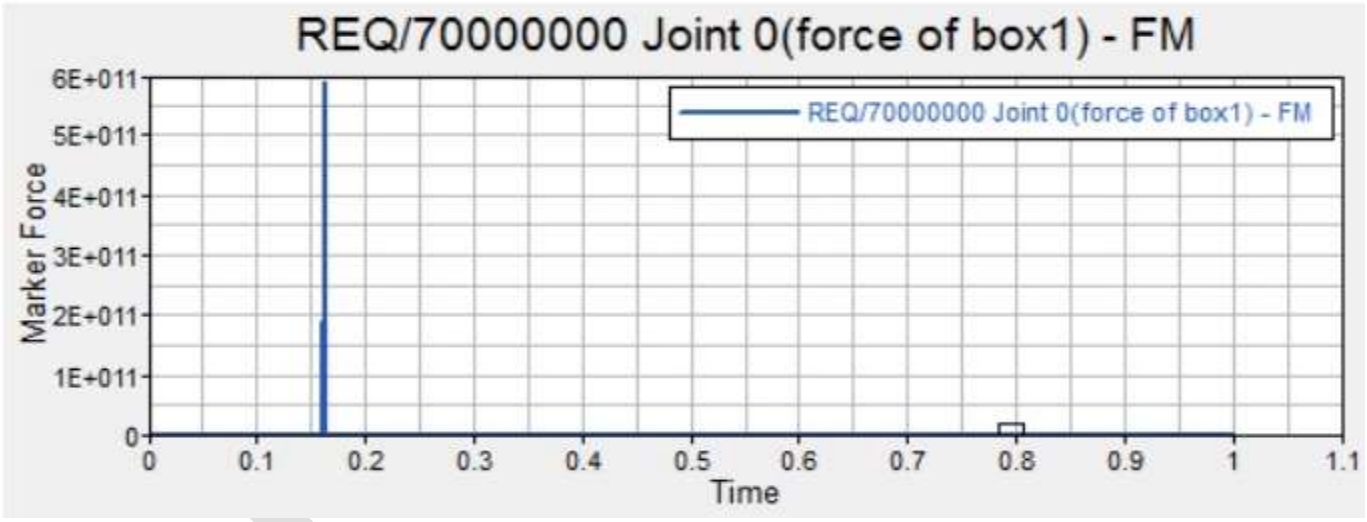

Fig. 6 Two free boxes without spring damper

In this it is assumed that the two boxes are moving towards each other with an initial velocity of 30000 mm/s. During the collision an impact force of magnitude $6*10^{11}$ N is observed, which is of very high magnitude and thus creates high impact stress which will cause the damage to the vehicle.

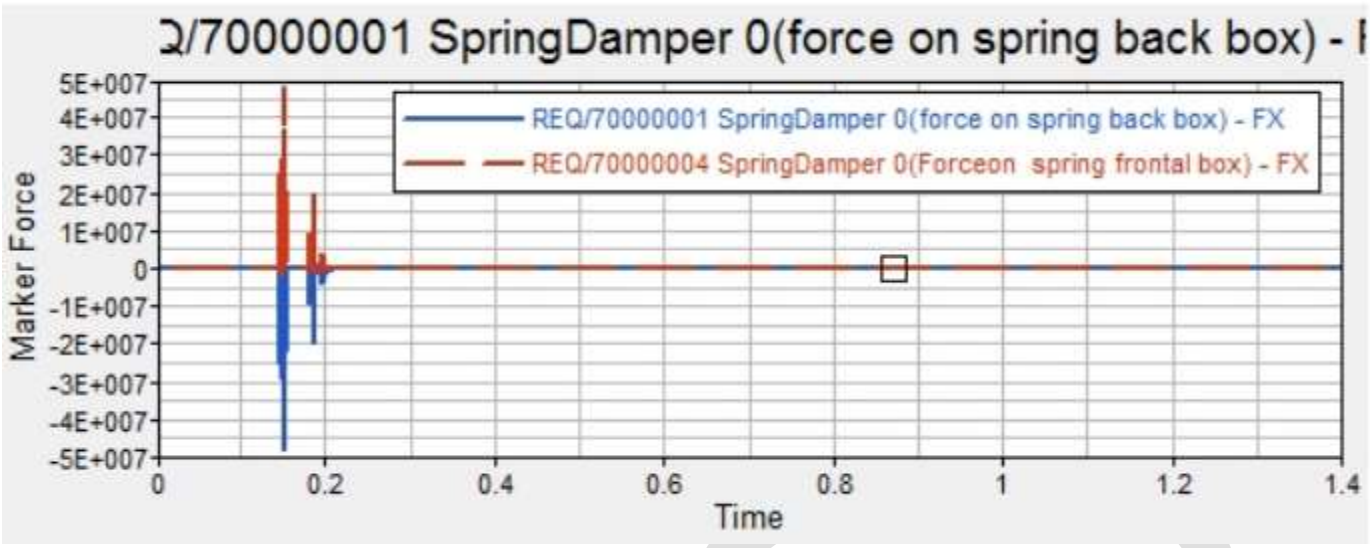

Fig. 7 Two free boxes and one of them with spring damper

In this a spring damper system is attached to the one of the boxes. So during the collision the impact force magnitude considerably reduced to $5*10^7$ N which is 14000 times lesser than without spring damper.

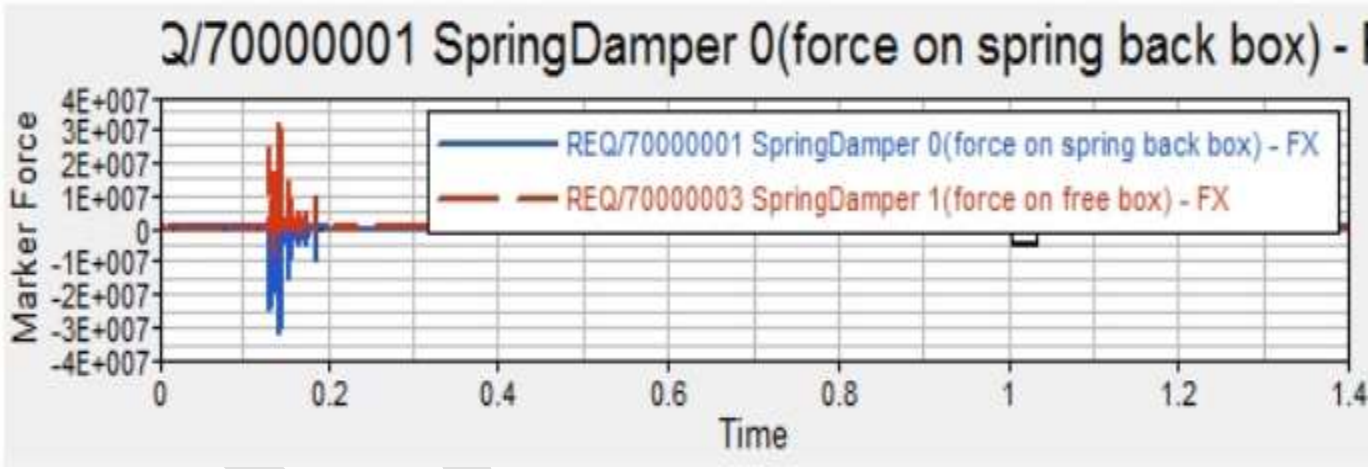

Fig. 8 Two boxes with two spring damper systems

In this the two boxes are attached to two different spring damper systems with the same properties. The magnitude of the force reduced by 1.67 times compared to the previous case in which spring damper is attached to only one box.

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CONCLUSION

The following conclusions are made from the work done

- With increase in damping coefficient, maximum displacement of spring is decreasing.
- With high damping, high acceleration is occurs. It implies that spring attains maximum displacement in less time.
- Variation in stiffness is having negligible effect on the maximum displacement and with increase in stiffness the spring is coming to rest within less time.
- Over damped system is used to reduce impact force.
- Low contact stiffness values lead to large rebound heights and large maximum penetration depths.
- Stiffness of the contact is not constant and it varies with the depth of penetration.
- Spring damper system reduces the impact force considerably.

REFERENCES:

1. Nond Hasbamrer, Increasing collision time through the use of cushioning, ISB Journal of physics, June 2009.
2. Kusekar Sambhaji Kashinath, Chunge Abhijit Balasaheb, Review of design and analysis of bumper beam, International journal of industrial electronics and electrical engineering, ISSN: 2347-6982, Volume-2, Issue-2, Feb-2014.
3. Galal A. Hassaan, Optimal design an anti-accidents vehicle –buffer, International journal of Research in Engineering and Technology(Impact: IJRET) ISSN(E): 2321-8843; ISSN(P):2347-4599, Vol-2, Issue-5, May-2014, 161-168.
4. K.Ashok Kumar, N.Boominathan, D.Akhilan, Design and analysis of automobile bumper with the capacity of energy release, IOSR Journal of Mechanical and Civil Engineering(IOSR-JMCE), e-ISSN: 2278-1684, p-ISSN: 2320-334X,Volume-11, Issue-2, Version-II (Mar-Apr. 2014), PP 21-27.
5. Wong, C.X., Daniel, M.C. and Rongong, J.A. (2009) Energy dissipation prediction of particle dampers. Journal of Sound and Vibration, 319 (1-2). pp. 91-118.
6. A. Agyei-Agyemang1, G. Y. Obeng2, P. Y. Andoh1, P.Y.(2014)Experimental Evaluation of the Attenuation Effect of a Passive Damper on a Road Vehicle Bumper, World Journal of Engineering and Technology, 2, 192-200.
7. P. Gawthrop, S. Neild and D. Wagg, "Semi-active damping using a hybrid control approach", Journal of Intelligent Material Systems and Structures, Vol.23, No.18, 2012, pp.2103-2116.
8. K. Li and A. Darby, "An approach to the design of buffer for a buffered impact damper", Structural Control and Health Monitoring, Vol.17, No.1, February 2010, pp.68-82.
9. Abe, G. and Richardson, J.A. (2006) Alarm timing, trust and driver expectation for forward collision warning systems, Applied Ergonomics, 37: 577-586.
10. G. Geldhof, Semi-active vibration dynamics control of multi-cart systems using a magnetorheological damper, M.Sc. Thesis, Chalmers University of Technology, Goteborg, Sweden, 2013.
11. R. Baig , S. Pugazhenthi, Design optimization of an active vibration isolation system, International Journal of the Physical Sciences, Vol.6., No.30, Nov-2011, pp.6882-6890.
12. A. Emarakbi, "Analysis of a new front-end structure offset impact: mass-spring-damper models with piecewise linear characteristics", International Journal of Vehicle Systems Modelling and Testing, Vo.5, No.4, 2010, pp.292-311.

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Enhancing parameters of MSA for s-band and c-band application by using dumb shell oval head DGS technique

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Abstract — A novel design of various defective ground structured co-axial feed micro strip rectangular patch antenna resulting to highly enhanced parameters when compared with results of fundamental MSA antenna , is proposed in this paper. The purposed antenna is multiband operated at 2.25 and 7.32 GHz still giving enhanced results when compared with that conventional MSA antenna. By employing DGS technique the parameters like GAIN , DIRECTIVITY , VSWR , IMPEDANCE MATCHING , RETURN LOSS were enhanced. The size and employment of material is also reduced and making it light in weight and smaller in size. Initially the antenna design will be presented and then it is simulated by using ANSOFT HFSS 13.0 [12] and then results will be deeply studied.

Keywords — dumb shell oval head, dgs, HFSS, msa, co-axial feed.

1. INTRODUCTION

In this paper the parameters of microstrip strip rectangular patch antenna which is coaxial feed are enhanced with an employment defective ground structures. This antenna operates on dual band. The results are calculated carefully with the aid of ANSOFT HFSS which stands for HIGH FREQUENCY STRUCTURE SIMULATOR which can be purchased easily. The enhanced parameters will further increase the gain of an antenna which can be employed in micro transceiver. Here first basic patch antenna is designed and its parameters are measured and then further these parameters are enhanced with the aid of DGS and made it efficient to operate upon the dual frequency. The design is constructed in high frequency structure simulator and after a number of attempts and final desired results was generated. In figure 1, micro strip Patch antenna is displayed which has a dielectric substrate in between and patch and ground plate at top and bottom. Gold and silver are preferred in making the radiating[2]. Photo etching this radiating patch with feed lines are put upon dielectric substrate on whom basic radiation occurs [1]. The proposed design operates in between the frequency span of 2GHz – 7.32 GHz and is proposed for satellite devotion. After designing it on (FR-4) 2 sided Fiber Reinforced epoxy , the performing characteristic parameters like the like GAIN , DIRECTIVITY , VSWR , IMPEDANCE MATCHING , RETURN LOSS were enhanced by employing the dumb shell oval head defective ground structure technique in this paper.

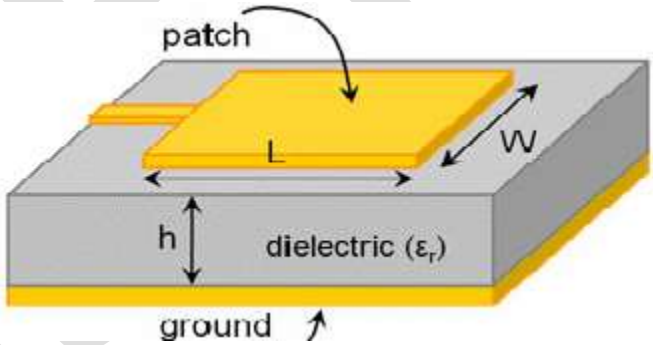

FIGURE 1 – micro strip patch antenna

1.1 OVERVIEW OF DGS TECHNIQUE

DGS is a technique which intrude the shield distribution of current in the ground plane due to defect in the ground which is cascaded periodic or may be non-periodic carved configuration defect in the ground of a planar transmission line[3]. Like line capacitance and inductance, there are many transmission line characteristics which will get change due to this intrusion[5]. Properly designed DGS and made at right coordinates always results beneficial in rising parameters. Purposed design has DGS of a dumb shell oval head shape. To make purposed design DGS shape, the two circular shapes and rectangular shaped DGS re merged together. as shown in figure 2

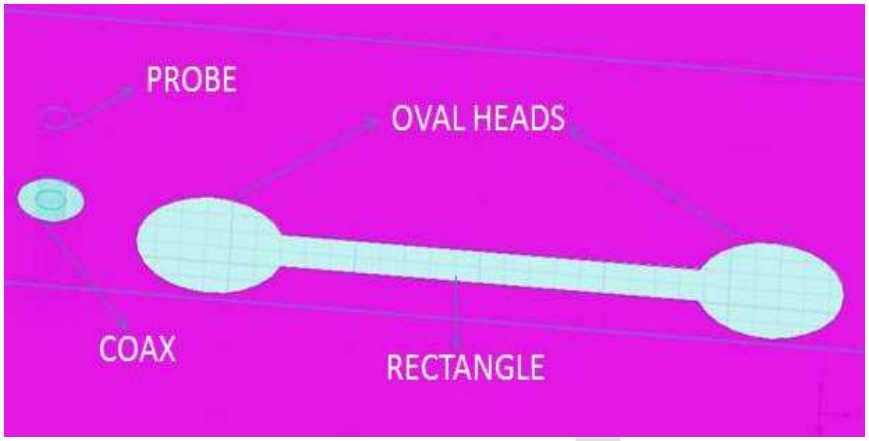

FIGURE 2 – dumb shell oval head dgs on HFSS 13.0

1.2 ANTENNA DESIGN

The design of coaxial fed micro strip rectangular patch antenna and dumb shell oval head defective ground structured coaxial fed micro strip rectangular patch antenna are displayed in Figure 3(a) and 3(b) which are operating on single band and purposed one is multiband i.e. at 2.25 GHz as well as on 7.32 GHz. The table 1 which is written below mentions co-axial feed micro strip rectangular patch antenna design without DGS dimensions. The feed points of this fundamental antenna are (30.5, 16.66) and the feed points of design with DGS are (31, 16.35). Positioning measurements of shapes and design of proposed DGS antenna are described in table 2.

VARIABLE	***VALUE***
Patch width	**40.57mm**
Patch length	**31.43mm**
Patch height	**1.6mm**
Ground width	**50.32mm**
Ground length	**41.19mm**
Interior Feed center radius	**0.3mm**
Exterior Feed center radius	**0.675mm**

Table 1 dimensions of the co-axial fed rectangular patch antenna without dgs for 2.25 GHz frequency

VARIABLE	***VALUE***
Patch width	**40.57mm**
Patch length	**31.43mm**
Patch height	**1.6mm**
Ground width	**50.32mm**
Ground length	**41.19mm**

Interior Feed center radius	**0.3mm**
Exterior Feed center radius	**0.675mm**
Radius of DGS ovals slot on the ground	**1.2mm**
Length & breath of DGS rectangle slot on the groun	**8.4mm , -1mr**

Table 2 Dimensions of the DGS MSA operating at 2.25 GHz and 7.32 GHz.

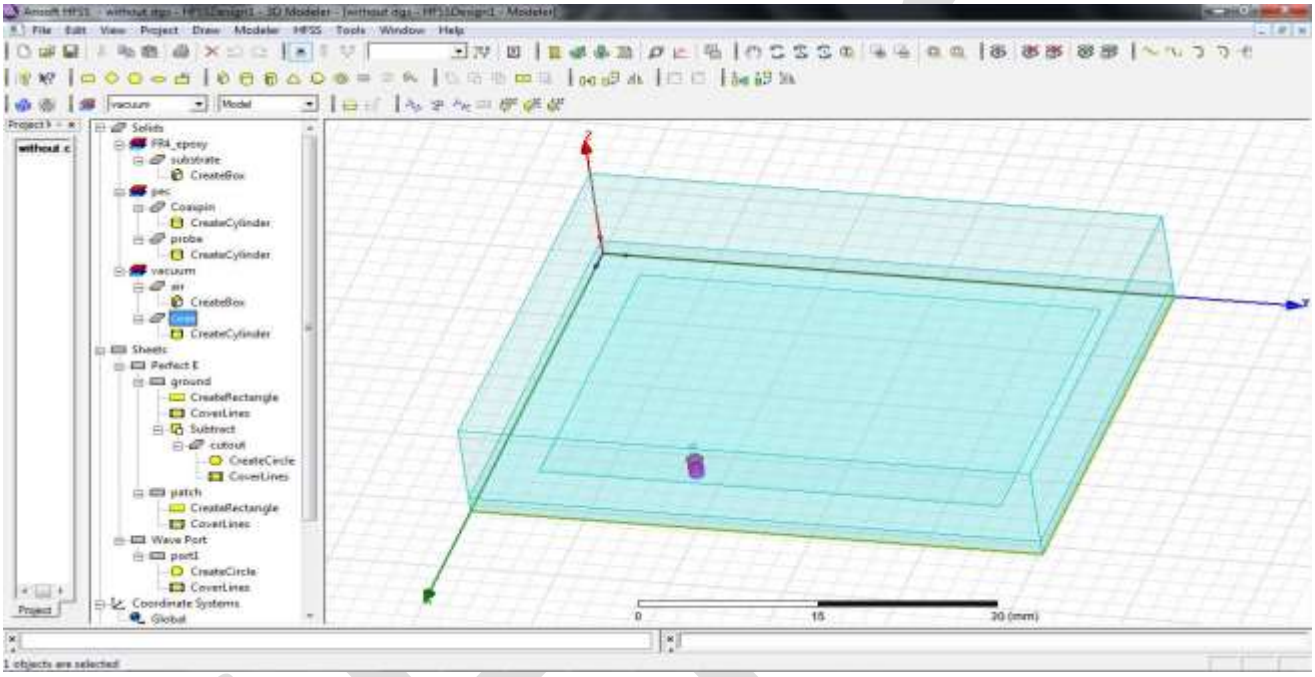

FIGURE 3(A) MSA without DGS on HFSS 13.0 operating at 2.25 ghz

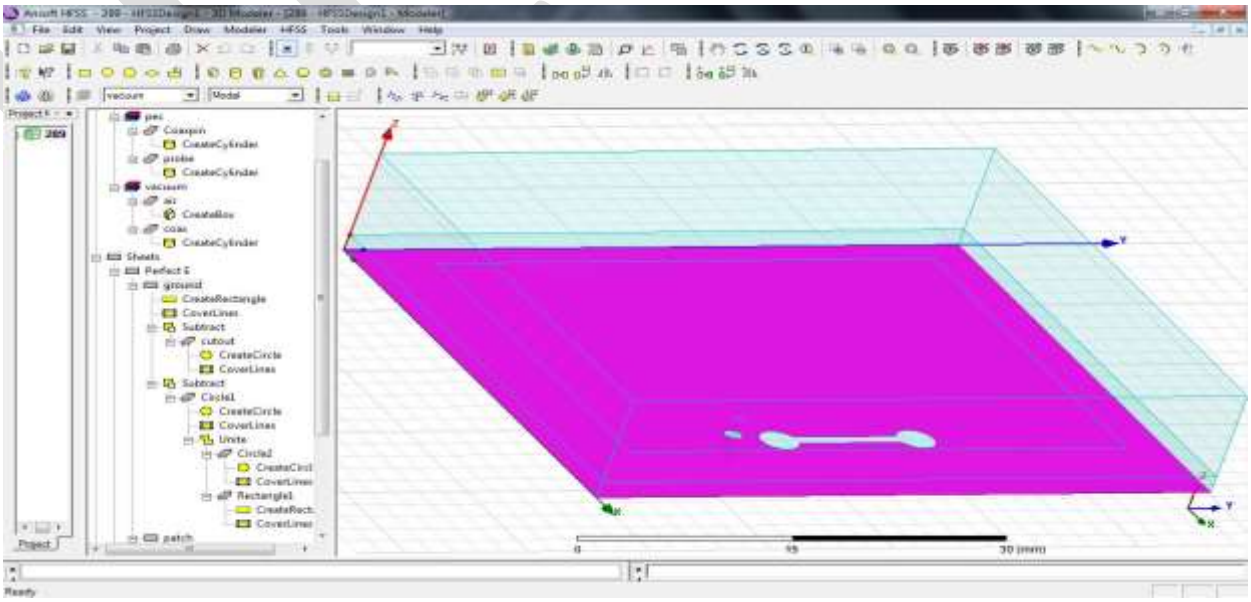

FIGURE 3(b) proposed design on HFSS 13.0 of MSA with dumb shell oval head shape DGS

2. SIMULATIONS AND RESULTS

The results of both above described antennas generated through the aid of HFSS 13.0 and parameters like S11, directivity, impedance & voltage standing wave ratio are simulated below:

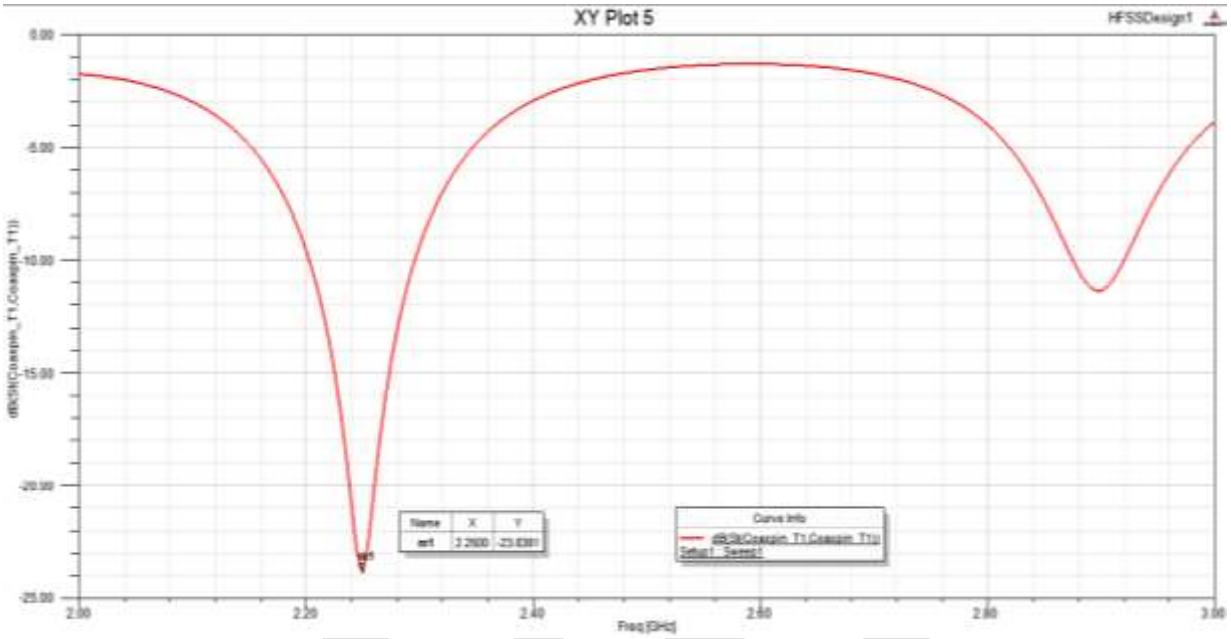

Figure 4 Simulated S11 on HFSS 13.0 of MSA without DGS operating at 2.25 GHz

The return loss S11 resulted by design without DGS is -23.8 which very close to -24 which is brilliant result while operating upon 2.25 GHz that is appropriate for Wireless Local Area Network and results the bandwidth of nearly 90 MHz. The WAN standards are - 2.2 - 2.483 GHz for IEEE 802.11 b/g and to calculate the bandwidth, the lower frequency is subtracted at -10 dB from upper bandwidth. Proposed design with DGS provides impedance of 44.8 ohms representing that antenna is approximately matched and the loss of power is very minimum. Here is represented the result of designed antenna:

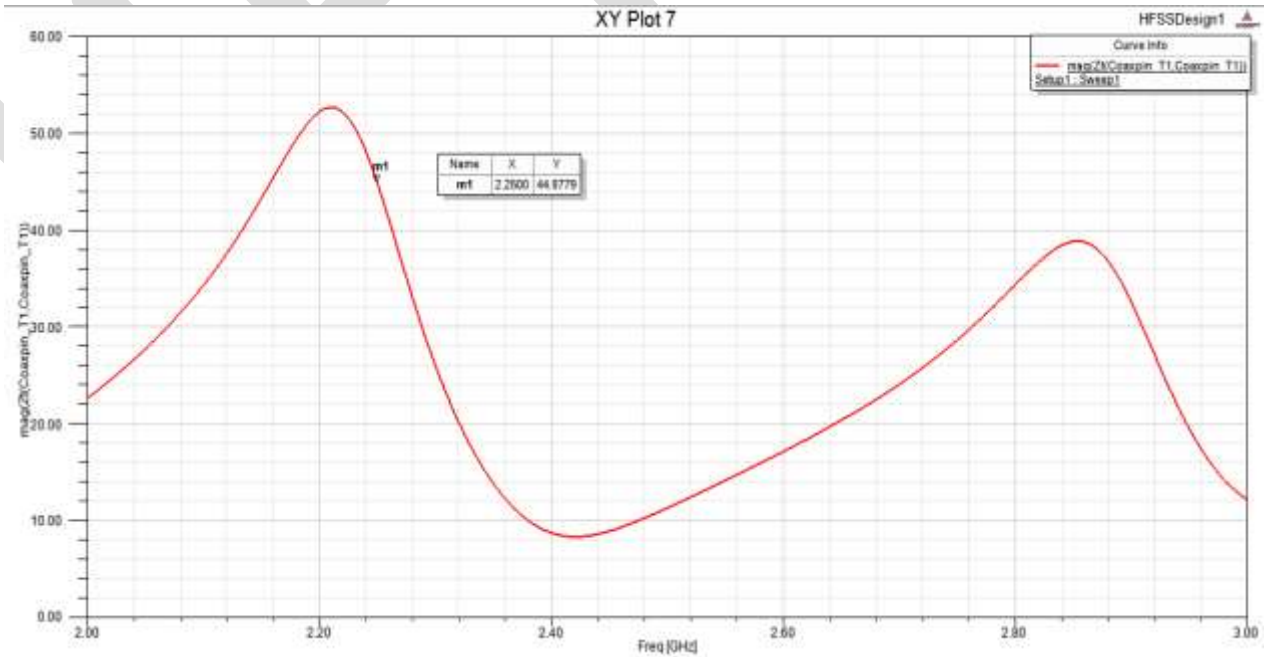

FIGURE 5 Simulated impedance on HFSS 13.0 of MSA without DGS operating at 2.25 GHz

The proposed design without DGS results out VSWR of 1.1374 in operating upon 2.25 GHz

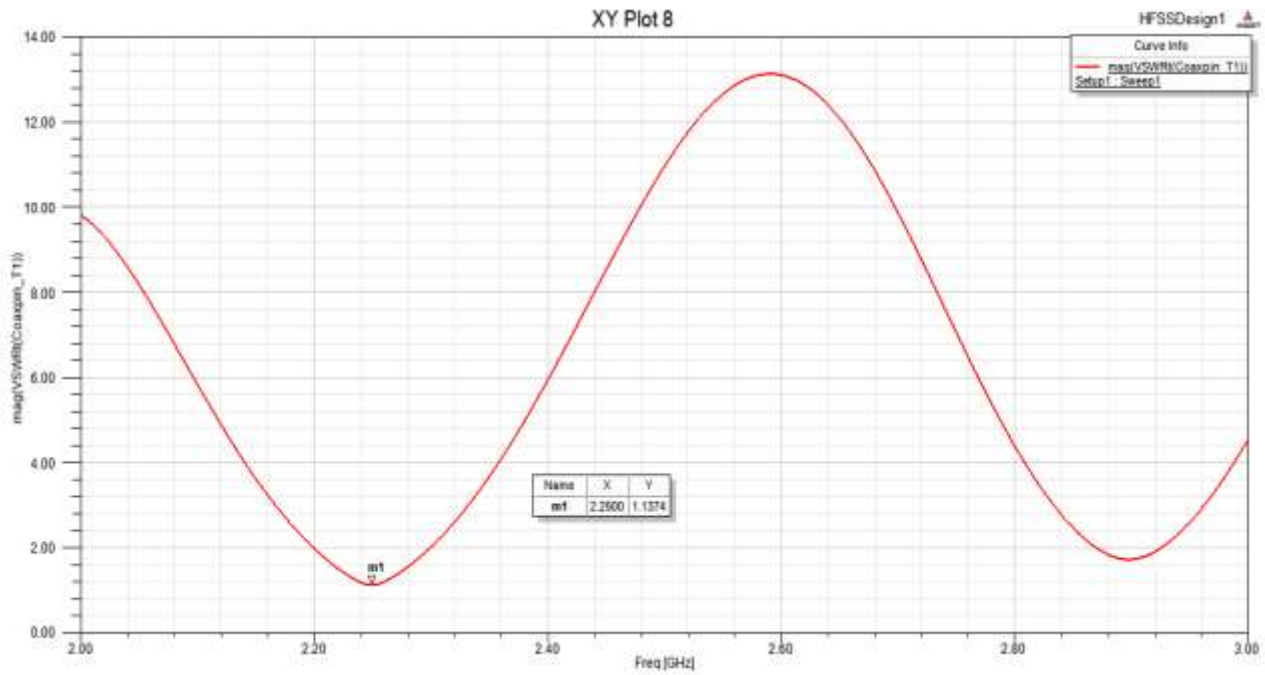

FIGURE 6 result of VSWR of MSA without DGS at 2.25 GHz on HFSS 13.0

The summarization of results generated above by HFSS 13.0 in the form of table 3 as below:

Parameters	**Values**
Operating frequency	2.25Ghz
Return loss	-23.8381
Impedance	44.8779
VSWR	1.1374
Bandwidth	90
GAIN	1.7
DIRECTIVITY	4.1

Table 3 Summary of results of designed antenna without DGS at 2.25 GHz frequency on HFSS 13.0.

2.1 SIMULATION OF PURPOSED DESIGN COAXIAL PROBE FED DUMB SHELL OVAL HEAD DEFECTIVE GROUND STRUCTURED MICROSTRIP RECTANGULAR PATCH ANTENNA

2.1.1 gain of purposed design at both c-band and s-band in HFSS

Here the simulation done very carefully in high frequency structure simulator upon two different frequencies and the results are shown simultaneously as below. The gain of microstrip antenna must be greater than 1.5dbi which is considered for c-band and s-band communication. The gain are shown in figure 7 and in figure 8. As the gain is obtained by this coaxial probe fed dumb shell oval head defective ground structured microstrip rectangular patch antenna when operated of multiple frequency is still very fine. The gain in 2.25GHz is 1.9842dbi and the gain upon that of 7.32GHz is 2.9762dbi which is good in both frequencies. So in case of gain parameter, this antenna is perfectly fine.

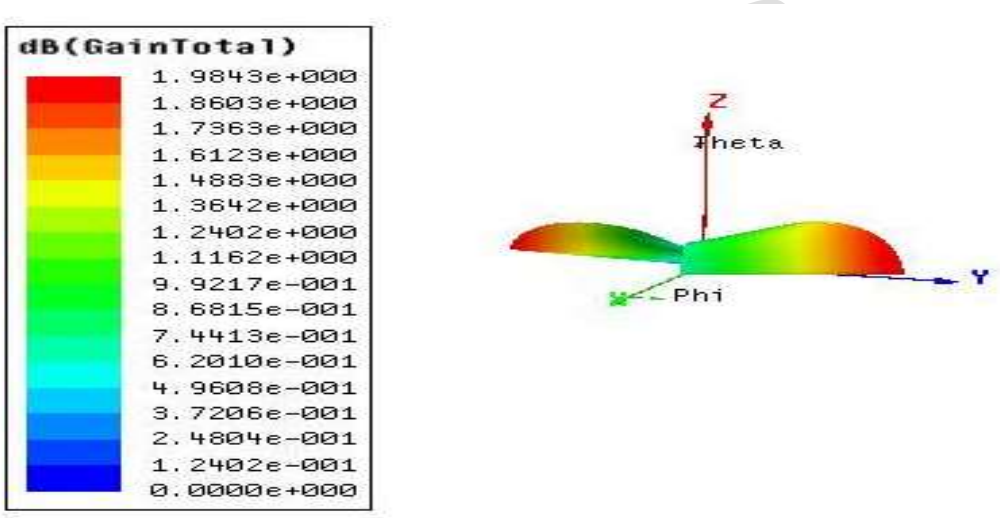

Figure 7 – gain of MSA with dumb shell oval head at 2.25GHz is 1.9843dbi

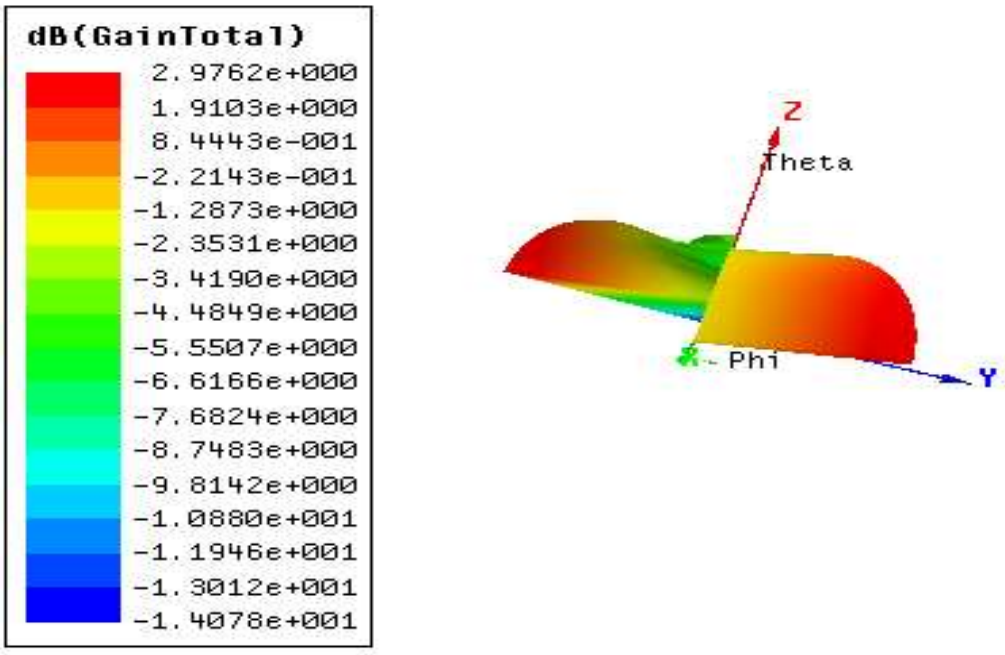

Figure 8. - gain of MSA with dumb shell oval head at 7.32GHz is 2.9762dbi

2.1.2 DIRECTIVITY of purposed design at both c-band and s-band in HFSS

As shown in figure 9 and 10 the directivity of coaxial probe fed dumb shell oval head defective ground structured microstrip rectangular patch antenna when operated of multiple frequency is still very fine. The ideal case directivity MSA is in between 5 – 7 dbi. The directivity is simulated on 2.25GHz and on 7.32GHz on HFSS and it found that the directivity on 2.25GHz is 4.2211dbi and the directivity on 7.32GHz is 4.4607dbi. therefore this antenna can be employed for c-band as well as s-band.

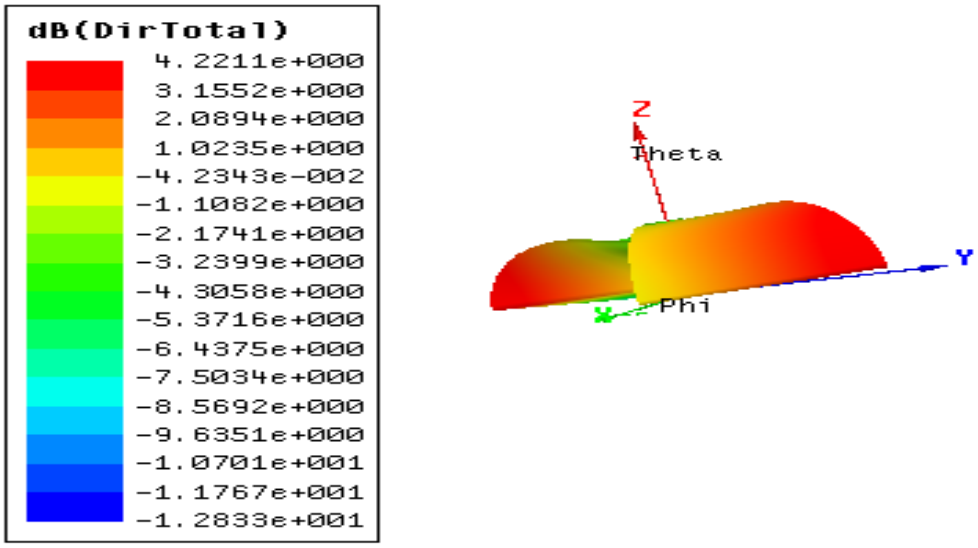

Figure 9 – directivity of MSA with dumb shell oval head at 2.25GHz is 4.2211dbi

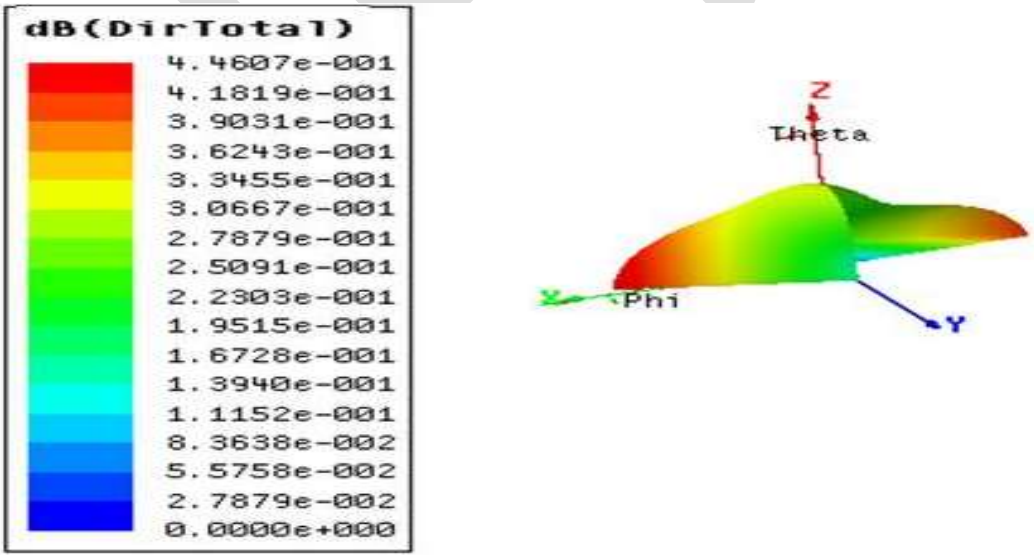

Figure 10. directivity of MSA with dumb shell oval head at 7.32GHz is 4.4607dbi

2.1.3 S11 result of purposed design at both c-band and s-band in HFSS.

The return loss parameter is perfectly simulated and results at both the frequencies are very good and it shows that this coaxial probe fed dumb shell oval head defective ground structured microstrip rectangular patch antenna can perform good for c-band and s-band communication as shown in figure 11 and 12. The return loss for 2.25 GHz is -29.5415db at 7.32GHz is -26.8db.

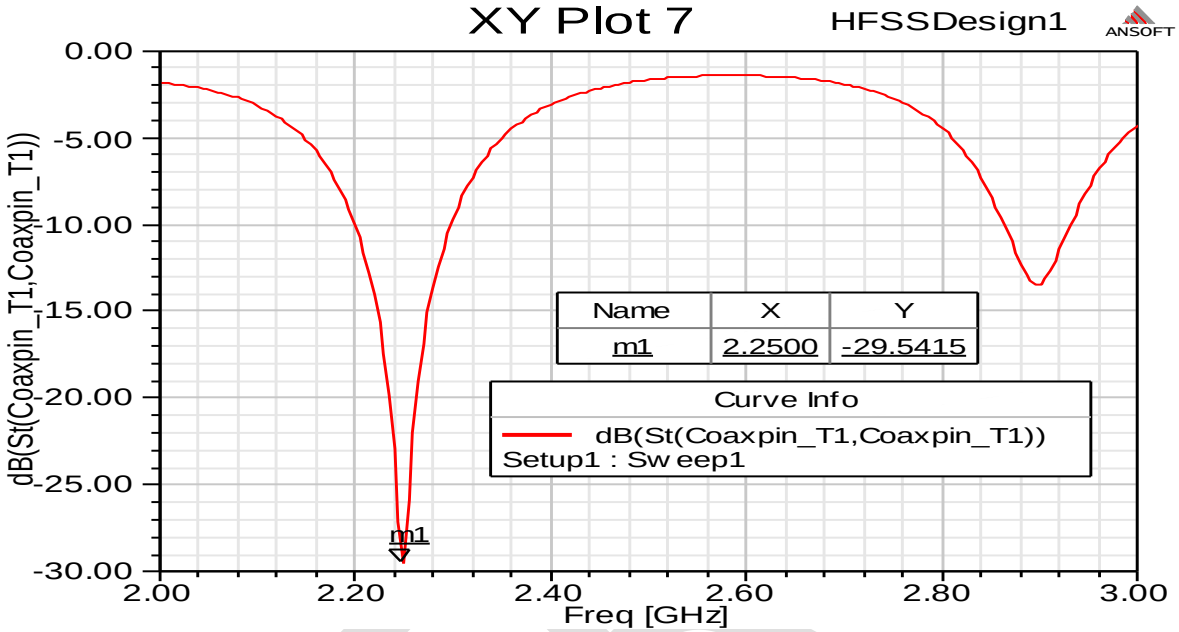

Figure 11 Simulated S11 of MSA with dumb shell oval head at 2.25GHz is -29.5415db

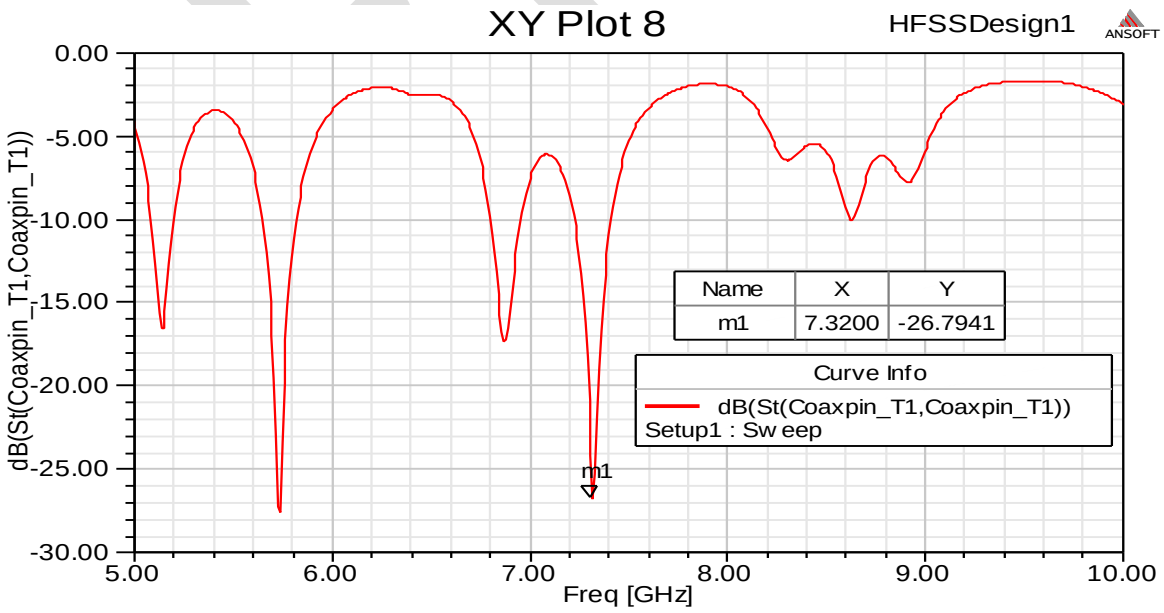

Figure 12 Simulated S11 of MSA with dumb shell oval head at 7.32GHz is -26.8db

2.1.4 vswr of purposed design at both c-band and s-band in HFSS.

The voltage standing wave ration for both the frequencies of coaxial probe fed dumb shell oval head defective ground structured microstrip rectangular patch antenna is very fine. The Simulated VSWR of MSA with dumb shell oval head at 2.25GHz is 1.06 and for 7.32GHz is 1.09 which are simulated in figure 13 and 14.

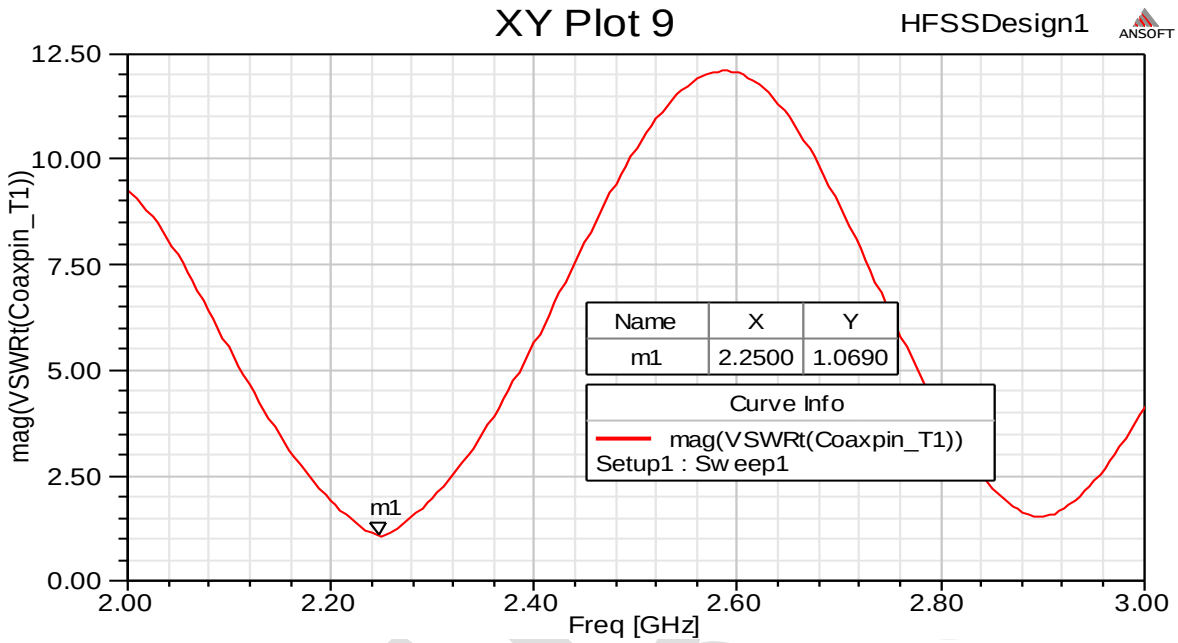

Figure 13 Simulated VSWR of MSA with dumb shell oval head at 2.25GHz is 1.06

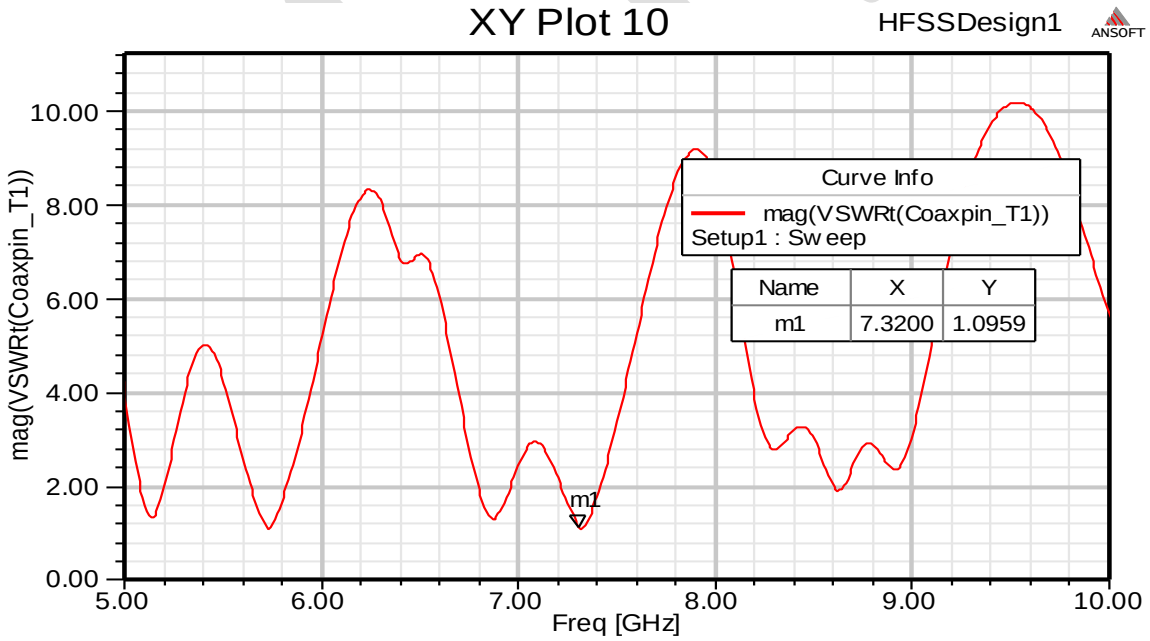

Figure 14 Simulated VSWR of MSA with dumb shell oval head at 7.32GHz is 1.09

2.1.5 impedance matching of purposed design at both c-band and s-band in HFSS.

The impedance matching being very important parameter is also calculated and is found that in both the operating frequencies the impedance matching is obtained perfectly well. The simulated impedance matching obtained for 2.25GHz is 47.1626 ohms and that of for 7.32GHz is 51.3952 ohms which are good for communication. The results are shown in figure 15 and 16..

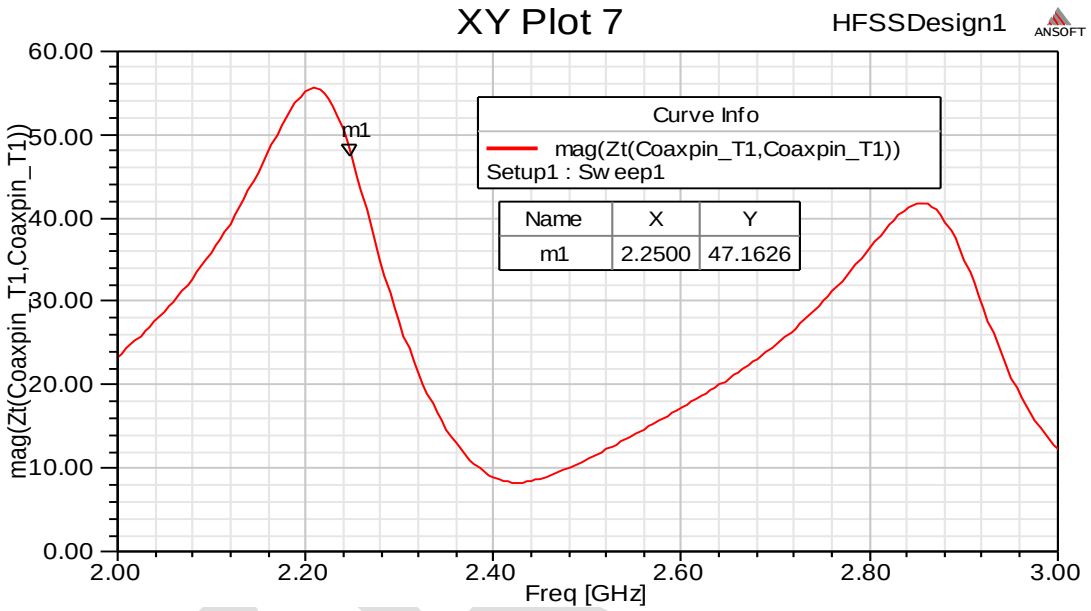

Figure 15 impedance matching of MSA with dumb shell oval head at 2.25GHz is 47.1626 ohms

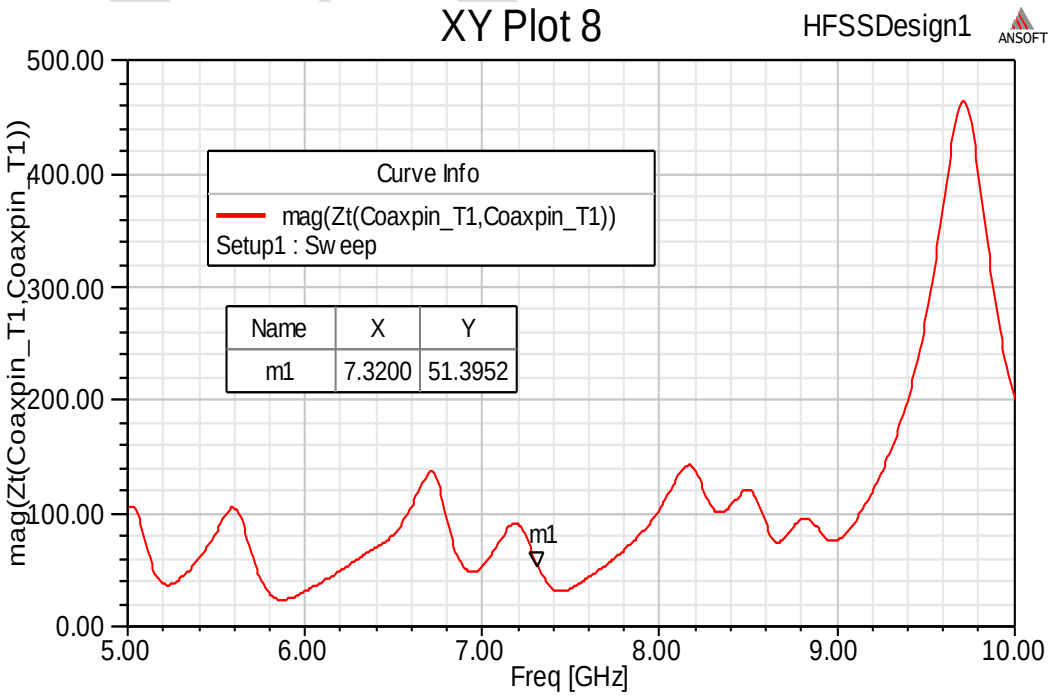

Figure 16 impedance matching of MSA with dumb shell oval head at 7.32GHz is 51.3952 ohms

3. CONCLUSION

This paper represents the designs of two antennas of co-axial feed micro strip rectangular patch antenna , with and without dumb shell oval head DGS technique , operating in between frequency spectrum of 2GHz−2.5 GHz. it is also simulationly proven that the design results out a bandwidth of nearly 4% which will always provide stable radiation pattern in between the allotted frequency range. In the center frequency the proposed design exhibit excellent impedance match of nearly 50 ohms. as proved above the enhancement of parameter by employing the dumb shell oval head DGS technique and further the comparison of both with and without DGS technique is displayed below. Which at last proves that dumb shell oval head DGS enhances an overall efficiency of co-axial feed micro strip rectangular patch antenna.

PARAMETERS	***FUNDAMENTAL MSA ANTENNA WITHOUT DGS***	***DUMB SHELL OVAL HEAD DUMBSHELL DGS***	
GHZ	***2.25***	***2.25***	***7.32***
GAIN	***1.7***	***1.9843***	***2.9762***
DIRECTIVITY	***4.1***	***4.2211***	***4.4607***
RETURN LOSS	***-23.8381***	***-29.54***	***-26***
VSWR	***1.1374***	***1.06***	***1.09***
IMPEDENCE MATCHING	***44.8779***	***47.16***	***51.39***

Table 5 Comparison of results of with and without DGS technique in MSA

3 CONCLUSION

The aim of this paper was to design a compact microstrip patch antenna for use in s-band and c-band. Therefore coaxial probe fed dumb shell oval head defective ground structured microstrip rectangular patch antenna was designed which multiband antenna. The size is also compact as ground plane dimensions for this antenna is **48. 32mm by 39.19mm**. The patch dimensions are **39.57mm by 29.43mm**. Hence the designed antenna is compact enough to be placed even in very small device. All the important parameters which are gain , directivity, VSWR, return loss (s11), impedance matching are simulated in HFSS and is proved that the MSA can operate very well just by employing defective ground structure orientation. Because of this DGS the area consumed by antenna is very much reduced and the material usage is also reduced. This is already proved that the antenna will perform well in s-band and c-band which was desired.

4 FUTURE WORK:

Another area for future work is to extend this concept to a multiband design in which the size of the antenna could be reduced by employing multiple DGS which could further increase the efficiency of an antenna. As in near future the size of the gadgets will be a great deal and small as well light gadgets will be preferred. So employing material can be reduced by various DGS.

REFERENCES:

[1] Balanis, C.A., "Antenna Theory Analysis and Design", 3rd Edition. New Jersey, John Wiley and Sons, 2005.
[2] Theodore S. Rappaport, "Wireless Communication and Practice", Second Edition, 2002.
[3] Lee, H. F., and W. Chen, "Advances in Microstrip and Printed Antennas", New York, John Wiley & Sons, 1997
[4] SunilKumar Vats1, and Hitanshu Saluja, International Journal of Engineering Research and General Science Volume 2, Issue 4, June-July, 2014 ISSN 2091-2730
[5] J. P. Geng, J. J. Li, R. H. Jin, S. Ye, X. L. Liang and M. Z. Li, "The Development of Curved Microstrip Antenna with Defected Ground Structure" Progress In Electromagnetic Research,PIER, vol. 98, pp 53-73, 2009.
[6] JaswinderKaur and Rajesh Khanna, "Co-axial Fed Rectangular Microstrip Patch Antenna for 5.2 GHz WLAN Application", Universal Journal of Electrical and Electronic Engineering 1(3):94-98, 2013.
[7] Alak majumder , "rectangular microstrip patch antenna using coaxial probe feeding technique to operate in s-band" international journal of engineering trends and technology (ijett) - volume4issue4- april 2013
[8] phani kumar tvb, abhinay kumar reddy s, aditya k,nagaraju a , "co-axial fed microstrip rectangular patch antenna design for bluetooth application" international journal of research in engineering and technology , eissn: 2319-1163 | pissn: 2321-7308
[9] MANDAL, A. DEPT. OF ECE, GURU NANAK INST. OF TECHNOL., KOLKATA, INDIA GHOSAL, A. ; MAJUMDAR, A. ; GHOSH, A. ; DAS, A. ; DAS, S.K. "ANALYSIS OF FEEDING TECHNIQUES OF RECTANGULAR MICROSTRIP ANTENNA " PUBLISHED IN: SIGNAL PROCESSING, COMMUNICATION AND COMPUTING (ICSPCC), 2012 IEEE INTERNATIONAL CONFERENCE ON 978-1-4673-2192-1
[10] BASILIO, LORENA I. ; COLL. OF BUS. ADM., HOUSTON UNIV., TX, USA ; KHAYAT, M.A. ; WILLIAMS, J.T. ; LONG, S.A. "THE DEPENDENCE OF THE INPUT IMPEDANCE ON FEED POSITION OF PROBE AND MICROSTRIP LINE-FED PATCH ANTENNAS" ANTENNAS AND PROPAGATION, IEEE TRANSACTIONS ON (VOLUME:49 , ISSUE: 1).
[11] Garima Sanyal1, Kirti Vyas2 , PW fed Circular Microstrip Patch Antenna with Defected Ground Structure , Volume 2, No.4, July – August 2013 , International Journal of Microwaves Applications.
[12] HFSS 13.0v pdf , "http://www0.egr.uh.edu/courses/ece/ECE6351-5317/SectionJackson/5113/HFSS%20waveguide%20combiner.pdf".

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Digital Meter for measuring Capacitance of an Ultra Capacitor

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ABSTRACT— Ultra Capacitors(UC) have large energy density, high power density, high capacitance in the order of farads coupled with low equivalent series resistance (ESR) and low rated voltages. Standard measurement devices like LCR meters, etc., are not suitable for measurement of capacitance of Ultra capacitors as the measurement ranges of these devices are much narrower. This paper proposes a Digital meter for measuring Capacitance of Ultra Capacitor using Charge-discharge method.

KEYWORDS— Ultracapacitors, Charge-Discharge Method, Capacitance Measurement, Operational Amplifier, Window Comparator, Inverting mode, digital meter

INTRODUCTION

Energy storage capability is constrained while using a single energy storage device in terms of size, cost and maintenance for meeting the electrical power requirements of applications. The more effective approach for supplying the electrical power requirements, is to arrive at the requirements from two perspectives viz., average power requirements and peak power requirements[1].

While batteries and fuel cells are widely used to provide the average power requirements of applications, capacitors with higher power capability, are commonly used for meeting the peak power requirements. With the trend of Increasing Pulse duration of peak power requirements, conventional capacitors are found to have limitations in energy density[2],[6]. Therefore, there is a need for a device that can deliver high power and as well as store large amount of energy. Ultra capacitors have been useful for such applications.

ULTRACAPACITORS

Ultra Capacitors (UC), also known as Super Capacitors or Electric Double Layer Capacitors (EDLC), are electrochemical capacitors having very large energy density and higher power density as compared to common capacitors[3], [4]. In Ultra Capacitors, the large energy density is achieved through enormous surface area created by porous carbon electrodes and also through small charge separation created by the dielectric separator[7]. These capacitors offer higher specific power density, higher efficiency, longer shelf and increased cycle-life than normal batteries.

An UC is a special type of capacitor with high capacitance, low equivalent series resistance (ESR), and low rated voltage values. The most attractive property of UCs is their high capacitance value which is expressed in a scale thousands of farads as against milli farads/micro farads of the conventional capacitors. These advantages have made UC attractive for varieties of potential applications such as consumer electronics, electric/hybrid vehicles, and industrial power management.[5]

NEED FOR NEW METHOD OF MEASURING CAPACITANCE OF ULTRACAPACITOR

Standard measurement devices like LCR meters are not sufficient for measuring the characteristics of an Ultracapacitor. For example, the measurement range of standard LCR meters for capacitance measurement is much narrower than the capacitance value of UCs. Furthermore, these measurement devices have limited energy[8],[9]. Most of them are battery powered. Therefore, these devices cannot change the stored energy levels in a UC with their limited energies, making them not suitable for measuring characteristics of UC. Hence, there is need for exploring a new method of measuring capacitance of an UC.

While developing a meter for measuring Capacitance of an UC, it is essential that the method is capable of applying large DC current signals at low rated voltage. Charging/Discharging method is apt and meets these requirements greatly. However, there is a need for Data acquisition, measurement and display system in Digital platform. Accordingly, the following method was evolved after studying the General Characteristics of Ultracapacitors and the requirements of a user.

DIGITAL METER FOR ULTRACAPACITOR

The proposed method is basis charging / discharging of UC. An UC is charged and time taken while charging from Set Voltage point V_1 to V_2, is converted into a pulse using a window Comparator. Pulse generated, is fed into a micro controller, with the help of which, the Capacitance of the UC is arrived and displayed.

The circuit deployed in this method is given below in Fig 1.

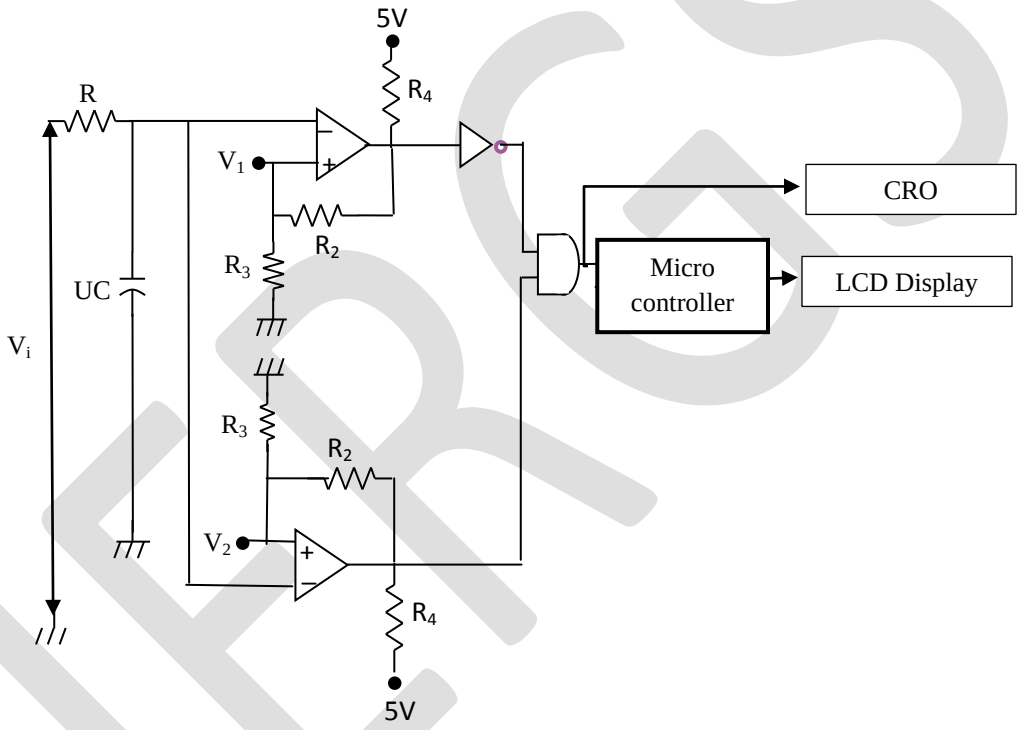

Fig. 1 Circuit of digital meter

R =10Ω, R_2 =100KΩ, R_3 =4.7KΩ, R_4=470Ω, V_i = 2V. V_1, V_2 are Set voltage points

A potential divider is used for setting the values of V_1 and V_2 using V_{CC} which is 5V. V_i of 2 V has been selected considering the low rated voltage of Ultra capacitors.

In the window comparator used in the circuit, both the comparators are working in inverting mode. Reference voltage is applied to the non- inverting input and Voltage across the capacitor is applied to the inverting input. Whenever, the voltage across the capacitor goes above set voltage (V_1 or V_2), the output of the comparator becomes low[10], [11]. Using NOT and AND gates, pulse is obtained from V_1 to V_2. Pulse can be observed in CRO and the same is fed to a microcontroller for evaluating capacitance value.

The calculations for arriving at Capacitance of UC is given below:

$$V_1 = V_i\,(1 - e^{-t_1/RC}) \quad \text{.....1}$$

$$V_2 = V_i\,(1 - e^{-t_2/RC}) \quad \text{.....2}$$

$$\frac{t_1}{RC} = -\ln(1 - \frac{V_1}{V_i}) \quad \text{.....3}$$

$$\frac{t_2}{RC} = -\ln(1 - \frac{V_2}{V_i}) \quad \text{.....4}$$

From the above equations, the value of C can be arrived by the following formula.

$$C = \frac{t_2 - t_1}{R\left[ln\left(1-\frac{V_1}{V_i}\right) - ln\left(1-\frac{V_2}{V_i}\right)\right]} \quad \text{.....5}$$

In the above equation, t_2-t_1 is the pulse width measured in seconds through the circuit. All other values, V_2, V_1 and R are known and hence, C can be arrived at using the above equation.

HARDWARE IMPLEMENTATION

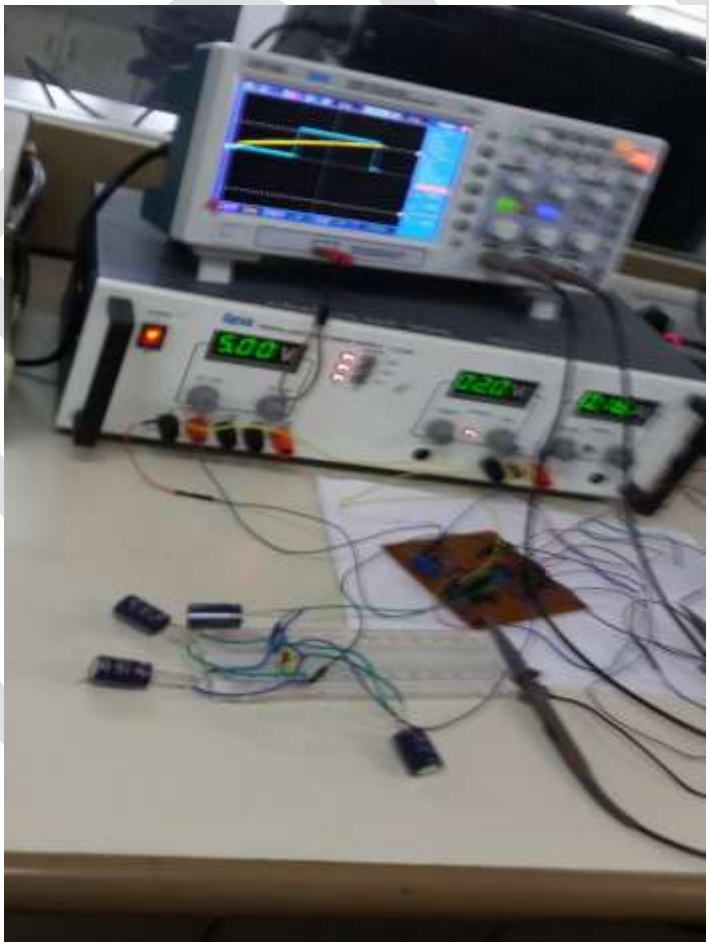

Fig 2 PCB Circuit and pulse display in CRO

Readings were taken for many values of capacitance of UC viz., 3, 25, 50, 75, 100 & 350 farads. The RMS value of errors, i.e. between Measured Value and Real Value were analyzed and the same are given below in Table 1.

Table 1

V1 (V)	V2 (V)	Pulse Width (Seconds)	Measured Value of C (Farads)	Real Value of C (Farads)	Error (Farads)	RMS Value of Error %
0.52	1.12	16.7	3.212	3	0.212	4.8%
0.54	0.94	10	3.123	3	0.123	
0.58	0.98	10.2	3.0834	3	0.0834	
0.58	0.98	10.4	3.1439	3	0.1439	
0.58	0.98	9.6	2.909	3	-0.091	
0.58	0.98	10.6	3.204	3	0.204	
0.42	0.98	12.8	2.925	3	-0.075	
0.58	0.98	88	26.602	25	1.602	7.2%
0.58	0.98	84	25.39	25	0.39	
0.62	1.00	88	27.33	25	2.33	
0.50	1.14	154	27.68	25	2.68	
0.54	0.94	85	26.545	25	1.545	
0.54	0.96	90	26.53	25	1.53	
0.56	0.96	88	27.044	25	2.044	
0.56	0.96	86	26.429	25	1.429	
0.58	0.98	180	54.41	50	4.41	12.4%
0.48	0.9	184	56.89	50	6.89	
0.46	0.9	184	54.7	50	4.7	
0.58	0.98	192	58.04	50	8.04	
0.58	0.98	272	82.225	75	7.225	12.8%
0.46	0.9	288	85.61	75	10.61	
0.46	0.9	288	85.61	75	10.61	
0.58	0.98	368	111.25	100	11.25	14.1%
0.58	0.98	380	114.8	100	14.8	
0.38	0.8	348	115.96	100	15.96	
0.58	0.98	1288	389.36	350	39.36	14.4%
0.58	0.98	1352	408.7	350	58.7	
0.58	0.98	1328	401.47	350	51.47	

Capacitance of Ultracapacitor - Measured Vs Real Value

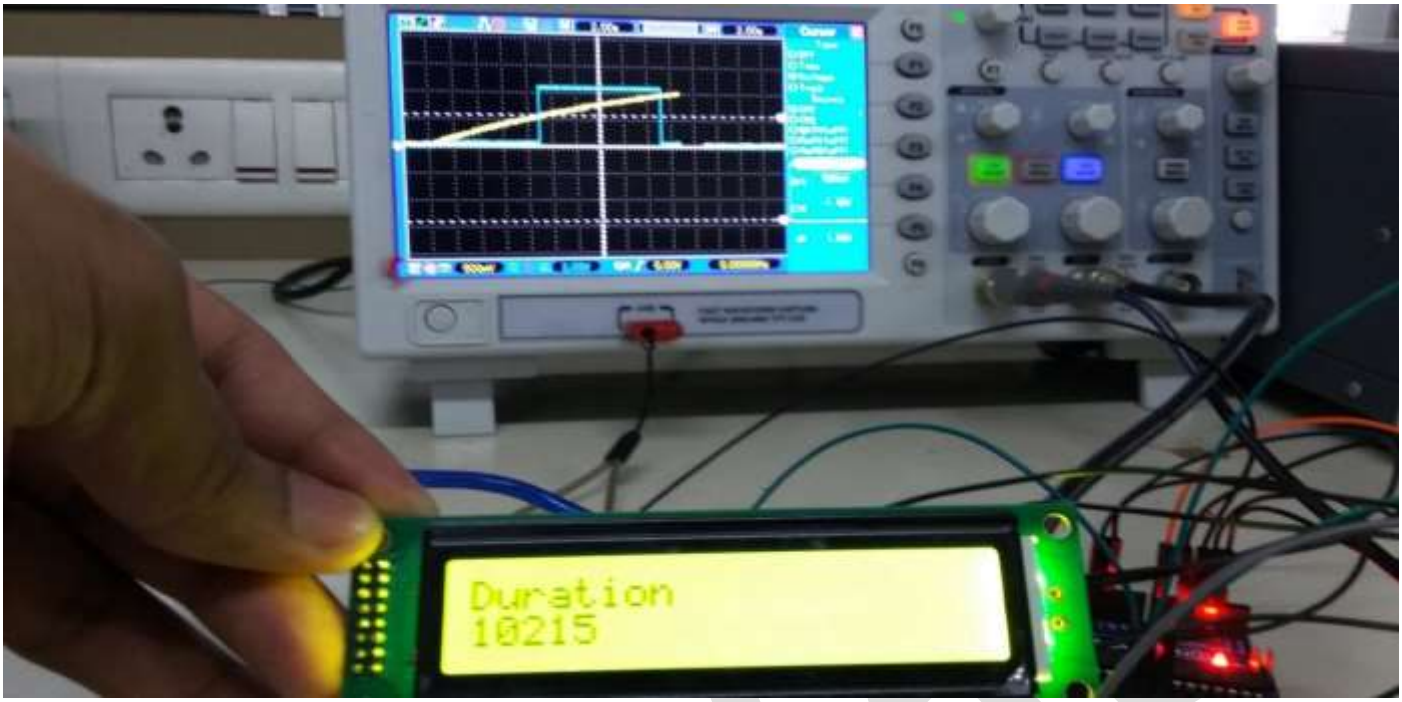

Fig 3. Output in CRO and LCD Display

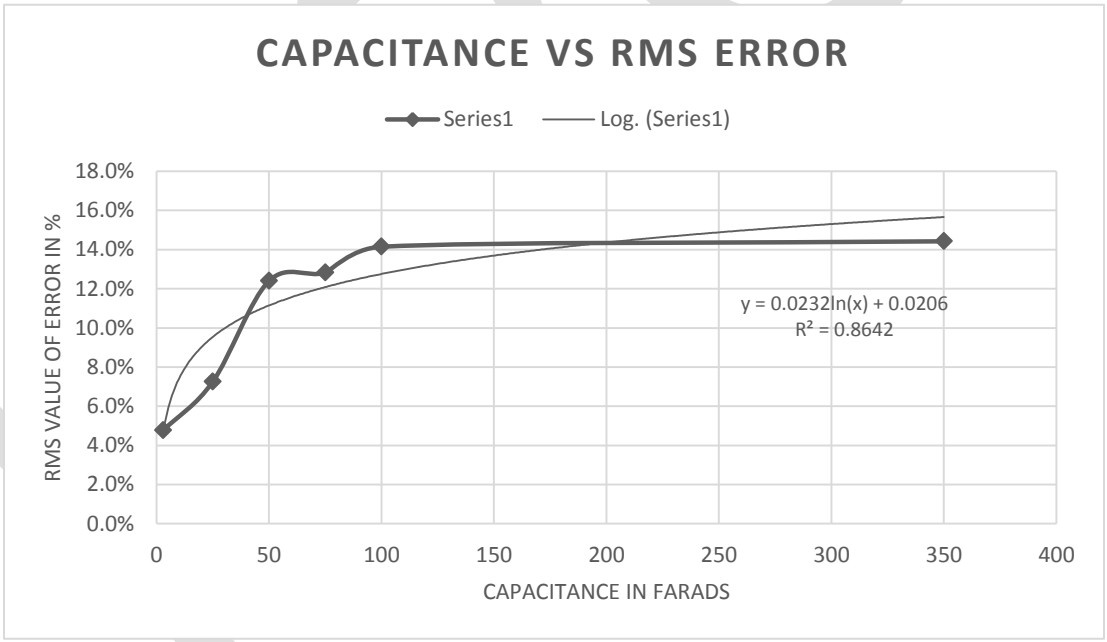

Fig. 4. Chart Capacitance Vs RMS Error

The points were plotted in the graph in Fig 4. Logarithmic function was found to be best fit for these values with R^2 as high as 0.8642. The errors were more or less saturated in the range of 12% to 14% for Capacitance Value range of 50 Farads to 350 Farads. For Capacitance Values below 50 Farads, the errors are further less and follows Logarithmic path.

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CONCLUSION

Measurement of Capacitance of Ultracapacitor has been a challenge in view of higher order of Capacitance values. Developing the digital meter which is simple to use will go a long way in deployment of Ultracapacitor in day-to-day applications mainly in Automobile and other high energy applications.

REFERENCES:

[1] Hasan Huseyin Eroglu, Ahmet M Hava, Gulhane Medical Military Academy, Middle East Technical University "*Design and Implementation of an Ultra capacitor Test System"* 978-1-4244-9312-8/11/$26 @ 2011 IEEE.

[2] R P Deshpande, *"Ultracapacitors, Future of Energy Storage",* ISBN-13: 978-9339214050.

[3] Maxwell Technologies, *"Gateway to a new thinking in energy management-Ultracapacitors",* San Diego, 2005

[4] J.R.Miller, A.F Burke, *"Electric vehicle capacitor test procedures manual, Revision 0,* Idaho National Engineering Laboratory, Report No. DOE/ID-10941, 1994.

[5] Chia-Jui Chiang, Jing-Long Yang, and Wen-Chin Cheng, "*Dynamic Modeling of the Electrical and Thermal Behavior of Ultracapacitors",*2013, 10th IEEE International Conference on Control and Automation (ICCA), Hangzhou, China, 978-1-4673-4708-2/13/$31.00 ©2013 IEEE

[6] A. Burke, *"Ultracapacitors: why, how, and where is the technology,"* Journal of Power Sources, vol. 91, pp. 37–50, 2000.

[7] R. Gallay, *"Properties and State of Art of High Power Ultracapacitors,"* 16 Seminario Interattivo, Bressanone Marzo, Italy, 2005.

[8] V.A. Shah, J.A. Joshi, R. Maheshwari and R. Roy, "Review of Ultracapacitor Technology and its Applications," In Fifteenth National Power Systems Conference (NPSC) Conf. Records, pp. 142-147, IIT Bombay, 2008.

[9] Y. Kim, *"Ultracapacitor Technology Powers Electronic Circuits,"* Power Electronics Technology, October 2003.

[10] Ramakant A. Gayakwad, *Op-Amps and Linear Integrated Circuits*, 3RD edition, Prentice-Hall India, 2011

[11] D.Roy Choudhury, Shail B. Jain, *Linear Integrated Circuits*, 4th edition, New age International Publishers, 2010.

[12] Fairchild Semiconductor, *LM311 single comparator, datasheet, Rev 1.0.1,* www.fairchildsemi.com

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An Approach to Selection of Third Party Reverse Logistics provider for Mobile Phone Industry using VIKOR Method

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Abstract— Reverse supply chain logistics is the transfer of goods from end users towards manufacturer in the way of product distribution. In these dynamic business scenarios, the companies must promote other uses of resources that may be economic and eco friendly by furnishing products' routine life cycles. RL activities i.e. Preserving, transporting and handling of used products ails a great challenge to reverse logistics executives as there is always chances of conflicted in terms of quality, quantity and time of return of EOL products in case of reverse supply chains. Business enterprises involving those of white/electronics goods manufacturing industries would strives to focus on their core competency areas and there is need of opting outsourcing decisions of their reverse logistics process to Third-Party reverse Logistics Providers (3PRLPs). Thus, most important strategic complication for top management is the evaluation and selection of third party logistics service provider who can effectively provide reverse logistics operation services to the firms. The significance of this work is to develop decision support system (DSS) to assist the top management of the company in selection and evaluation of best 3PRL service using VIKOR method.

Keywords— TOPSIS, Normalized decision matrix, Alternative criterion function, maximum criterion function, Utility measure, Regret measure, VikorIndex.

INTRODUCTION

Supply chain management systems have seen a dynamic change in operational style since last two decades. In earlierbusiness practices, supply chain flow happens in the forward direction only. In current business environment industries arefacing the problem of return flow of the products in the supply chain for a variety of reasons like product recalls, warrantyfailure, service failure, commercial returns, manufacturing returns, end-of-life (EOL) and end-of-use returns. Reverselogistics is the process of return product handling mechanism in forward supply chain.The productive utilization of 3PLS providers for reverse logistics activities may lead to enhancement of profit margin and effective integrated supply chain network for organizations. Therefore, a very important strategic issue for company management is the evaluation andselection of 3PL logistics service providers who can efficiently provide reverse logistics services to organization. In this paper, a hybrid approach VIKOR has been used for making strategic decision in multi-attributedecision environment for selection of 3PL service providers for collection of end-of-life (EOL) mobile phones. This paper organized as follows.

LITERATURE REVIEW

In this work, an attempt is made to discover the potential and applicability of Vikor (a ranking compromise) method while selecting the reverse logistics for a particular industrial application. VIKOR (the Serbian name is 'VlseKriterijumskaOptimizacijaKompromisnoResenje' which means multicriteria optimization (MCO and compromise solution) method was mainly Established by Zeleny [1] and later advocated by Opricovic and Tzeng [2-3]. This method is developed to solve the Attributes MCDM problems with conflicting and non-commensurable (different units criteria), assuming that compromise may be acceptable for conflict resolution, when the decision maker wants a solution that is the closest to the ideal solution and the alternatives can be evaluated with respect to all the attributes set.

METHODOLOGY

VIKOR (VlseKriterijumskaOptimizacijaKompromisnoResenje), also known as Compromise Ranking Method is a possible solution that is closest to the ideal solution and the meaning of compromise is agreement generated by mutual concession.The VIKOR MCDM approach presented in this work and applied in evaluation & selection of 3PL for a mobilephone manufacturing industry. There are 20 outsourcing service providers were interested to conduct reverse logistics operation for the cell manufacturing industry. In the preliminary screening 11 service providers were rejected easily by the company management. The final selection from the remaining nine potential 3PRLPs (A, B, C, D, E, F, G, H and I) was very tough task because almost all the service providers fulfill the requirement of the company. These attributes are E-Waste Storage Capacity (EWSC), Availability of Skilled Personnel (AOSP), Level of Noise Pollution (LNP) and Impacts of Environmental Pollution (IEP), Safe Disposal Cost (SDC), Availability of a covered and

closed Area (ACCA), Possibilities to work with NGOs (PWNGO), Inspection/sorting and disassembly cost (ISDC), Mobile phone Refurbishing cost (MPRC), Mobile recycling cost (MRC). Among these attributes, ISDC (thousands of Rupees), EWSC (in tones), MPRC (INR/hour), MRC (thousands of INR) and final disposal cost (thousands of INR) are quantitative in nature, having absolute numerical values. Attributes AOSP, LNP, ACCA, IEP and PWNGO have qualitative measures and for these a ranked value judgment on a scale of 1–5 (here 1 corresponds to lowest, 3 is moderate and 5 corresponds to highest) has been recommended. The cost of recycling of EOL or used mobiles phones ranges from INR.1000 to INR.1600 per unit and INR.1200 to INR.2000 per unit for safe disposal of hazardous waste from mobile. A single mobile refurbishing technician can test and troubleshoot a used mobile, make necessary repairs and upgrade and package it for reuse in 3 hours at a cost of on an average INR.1500 (Techsoup, 2008). These data was provided by various remanufacturing companies during this research project and has been used as the reference for the formulation of reverse logistics data for the case company dealt inthis work. The data for all 3PL with respect to various attributes.

The calculation of VIKOR values, we go through the following steps:

Step 1: In the first step, we have to determine the objective and to identify the attribute values for each alternative.

Step 2: Establish the decision matrix

The first step of the TOPSIS method involves the construction of a Decision Matrix (DM).

$$DM = \begin{array}{c} \\ L_1 \\ L_2 \\ \vdots \\ L_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \end{array} \quad \text{---------- (1)}$$

Where 'i' is the criterion index (i = 1 . . . m); m is the number of potential sites and 'j' is the alternative index (j= 1 . . . n). The elements C_1, $C2_{\ldots}$, C_n refer to the criteria: while L_1, $L_{2\ldots}$, and Lnrefer to the alternative locations. The elements of the matrix are related to the values of criteria i with respect to alternative j.

Step 3: Calculate a normalised decision matrix

The normalized values denote the Normalized Decision Matrix (NDM) which represents the relative performance of the generated design alternatives.

$$\mathrm{NDM} = R_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x^2{}_{ij}}} \quad \text{----------(2)}$$

Step 4: Depending upon the relative importance of different attributes obtain weight for each attributes using the formula given below and the sum of the weights should be 1.

$$W_j = V_j / \sum_{i=1}^{m} V_j \;\; \& \;\; \sum_{j=1}^{m} w_j = 1 \quad \text{---------- (3)}$$

Step 5: Obtain the value of the criterion function for all the alternative f_{ij}. $f_{ij}$is the j_{th} criterion function of X_i alternative .

Here, i=1, 2… n: the number of alternatives.
j=1, 2… m: the number of criteria.

Step 6: Obtain the maximum criterion function f j* and the minimum criterion function f j- , where j = 1. . . . . m.

$$f_j^* = \max_i f_{ij} = max\,[(f_{ij})|\, i = 1, 2, \ldots\ldots, n] \quad \text{---------- (4)}$$

$$f_j^- = \min_i f_{ij} = min\,[(fij)\mid i = 1, 2, \ldots\ldots, n] \quad \text{---------- (5)}$$

Step 7: Calculate the utility measure and regret measure for all the alternatives given as:

a) Utility measure

$$S_i = \sum_{j=1}^{m} W_j (f_j^* - f_{ij}) / (f_j^* - f_j^-) \quad \text{---------- (6)}$$

b) Regret measure

$$R_i = \max_j \left[W_j (f_j^* - f_{ij}) / (f_j^* - f_j^-) \right] \quad \text{---------- (7)}$$

Step 8: Calculate the value of VIKOR index for each alternative expressed as follows:

$$Q_i = v(S_i - S^*)/(S^- - S^*) + (1 - v)(R_i - R^*)/(R^- - R^*) \quad \text{---------- (8)}$$

Where,
Qi represents the VIKOR index value of i_{th} alternative. I=1,2,……,n

$$S^* = \min_i S_i = \min [(S_i) \mid i = 1, 2, \ldots\ldots, n]$$

$$S^- = \max_i S_i = \max [(S_i) \mid i = 1, 2, \ldots\ldots, n]$$

$$R^* = \min_i R_i = \min [(R_i) \mid i = 1, 2, \ldots\ldots, n]$$

$$R^- = \max_i R_i = \max [(R_i) \mid i = 1, 2, \ldots\ldots, n] \quad \text{---------- (9, 10, 11, and 12)}$$

V is the weight for the maximum value of group utility and 1 – v is the weight of the individual regret. v is generally set to 0.5.

Step 9: Rank of the alternatives is done by observing the Qi value. The less the value indicates a better quality.

INPUT TABLES

Table 1: AHP Measurement Scale

	Numerical rating
Extremely preferred	9
Very strongly preferred	7
Strongly preferred	5
Moderate preferred	3
For compromise	2,4,6&8
Equally preferred	1

Table 2: Decision matrix

3PRLSP	EWSC	ISDC	MPRC	MRC	SDC	ACCA	PWNGO	AOSP	LNP	IEP
A	150	160	130	1200	1400	3	4	3	4	5
B	140	170	150	1300	1800	5	5	4	3	4
C	170	160	180	1350	1480	4	3	5	5	5
D	180	165	160	1500	1600	2	3	3	1	2
E	110	150	160	1500	1400	1	3	5	2	5
F	120	180	130	1400	1400	5	3	4	4	2
G	130	165	150	1300	1750	3	2	4	3	5
H	200	160	130	1550	1800	4	1	2	4	4

I	150	110	140	1200	1650	5	2	2	4	5
sum	1350	1420	1330	12300	14280	32	26	32	30	37

RESULTS TABLES

- Normalized decision matrix

Table 3: Normalized decision matrix

3PRLSP	EWSC	ISDC	MPRC	MRC	SDC	ACCA	PWNGO	AOSP	LNP	IEP
A	0.11111	0.112676	0.097744	0.097561	0.098039	0.09375	0.153846	0.09375	0.133333	0.135135
B	0.10374	0.119718	0.112782	0.105691	0.12605	0.15625	0.192308	0.125	0.1	0.108108
C	0.125926	0.112676	0.135338	0.109756	0.103641	0.125	0.115385	0.15625	0.166667	0.135135
D	0.133333	0.116197	0.120301	0.121951	0.112045	0.0625	0.115385	0.09375	0.033333	0.054054
E	0.081481	0.105634	0.120301	0.121951	0.098039	0.03125	0.115385	0.15625	0.066667	0.135135
F	0.088889	0.126761	0.097744	0.113821	0.098039	0.15625	0.115385	0.125	0.133333	0.054054
G	0.096296	0.116197	0.112782	0.105691	0.122549	0.09375	0.076923	0.125	0.1	0.135135
H	0.148148	0.112676	0.097744	0.126016	0.12605	0.125	0.038462	0.0625	0.133333	0.108108
I	0.111111	0.077465	0.105263	0.097561	0.115546	0.15625	0.076923	0.0625	0.133333	0.135135
$X^{*}_{ij\ mean}$	0.111111	0.111111	0.111111	0.111111	0.111111	0.111111	0.111111	0.111111	0.111111	0.111111

- Variance of different attributes

Table 4: Variance of different attributes

EWSC	ISDC	MPRC	MRC	SDC	ACCA	PWNGO	AOSP	LNP	IEP
0.000533	0.00022	0.00019	0.000127	0.000167	0.002263	0.002301	0.001426	0.001905	0.001345

- Weights of different attributes

Table 5: Weights of different attributes

EWSC	ISDC	MPRC	MRC	SDC	ACCA	PWNGO	AOSP	LNP	IEP
0.050861	0.020994	0.018152	0.012164	0.015896	0.215949	0.219572	0.136077	0.181752	0.128337

- Maximum criterion function

$$(f_j^{*} = \max_i f_{ij})$$

Table 6:Maximum criterion functions

EWSC	ISDC	MPRC	MRC	SDC	ACCA	PWNGO	AOSP	LNP	IEP
0.148148	0.126761	0.135338	0.126016	0.12605	0.15625	0.192308	0.15625	0.166667	0.135135

- Minimum criterion function

$$(f_j^{-} = \min_i f_{ij})$$

Table 7: Minimum criterion function

EWSC	ISDC	MPRC	MRC	SDC	ACCA	PWNGO	AOSP	LNP	IEP
0.081481	0.077465	0.097744	0.097561	0.098039	0.03125	0.038462	0.0625	0.033333	0.054054

- Utility measure

$$(S_i = \sum_{j=1}^{m} W_j (f_j^* - f_{ij}) / (f_j^* - f_j^-))$$

Table 8: Utility measure

A	B	C	D	E	F	G	H	I
0.37949	0.2355	0.206393	0.705303	0.546802	0.413392	0.474513	0.522005	0.428092

S* = 0.206393; S- = 0.705303

- Regret measure

$$(R_i = \max_j [W_j (f_j^* - f_{ij}) / (f_i^* - f_j))$$

Table 9: Regret measure

A	B	C	D	E	F	G	H	I
0.107974	0.090876	0.109786	0.181752	0.215949	0.128337	0.164679	0.219572	0.164679

R* =0.090876; R- =0.219572

- VIKOR Index value

$$Q_i = v(S_i - S^*)/(S^- - S^*) + (1 - v)(R_i - R^*)/(R^- - R^*)$$

Table 10: VIKOR index value Qi

	A	B	C	D	E	F	G	H	I
Qi	0.239905	0.029171	0.073468	0.853064	0.827076	0.352992	0.555439	0.816301	0.508917
Rank	7	9	8	1	2	6	4	3	5

CONCLUSION

The analysis and selection of the 3PL for mobile industry is a management level strategic decision. The amount of e-waste is enormouslyescalating and it poses complicated to society and environmental burden. The electronics appliances manufacturing companies are quite interested to focus towards their core competencies and services of 3PL is a right choice for them to separate reverse logistics operations. Therefore, hiring the services of 3PL is an importance issue and present work is very significant in this regards.The manufacturing industries does not have enough competence to manage their product reverse flow in supply chain, thus they have to only option to outsource their reverse logistics operations to the 3PL service provider for conduct of reverse logistics (RL) activities. Finally, the TOPSIS method is employed to evaluate the best 3PRL service provider considering various criteria's.The results showthat 3PRL service provider 'D' is most suitable among all other service providers. Least preference is given to service provider 'B' according to its ranking.

FUTURE SCOPE

The scope of present work may be carried for evaluating 3PRL Service provider using other MCDM techniques especially Fuzzy-TOPSIS, Grey Relational Analysis, ANP, Promthee, Electree, Multi goal Programming (or) Multi objective decision making and hybrid Techniques.

REFERENCES:

[1] Zeleny, M., 2002, "Multiple Criteria Decision Making, McGraw Hill," New York.
[2] Opricovic, S., and Tzeng, G. H., 2004, "Compromise Solution by MCDM Methods: A Comparative Analysis of VIKOR and TOPSIS," European Journal of Operational Research, 156, pp. 445-455.
[3] 14 Opricovic, S., and Tzeng, G. H., 2007, "Extended VIKOR Method in Comparison with Outranking Methods," European Journal of Operational Research, 178, pp. 514-529.
[4] Franke, C., B. Basdere, M. Ciupek, and S. Seliger(2006) 'Remanufacturing of Mobile Phones—Capacity, Programand Facility Adaptation Planning" Omega, 34 (2006) 562 – 570.
[5] Hwang, C.L. and Yoon, K. (1981) Multiple Attribute Decision Making-Method and Applications: A State-of-the-Art Survey, Springer-Verlag, New York.
[6] Knemeyer, A.M., Ponzurick, T.G. and Logar, C.M. (2002) 'A qualitative examination of factors affecting reverselogistics systems for end-of-life computers', International Journal of Physical Distribution and Logistics Management, Vol. 32, No. 6, pp.455–479.
[7] Qureshi, M.N., Kumar, P. and Kumar, D. (2009) 'Selection of Logistics Services Provider (LSP) under fuzzyenvironment: a graph-theoretic and matrix approach', International Journal of Logistics Systems and Management,Vol. 5, No. 5, pp.551–573.
[8] Ravi, V., Shankar, R. and Tiwari, M.K. (2008) 'Selection of a reverse logistics projects for end-of-life computers:ANP and goal programming approach', International Journal of Production Research, Vol. 46, No. 17, pp.4849–4870.
[9] Saaty, T.L. (1980) The Analytic Hierarchy Process, McGraw-Hill, New York.
[10] Sasikumar, P. and Haq, A.N. (2010) 'A multi-criteria decision making methodology for the selection of reverselogistics operating modes', International Journal of Enterprise Network Management, Vol. 4, No. 1, pp.68–79.
[11] Rao, R. V., 2007, "Decision Making in the Manufacturing Environment using Graph Theory and Fuzzy Multiple Attribute Decision Making Methods," Springer-Verlag, London.
[12] Vijayvargiya, A. and Dey, A.K. (2010) 'An analytical approach for selection of a logistics Provider', ManagementDecision, Vol. 48, No. 3, pp.403–418.

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Improvising Round – Robin Process Scheduling through Dynamic Time Quantum Estimation

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Abstract— Round Robin, considered as the most widely adopted CPU scheduling algorithm, undergoes severe problems directly related to quantum size. If time quantum chosen is too large, the response time of the processes is considered too high. On the other hand, if this quantum is too small, it increases the overhead of the CPU due to frequent context switches. In this paper, we propose a new algorithm based on a new approach called dynamic-time-quantum estimation intending to reduce the number of context switches among processes and offering optimal response time. The idea of this approach is to make the operating systems adjust the time quantum according to the second maximum (S_MAX) burst time of the set of waiting processes in the ready queue. A register is maintained for storing S_MAX, named as Second Max. Register (SMR). Based on the simulations and experiments, we show that the proposed algorithm solves the fixed time quantum problem and improvises the performance of Round Robin.

Keywords— *Round Robin, Time Quantum, Context Switch, Response Time, CPU Scheduling Algorithm, Operating Systems, S_MAX, SMR*

1. INTRODUCTION

Modern Operating Systems are moving towards multitasking environments which mainly depend on the CPU scheduling algorithm since CPU is the most effective or essential part of the computer. Round Robin is considered the most widely used scheduling algorithm in CPU scheduling [8, 9], also used for flow passing scheduling through a network device [1]. CPU Scheduling is an essential operating system task, which is the process of allocating the CPU to a specific process for a time slice. Scheduling requires careful attention to ensure fairness and avoid process starvation in the CPU. This allocation is carried out by software known as scheduler and dispatcher [8, 9]. Operating systems may feature up to 3 distinct types of a long-term scheduler (also known as an admission scheduler or high-level scheduler), a mid-term or medium term scheduler and a short-term scheduler (fig1). The dispatcher is the module that gives control of the CPU to the process selected by the short-term scheduler [8].

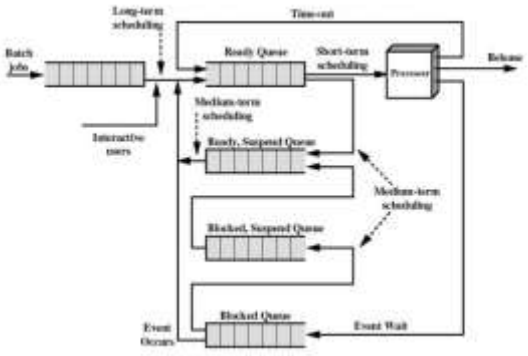

Figure 1.Queuing diagram for scheduling

There are many different scheduling algorithms which varies in efficiency according to the holding environments, which means what we consider a good scheduling algorithm in some cases which is not so in others, and vice versa. The Criteria for a good scheduling algorithm depends, among others, on the following measures [8]:

-Fairness: all processes get fair share of the CPU,

-Efficiency: keep CPU busy 100% of time,

-Response Time: minimize response time,

-Turnaround Time: minimize the time batch users must wait for output,

-Throughput: maximize number of jobs per hour.

Moreover, we should distinguish between the two schemes of scheduling: preemptive and non preemptive algorithms. Preemptive algorithms are those where the burst time of a process being in execution is preempted when a higher priority process arrives. Non preemptive algorithms are used where the process runs to complete its burst time even a higher priority process arrives during its execution time. First-Come-First-Served (FCFS) [8, 9] is the simplest scheduling algorithm, it simply queues processes in the order that they arrive in the ready queue. Processes are dispatched according to their arrival time on the ready queue. Being a non preemptive discipline, once a process has a CPU, it runs to completion. The FCFS scheduling is fair in the formal sense or human sense of fairness but it is unfair in the sense that long jobs make short jobs wait and unimportant jobs make important jobs wait [8, 9]. Shortest Job First (SJF) [8, 9] is the strategy of arranging processes with the least estimated processing time remaining to be next in the queue. It works under the two schemes (preemptive and non-preemptive). It's provably optimal since it minimizes the average turnaround time and the average waiting time. The main problem with this discipline is the necessity of the previous knowledge about the time required for a process to complete. Also, it undergoes a starvation issue especially in a busy system with many small processes being run [8, 9, 10]. Round Robin (RR) [8, 9]which is the main concern of this research is one of the oldest, simplest and fairest and most widely used scheduling algorithms, designed especially for time-sharing systems. It's designed to give a better response but the worst turnaround and waiting time due to the fixed time quantum concept. The scheduler assigns a fixed time unit (quantum) per process usually 10-100 milliseconds, and cycles through them. RR is similar to FCFS except that preemption is added to switch between processes [2, 3, 8]. In this paper, we propose a new algorithm to solve the constant time quantum problem. The algorithm is based on dynamic time quantum approach where the system adjusts the time quantum according to the second maximum (S_MAX) burst time of processes found in the ready queue. The second section states some of previous works done in this field. Section III describes the proposed method in details. Section IV discusses the simulation done in this method, before concluding this paper in the last section.

2. PREVIOUS WORKS

Round Robin becomes one of the most widely used scheduling disciplines despite of its severe problem which rose due to the concept of a fixed pre-determined time quantum [2, 3, 4, 5, 6, and 7]. Since RR is used in almost every operating system (windows, BSD, UNIX and UNIX based etc…), many researchers have tried to fill this gap, but still much less than needs. Matarneh [2] found that an optimal time quantum could be calculated by the median of burst times for the set of processes in ready queue, unless if this median is less than 25ms. In such case, the quantum value must be modified to 25ms to avoid the overhead of context switch time [2]. David B. Stewart and Pradeep K. Khosla proposed the maximum-urgency-first algorithm, which can be used to predictably schedule dynamically changing systems [11].Other works [7], have also used the median approach, and have obtained good results. Helmy et al. [3] propose a new weighting technique for Round-Robin CPU scheduling algorithm, as an attempt to combine the low scheduling overhead of round robin algorithms and favor short jobs. Higher process weights means relatively higher time quantum; shorter jobs will be given more time, so that they will be removed earlier from the ready queue [3]. Other works have used mathematical

approaches, giving new procedures using mathematical theorems [4]. Mohanty and others also developed other algorithms in order to improve the scheduling algorithms performance [5, 6, 7]. One of them is constructed as a combination of priority algorithm and RR [5] while the other algorithm is much similar to a combination between SJF and RR [6].

3. PROPOSED METHODOLOGY

In this paper, we present a solution to the fixed time quantum problem of RR by making the operating system adjust the time quantum according to the second maximum (S_MAX) burst time among the set of processes in the ready queue. When operating system boots for the first time, it begins with time quantum equals to the burst time of first dispatched process, which is subject to change after the end of the first time quantum. So, we assume that the system will immediately take advantage of this method. The determined time quantum represents real and optimal value because it is based on real burst time unlike the other methods, which depends on fixed time quantum value. Our methodology performs an estimation to decide the value for the subsequent time quantum i.e., when a new process is loaded into the ready queue in order to be executed, the operating system identifies the second maximum (S_MAX) of the burst times among the processes in the ready queue including the new arrival process. This method needs a register to store the identified second maximum (S_MAX) burst time, we have named it as SMR i.e., Second Maximum Register. When a process in execution finishes its time slice or its burst time, the ready queue and the registers will be updated to store the new data values.

The algorithm described in the previous section can be formally described by pseudo code and flow chart like follows:

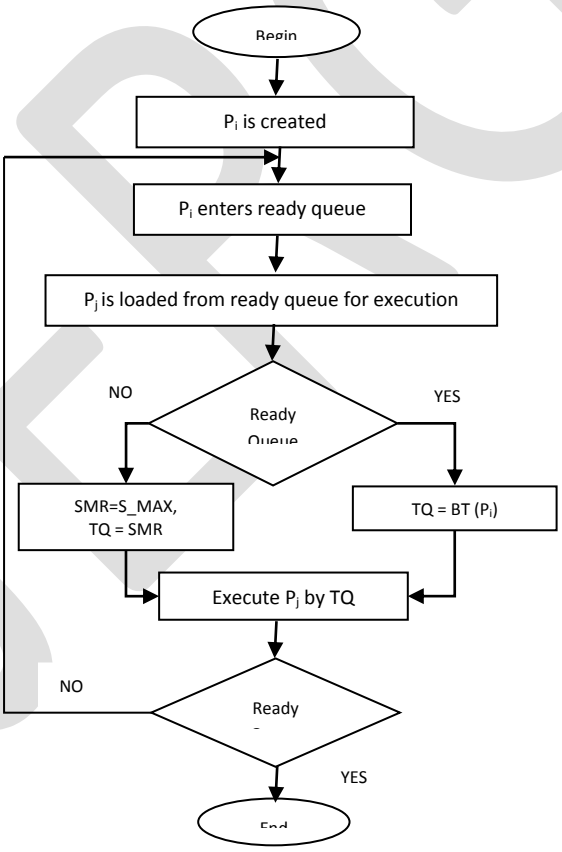

Figure 2.Flowchart of the proposed work

Pseudo code:

```
New process P arrives
P Enters ready queue
Update SMR with its BT
Process P is loaded from ready queue into the CPU to be executed
IF (Ready Queue is Empty)
```

```
S_MAX <- BT (P)
SMR <- S_MAX
TQ <- SMR
End if
IF (Ready Queue is not empty)
Identify second maximum (S_MAX) burst time
SMR <- S_MAX
TQ <- SMR
End if
CPU executes P by TQ time
IF (P is terminated)
Update SMR
End if
IF (P is not terminated)
Return P to the ready queue with its updated burst time
Update SMR
End if
```

SIMULATIONS

In order to validate our algorithm over the existing Round Robin, we have used PSSAV 201007282301, a simulator built using Java Net Beans, presents the user data and solutions after fetching in a graphical representation which is not found in most other languages. This simulator calculates the average waiting time and the average turnaround time of the whole system consisting of N processes according to the traditional Round Robin algorithm. We interrupt the process to edit TQ according to the proposed methodology. Following section deals with the results and observations.

4. RESULTS AND OBSERVATIONS

As a result of the simulation and hand solved examples we've reached to a conclusion that our proposed methodology could improve the efficiency of Round Robin by changing the idea of fixed time quantum to dynamically estimated one.

To evaluate our proposed method, we have considered different scenarios with random burst, in fact the number of processes does not change the result because the algorithm works effectively even if it is used with a very large number of processes. For each case, we will compare the result of our developed method with the traditional Round Robin approach (with fixed TQ = 10ms) and with the method proposed. We have observed the performance of our proposed work considering 5 different cases along with randomly taken burst and arrival times. Values shown in the below tables and subsequent graphs would justify our work.

CASE 1: Consider all processes arrive at time 0, Burst times P1 = 2ms, P2 = 4ms, P3 =8ms, P4 =10ms.

	Round Robin	Proposed Work
AWT	8.5	5.5
ATAT	14.5	11.5
CS	3	3

CASE 2: Consider all processes arrive at time 0, Burst times P1 = 10ms, P2 = 20ms, P3 =30ms, P4 =40ms.

	Round Robin	Proposed Work
AWT	33.5	25.0
ATAT	58.5	50.0

CS	8	3

CASE 3: Consider all processes arrive at time 0, Burst times P1 = 5ms, P2 = 10ms, P3 =15ms, P4 =20ms.

	Round Robin	Proposed Work
AWT	13.5	12.5
ATAT	31.0	25.0
CS	8	3

CASE 4: Consider all processes arrive at different time as shown below,

Process	Arrival Time (ms)	Burst Time (ms)
P1	0	22
P2	1	44
P3	2	66
P4	3	88

	Round Robin	Proposed Work
AWT	103.5	53.25
ATAT	158.5	108.5
CS	13	3

CASE 5: Consider all processes arrive at different time as shown below,

Process	Arrival Time (ms)	Burst Time (ms)
P1	0	15
P2	0	25
P3	29	27
P4	29	29

	Round Robin	Proposed Work
AWT	28.5	13.5
ATAT	52.5	51.0

CS	11	5

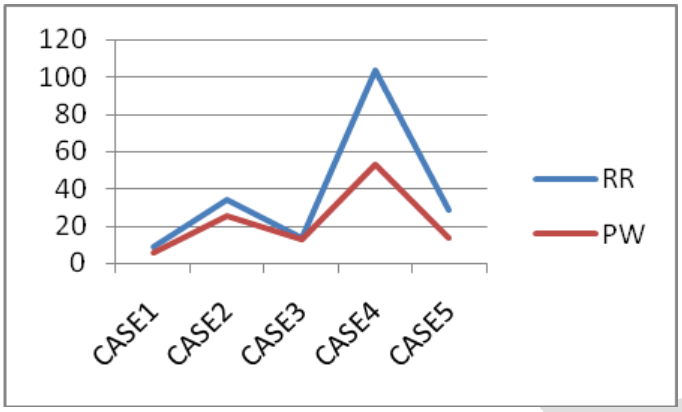

Figure 3 Performance comparison of the proposed work over RR w.r.t Average Waiting Time

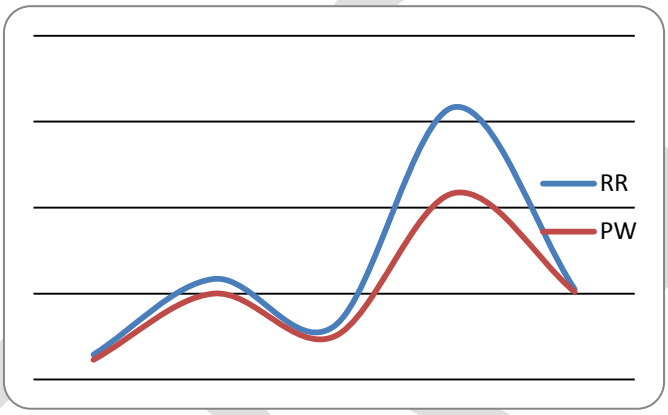

Figure 4 Performance comparison of the proposed work over RR w.r.t Average Turnaround Time

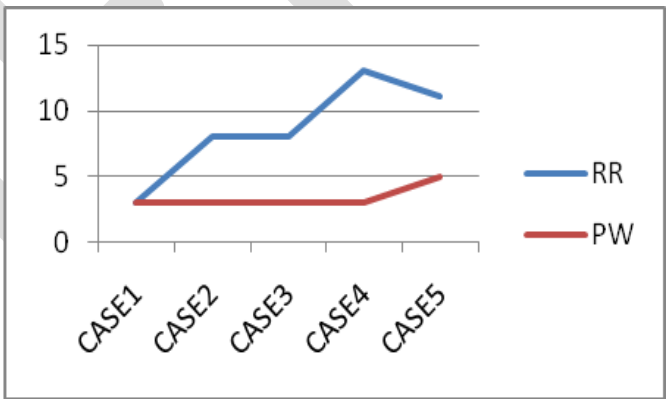

Figure 5 Performance comparison of the proposed work over RR w.r.t Context Switches

5. CONCLUSIONS

Time quantum is the bottleneck facing round robin algorithm and was more frequently asked question: What is the optimal time quantum to be used in Round Robin algorithm? In light of the effectiveness and the efficiency of the RR algorithm, this paper provides an answer to this question by using dynamic time quantum instead of fixed time quantum, where the operating system itself finds the optimal time quantum without user intervention. In this paper, we have discussed our proposed methodology that could be a simple step for a huge aim in obtaining an optimal scheduling algorithm. It will need much more efforts and researches to score a goal.

REFERENCES:

[1] Weiming Tong, Jing Zhao, "Quantum Varying Deficit Round Robin Scheduling Over Priority Queues", International Conference on Computational Intelligence and Security. pp. 252- 256, China, 2007.

[2] Rami J. Matarneh, "Self-Adjustment Time Quantum in Round Robin Algorithm Depending on Burst Time of the Now Running Processes", American Journal of Applied Sciences, Vol 6, No. 10, 2009.

[3] Tarek Helmy,Abdelkader Dekdouk, "Burst Round Robin as a Proportional-Share Scheduling Algorithm", In Proceedings of The fourth IEEE-GCC Conference on Towards Techno-Industrial Innovations, pp. 424-428, Bahrain, 2007.

[4] Samih M. Mostafa, S. Z. Rida, Safwat H. Hamad, "Finding Time Quantum Of Round Robin Cpu Scheduling Algorithm In General Computing Systems Using Integer Programming", International Journal of Research and Reviews in Applied Sciences (IJRRAS), Vol 5, Issue 1, 2010.

[5] Rakesh Mohanty, H. S. Beheram Khusbu Patwarim Monisha Dash, M. Lakshmi Prasanna , "Priority Based Dynamic Round Robin (PBDRR) Algorithm with Intelligent Time Slice for Soft Real Time Systems", (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No.2, February 2011.

[6] Rakesh Mohanty, H. S. Behera, Khusbu Patwari, Monisha Dash, "Design and Performance Evaluation of a New Proposed Shortest Remaining Burst Round Robin (SRBRR) Scheduling Algorithm", In Proceedings of International Symposium on Computer Engineering & Technology (ISCET), Vol 17, 2010.

[7] Rakesh Mohanty, H. S. Behera, Debashree Nayak, "A New Proposed Dynamic Quantum with Re-Adjusted Round Robin Scheduling Algorithm and Its Performance Analysis", International Journal of Computer Applications (0975 – 8887), Volume 5– No.5, August 2010.

[8] Silberschatz ,Galvin and Gagne, Operating systems concepts, 8th edition, Wiley, 2009.

[9] Lingyun Yang, Jennifer M. Schopf and Ian Foster, "Conservative Scheduling: Using predictive variance to improve scheduling decisions in Dynamic Environments", SuperComputing 2003, November 15-21, Phoenix, AZ, USA.

[10] C. Yaashuwanth and R. Ramesh, : A New Scheduling Algorithm for Real Time System, International Journal of Computer and Electrical Engineering (IJCEE), Vol. 2, No. 6, pp 1104-1106, December, 2010.

[11] David B. Stewart and Pradeep K. Khosla: Real-Time Scheduling of Dynamically Reconfigurable Systems, Proceedings of the IEEE International Conference on Systems Engineering, pp 139-142, August, 1991

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Design and Development of Speed Control of Induction motor drive using Pulse-Width Modulation

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Abstract–Speed control of induction motor is one of the major problems for many industries. Designing the drive for speed control of induction motor by use of V/f method. This V/f control was done by Pulse-width modulation technique for single-phase induction motor. By using this method, speed control of induction can be done more accurately and precisely. This technique is currently used by Tesla motors for controlling speed of electric cars and implemented successfully upto 1 HP motor.
Keywords–Speed control, Induction motor, Pulse-width modulation, v/f method, power electronic devices, inverter, IEEE

INTRODUCTION

Synchronous speed can be controlled by varying frequency. Voltage induced in the stator is $E_1 \alpha \Phi * f$, where Φ is the air gap flux and f is the supply frequency. As we can neglect the stator voltage drop we obtain terminal voltage $V_1 \alpha \Phi * f$ thus reducing the frequency without changing the supply voltage lead to an increase air-gap flux which is undesirable. Hence whenever frequency is varied in order to control speed, the terminal voltage is also varied so as to maintain V/f ratio constant. Thus by maintaining a constant V/f ratio, the maximum torque of the motor becomes constant for changing speed. It provides us good range of speed, low starting current requirement, more stable operation and easy to implement.

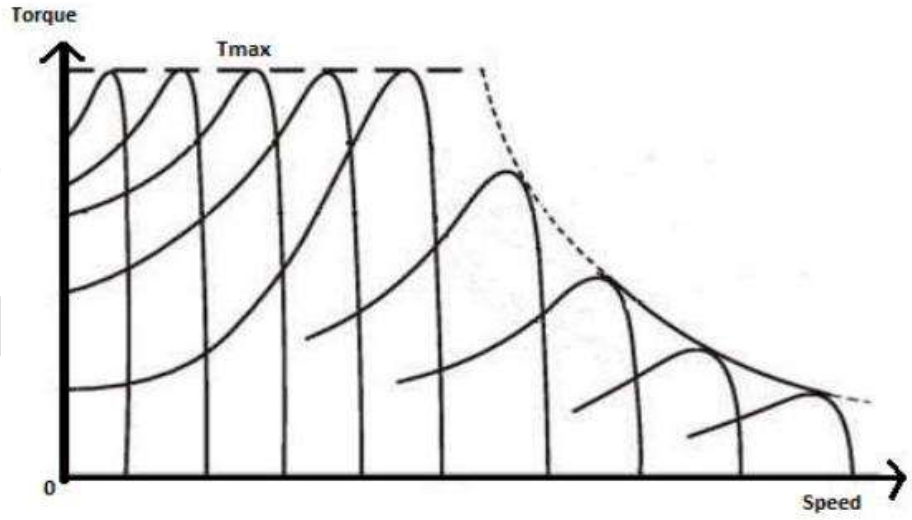

FIGURE 1 V/f Method

Principle of Pulse-width Modulation

In this method of modulation two pulses are compared in comparator (Generally one wave is Sinusoidal and another wave is Triangular wave) and intersection of two waves determines the switching instants and commutation of the modulated pulse, in fig 2, A_c is the peak value of triangular carrier wave and A_m is peak value of sinusoidal wave. The carrier and reference waves are mixed in a comparator as in fig 1, when sinusoidal wave has magnitude higher than the triangular wave, the comparator output is high otherwise it is low. When triangular carrier wave has its peak coincident with zero of the reference sinusoidal, there are $N=\frac{f}{2f}$ pulse per half cycle. Here the ratio of V_r/V_c is called as Modulation Index (MI) and it controls the harmonics content of the output voltage waveform.

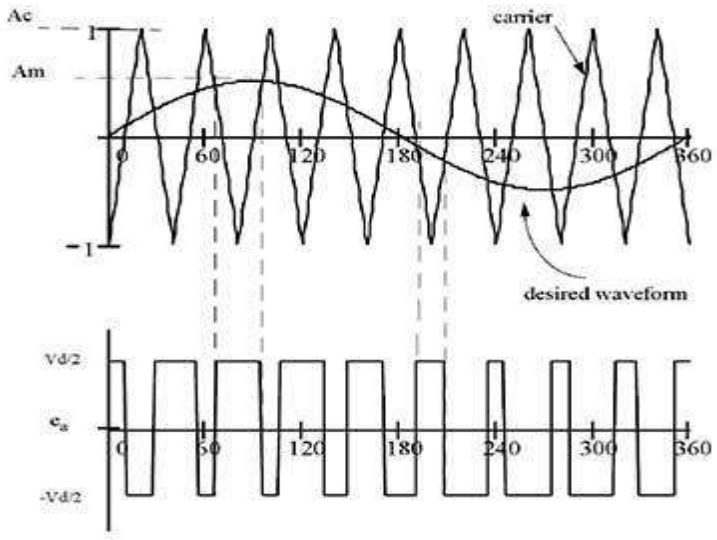

FIGURE 2 Basic idea of PWM

MATLAB simulation of PWM inverter

An inverter is circuit which is converting a DC power input into an AC power output at a desired output voltage and frequency. This conversion is achieved by controlled turn-on and turn-off of devices like IGBT, TRIAC etc. The output voltage of an inverter should be strictly sinusoidal but outputs are usually rich in harmonics and are always non-sinusoidal. Square wave or quasi-square wave voltage are also acceptable. The control circuit of a PWM Generator. The PWM signals are obtained by comparing the sinusoidal wave with a pulse train and modulating the pulse width accordingly. The PWM signals are applied to gates of IGBT's so as to trigger them. While one pair of IGBT's are fed signals from the relational operator (>=) and other pair of IGBT'

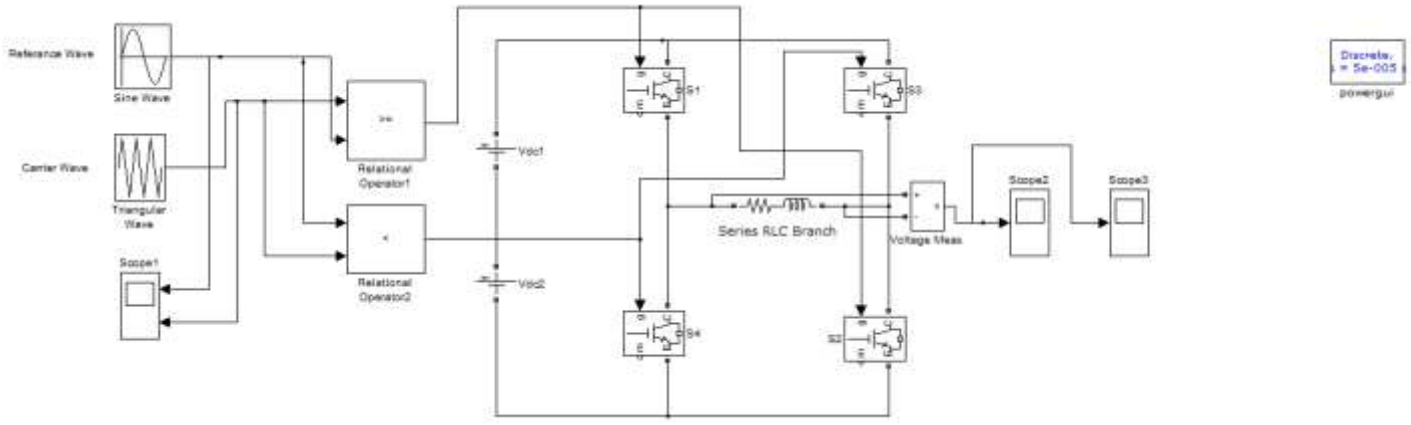

FIGURE3.1 Simulation model of Single-phase Pulse-width modulation inverter

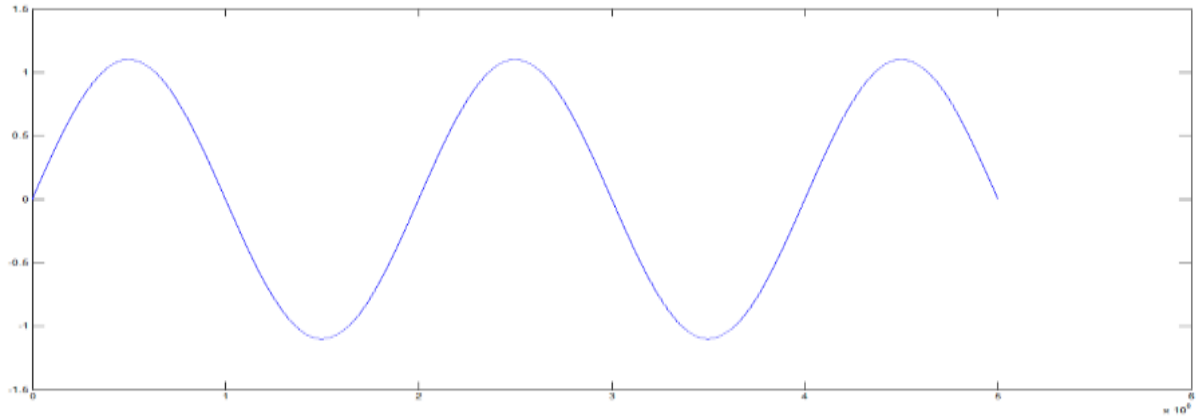

Figure 4 Input sinusoidal Reference wave) of PWM inverter

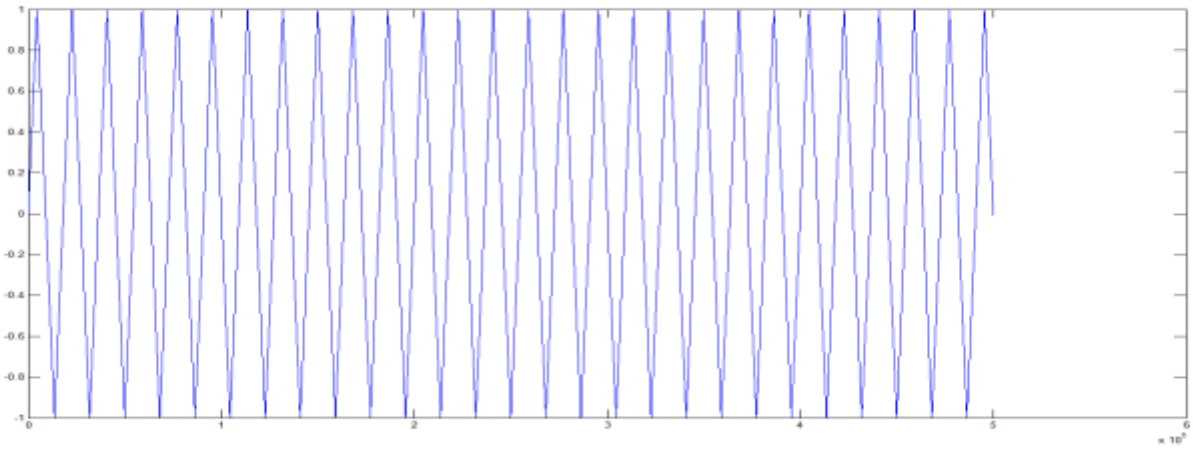

Figure 5 Input triangular (carrier wave) waveforms of PWM inverter

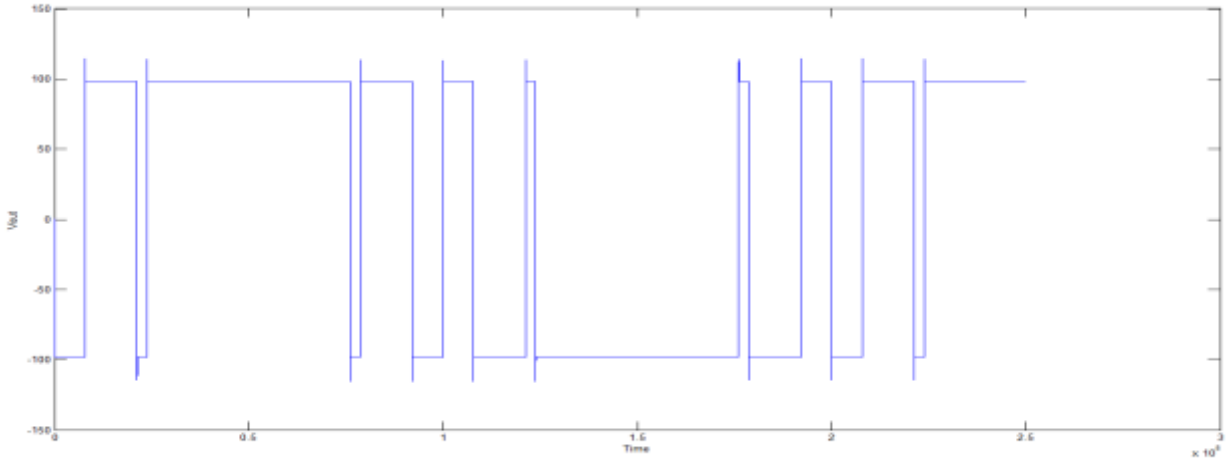

Figure 6 Output waveform of PWM inverter

The distorted waveforms are generated due to harmonics generated in power electronic devices and distortion in electric power supply.

Hardware implementation

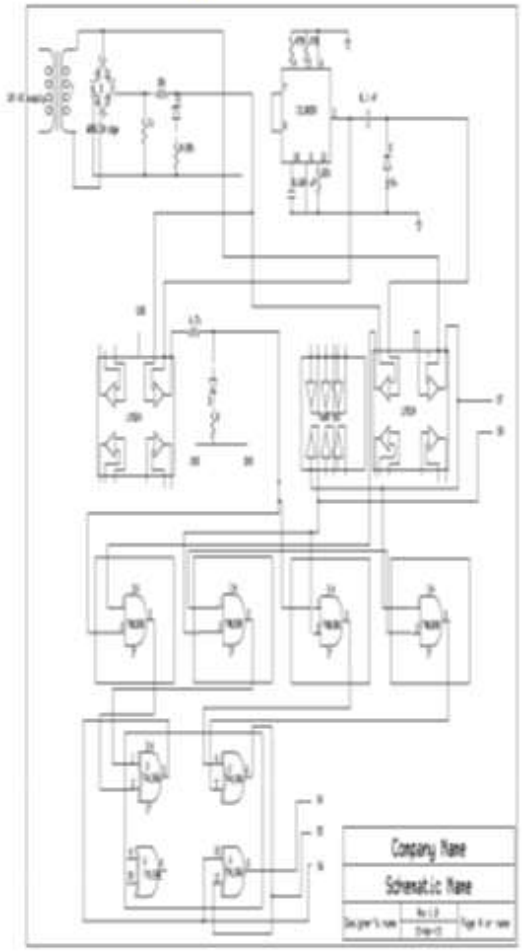

Figure 7 Circuit diagram of Control circuit

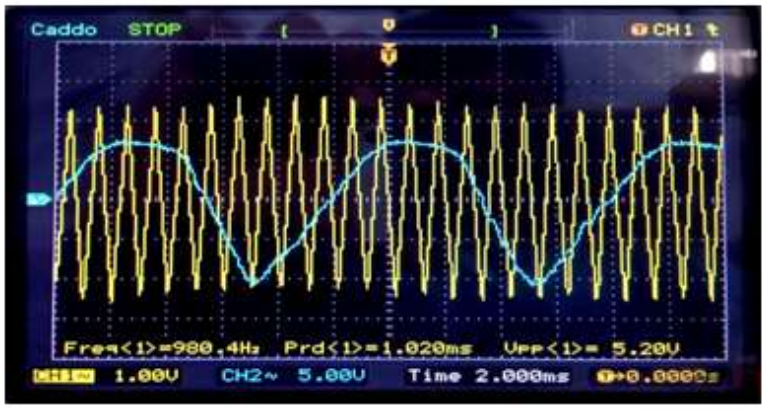

Figure 6 Actual Output of Control circuit

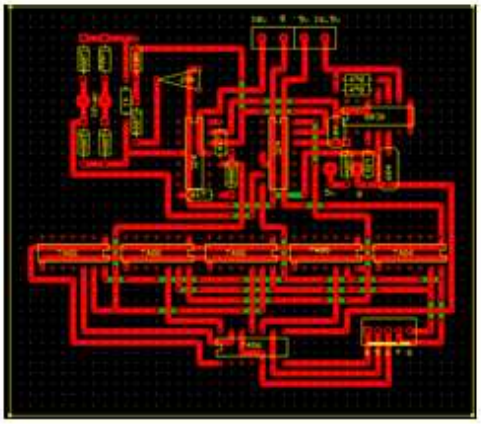

Figure 8 Silk layer of control circuit

Figure 9 Actual PCB of Control circuit

1) For MI less than one, largest harmonic amplitudes in the output voltage are associated with harmonics of order $f\,c/f$ =1 or 2N=1, where N is the number of pulses per half cycle, the order of dominant harmonic frequency can be raised, which can then be filtered out easily. It is observed from above that as N is increased, the order of significant harmonic increase and the filtering requirement are according minimized. But higher value of N entails higher switching frequency should be made.

2) For MI greater than one, lower order harmonics appear, since for MI > 1, pulse width is no longer a sinusoidal function of the angular position of the pulse.

Concept of over modulation:
1) With increase in the modulation index, the pulses having larger widths will start merging with each other. As the modulation index increase above "1". The over modulation takes place and the PWM waveform will degenerate to a square wave.

2) Due to over modulation harmonic distortion increase to a great extent. This is advantageous in application such as uninterruptable power supply (UPS)

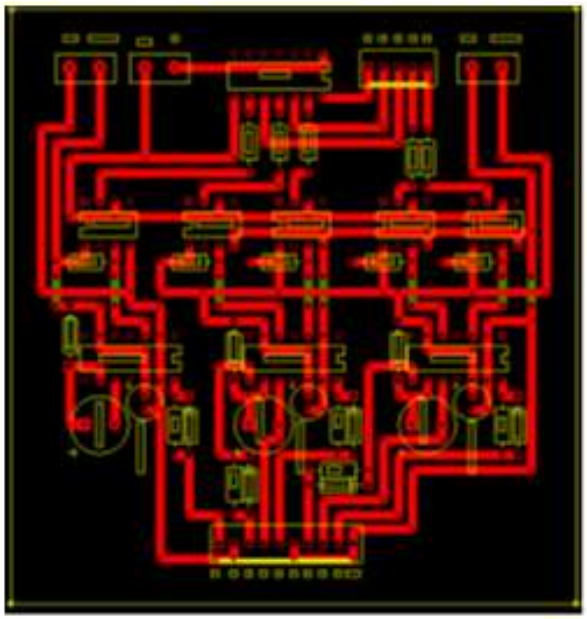

Figure 10 Silk layer of driver circuit

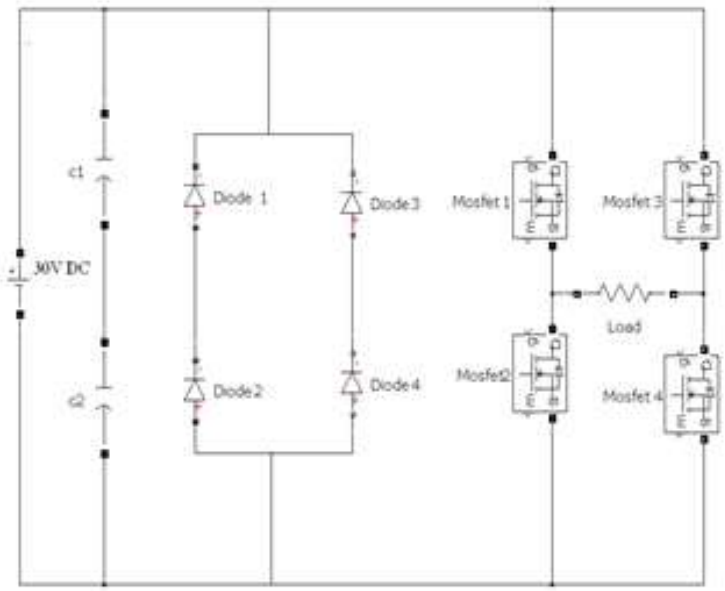

Figure 11 Circuit diagram of Power circuit

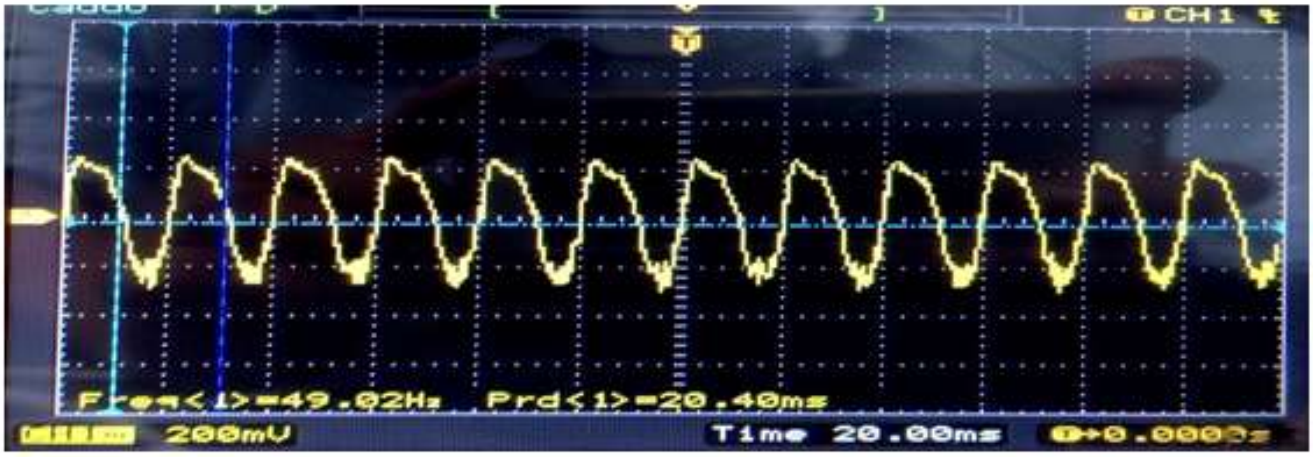

Figure 12 Actual output of PWM inverter

The Power Circuit consists of 4 bi-directional IGBT's arranged in bridge-form. The input to the circuit is 100 V DC supply from battery or other power supply. The IGBT/Diodes are triggered in two distinct cycles. In the first cycle, from 0 to 180 degrees, S1 and S3 are triggered by applying signal to their gates. Thus they conduct during this period and output is obtained across the load.
In the next cycle, from 180 to 360 degree, S2 and S4 are triggered and they conduct during this period. Hence the output of 100 V is obtained the load in the opposite direction. Thus a DC supply voltage is converted to AC voltage across the load and Inverter action is obtained.

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CONCLUSION

The speed control of induction motor can be achieved precisely by using the V/f method which has number of advantages rather than conventional method. By using of V/f method frequency as well as amplitude of voltage can be changed precisely. The amplitude of the either sine wave or triangular wave can be changed which is done by changing the value of the variable resistor. The PWM technique in which the sinusoidal and triangular wave is compared in control circuit and output is given to the power circuit via driver

circuit. Hence, by changing the value of the voltage as well as frequency and maintaining the ratio of V/f constant the amplitude of the wave can be changed and speed of the induction motor changed precisely and accurately.

REFERENCES:

1. Speed control using V/f method from M.S.Aspalli., Asha.R, P.V. Hunagund, and International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 1, Issue 5, November 2012."Three phase induction motor drive using IGBT's and constant v/f method"

2. P.S.Bimbhra "Power Electronics" for Pulse-Width Modulation inverter and Sinusoidal Pulse-Width Modulation inverter and Total Harmonic Distortion Analysis.

3. Hamad S.H, S M. Bhasi, I Arifs and N.F.Mailah "Speed drive of single phase induction motor" National Power & Energy Conference (PEcon) 2004 Proceedings, Kuala Lumpur, Malaysia.

4. Use of semiconductor devices like IGBT and TRIAC from D.W. Novotney, et al (editor), "Introduction to Field Orientation and High Performance AC drives", IEEE IAS tutorial course, 1986.

5. SeN and N.Butterworth,Analysis and Design of a PWM converter system,IEEE peoceeding on Electric power application,Vol.144,no.5,pp 357-371,1997.

6. M.F.Escalante ,J.C.Vannier,et at., Flying capacitor Multi level inverters and motor drive applications,IEEE power electronics specialists conference,1992,pp.397- 403.

7. Mohommad H. Rashid, "Power Electronics", Chapter 9,pp.406-430;248-280. B.E ELECTRICAL SSASIT Page 59

8. A.Nabae,I.Takahashi and H.Akagi,"A new neutral-point Clamped PWM Inverter",IEEE Trans. Ind. Applicant,Vol.IA-17,pp.518-523,Sept/Oct

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Effect of Chemicals on Index Properties of Soil

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Abstract— Change in geotechnical behaviour of fine grained soils under the influence of inorganic salts depends on the chemistry of the soil constituents and the pore fluid. The modification of soil behaviour largely depends upon the clay particles which belongs to size 0.002 mm and less and it is unique in nature. The different nature of clay is due to net electrical charge on them. In general, clay particles surface are negatively charged and its edges are positively charged. To preserve electrical neutrality the negative charge of the clay particle is balanced by the attraction of cations which are held between the layers, and on the surface of the particles. The charged clay surface together with the counter–ions in the pore water form diffuse double layer**.** Furthermore, the double layer is influenced by the valency of the counter–ions and the temperature. Use of salt solution as pore fluid generally causes decrease in liquid limits. The higher the cation valance, higher decrease in liquid limits.

Keywords—Diffuse double layer, Clay particles, Atterberg Limits, Liquid Limit, Plastic limit, Plasticity index, Cation size, Cation valency

INTRODUCTION

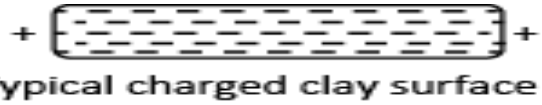
Generally, change in geotechnical behaviour of fine grained soils under the influence of inorganic salts depends on the chemistry of the soil constituents and the pore fluid. The source of chemical constituents may be indigenous or this may come from outside by contamination. For residual top soils, which are directly formed from rock, salts may be present in natural condition and depends on the composition of mother rock. And now a days the soil can frequently get contaminated by salts by industrial activities. Sources of contaminants into soil by various operations can be traced within the environment in developing and developed countries. Ocean surges cause occasional flooding in coastal area with salt water. This action would lead to addition of salt minerals into soil. Where mining takes place, metallic elements are present in greater amount. [1] Disposal of solid or liquid effluents, waste by products over the land causes alterations of the physical and mechanical properties of the ground. Alteration of soil properties sometimes causes degradation in soil properties. The wastes from chemical industries are found littering both urban and rural soils due to improper management system [2]. Modification of soil properties causing foundation failure, structural damage in light industrial buildings on soil contaminated by various industrial effluents have been reported.

Sometimes the soils may be lacking the geotechnical properties for soil to be used as construction materials, which are to be stabilised using additives, sometimes good enough soil can get contaminated by industrial wastes which become severely affected to be used at all. Then these need decontamination.

In the present paper, study has been done to understand how the various chemical salts affect Atterberg limits of soil.

Mechanisms behind the Modification in Physical and Engineering Properties of Soil

The modification of soil behaviour largely depends upon the clay particles which belongs to size 0.002 mm and less and it is unique in nature. Clay with a large quantity of water behaves like a viscous liquid, with less water it can be moulded and when dried it looks like a solid. On the other hand sand, silt or rock dust are very difficult to mould. The different nature of clay is due to net electrical charge on them. In general, clay particles surface are negatively charged and its edges are positively charged (Fig. 1). Due to the surface charge, it would adsorb or attract cations (+ve charged) and dipolar molecules like water towards it. As a result, a layer of adsorbed water exists adjacent to clay surface, usually a negative charge on their faces and a positive charge on their ends. [3]



Typical charged clay surface

Fig. 1 Typically charged clay particle

Diffuse double layer

To preserve electrical neutrality the negative charge of the clay particle is balanced by the attraction of cations which are held between the layers, and on the surface of the particles (Fig.2), while electrostatically attracted the concentration of these cations or counter–ions diminishes with increasing distance from the clay particle surface. The charged clay surface together with the counter–ions in the pore water, form the so-called diffuse double layer**.** [4],[5] Furthermore, the double layer is influenced by the valency of the counter–ions and the temperature.

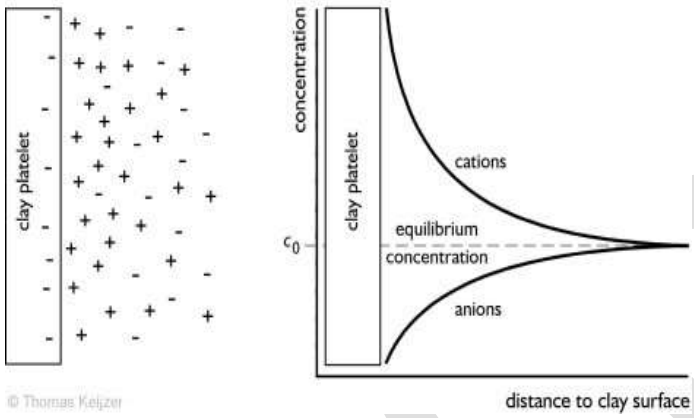


Fig. 2 Distribution of cations and anions adjacent to a clay platelet according to the diffuse double layer theory

The influence of pore fluid chemistry on the engineering behaviour of clay soil in many respects is still unclear and is even controversial in some cases. However, modification in all the engineering properties and behaviours have been reported and explained in most cases in the light of change in thickness in diffuse double layer with the addition of salt in soil. Changes in fine grained soil behaviour due to contaminants can be explained by changes in diffuse double layer theory and fabric changes. According to Gouy-Chapman theory by increasing the ion concentration, the thickness of diffuse double layer decreases which leads to flocculation of the clay particles [6].

To understand the mechanisms behind the modification in physical and engineering properties of soil, one have to understand the structure of clay particles and source of negative charges.

Structure of Clay Particles and source of negative charges:

Clay particles due to their small size, coupled with plate-like shapes, contribute to very high external surface areas that are complemented in some cases with even more extensive internal surface areas. These surfaces characteristically carry negative and/or positive charges that influence the attraction and repulsion of the particles toward each other and that attract swarms of ions of the opposite charge along with numerous water molecules (Fig 3).

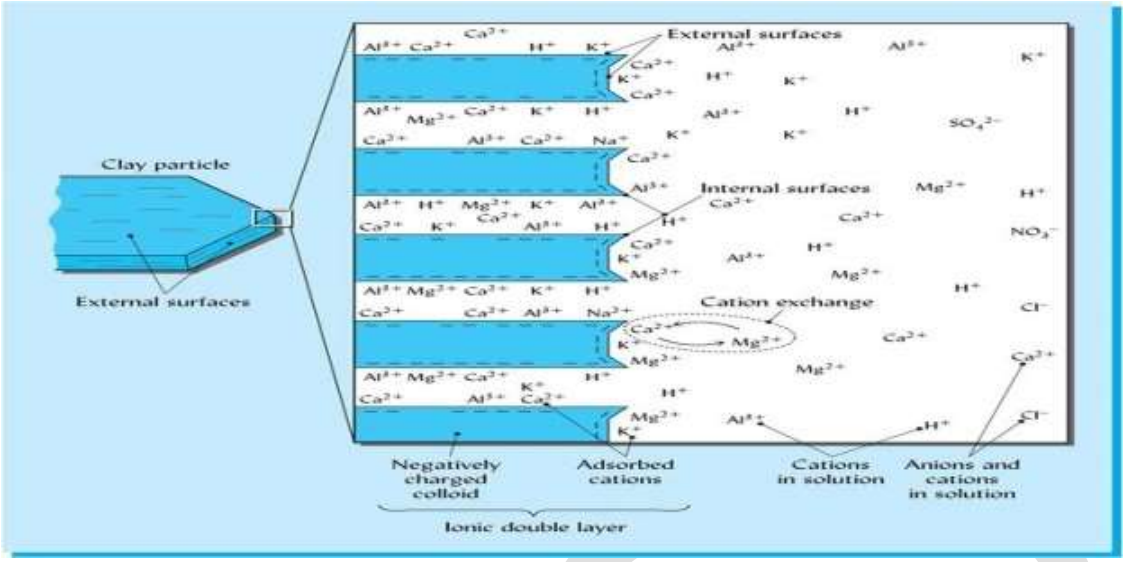


Fig. 3 Representation of a clay crystal, its complement of adsorbed cations, and ions in the surrounding soil solution.

More Simplified sheet structure of clay particle can be shown below: (Fig 4)

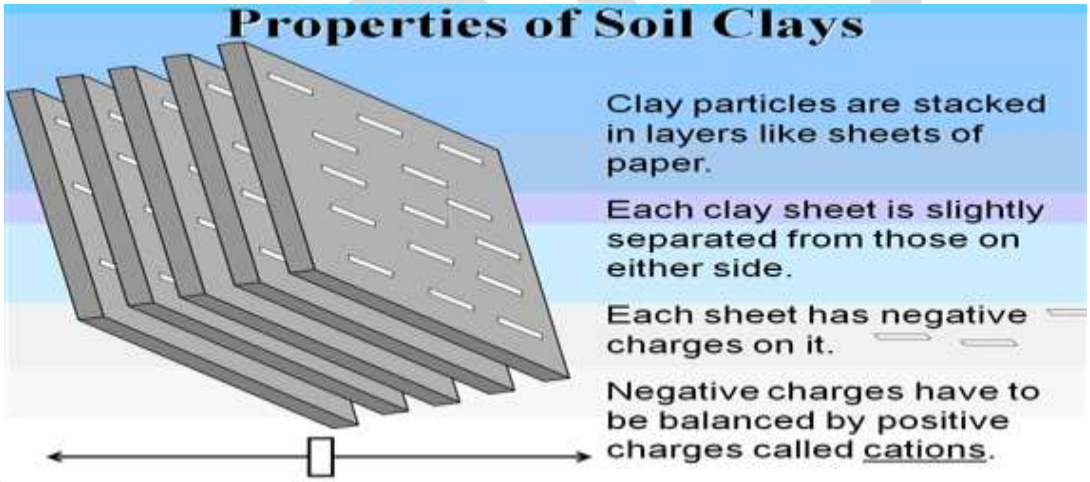


Fig. 4 Simplified sheet structure of clay particles

Source of Negative Charges and Isomorphous Substitution

Now why the clay particles are charged particles and where from the charges are coming. To get an explanation, one has to know about isomorphous substitution in clay particle, which is a common phenomenon in most of clay particles.

In nature, ions having nearly the same radius as a silicon atom (e.g. Aluminium) can fit in the tetrahedral sheet through a process called isomorphous substitution. If the substituting ion has a lower valence than silicon, an unsatisfied negative charge within the crystal results. This is the primary source of the negative charge on the crystal.[14] Similar isomorphous substitution can take place in the octahedral sheet with aluminium being replaced by a similar-sized lower-valent cation (e.g. magnesium) likewise giving rise to a negative charge. Isomorphous Substitution - internal charge not satisfied because of ionic substitution of Al^{3+} for Si^{4+} or Mg^{2+} for Al^{3+} (Fig.5).

In vermiculite the replacement of Si^{4+} with Al^{+3} in 25% of tetrahedrals creates 1 negative site for each substitution.

In smectite Mg^{2+} replaces Al^{3+} in Octahedral layers about 1/4 of the time and creates negative sites. These negative charges can then attract cations from the soil solution.

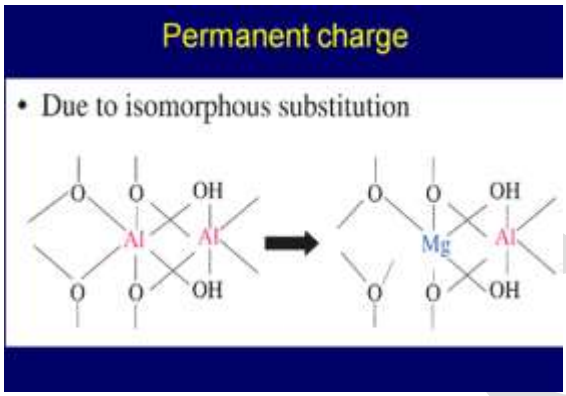


Fig. 5 Source of Negative Charges and Isomorphous Substitution

Atterberg Limits

In the form of dry powder, clay particles exist as packets, each packet containing numerous particles. The packet is electrically inert since the particles within it satisfy each other's charges. When given access to water, the packet disintegrates into particles and they begin to interact with each other giving clay its property of plasticity. The amount of water present in clay play a very significant role in determining its behaviour. With enough water in clay it behaves like a liquid, with removal of water it starts solidifying. The water contents at which the consistency changes from one state to the next are called consistency limits or Atterberg limits (Fig 7) Consistency varies with the water content of the soil. The consistency of a soil can range from (dry) solid to semi-solid to plastic to liquid (wet)[3].

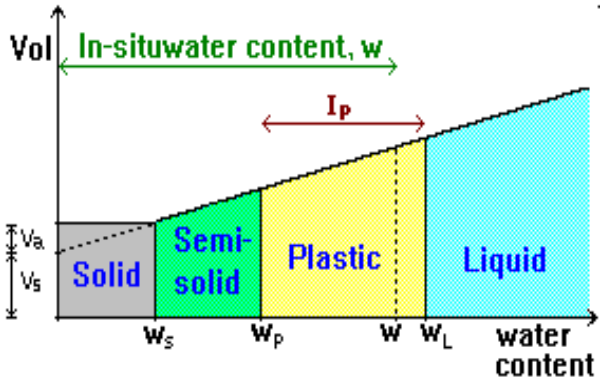


Fig. 6 Consistency limits and plasticity graph

Liquid limit (w_L) - change of consistency from plastic to liquid

Plastic limit (w_P) - change of consistency from brittle/crumbly to plastic

The consistency of most soils in the ground will be plastic or semi-solid. Soil strength and stiffness behaviour are related to the range of plastic consistency. The range of water content over which a soil has a plastic consistency is termed the **Plasticity Index** (I_P or PI).

I_P = liquid limit($w_{L)}$ - plastic limit(w_P)

Classification and Soil Behaviour

The size of particles along with Atterberg Limits can enable the classification of the soil. The purpose of classification is to get a qualitative idea about how the soil would behave from an engineering view point. Such a preview is presented in Table 1.

Table 1- Classification and Soil Behaviour

Sl No	Soil Type	Engineering Behaviour of Soil
1	Cobbles	On account of their sizes they usually lend stability to slopes as well as foundations
2	Gravel and Sand	Have similar behaviour. High permeability behaviour; gravels more resistant to erosion. Well graded mixes are more stable and less permeable. Presence of water in voids is of little consequence.
3.	Silt	Relatively less pervious, erodable, unstable. Presence of water increases potential for instability.
4.	Clay	Marked by its sticky nature. Has very low permeability and therefore difficult to drain, moderately resistant to erosion. Highly compressible. Properties influenced by mineralogy – Marked influence of presence of water.

Influence of salts on Atterberg Limits

According to Sridharan and Jaideva (1982) thickness of double layer is a function of dielectric constant of pore fluid, electrolytic concentration and cationic valency. The electric double layer suppressed when following things occur:

(1) A decrease in di electric constant of pore fluid
(2) An increase in electrolyte concentration
(3) An increase in cationic valency
Correspondingly, a decrease in Liquid Limit will occur in all the above conditions. Sometimes hydrated cationic radius affects the LL, although valency being same.
Table 2 shows the influence of cation size, valency and hydrated cationic radius for adsorbed cations on LL. Clay used was Bentonite type [7]

Table 2- Influence of cation size, valency and hydrated cationic radius on Limits (Shridaran et al, 1986)

Adsorbed Cation	Specific Gravity	Liquid Limit (%)	Plastic Limit (%)	Hydrated cationic radiusA^0
Lithium (Li^+)	2.61	675	49.1	7.30-10.10
Sodium(Na^+)	2.81	495	49.2	5.60-7.90
Ammonium (NH_4^+)	2.59	223	55.8	5.37
Potassium(K^+)	2.72	233	57.8	3.80-5.32
Magnesium (Mg^{++})	2.65	129	49.9	10.80
Calcium(Ca^{++})	2.65	125	40.6	9.50
Barium(Ba^{++})	2.73	108	45.8	8.80
Aluminium (Al^{+++})	2.43	108	60.5	-
Iron(Fe^{+++})	2.70	120	63.5	-

Table summarizing the effect of salt, electrolyte concentration and cationic valency, hydrated cationic radius on liquid limits of clays has been reported in the literature which can be presented as follows: Table 2

Table 2 - Effect of salts on liquid limits

Clay type	Electrolytic salt solution used	Concentration of electrolyte solution	Liquid Limit (%)	Work referred by
Na- Montmorillonite	Water	-	950	Yong and Warkentin (1975)
Na- Montmorillonite	NaCl	0.1N	780	Yong and Warkentin (1975)
Na- Montmorillonite	NaCl	1.0 N	350	Yong and Warkentin (1975)
Ca- Montmorillonite	Water	-	360	Yong and Warkentin (1975)
Ca- Montmorillonite	$CaCl_2$	1.0 N	310	Yong and Warkentin (1975)
Bentonite	Water	-	332	Sridharan and Prakash(1999)
Bentonite	NaCl	0.5 N	94	Sridharan and Prakash(1999)
Black Cotton soil (Montmorillonitic)	Water	-	92	Sridharan and Prakash(1999)
Black Cotton soil (Montmorillonitic)	NaCl	0.5 N	85	Sridharan and Prakash(1999)
Na- Montmorillonite	-	-	700	White (1949)
Ca- Montmorillonite	-	-	177	White (1949)
Na- Bentonite	-	-	410	Rao et. al (1993)
Bentonite	Sea Water equillibrated	-	142	Rao et. al (1993)
Li^+- Bentonite	-	-	675	Sridharan, Rao and Murthy(1986)
Na^+- Bentonite			495	Sridharan, Rao and Murthy(1986)
NH_4^+- Bentonite			223	Sridharan, Rao and Murthy(1986)
K^+- Bentonite			233	Sridharan, Rao and Murthy(1986)
Mg^{++}- Bentonite			129	Sridharan, Rao and Murthy(1986)
Ca^{++}- Bentonite			125	Sridharan, Rao and Murthy(1986)
Ba^{++}- Bentonite			108	Sridharan, Rao and Murthy(1986)
Al^{+++}- Bentonite			108	Sridharan, Rao and Murthy(1986)

Studies on effect of salts on soils

Effect of three inorganic salts NaCl, $CaCl_2$ and $MgCl_2$ on consistency limits of mixture of cohesive fine grained soil and bentonite in various proportions has been studied by Nader Shariatmadari, et al (2011)[6]. The samples were prepared in 2 proportions of 100:10 and 100:20 (100 is the total weight and 10 and 20 are the weight of bentonite). The used pore fluids were DI water, and NaCl, $CaCl_2$ and $MgCl_2$ with various concentrations of 0.01N, 0.1N, 1.0 N and 2.0 N. The soil mixtures were exposed to salt solutions and then placed in plastic bags for 24 hours. The result indicates that using salt solutions as pore fluids decreases the limit of the mixtures. Furthermore by increasing salt concentration the liquid limit decreases. Also it could be concluded that with increasing cation valance the decrease in liquid limit will be higher. Increasing salt concentration and the cation valance decreases the inter-particle repulsion which results in particles moving more freely in lower water contents, thus the liquid limit of the mixtures decreases.

Investigation was done by Sivapullaiah et.al, (2005)[8] to see the effect of NaOH solution on some geotechnical properties of soil with low plasticity (LL 38%). Their results have shown that the liquid limits of soil increases as the as NaOH solution concentration increases. The reason behind that is the formation of a new swelling compound created by reaction of alkali solution with clay.

Studies were conducted on the effects of phosphate ions (PO_4^{-3}) on index properties by Sreepada Rao (1982) [9]. Anion adsorption was caused by treating kaolinite and montmorillonite clays with phosphate and acetates at low pHs. Phosphate adsorption increases the liquid limit, of kaolinite and liquid limit of Na-montmorillonite decreased on phosphate adsorption. In Ca-montmorillonite, initially

these values decreased with treatment, but subsequently increased. The treatment appreciably changed the physico-chemical properties of both kaolinite and montmorillonite clays, Phosphoric acid increases stable aggregation leading to higher porosities and water holding capacities but lower bulk densities. Phosphate adsorption increases the liquid limit, the surface area and the free swell volumes of kaolinite significantly because of flocculation of clay particles. Because of aggregation, the liquid limit of Na-montmorillonite decreased on phosphate adsorption. In Ca-montmorillonite, initially these values decreased with treatment, but subsequently increased because of the exchange of divalent calcium by monovalent hydrogen.

Effect of four salt solutions including NH_4Cl, KCl, $CuSO_4$ and $FeSO_4$ on consistency limits of CL clay and CH clay was studied by Arsan and Yetimoglu (2008)[10] . The conclusions were as follows:

- For CL clay, the liquid limits and plastic limits increased with increase of salt concentrations up to 0.2M. The salt solutions at a concentration greater than 0.2M seemed to damage the clay fabric: thus the clay behaved as anon plastic soil and the plastic limit could not be obtained.
- All the salt solution s with a concentration up to approximately 0.2M significantly reduced the liquid limits of CH class clay. For NH_4Cl and KCl concentrations greater than around 0.2M, the liquid limit of CH clay remained more or less constant. However, for $FeSO_4$ and $CuSO_4$ metallic salts the liquid limit of CH clay tended to increase at concentration higher than 0.2M.
- For CH clay plastic limit decreased at low salt concentrations (between 0.0001 and 0.001M) and then increased with increase in salt concentration between 0.001 and 0.2M. For concentration value higher than 0.2M, the plastic limit was not significantly affected by salt solutions and plastic limit value approached the raw clay sample.
- Both CL and CH clays flocculated and formed clusters as the clay class tended to be changed. For the conditions investigated, CL and CH class clays were transformed into ML and MH class soils respectively according to Unified Soil Classification System (USCS).

Investigation was done to see the effect of different chloride compounds such as NaCl, $CaCl_2$ and $MgCl_2$ on various geotechnical properties by Tamadher T Abood et. al. (2007)[11]. According to them liquid limit, plastic limit and plasticity index decreases with increase of salt content.

Studies was conducted to show the effect of saline water on geotechnical properties of fine grained soil Rassoul Ajalloian et. al., (2013)[12]. They used three types of water, distilled, saline and half saline water. Chemical analysis values of these three types of waters used for the study is presented in table 4

Table 4 - Effect of saline water on Atterberg limits - Chemical analysis values

Water type	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	TDS (ppm)
Distilled water	0.82	0.4	3	0.08	4.3
Half saline water	92	42	1739	4.6	1877.6
Saline water	678	648	95652	42	97020

According to their study Atterberg limits decreased as the water salinity increases for CL soil.

In another study Ayininuola, G.M, and Agbede, O.A (2013)[13] focused on the influence of 3 inorganic salts viz. Sodium Chloride (NaCl), Potassium Nitrate, (KNO_3) and Calcium Sulphate ($CaSO_4$) in various concentrations on liquid limits and plastic limits of 2 sub soils. The limits were monitored before and after contamination. The soil cation exchange capacity (CEC), exchangeable cations and exchangeable anions were also determined. A set of equations for predicting LL and PL at different level of chemical interaction with time was developed using multiple regression analysis model. The results showed that both NaCl and KNO_3 brought about reduction in LL and PL while $CaSO_4$ addition led to increment in LL and PL. The predicting equations revealed that there is high tendency for the contaminated soils to regain their uncontaminated LL and PL values with time.

CONCLUSION

Changes in fine grained soil behaviour due to contaminants can be explained by changes in diffuse double layer theory and fabric changes. Although the influence of pore fluid chemistry on the engineering behaviour of clay soil in many respects is still unclear and

is even controversial in some cases, but in general, it can be explained in light of changes in diffuse double layer. By increasing the ion concentration, the thickness of diffuse double layer decreases which leads to flocculation of the clay particles.
Use of salt solution as pore fluid generally causes decrease in liquid limits. The higher the cation valance, higher decrease in liquid limits.

REFERENCES:

[1] B.E Davies, Trace Element Content of Soils Affected by Base METAL mining in the West of England, Oikos, 22 (1971), 366-372
[2] A.G.Matthew et.al., Journal of earth sciences and geotechnical engineering, vol. 3, 2014, pp 37.
[3] S.K.Gulhati, Engineering Properties of Soil, 1978, Tata McGraw Hill Publishing Co Ltd
[4] Dukhin, S. S, Derjaguin, B. V. "Electrokinetic Phenomena", J. Willey and Sons, 1974
[5] Russel,W.B, Saville, D.A., Schowalter, W.R. "Colloidal Dispersions", Cambridge University Press, 1989
[6] Sariatmadari. N., Salami. M and Fard, M.K. (2011) " Effect of inorganic salt solutions on some geotechnical properties of soil-bentonite mixtures as barrier", *International Journal of Civil Enginnering, 9,* 103-110
[7] Sridharan,A., Rao, S.M, Murthy, N.S (1986) Liquid Limits of Montmorillonite Soils, Geotechnical Testing Journal, 9(3): 156-159
[8] Sivapullaiah N.,and Manju, H. (2005) "Kaolinite –Alkali interaction and Effects on Basic Properties", *Geotech. Geol. Eng*., 23, 201-214
[9] Sreepada Rao, A. (1982) "Physico Chemical Properties and Engineering Behaviour of Anion Adsorbed Clay", *Ph.D.Thesis*, Indian Institute of Science, Bangalore
[10] Arasan S. and Yetimoglu, T.(2008) "Effect of inorganic salt solutions on consistency limits of two clays"*Turkish Journal Eng. Env. Sci*., 32, 107-115
[11] Abood, T., Kasa, A.B., Chik, Z.B. (2007) "Stabilisation of silty clay soil using chloride compounds" *Journal of Engineering Science and Technology,* vol.2, , 102-110
[12] Rassoul Ajalloeian, Hadiseh Mansouri, Amir Hossein Sadeghpour (2013) "effect of saline water on geotechnical properties of fine grained soil", *Electronic Journal of Geotechnical Engineering vol. 18,* 1419-1435
[13] Ayininuola, G.M, and Agbede, O.A. (2013) "Influence of Inorganic Salt on Soils Liquid and Plastic Limit" (*Civil Engineering Dimension, Academic Journal*, vol. 15, Issue 1, pp51)
[14] B.C.Punmia, Soil Mechanics and Foundations, 13th edition

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Key Policy- Based Security Framework for Cloud Computing

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Abstract— A complete acknowledgement about the security concerns is that can the cloud can act as barriers to the adoption of cloud computing which researchers have identified over the last some years. While outsourcing the data on a huge level that means its business-critical data and computations to the cloud, an enterprise loses control over them by the loss of data due to the authority provided on the cloud. How should the organization can be done to decide what security measures one should have to apply to protect its data and computations, which have different security requirements from a Cloud Service Provider (CSP) with an unspecified or undetermined level of corruption? The answer to this question can be found on the organization's perception about the CSP's reliability and the trustworthiness and the security requirements of its data of an organization. This paper proposes a decentralized, dynamic and evolving policy-based security framework that helps any of an organization to derive such perceptions to provide the proper authority from knowledgeable and trusted employee responsibilities and their functionality are based on that, the choice of the most relevant security policy postulating the confidential measures is very much necessary for outsourcing data and computations to the cloud. The organizational opinion is developed completely direct user participation with that particular organization and is allowed to advance with respect to the time and requirement of an organization.

Keywords— Cloud, Cloud organization, Data privacy, Cloud service provider (CSP), Information Dispersal Algorithms (IDA), Security framework, Cloud security policy.

INTRODUCTION

Cloud computing has given a boom in the present scenario. From each and every enterprise customers are very much reluctant for the deployment of their business on the cloud. But as far as we are concern the security issue is one of the most important and major issue in which gives a negative point and also reduced the vast market of cloud computing and it also result in the complications of the privacy of the data [2]. Data privacy and data protection also get affected from this issue. As we know that in an organization there are several data, which must be kept hidden from the external entities and possesses the sensitivity of the organization's data.

These data can be the very much confidential data like customer data, his private business details, and his family details and so on. Such kind of data would be kept confidential from the third party while exchanging the data [1]. There may be various situations where the data have to flow but they doesn't have permission to change it, for an example employee of the organization needs to access the data of different field respective of his work because of his role in an organization so that would be not to be restricted but any other individual like ordinary employee, supplier and any customer want to access the data then he can only view the data but cannot make any change in it [3]. But with the use of cloud computing we are often in confusion that whether we will outsource the data and its computations on public cloud or not? It includes the loss of control over the data; it will dissolve the concept of the security, trustworthiness of the cloud service provider, data confidentiality, availability of the data and other factors. Some major factors here are legal and Trans border issues, data privacy and data location.

Due to these problems many of the research scholars have tried to resolve this problem and proposed the solution. They have given their contribution in the search of cloud security and their approach has become almost successful also. Their methodology had provided the facility to an organization to outsource their confidential data with security requirements. When an organization is outsourcing its data it is keeping a degree of trust on the service provider of the cloud. The responsibility of the cloud service provider is to protect the data from third party, internal and external attacks [5]. As we know that the agreement between the cloud service provider and organization will be signed which is called service level agreement (SLA).

We had tried to purpose a solution on this problem which is dynamic, decentralized methodology for the highly secure outsourcing on the cloud. Here we can understand the meaning of decentralized as decentralized can be defined as achievement of two taking two accounts, for an example the CEO of the company will tell us the best possible way of the financial sensitive data of his company.

In this paper we will suggest the best possible method of the organizational implementation by our acknowledgement studies.

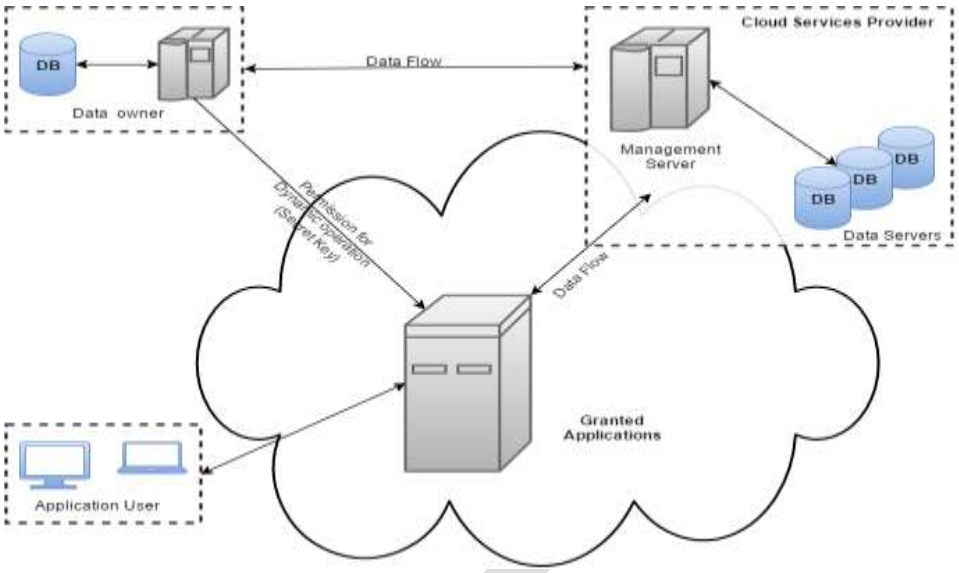

Figure 1.1 Audit System Architecture for cloud computing

The above figure illustrates the cloud computing architecture of the organization. The data owner has its data flow to the data server and management server that is cloud service provider. The application users have to grant the permission to access the data of the organization. First of all the verification will be done and then the permission will be granted to the application user.

LITERATURE SURVEY:

1. A POLICY-BASED SECURITY FRAMEWORK FOR STORAGE AND COMPUTATION ON ENTERPRISE DATA IN THE CLOUD

SouryaJoyee De, Asim K. Pal, 2014 47th Hawaii International Conference on System Science

Previous workings on protected cloud storage and computation have careful consideration on different adversarial models. These models consider a Byzantine adversary, which can be defined as the challenger, which can act as a random, which can corrupt as small number of servers. In this corruption process, the corrupted clouds can blastoff three types of attacks:

1) The storage cheating on corrupted servers can delete rarely accessed files (which means the file which cannot use by user frequently) to moderate the cost of storage or arbitrarily change the stored data.

2) Computation – this is a type of cheating in which the servers either generate improper (incorrect) results of computations or it may uses different inputs for computations going on to reduce computational cost.

3) Privacy- this is a kind of cheating in which corrupted cloud server can leak user's confidential information to other parties. It means that the data of the user is not at all safe the data can be transferred from user's account to other accounts.

Here we can consider that the un-trusted cloud can fail in a Byzantine [4] way i.e. stored user data can be deleted, modified or leaked to other parties and it can result in the argue and argument this causes the most general fault model which results into account both malicious attacks on CSPs as well as events like accidental data corruption. A set of scenarios of different trust levels assigned to cloud has been identified by it. According to them, a trusted cloud is one, which, in the absence of unpredictable failures, serves users correctly in accordance with SLA, and there are no malicious insiders.

Existing System

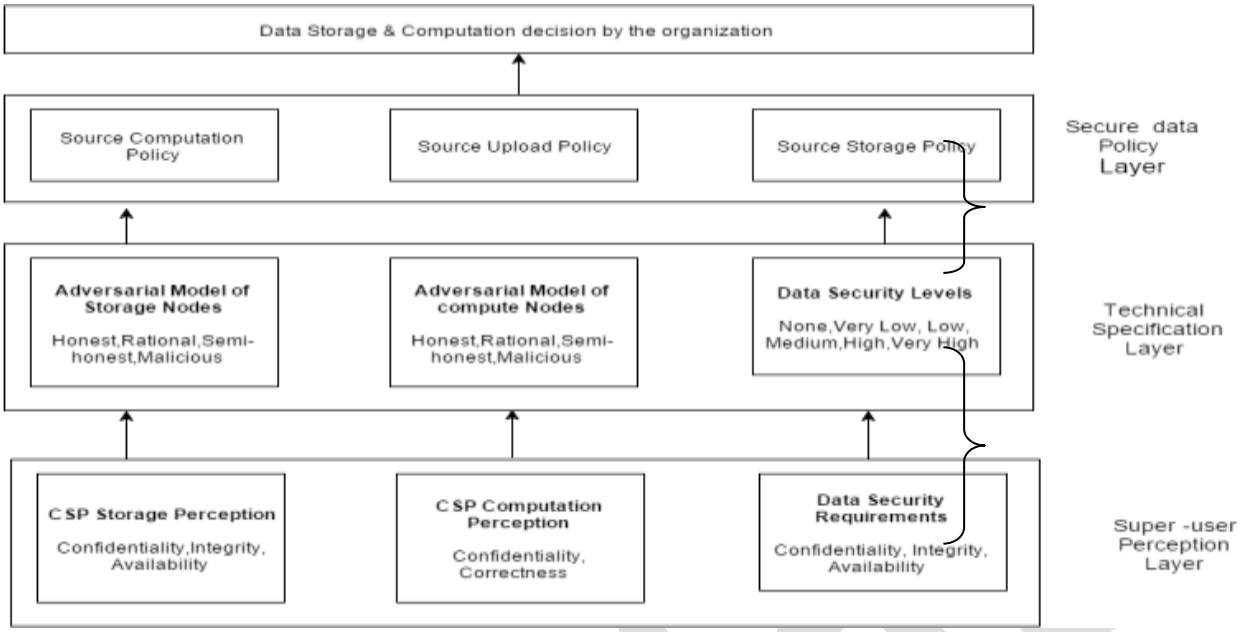

Figure 1.2 Policy-based Security Framework

There are three basic trust relationships that form the basis of our security framework: organization vs. user; user vs. CSP and organization vs. CSP.[3]

The organization does not trust all the users equally, e.g. people in the top positions are more trusted than others. Users are trusted with only those data and computations that are connected to the role the user is assigned. The organization vis-a-vis user trust relationship is guided by the Enterprise Data Access Policy (EDAP) matrix which tells for each user and data element pair what kind of accesses and rights are permitted. A user who is allowed to choose a security policy for data elements he has access to is called super-user for those data elements.

EDAP Matrix.

Access control matrices specify access rights on objects. An object is the abstraction of resources controlled by a computer system. Role based access control (RBAC)[4] policies regulate a user's access to objects in a system based on the activities he performs on these. We present the EDAP matrix as an intermediate access control matrix derived from role-based access control policies used in the organization. It specifies user's data access rights from which one can validate the computation permitted for each role in the organization. We note that computations require different data elements as inputs and produce new data elements and / or modify existing data elements as output. Therefore, a user can perform a computation only when he has the necessary access rights to relevant input and output data elements [5].

Propose System:

We propose the system with multiple uses and owners. For any organization, Institute confidential file s/data handle by more than one director .in such type of situation data security and authentication is challenging task. We are proposing system have more one owner, each owner having individual access key and password for accessing the data/files of organization. We also define key based policy with following descriptions [3]:

- Data store and share in-group by any owner.
- Policies created by any owner but need approval by all owners
- Changing in policy, all owners' permission needed.
- Owner can only access private files.
- Registered users can access public files which uploaded by owner.

- Public file access policy is defined by all owners.

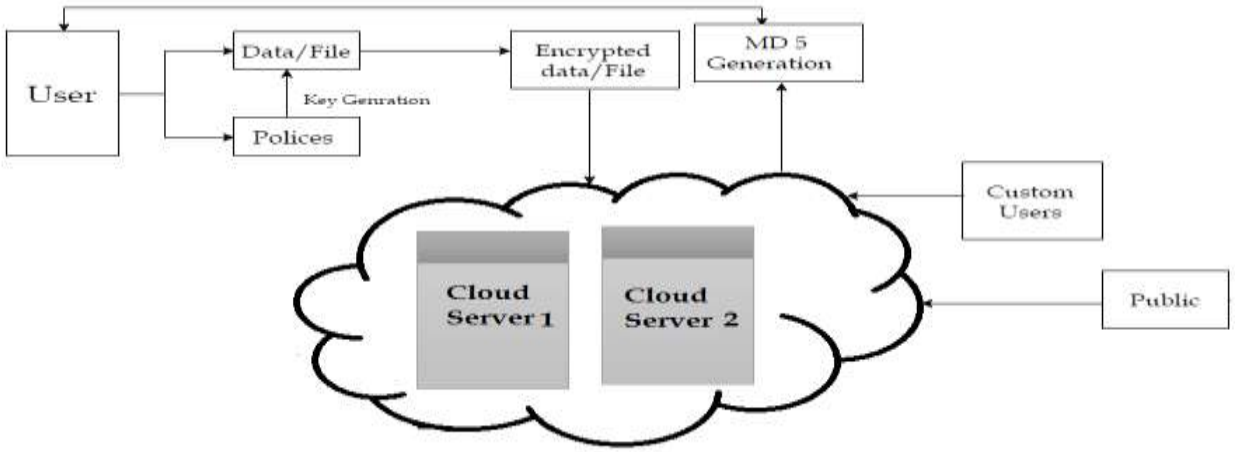

Figure 1.3 Proposed System

Proposed system consists of following Operation:

- **Key Generation:** Access secret is generated for every user UN agency registers within the system. System collects some attributes from user as well as identity attributes like e-mail, user-name etc. mistreatment these attributes and a few alternative options a singular secret is generated and from that key, employing a pattern operate, a 6 digits code is passed and generated to the user [7]. In propose system three type of users
  - Owner
  - Public User
  - Customer

- **Define Access Policy and Encryption Key**: File Access policies are generated for every file supported the confidentiality of the file. The owners might store the file as non-public, public or custom and should set the permissions as scan, edit, transfer and delete.

- **Decryption:** Before accessing a file, the file policies and user policies are matching. If each matches, then per the access key of user the system finds the permissions allowed for that user and retrieves the mix code. The key codes are retrieved and combined to form the key. Then secret writing is doing thereupon key.

- **File Revocation:** File revocation suggests that creating the file for good inaccessible. Deleting the file policies and coding keys will this. Deleted the key can't be reformed and secret writing is not possible. Once a file is making an attempt to access, initial the file policies are checked, if there's no file policy then there itself the file is inaccessible. The system twice ensures the inconvenience of a file [9].

- **Hash Value (MD-5):** Generate the hash price for store file on cloud. MD5 processes a variable-length message into a fixed-length output of 128 bits. Those functions are as follows:

  F(A,B,C) = (A ^ B) | (~(A) & C)
  G(A,B,C) = (A& B) | (B & ~(C))
  H(A,,B,C) = A ^ B ^ B
  I(A,B,C) = A ^ (B | ~(B)

Proposed Algorithm:

KP-ABE may be the dual to CP-ABE within the sense that a good access policy is encoded into the users secret essential, e. g., $(A \wedge C)^{V} D$, and a cipher text is computed with respect to a set connected with attributes, e. g., A,B. In this example the person would not be able to decrypt the cipher text but would for instance be able to decrypt a cipher text with respect to A, C.

An important property, which should be achieved by both, CP- and KP-ABE is referred to as collusion resistance. This basically shows that it should not be possible for unique users to "pool" his or her secret keys such that they could with each other decrypt a cipher text that neither ones could decrypt independently (which is realized by independently randomizing users' solution keys).

Algorithms of for KP-ABE with enhancement are discussed as below:

KP-ABE Key Generation (A, M_K):

Proposed algorithm output a secret key D added with a access structure T. Following three step describe access structure A:

1. Every root node represent with r, set secret value = y.

2. Using loop each non leaf node

   a. If the ^ (And) operator and all child node mark with unsigned.

   b. If the ^{V} (OR)operator), and Mark this node as assigned and set value s.

3. For each leaf attribute a_j,i ε T , compute $D_j;i = T_j \wedge si$

   Secret Key $S_k = \{ D_j,i\}$

4) KP-ABE Decryption (E, D): Proposed algorithm takes input as cipher text (E) using the attribute policy decrypted the Message with secret S_k and public key $Pk_$

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CONCLUSION

In this paper we have spoken our ongoing research about a semantic approach about our policy-based security framework for business management processes. We have renowned all the security concerns, which are demanded in day-to-day purpose and these requirements, are classified into two levels that is Task and Process Level. The architecture of security framework is premeditated to maintenance runtime policy controlling and execution. Security policies are built on the top of ontology to enrich representation of security concerns and enable reasoning for the clash of detection and policy negotiations.

REFERENCES:

[1] Acquisti, and J. Grossklags, "Privacy and Rationality in Individual Decision Making", IEEE Security and Privacy Vol. 3 No. 1, IEEE, 2005, pp. 26-33.

[2] M. A. AlZain, and E. Pardede, "Using Multi Shares for Ensuring Privacy in Database-as-a-Service", 44th Hawaii International Conference on System Sciences, IEEE, 2011.

[3] M. A. AlZain, E. Pardede, B. Soh, and J. A. Thom, "Cloud Computing Security: From Single to Multi- Clouds", 45th Hawaii International Conference on System Sciences, IEEE, 2012.

[4] A. Bessani, M. Correia, B. Quaresma, F. Andre, and P. Sousa, "DEPSKY: Dependable and Secure Storage in a Cloud-of-Clouds",

Proceedings of the 6th conference on computer systems EuroSys'11, ACM, New York USA, 2011, pp. 31-46.

[5] S. Bugiel, S. Nurnberger, A. Sadeghi, and T. Schneider, „Twin Clouds: An Architecture for Secure Cloud Computing", Workshop on Cryptography and Security in Clouds, 2011.

[6] S. Chaves, C. B. Westphall, and F. R. Lamin, "SLA Perspective in Security Management for Cloud Computing", 6th International Conference on Networking and Services, IEEE, 2010.

[7] Y. Chen, and R. Sion, "On Securing Untrusted Clouds with Cryptography", Proceedings of the 9th annual ACM Workshop on Privacy in Electronic Society WPES'10, ACM, New York USA, 2010, pp. 109-114.

[8] N. Christin, S. Egelman, T. Vidas, and J. Grossklags, „ It's All About the Benjamins: An empirical study on incentivizing users to ignore security advice", Financial Cryptography and Data Security, Springer Berlin Heidelberg, 2012, pp. 16-30.

[9] S. De, S. Saha, and A. K. Pal, "Achieving Energy Efficiency and Security in Mobile Cloud Computing", Proceedings of the 3rd International Conference on Cloud Computing and Services Sciences CLOSER 2013, SciTePress, 8-10 May 2013, Aachen, Germany.

[10] J. Fontana**, "**Are human firewalls the enterprise info. sec of the future? http://www.zdnet.com/are-human- firewalls-the-enterprise-info-sec-of-the-future- 7000008497/" (a discussion on Tom Scoltz et al, Gartner's Report on People Centric Information Security Strategy, 2012.)

[11] O. Goldreich, "Foundations of Cryptography Volume II Basic Applications". Cambridge, UK: Cambridge University Press, 2004

[12] W. Itani, A. Kayssi, and A. Chehab, "Privacy as a Service: Privacy-Aware Data Storage and Processing in Cloud Computing Architectures", 8th IEEE Conference on Dependable, Autonomic and Secure Computing, IEEE, 2009, pp. 711-716.

[13] A. W. Jansen, "Cloud Hooks: Security and Privacy Issues in Cloud Computing", 44th Hawaii International Conference on System Sciences, 2011, pp. 1-10.

[14] M. Jensen, J. Schwenk, J. Bohli, N. Gruschka, and L. Iacono, "On T echnical Security Issues in Cloud Computing", IEEE International Conference on Cloud Computing, IEEE, 2009.

[15] M. Jensen, J. Schwenk, J. Bohli, N. Gruschka, and L. Iacono, "On T echnical Security Issues in Cloud Computing", IEEE International Conference on Cloud Computing, IEEE, 2009.

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A Large Block Cipher Involving a Key Applied on Both the Sides of the Plain Text

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Abstract: In this paper, we have developed a block cipher by modifying the Hill cipher. In this, the plain text matrix P is multiplied on both the sides by the key matrix. Here, the size of the key is 512 bits and the size of the plain text is 2048 bits. As the procedure adopted here is an iterative one, and as no direct linear relation between the cipher text C and the plain text P can be obtained, the cipher cannot be broken by any cryptanalytic attack.

Keywords: Block Cipher, Modular arithmetic inverse, Plain text, Cipher text, Key.

1. Introduction

The study of the block ciphers, which was initiated several centuries back, gained considerable impetus in the last quarter of the last century. Noting that diffusion and confusion play a vital role in a block cipher, Feistel etal, [1 – 2] developed a block cipher, called Feistel cipher. In his analysis, he pointed out that, the strength of the cipher increases when the block size is more, the key size is more, and the number of rounds in the iteration is more.

The popular cipher DES [3], developed in 1977, has a 56 bit key and a 64 bit plain text. The variants of the DES are double DES, and triple DES. In double DES, the size of the plain text block is 64 bits and the size of the key is 112 bits. In the triple DES, the key is of the length 168 bits and the plain text block is of the size is 64 bits. At the beginning of the century, noting that 64 bit block size is a drawback in DES, Joan Daemen and Vincent Rijmen, have developed a new block cipher called

AES [4], wherein the block size of the plain text is 128 bits and key is of length 128,

192, or 256 bits. In the subsequent development, on modifying Hill cipher, several researchers [5 – 9], have developed various cryptographical algorithms wherein the length of the key and the size of the plain text block are quite significant.

In the present paper, our objective is to develop a block cipher wherein the key size and the block size are significantly large. Here, we use Gauss reduction method for obtaining the modular arithmetic inverse of a matrix. In what follows, we present the plan of the paper.

In section 2, we have discussed the development of the cipher. In section 3, we have illustrated the cipher by considering an example. In section 4, we have dealt with the cryptanalysis of the cipher. Finally, in section 5, we have presented the computations and arrived at the conclusions.

2. Development of the cipher

Consider a plain text P which can be represented in the form of a square matrix given by

$$\mathbf{P = [P_{ij}]}, \qquad i = 1 \text{ to } n,\ j = 1 \text{ to } n, \tag{2.1}$$

where each P_{ij} is a decimal number which lies between 0 and 255.

Let us choose a key k consisting of a set of integers, which lie between 0 and 255. Let us generate a key matrix, denoted as K, given by

$$\mathbf{K = [K_{ij}]}, \qquad i = 1 \text{ to } n,\ j = 1 \text{ to } n, \tag{2.2}$$

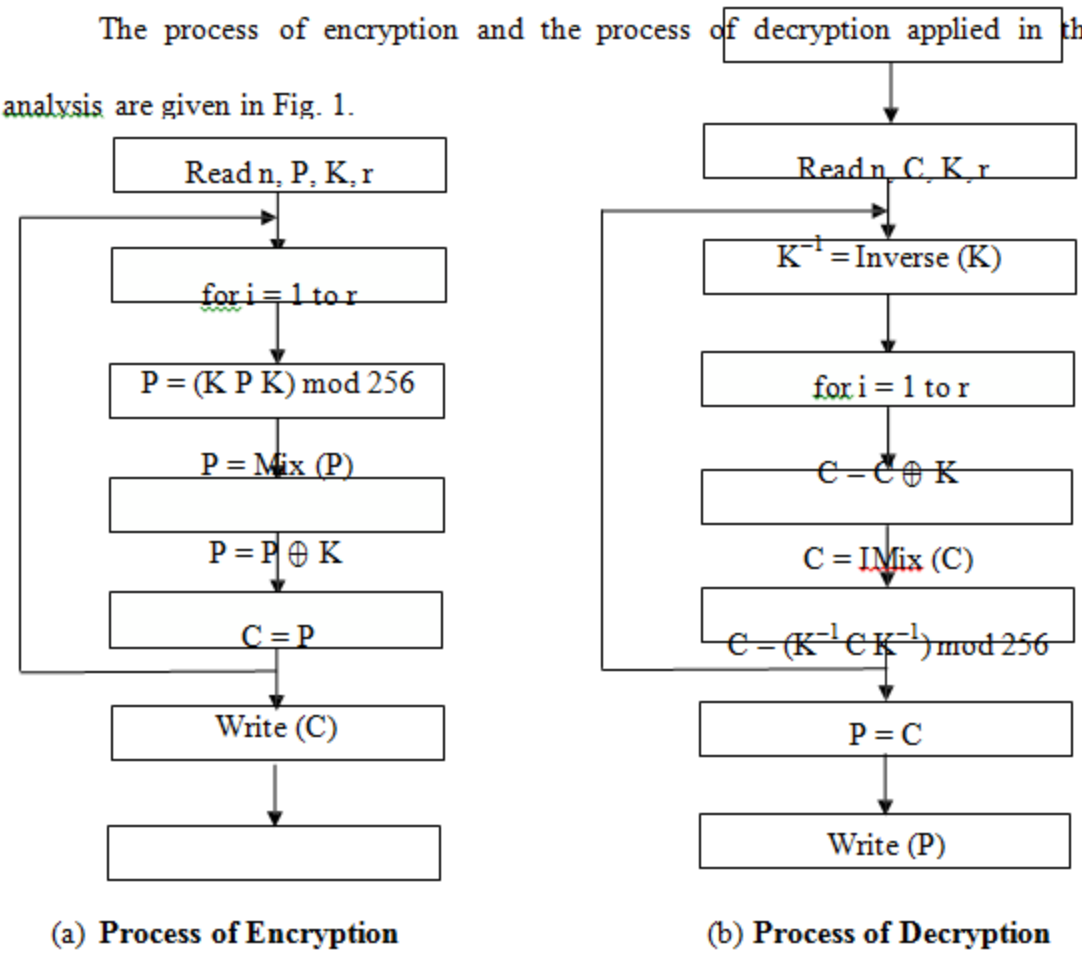
where each K_{ij} is also an integer in the interval [0 – 255].

Let

$$\mathbf{C = [C_{ij}]}, \qquad i = 1 \text{ to } n,\ j = 1 \text{ to } n \tag{2.3}$$

be the corresponding cipher text matrix.

The process of encryption and the process of decryption applied in this analysis are given in Fig. 1.



(a) **Process of Encryption** (b) **Process of Decryption**

Fig. 1. Schematic diagram of the cipher

Here r denotes the number of rounds.

In the process of encryption, we have used an iterative procedure which includes the relations

$$\mathbf{P = (K\ P\ K)\ mod\ 256,} \tag{2.4}$$

$$\mathbf{P = Mix\ (P),} \tag{2.5}$$

and

$$\mathbf{P = P \oplus K} \tag{2.6}$$

The relation (2.4) causes diffusion, while (2.5) and (2.6) lead to confusion. Thus, these three relations enhance the strength of the cipher.

Let us consider **Mix (P)**. In this the decimal numbers in P are converted into their binary form. Then we have a matrix of size n x 8n, and this is given by

$$\begin{pmatrix} P_{111}, P_{112}, \ldots, P_{118}, P_{121}, P_{122}, \ldots, P_{128}, \ldots, P_{1n1}, P_{1n2}, \ldots, P_{1n8} \\ P_{211}, P_{212}, \ldots, P_{218}, P_{221}, P_{222}, \ldots, P_{228}, \ldots, P_{2n1}, P_{2n2}, \ldots, P_{2n8} \\ \ldots \\ P_{n11}, P_{n12}, \ldots, P_{n18}, P_{n21}, P_{n22}, \ldots, P_{n28}, \ldots, P_{nn1}, P_{nn2}, \ldots, P_{nn8} \end{pmatrix}$$

Here, $P_{111}, P_{112}, \ldots, P_{118}$ are binary bits corresponding to P_{11}. Similarly, $P_{ij1}, P_{ij2}, \ldots, P_{ij8}$ are the binary bits representing P_{ij}.

The above matrix can be considered as a single string in a row wise manner. As the length of the string is $8n^2$, it is divided into n^2 substrings, wherein the length of each substring is 8 bits. If n^2 is divisible by 8, we focus our attention on the first 8 substrings. We place the first bits of these 8 binary substrings, in order, at one place and form a new binary substring. Similarly, we assemble the second 8 bits and form the second binary substring. Following the same procedure, we can get six more binary substrings in the same manner. Continuing in the same way, we exhaust all the binary substrings obtained from the plain text.

However, if n^2 is not divisible by 8, then we consider the remnant of the string, and divide it into two halves. Then we mix these two halves by placing the first bit of the second half, just after the first bit of the first half, the second bit of the second half, next to the second bit of the first half, etc. Thus we get a new binary substring corresponding to the remaining string. This completes the process of mixing.

In order to perform the exclusive or operation in $P = P \oplus K$, we write the matrices, both P and K, in their binary form, and carryout the XOR operation between the corresponding binary bits.

In the process of decryption, the function IMix represents the reverse process of Mix.

In what follows, we present the algorithms for encryption, and decryption. We also provide an algorithm for finding the modular arithmetic inverse of a square matrix.

Algorithm for Encryption

1. Read n, P, K, r

2. for i = 1 to r

{

P = (K P K) mod 256

P = Mix (P) P = P $\oplus$ K

}

3. C = P

4. Write (C)

Algorithm for Decryption

1. Read n, C, K, r

2. K^{-1} = Inverse (K)

3. for i = 1 to r

{

C = C $\oplus$ K

C = IMix (C)

C = (K^{-1} C K^{-1}) mod 256

}

4. P = C

5. Write (P)

Algorithm for Inverse (K)

// The arithmetic inverse (A^{-1}), and the determinant of the matrix (Δ) are obtained by Gauss reduction method.

1. A = K, N = 256

2. $A^{-1} = [A_{ji}] / \Delta$, i = 1 to n, j = 1 to n //A_{ji} are the cofactors of a_{ij}, where a_{ij} are elements of A, and Δ is the determinant of A

3. for i = 1 to n {

if ((i Δ) mod N = 1)

d = i;

break;

}

4. B = [d A_{ji}] mod N // B is the modular arithmetic inverse of A

3. Illustration of the cipher

Let us consider the following plain text.

No country wants to bring in calamities to its own people. If the people do not have any respect for the country, then the Government has to take appropriate measures and take necessary action to keep the people in order. No country can excuse the erratic behaviour of the people, even though something undue happened to them in the past. Take the appropriate action in the light of this fact. Invite all the people to come into the fold of the Government. Try to persuade them as far as possible. Let us see!! (3.1)

Let us focus our attention on the first 256 characters of the above plain text which is given by

No country wants to bring in calamities to its own people. If the people do not have any respect for the country, then the Government has to take appropriate measures and take necessary action to keep the people in order. No country can excuse the erratic !! (3.2)

On using EBCDIC code, we get 26 numbers, corresponding to 256 characters.

Now on placing 16 numbers in each row, we get the plain text matrix P in the decimal form

$$P = \begin{bmatrix} 64 & 163 & 150 & 64 & 130 & 153 & 137 & 149 & 135 & 64 & 137 & 149 & 64 & 131 & 129 & 147 \\ 129 & 148 & 137 & 163 & 137 & 133 & 162 & 64 & 163 & 150 & 64 & 137 & 163 & 162 & 64 & 150 \\ 166 & 149 & 64 & 151 & 133 & 150 & 151 & 147 & 133 & 75 & 64 & 201 & 134 & 64 & 163 & 136 \\ 133 & 64 & 151 & 133 & 150 & 151 & 147 & 133 & 64 & 132 & 150 & 64 & 149 & 150 & 163 & 64 \\ 136 & 129 & 165 & 133 & 64 & 129 & 149 & 168 & 64 & 153 & 133 & 162 & 151 & 133 & 131 & 163 \\ 64 & 134 & 150 & 153 & 64 & 163 & 136 & 133 & 64 & 131 & 150 & 164 & 149 & 163 & 153 & 168 \\ 107 & 64 & 163 & 136 & 133 & 149 & 64 & 163 & 136 & 133 & 64 & 199 & 150 & 165 & 133 & 153 \\ 149 & 148 & 133 & 149 & 163 & 64 & 136 & 129 & 162 & 64 & 163 & 150 & 64 & 163 & 129 & 146 \\ 133 & 64 & 129 & 151 & 151 & 153 & 150 & 151 & 153 & 137 & 129 & 163 & 133 & 64 & 148 & 133 \\ 129 & 162 & 164 & 153 & 133 & 162 & 64 & 129 & 149 & 132 & 64 & 163 & 129 & 146 & 133 & 64 \\ 149 & 133 & 131 & 133 & 162 & 162 & 129 & 153 & 168 & 64 & 129 & 131 & 163 & 137 & 150 & 149 \\ 64 & 163 & 150 & 64 & 146 & 133 & 133 & 151 & 64 & 163 & 136 & 133 & 64 & 151 & 133 & 150 \\ 151 & 147 & 133 & 64 & 137 & 149 & 64 & 150 & 153 & 132 & 133 & 153 & 75 & 64 & 213 & 150 \\ 64 & 131 & 150 & 164 & 149 & 163 & 153 & 168 & 64 & 131 & 129 & 149 & 64 & 133 & 167 & 131 \\ 164 & 162 & 133 & 64 & 163 & 136 & 133 & 64 & 133 & 153 & 153 & 129 & 163 & 137 & 131 & 64 \end{bmatrix} \quad (3.3)$$

Obviously, here the length of the plain text block is 16 x 16 x 8 (2048) bits.

Let us choose a key k consisting of 64 numbers. This can be written in the form of a matrix given by

$$Q = \begin{bmatrix} 175 & 173 & 27 & 65 & 32 & 65 & 17 & 76 \\ 232 & 84 & 72 & 69 & 32 & 185 & 69 & 82 \\ 27 & 179 & 102 & 33 & 83 & 97 & 73 & 32 \\ 65 & 84 & 143 & 69 & 105 & 153 & 213 & 163 \\ 184 & 28 & 49 & 5 & 69 & 31 & 166 & 109 \\ 208 & 185 & 77 & 234 & 207 & 171 & 71 & 80 \end{bmatrix} \quad (3.4)$$

The length of the secret key (which is to be transmitted) is 512 bits. On using this key, we can generate a new key K in the form

$$K = \begin{bmatrix} Q & R \\ S & U \end{bmatrix} \quad (3.5)$$

where $U = Q^T$, in which T denotes the transpose of a matrix, and R and S are obtained from Q and U as follows. On interchanging the 1st row and the 8th row of Q, the 2nd row and the 7th row of Q, etc., we get R. Similarly, we obtain S from U. Thus, we have

$$K = \begin{bmatrix} 175 & 173 & 27 & 65 & 32 & 65 & 17 & 76 & 127 & 107 & 32 & 85 & 117 & 254 & 165 & 87 \\ 232 & 84 & 72 & 69 & 32 & 185 & 69 & 82 & 237 & 249 & 101 & 57 & 95 & 191 & 37 & 132 \\ 27 & 179 & 102 & 33 & 83 & 97 & 73 & 32 & 208 & 185 & 77 & 234 & 207 & 171 & 71 & 80 \\ 65 & 84 & 143 & 69 & 105 & 153 & 213 & 163 & 184 & 28 & 49 & 5 & 69 & 31 & 166 & 109 \\ 184 & 28 & 49 & 5 & 69 & 31 & 166 & 109 & 65 & 84 & 143 & 69 & 105 & 153 & 213 & 163 \\ 208 & 185 & 77 & 234 & 207 & 171 & 71 & 80 & 27 & 179 & 102 & 33 & 83 & 97 & 73 & 32 \\ 237 & 249 & 101 & 57 & 95 & 191 & 37 & 132 & 232 & 84 & 72 & 69 & 32 & 185 & 69 & 82 \\ 127 & 107 & 32 & 85 & 117 & 254 & 165 & 87 & 175 & 173 & 27 & 65 & 32 & 65 & 17 & 76 \\ 76 & 82 & 32 & 163 & 109 & 80 & 132 & 87 & 175 & 232 & 27 & 65 & 184 & 208 & 237 & 127 \\ 17 & 69 & 73 & 213 & 166 & 71 & 37 & 165 & 173 & 84 & 179 & 84 & 28 & 185 & 249 & 107 \\ 65 & 185 & 97 & 153 & 31 & 171 & 191 & 254 & 27 & 72 & 102 & 143 & 49 & 77 & 101 & 32 \\ 32 & 32 & 83 & 105 & 69 & 207 & 95 & 117 & 65 & 69 & 33 & 69 & 5 & 234 & 57 & 85 \\ 65 & 69 & 33 & 69 & 5 & 234 & 57 & 85 & 32 & 32 & 83 & 105 & 69 & 207 & 95 & 117 \\ 27 & 72 & 102 & 143 & 49 & 77 & 101 & 32 & 65 & 185 & 97 & 153 & 31 & 171 & 191 & 254 \\ 173 & 84 & 179 & 84 & 28 & 185 & 249 & 107 & 17 & 69 & 73 & 213 & 166 & 71 & 37 & 165 \\ 175 & 232 & 27 & 65 & 184 & 208 & 237 & 127 & 76 & 82 & 32 & 163 & 109 & 80 & 132 & 87 \end{bmatrix} \quad (3.6)$$

whose size is 16 x 16.

On using the algorithm for modular arithmetic inverse (See Section 2), we get

$$K^{-1} = \begin{bmatrix} 251 & 24 & 106 & 200 & 158 & 133 & 226 & 83 & 167 & 67 & 140 & 200 & 10 & 73 & 96 & 177 \\ 189 & 50 & 239 & 168 & 171 & 96 & 93 & 45 & 253 & 21 & 6 & 20 & 58 & 97 & 122 & 2 \\ 167 & 129 & 255 & 47 & 0 & 60 & 68 & 133 & 57 & 42 & 124 & 111 & 233 & 10 & 229 & 62 \\ 252 & 3 & 168 & 207 & 100 & 111 & 0 & 6 & 93 & 115 & 162 & 210 & 132 & 123 & 13 & 244 \\ 55 & 187 & 60 & 254 & 50 & 101 & 174 & 15 & 19 & 101 & 152 & 140 & 246 & 118 & 90 & 5 \\ 5 & 75 & 51 & 226 & 243 & 127 & 150 & 253 & 239 & 137 & 52 & 104 & 219 & 178 & 175 & 4 \\ 38 & 75 & 1 & 220 & 99 & 46 & 155 & 104 & 22 & 249 & 205 & 162 & 104 & 202 & 208 & 108 \\ 167 & 33 & 253 & 52 & 36 & 37 & 128 & 104 & 115 & 92 & 2 & 82 & 229 & 6 & 164 & 201 \\ 83 & 226 & 133 & 158 & 200 & 106 & 24 & 251 & 177 & 96 & 73 & 10 & 200 & 140 & 67 & 167 \\ 45 & 93 & 96 & 171 & 168 & 239 & 50 & 189 & 2 & 122 & 97 & 58 & 20 & 6 & 21 & 253 \\ 133 & 68 & 60 & 0 & 47 & 255 & 129 & 167 & 62 & 229 & 10 & 233 & 111 & 124 & 42 & 57 \\ 6 & 0 & 111 & 100 & 207 & 168 & 3 & 252 & 244 & 13 & 123 & 132 & 210 & 162 & 115 & 93 \\ 15 & 174 & 101 & 50 & 254 & 60 & 187 & 55 & 5 & 90 & 118 & 246 & 140 & 152 & 101 & 19 \\ 253 & 150 & 127 & 243 & 226 & 51 & 75 & 5 & 4 & 175 & 178 & 219 & 104 & 52 & 137 & 239 \\ 104 & 155 & 46 & 99 & 220 & 1 & 75 & 38 & 108 & 208 & 202 & 104 & 162 & 205 & 249 & 22 \\ 104 & 128 & 37 & 36 & 52 & 253 & 33 & 167 & 201 & 164 & 6 & 229 & 82 & 2 & 92 & 115 \end{bmatrix} \quad (3.7)$$

On using (3.6) and (3.7), it can be readily shown that

$$\mathbf{K\,K^{-1}\ mod\ 256 = K^{-1}K\ mod\ 256 = I}. \quad (3.8)$$

On applying the encryption algorithm, described in Section 2, we get the cipher text C in the form

$$C = \begin{bmatrix} 57 & 57 & 108 & 41 & 0 & 4 & 105 & 26 & 38 & 128 & 194 & 61 & 148 & 67 & 11 & 71 \\ 116 & 195 & 96 & 224 & 213 & 18 & 92 & 194 & 42 & 125 & 198 & 39 & 226 & 90 & 56 & 234 \\ 174 & 156 & 30 & 14 & 207 & 134 & 166 & 65 & 233 & 207 & 151 & 29 & 93 & 237 & 11 & 201 \\ 50 & 100 & 40 & 36 & 47 & 202 & 17 & 243 & 232 & 47 & 145 & 191 & 45 & 39 & 39 & 100 \\ 76 & 147 & 3 & 79 & 51 & 44 & 141 & 49 & 122 & 20 & 153 & 121 & 75 & 143 & 128 & 5 \\ 25 & 1 & 212 & 6 & 195 & 243 & 47 & 75 & 50 & 165 & 103 & 85 & 92 & 130 & 47 & 184 \\ 127 & 163 & 199 & 174 & 221 & 85 & 43 & 207 & 203 & 168 & 137 & 28 & 186 & 100 & 156 & 98 \\ 140 & 28 & 151 & 78 & 245 & 132 & 217 & 175 & 218 & 189 & 223 & 78 & 51 & 92 & 100 & 30 \\ 166 & 222 & 199 & 196 & 10 & 120 & 202 & 101 & 167 & 48 & 154 & 46 & 32 & 197 & 196 & 36 \\ 186 & 25 & 214 & 134 & 103 & 134 & 52 & 104 & 154 & 202 & 207 & 122 & 108 & 141 & 52 & 204 \\ 6 & 100 & 188 & 114 & 107 & 19 & 185 & 201 & 31 & 53 & 106 & 235 & 228 & 171 & 102 & 69 \\ 216 & 104 & 181 & 34 & 122 & 95 & 196 & 142 & 253 & 142 & 59 & 199 & 102 & 199 & 49 & 146 \\ 167 & 137 & 157 & 25 & 55 & 162 & 102 & 211 & 91 & 159 & 19 & 83 & 225 & 220 & 251 & 149 \\ 109 & 14 & 88 & 147 & 93 & 16 & 7 & 208 & 93 & 46 & 2 & 160 & 90 & 61 & 198 & 116 \\ 252 & 104 & 35 & 60 & 222 & 157 & 64 & 207 & 212 & 239 & 203 & 79 & 24 & 10 & 40 & 55 \\ 25 & 129 & 49 & 123 & 117 & 82 & 228 & 172 & 130 & 104 & 79 & 189 & 47 & 209 & 12 & 143 \end{bmatrix} \quad (3.9)$$

On using (3.7) and (3.9), and applying the decryption algorithm presented in section 2, we get the Plain text P.

This is the same as (3.3).

Let us now find out the avalanche effect. To this end, we focus our attention on the plain text (3.2), and modify the 88^{th} character 'y' to 'z'. Then the plain text changes only in one binary bit as the EBCDIC code of y is 168 and that of z is 169.

On using the encryption algorithm, we get the cipher text C corresponding to the modified plain text (wherein y is replaced by z) in the form

$$C = \begin{bmatrix}
119 & 213 & 181 & 74 & 20 & 56 & 48 & 122 & 209 & 55 & 60 & 43 & 150 & 252 & 154 & 247 \\
224 & 97 & 64 & 47 & 160 & 153 & 76 & 194 & 250 & 98 & 160 & 49 & 221 & 74 & 225 & 63 \\
117 & 169 & 215 & 90 & 103 & 102 & 47 & 62 & 163 & 210 & 63 & 242 & 30 & 153 & 218 & 163 \\
22 & 87 & 232 & 166 & 71 & 179 & 220 & 230 & 215 & 250 & 255 & 67 & 156 & 48 & 120 & 241 \\
236 & 60 & 224 & 27 & 162 & 28 & 74 & 49 & 158 & 99 & 206 & 97 & 220 & 119 & 32 & 120 \\
251 & 31 & 248 & 20 & 146 & 64 & 117 & 76 & 35 & 59 & 35 & 181 & 119 & 58 & 110 & 10 \\
227 & 102 & 247 & 97 & 16 & 73 & 247 & 64 & 165 & 41 & 60 & 249 & 187 & 251 & 47 & 221 \\
223 & 219 & 51 & 108 & 15 & 23 & 227 & 118 & 244 & 106 & 52 & 46 & 253 & 228 & 137 & 209 \\
202 & 31 & 162 & 67 & 159 & 76 & 5 & 117 & 156 & 163 & 249 & 62 & 193 & 29 & 169 & 150 \\
187 & 57 & 226 & 189 & 141 & 85 & 91 & 66 & 68 & 24 & 117 & 109 & 199 & 108 & 224 & 83 \\
126 & 236 & 118 & 190 & 173 & 148 & 149 & 35 & 21 & 59 & 248 & 176 & 5 & 132 & 100 & 222 \\
247 & 230 & 224 & 201 & 212 & 0 & 231 & 137 & 43 & 251 & 118 & 87 & 179 & 230 & 231 & 97 \\
212 & 73 & 90 & 156 & 41 & 108 & 241 & 42 & 62 & 147 & 39 & 93 & 114 & 231 & 102 & 182 \\
54 & 23 & 85 & 48 & 211 & 253 & 249 & 131 & 135 & 210 & 212 & 119 & 5 & 24 & 121 & 79 \\
229 & 37 & 225 & 196 & 235 & 2 & 172 & 113 & 94 & 88 & 192 & 100 & 56 & 107 & 156 & 0 \\
184 & 244 & 252 & 74 & 119 & 203 & 231 & 175 & 244 & 143 & 202 & 175 & 36 & 155 & 230 & 114
\end{bmatrix} \quad (3.10)$$

On comparing (3.9) and (3.10), we find that the two cipher texts differ in 898 bits, out of 2048 bits, which is quite considerable. However, it may be mentioned here that, the impact of changing 1 bit is not that copious, as the size of the plain text is very large. Even then it is remarkable.

Now let us change the key K given in (3.6) by one binary bit. To this end, we replace the 60^{th} element 5 by 4. Then on using the original plain text given by (3.3),

we get C in the form

$$C = \begin{bmatrix}
13 & 0 & 2 & 74 & 218 & 57 & 239 & 116 & 240 & 123 & 248 & 155 & 123 & 226 & 199 & 97 \\
214 & 46 & 176 & 82 & 224 & 159 & 65 & 89 & 114 & 153 & 103 & 141 & 90 & 39 & 149 & 117 \\
207 & 38 & 134 & 116 & 4 & 150 & 109 & 244 & 181 & 245 & 46 & 37 & 112 & 20 & 55 & 224 \\
9 & 208 & 90 & 166 & 110 & 162 & 51 & 145 & 130 & 211 & 113 & 169 & 166 & 182 & 243 & 219 \\
220 & 212 & 58 & 153 & 191 & 123 & 155 & 14 & 8 & 26 & 124 & 250 & 141 & 178 & 212 & 187 \\
142 & 133 & 151 & 95 & 44 & 230 & 219 & 14 & 63 & 150 & 206 & 24 & 49 & 138 & 6 & 144 \\
118 & 209 & 75 & 27 & 60 & 74 & 15 & 105 & 101 & 203 & 216 & 57 & 207 & 38 & 86 & 59 \\
150 & 224 & 52 & 39 & 226 & 91 & 210 & 126 & 163 & 214 & 163 & 163 & 5 & 133 & 15 & 205 \\
157 & 112 & 61 & 108 & 16 & 37 & 196 & 128 & 18 & 138 & 195 & 115 & 147 & 143 & 136 & 84 \\
100 & 189 & 55 & 90 & 38 & 178 & 219 & 150 & 108 & 141 & 241 & 205 & 169 & 104 & 26 & 136 \\
218 & 174 & 206 & 39 & 170 & 249 & 129 & 175 & 44 & 133 & 229 & 242 & 223 & 119 & 85 & 95 \\
40 & 212 & 255 & 90 & 188 & 66 & 184 & 37 & 81 & 143 & 24 & 17 & 214 & 24 & 86 & 71 \\
214 & 158 & 227 & 168 & 247 & 39 & 190 & 158 & 159 & 41 & 94 & 184 & 196 & 158 & 160 & 5 \\
205 & 127 & 57 & 145 & 126 & 151 & 31 & 230 & 30 & 241 & 66 & 106 & 17 & 59 & 177 & 210 \\
238 & 58 & 117 & 129 & 63 & 116 & 195 & 84 & 98 & 38 & 180 & 234 & 219 & 107 & 46 & 251
\end{bmatrix} \quad (3.11)$$

On comparing (3.9) and (3.11), we find that the cipher texts differ in 915 bits, out of 2048 bits

From the above analysis, we find that the avalanche effect is quite pronounced and shows very clearly that the cipher is a strong one.

4. Cryptanalysis

In the literature of cryptography, it is well known that the different types of attacks for breaking a cipher are:

(1) Cipher text only attack, (2) Known plain text attack, (3) Chosen plain text attack, (4) Chosen cipher text attack.

In the first attack, the cipher text is known to us together with the algorithm. In this case, we can determine the plain text, only if the key can be found. As the key contains 64 decimal numbers, the key space is of size

$$2^{512} \simeq (10^3)^{51.2} = 10^{153.6}$$

which is very large. Hence, the cipher cannot be broken by applying the brute force approach.

We know that, the Hill cipher [1] can be broken by the known plain text attack, as there is a direct linear relation between C and P. But in the present modification, as we have all nonlinear relations in the iterative scheme, the C can never be expressed in terms of P, thus P cannot be determined by any means in terms of other quantities. Hence, this cipher cannot be broken by the known plain text attack.

As there are three relations, which are typical in nature, in the iterative process for finding C, no special choice of either the plain text or the cipher text or both can be conceived to break the cipher.

5. Conclusions

In the present paper, we have developed a large block cipher by modifying the Hill cipher. In the case of the Hill cipher, it is governed by the single, linear relation

C = (K P) mod 26, (5.1) while in the present case, the cipher is governed by an iterative scheme, which includes the relations

P = (K P K) mod 256, (5.2)

P = Mix (P), (5.3)

and **P = P ⊕ K.** (5.4)

Further, it is followed by **C = P** **(**5.5)

In the case of the Hill cipher, we are able to break the cipher as there is a direct linear relation between C and P. On the other hand, in the case of the present cipher, as we cannot obtain a direct relation between C and P, this cipher cannot be broken by the known plain text attack.

By decomposing the entire plain text given by (3.1) into blocks, wherein each block is of size 256 characters, the corresponding cipher text can be obtained in the decimal form. The first block is already presented in (3.9) and the rest of the cipher text is given by

185	14	96	57	33	156	10	74	214	184	19	44	237	13	121	141
157	250	120	112	34	186	172	9	89	206	225	222	59	115	173	136
30	181	147	17	186	218	133	206	47	55	79	64	113	114	218	70
106	93	172	169	102	146	109	190	49	150	211	208	39	112	3	191
154	131	34	159	83	47	154	232	44	156	122	78	253	61	184	98
166	122	142	238	193	253	202	250	43	137	116	45	70	197	245	52
40	44	78	134	13	38	123	162	194	198	210	191	247	248	144	234
78	104	122	55	244	183	248	240	99	91	160	212	66	244	85	197
137	169	82	213	145	176	103	211	19	15	226	208	154	192	241	92
17	101	116	186	230	110	63	238	183	118	126	148	17	3	202	117
162	54	8	58	190	226	244	214	254	99	125	39	197	200	112	108
90	232	19	216	95	226	25	133	180	56	190	121	247	209	174	60
71	134	138	47	69	232	67	136	63	208	50	145	35	188	81	126
165	182	219	38	135	174	69	215	192	253	164	76	91	168	214	26
96	9	88	227	107	140	131	82	59	148	1	171	235	9	203	97
32	14	122	27	122	90	225	6	140	48	17	115	172	106	125	234

In this analysis, the length of the plain text block is 2048 bits and the length of the key is 512 bits. As the cryptanalysis clearly indicates, this cipher is a strong one and it cannot be broken by any cryptanalytic attack. This analysis can be extended to a block of any size by using the concept of interlacing [5]

REFERENCES:

1. Feistel H, "*Cryptography and Computer Privacy*", Scientific American, May1973.
2. Feistel H, Notz W, Smith J, "*Some Cryptographic Techniques for Machine-to- Machine Data Communications*", Proceedings of the IEEE, Nov. 1975.
3. William Stallings, *Cryptography and Network Security*, Principles and Practice, Third Edition, Pearson, 2003.
4. Daemen J, Rijmen V, "*Rijdael: The Advanced Encryption Standard*", Dr. Dobb'sJournal, March 2001.
5. V. U. K. Sastry, V. Janaki, "*On the Modular Arithmetic Inverse in the Cryptology of Hill Cipher*",Proceedings of North American Technology and Business Conference, Sep. 2005, Canada.

6. V. U. K. Sastry, S. Udaya Kumar, A. Vinaya Babu, "*A Large Block Cipher using Modular Arithmetic Inverse of a Key Matrix and Mixing of the Key Matrix and the Plaintext*", Journal of Computer Science 2 (9), 698 – 703, 2006.

7. V. U. K. Sastry, V. Janaki, "*A Block Cipher Using Linear Congruences*", Journal of Computer Science 3(7), 556 – 561, 2007.

8. V. U. K. Sastry, V. Janaki, "*A Modified Hill Cipher with Multiple Keys*", International Journal of Computational Science, Vol. 2, No. 6, 815 – 826, Dec.2008.

9. V. U. K. Sastry, D. S. R. Murthy, S. Durga Bhavani, "*A Block Cipher Involving a Key Applied on Both the Sides of the Plain Text*", Sent for publication.

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REVIEW ON MONOPILE FOUNDATION FOR FIXED OFFSHORE STRUCTURE

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Abstract - This paper provides a broad overview of some of the key factors in the design monopile foundation for fixed offshore structure. During the last years, offshore wind turbine structures were reported to settle on the monopile structure and the resulting force flow in the structures was different to that intended at the design stage. A joint industry project was therefore carried out by Det Nordce Veritas (DNV) [1] to investigate the structural capacity of these connections from autumn 2009 to January 2011. It was found that the axial capacity of the grouted connections is a more sensitive function to the diameter and surface tolerances than that accounted for in existing design standards.

Keywords: Monopile foundation, Fixed Platform, Spar structure, offshore turbine, Heave displacement, Hydrodynamics, Offshore Wind Turbine

1 INTRODUCTION

Monopile foundation used for offshore wind farms is basically a cylindrical tube usually made of steel, which is directly installed into the seabed using hammering or vibration. This technique has been used in die offshore for erecting Platform for wind turbine and has proven to be very effective. So far the monopile support structure is the most popular support structure used for the construction of wind farms. It is estimated that 75% of all installed offshore wind turbines use the monopile support [2]. There are a lot of factois that contribute to the popularity of monopile. Firstly it is a very simple design, which can also be manufactured in two straightforward steps, rolling and welding. The calculation and analysis of this structure are also easy and always the first step while designing any type of support structure. The growing requirement for clean and sustainable energy production in die near future has resulted in die search for alternatives to fossil fuels as an energy source. As a result of that, wind energy is one of the most promising options for generating electricity.

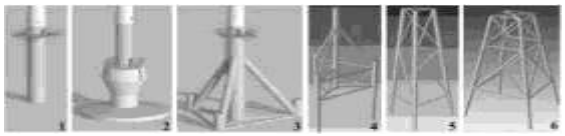


Fig.1 Types of Monopile Foundation

2 TYPES OF MONOPILE FOUNDATION

2.1 Structure 1 - Monopile Foundation

This is a simple structure consisting of a steel pipe piled into die seabed by driving and/or drilling methods. A larger diameter sleeve is attached to the pile by concrete casting, where its top rim is a flange that accommodates fixation of the turbine tower by bolting.

2.2 Structure 2 - Gravity Based Foundation

This structure is currently used on most offshore wind projects at shallow water depths up to 5 m. It consists of a large base constructed from steel and concrete, resting on the seabed. It relies on weight of the structure to resist overturning; hence the turbine is dependent on gravity to remain erect. The structure is resistant to scour and deformation due to its massive weight. The wind turbine tower is attached similarly to monopole foundations.

2.3 Structure 3 - Tripod Foundation

This design is typically used forplatforms in the oil and gas industry. It is made from steel tubes welded together, typically 1 to 2.5 *m* in diameter. It is anchored 20 to 40 *m* into the seabed by means of driven or drilled piles from 1 to 2.5 *m* in diameter. The transition piece is typically attached onto the centre column by means of concrete casting as well.

Jacket structures are made from steel tubes, typically 0.5 - 1.5 *m* in diameter, welded together to form a structure similar to lattice towers. They are anchored to the seabed by driven or drilled piles, ranging from 1-2.5 *m* in diameter. Several 3 to 4 legged jacket structures have been proposed as illustrated in Fig.1

3 DESIGN CONSIDERATIONS FOR FOUNDATIONS

One of the main aims of the foundations is to transfer all the loads from the wind turbine structure to die ground within the allowable deformations. Guided by limit state design philosophy, the design considerations are to satisfy:

1. Ultimate Limit State (ULS): This would require the computation of capacity of tire foundation. For monopiles type of foundation, this would require computation of ultimate moment, lateral and axial load carrying capacity.
2. Serviceability Limit State (SLS): This would require the prediction of tilt at the hub level over the life time of the wind turbine.
3. Fatigue Limit State: This would require predicting the fatigue life.

4 HYDRODYNAMICS

The characteristics of currents and waves, themselves would be very much site dependent, with extreme values of principal interest to the LFRD approach used for offshore structure design, associated with the statistics of the climatic condition of the site of interest. A

number of regular wave theories have been developed to describe the water particle kinematics associated with ocean waves of varying degrees of complexity and levels of acceptance by the offshore engineering community, [4]. These would include linear or Airy wave theory, Stokes second and other higher order theories, Stream- Function and Cnoidal wave theories, amongst others, [5]. The rather confused irregular sea state associated with storm conditions in an ocean environment is often modelled as a superposition of a number of Airy wavelets of varying amplitude, wavelength, phase and direction, consistent with the conditions at the site of interest, [3]. Consequently, it becomes instructive to develop an understanding of the key features of Airy wave theory not only in its context as the simplest of all regular wave theories but also in terms of its role in modeling the character of irregular ocean sea states.

5 AIRY WAVE THEORY

The surface elevation of an Airy wave of amplitude *a,* at any instance of time *t* and horizontal position *x* in the direction of travel of the wave, is denoted by q *(x,t)* and is given by:

$$q\ (x,t) = a \cos(kx: -cot)$$

where wave number $k = 2ji / L$ in which *L* represents the wavelength and circular frequency oo = *In IT in.* which *T* represents the period of the wave. The celerity, or speed, of the wave *C* is given by *L/T* or *oq/k,* and the crest to trough wave height, *H,* is given by *2a.* Le Mahaute [6] provided a chart detailing applicability of various wave theories using wave steepness versus depth parameter in his description. With the increasing popularity of wind- turbines in the United States, an increasing number of these structures are being placed in the Western United States due to higher wind energy; however, this region is also prone to high seismicity. Amongst several ofthe studies cited those by Taniwaki and Ohkubo [7] and Kocer and Arora [8] are amongst toe very few to consider seismic loading.

Wijngaarden [9] outlined a feasibility study of various

supporting structures for OWT considering different design considerations and found that monopile foundation is an efficient solution up to 20 m water depth. A review on cost effective design of OWT on the basis of theoretical basics of dynamics were addressed by Tempel and Molenaar [10]. Camp et al. [11] outlined various design aspects of OWT considering different foundation modeling techniques and hydrodynamic loading and suggested that combination of soil-monopile and tower in dynamic model is essential in order to achieve an optimized design.

Research studies on design issues of an OWT in order to reduce the risk of failure incorporating dynamic soil- monopile-tower interaction are limited in number. LeBlanc [12] outlined various design considerations for OWT support structure in sand considering long term response of monopile under cyclic loads. An optimum design of wind turbine stower and foundation system was carried out by Nicholson [13] without taking into account of dynamic soil-structure interaction. It was observed that foundation stiffness greatly affects the optimal design of an OWT. Morgan and Ntambakwa [14] pointed out toe strength; stiffness and stability of foundation are the essential design criteria for wind turbine foundation design. They indicated that cost of toe foundation can be minimized if appropriate soil-structure interaction including fatigue and ultimate limit state is accounted for wind turbine analysis.

6. OBJECTIVE:

The objective of this concept design study is to investigate the technical and economic feasibility of offshore wind turbine platforms for offshore wind turbine installation. More specifically, the goals are to:

1. To design and analysis Of Monopile foundation for Offshore platform.

2. Identify the optimal Monopile platform configuration for the specified wind turbine and design

3. Identify technical challenges to the successful development of the selected concept.

7. DESIGN METHODOLOGY

A .Geometry

B. Model

C. setup

D. Results

PRELIMINARY DESIGN & MODELLING

Design Codes and Standards

There are several design standards and guidelines for the design of offshore wind turbines. Two commonly used design standards:

1. Guidelines for the design of wind turbines (DNV, 2001);
2. Design of offshore wind turbine structures (DNV, 2007).
3. American Petroleum Institute Recommended Practice for Fixed Offshore Structures (API RP2A, 2000)

1. The methodology carried out for this Project is worked out in ANSYS AQWA.

2. In Ansys Aqwa, the design is carried out in Hydrodynamic Diffraction (AQWA)

3. Sequence of operations performed to design are

A .Geometry

B. Model

C. setup

D. Results

4. For performing the operations in Geometry Select by double clicking it, obtaining Design Modular

5. In the Design Modular give the input details like sketching, diameter of the monopile, height of the monopile

Top diameter	4.6 m
Bottom diameter	4.6 m
Thickness	0.06m
Height of monopile	125m
Free board	15m

Draft	110m
Water depth	150m
Rating	5 MW
Rotor Orientation	Upwind
Hub Height	80 m
Rotor Mass	110 tonnes
Nacelle Mass	240 tonnes
Total point Mass	55000 tonnes

6. The preliminary design steps are shown as in fig. 1 to 10

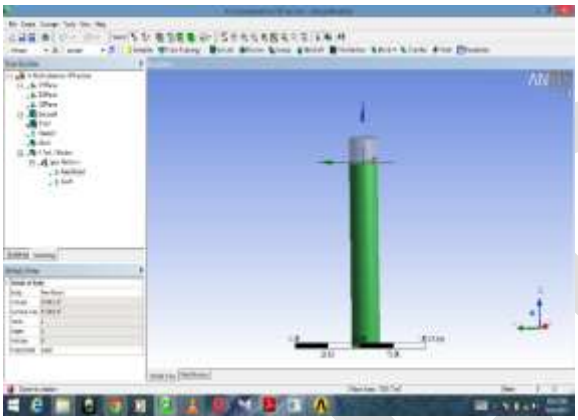


Fig.1

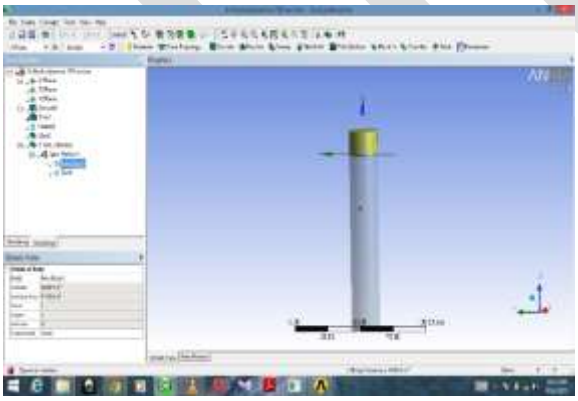


Fig.2

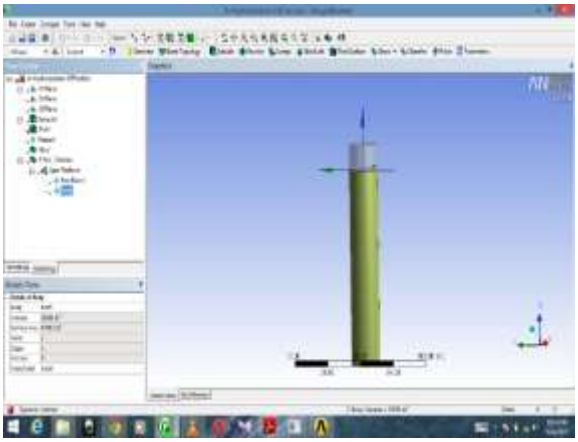


Fig.3

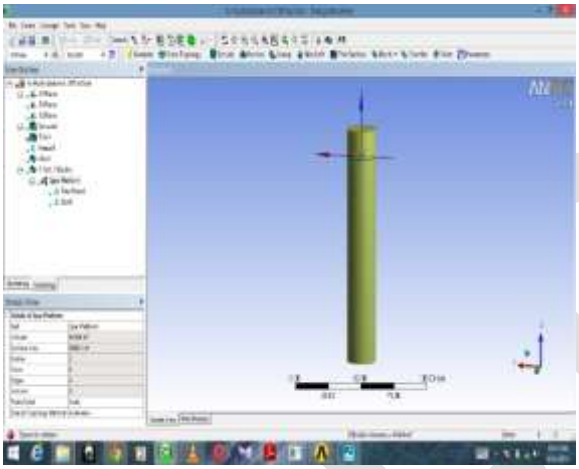


Fig.4

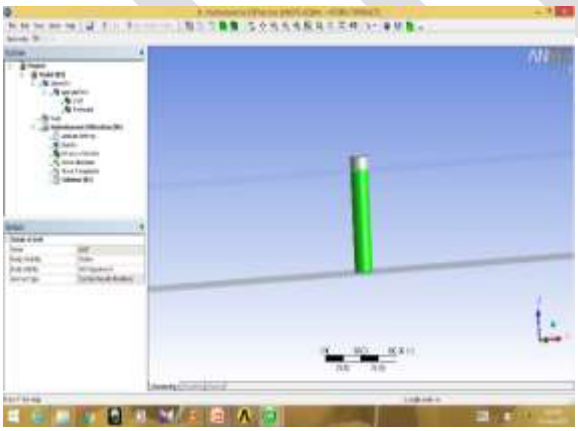


Fig.5

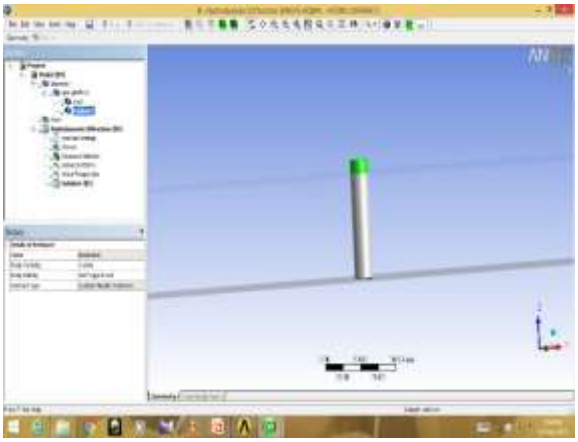


Fig.6

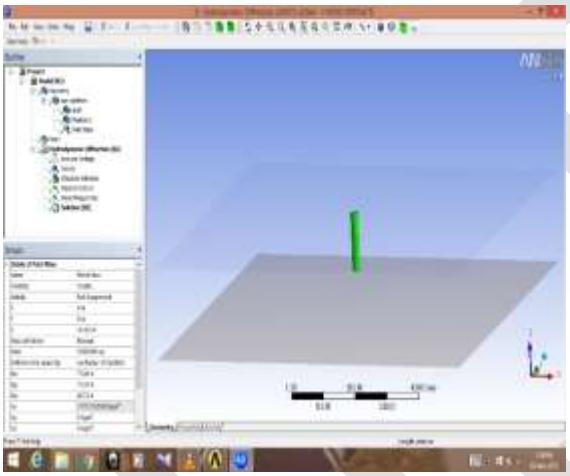


Fig.7

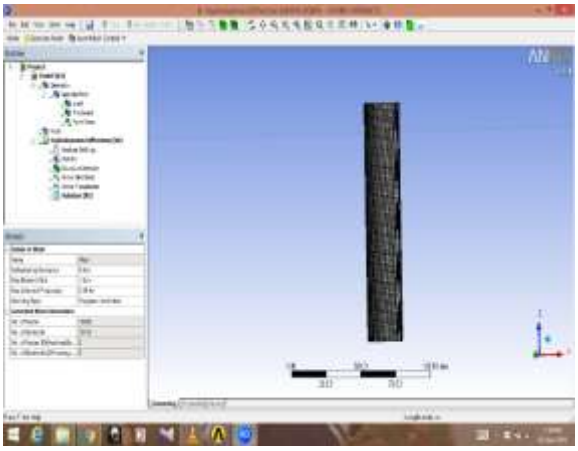


Fig.8

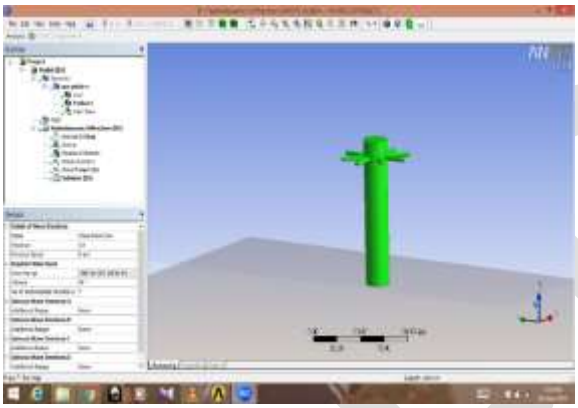


Fig.9

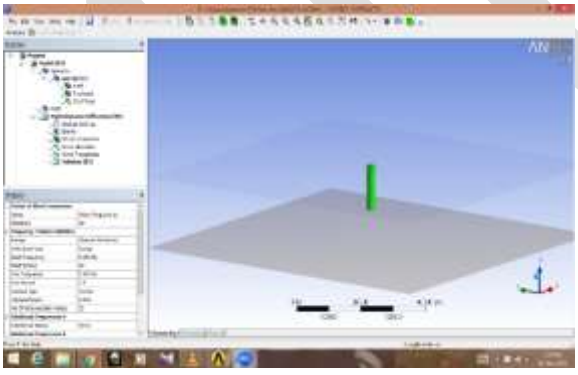
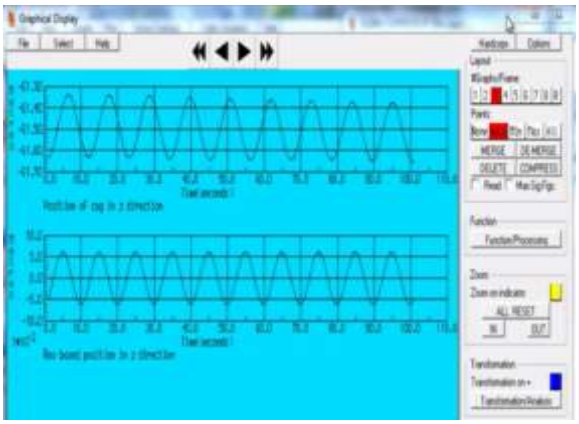


Fig.10

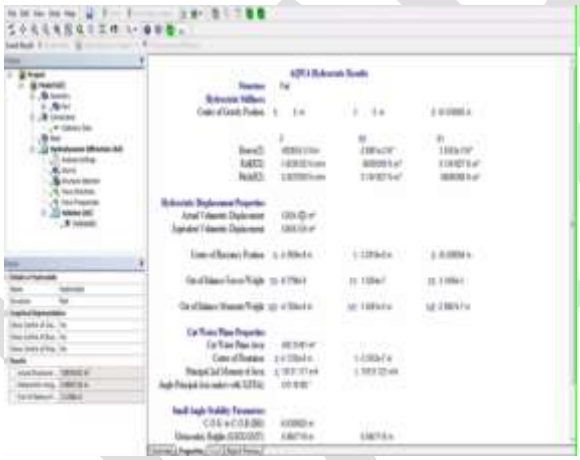
8. RESULTS & CONCLUSION

Graphical display: showing very little displacement.



AQWA Hydrostatics Results

1. The designed monopile is able to control the Heave displacement to a great extension. 2. Wind speed largely affects toe material consumption of an OWT system. The steel requirement is less when the structure is designed at less wind speed due to reduction in aerodynamic load. Fatigue life of structure also improves due to decreased wind speed value. An increase in embedded length of monopile marginally affects the total steel consumption of an OWT structure, since response and fatigue life of the structure vary marginally due to increase in embedment depth beyond its critical depth



REFERENCES:

[1] DNV-OS-J101. Design of offshore wind turbine structures. DET NORSKE VERITAS; 2010.
[2] Moeller, A. (2008). Efficient offshore wind turbine foundations. POWER EXPO 2008 - International Exhibition on Efficient and Sustainable Energy
[3] Nigam, N. C. & Narayanan, S. 1994. Applications ofRandomVibrations, New York: Springer-Verlag
[4] Chakrabarti, S. K. (ed) 2005. Handbook of Offshore Engineering, San Francisco: Elsevier
[5] Dean R G. & Dalrymple, R. A. 1991. Water Wave Mechanics for Engineers and Scientists, New Jersey: World Scientific.
[6] Le Mehaute, B. 1969. An introduction to hydrodynamics and water waves, Water Wave Theories, Vol. fi, TR ERL 118- POL-3-2, U.S. Department of Commerce, ESSA, Washington, DC.
[7] Taniwaki, K. and Ohkubo, S. (2004). "Optimal Synthesis Method for Transmission Tower Truss Structures Subjected to Static and Seismic Loads," Structural and Multidisciplinary Optimization, 26(6), 441-454.
[8] Jonkman, J.M. Dynamics Modeling and Loads Analysis of an Offshore Floating Wind Turbine. Ph.D. Thesis. Boulder, CO: Department of Aerospace Engineering Sciences, University of Colorado, 2007; National Renewable Energy

[9] DOWNIE M. J., GRAHAM J. M. R., HALL C. et al. An experimental investigation of motion control devices fortruss spars[J]. **Marine Structures**, 2000, 13: 75-90.

[10] Comparison of truss spar model test results withnumerical predictions[C]. 18th InternationalConference on Offshore Mechanics and ArcticEngineering., Newfoundland, Canada,OMAE99/OFT-4231, 1999.

[11] LU R. R., WANG J. J. and ERDAL E. Time domainstrength and fatigue analysis of truss spar heave plate[C].Proceedings of the Thirteenth International Offshore and Polar Engineering Conference. Hawaii, USA, 2003, 272-279.

[12] ZHANG Fan, YANG Jian-min, LI Run-pei et al.Experimental investigation on hydrodynamicbehaviorof the geometric spar platform[J]. China OceanEngineering, 2006, 20(2): 213-224

[13] AGARWAL A. K. and JAIN A. K. Dynamic behavior of offshore spar platforms under regular sea waves[J]. Ocean Engineering, 2003, 30: 487-516

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Constructed Wetland and Its Perspective- A Review

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Abstract— The majority of disease spreads through the sources of water and the waste produced should to be treated before it is finally disposed-off in the open or in the natural water body for its further purification by self-purification process. In the area where there is unavailability of the treatment plant for the treatment in wastewater treatment plant as the cost of construction is very high and in such cases the water is directly thrown in the open land and this wastewater reaches the underground water table and contaminating the whole aquifer of the water present in that area and as there is unavailability of water treatment plant so people in such areas use the underground water directly causing various water borne disease. In such areas where the cost is one of the major factor, there the constructed wetland can be use very effectively as the cost of construction and maintenance is very low and can serve as an effective mean of treatment of domestic waste water.

Keywords— wastewater, constructed wetland, low cost treatment, types of constructed wetland,

INTRODUCTION

Wetland which can be either a natural or artificial is a cheap and low cost treatment alternative treatment of the wastewater mainly for small communities as treatment and maintenance cost is low[12][13][2]. A constructed wetland is a artificially designed system used for the improvement of the wastewater quality parameter before it is finally discharged in the open or natural stream. Earlier the number of such system was very limited as there was not enough research data is available and as the research in the world continues the no. of number of such plant has increased where it was first used in the pilot scale was in the 1960. Even the treatment plant construction is limited in the developing countries as the cost of construction and the maintenance cost is high and this focus our attention to the constructed wetland system for improving the receiving water quality, water reclamation and reuse is currently the driving force for the implementation of the artificially constructed wetland all over the world. Constructed wetlands has emerged as an alternative to the conventional wastewater treatment plant, which can be used as part of decentralized wastewater treatment systems and are a robust and "low tech" technology with low operational requirements [6][7][8][10].

Recently for our development work to fulfil the needs of the pubic and there is being reduction in the number of natural wetland in the world whose consequences can be seen as there is no control for flooding and has totally destroyed the function and the values of the natural wetland in the world.

The number of CWTS for use has very much increased in the past few years. Constructed wetlands are now proves a viable source for the wastewater treatment as its result shows from the various researchers in this field. Most of these systems cater for tertiary treatment from towns and cities. They are larger in size, mostly using surface-flow system to remove low concentration of nutrient (N and P) and suspended solids.

Typically, wetlands are constructed for one or more of four primary purposes: creation of habitat to compensate for natural wetlands converted for agriculture and urban development, water quality improvement, flood control, and production of food and fibre (constructed aquaculture wetlands).

TYPES OF CONSTRUCTED WETLAND SYSTEM

Constructed wetland is classified into two types:

1. Horizontal flow system and
2. Vertical flow system

Horizontal flow system has two types:

a. Surface flow system and
b. Sub-surface flow system

In horizontal flow system the water is passes into inlet and passes horizontally through bed to the outlet point.

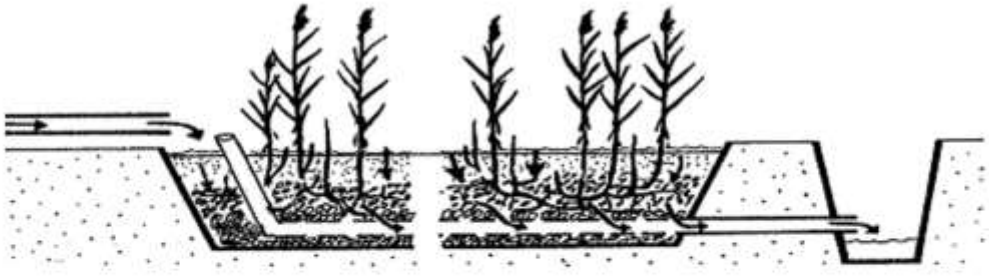

Fig.1 Subsurface horizontal flow wetland system

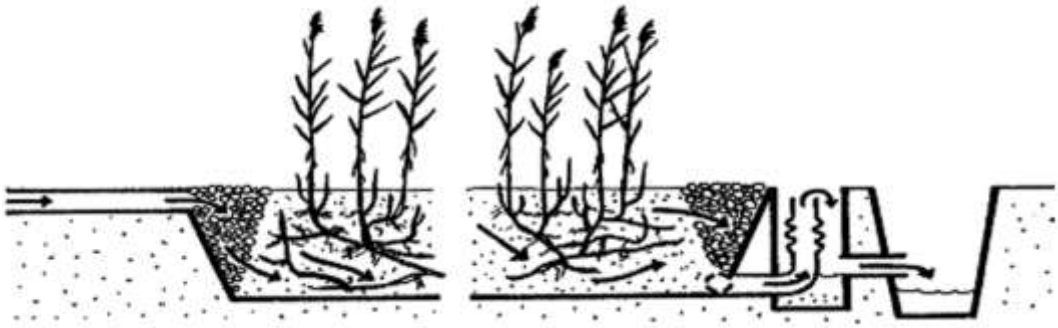

Fig.2 Subsurface vertical flow wetland system

Surface Flow System:

In this type the influent water flows across the basin which supports the vegetation and water is clearly above the substrate material, the material can be locally available soil or clay which act as a impervious layer. These systems are used for the treatment of the municipal domestic waste water as quantity of flow is more and this act as a polishing for the nutrient. The depth of this bed is about 0.4m.

Sub-Surface Flow System:

In this system the wastewater flows one point to other through permeable substrate which can be a mixture of gravel and soil, which support the roots of the plant called as root-zone method or rock-reed method or emergent vegetation bed system. The depth of this medium is more than the surface flow system i.e about 0.6m. the free water is not visible in this type

CONSTRUCTION OF WETLAND SYSTEM

The construction of wetland treatment system is divided into constructed wetland creation and plantation of vegetation. For construction of constructed wetland land is cleared for site preparation followed by construction of wetland and then installation of water control system.it should be seen that while clearing the site all the vegetation are removed with all the roots in the soil.

The wetland is provided with slope, then there is construction of wetland cell berms by compacting soil and installing of liners. Final site grading consists of levelling the wetland cell bottom to optimise the spreading of wastewaters in the completed wetland. The

wetland cells are flooded to a 'wet' condition for planting. Wetland plants are transferred to the site and planted manually. After plants are established, water levels are gradually increased to normal water levels, and wetlands are completely created.

ROLES OF WETLAND PLANTS IN WASTEWATER TREATMENT

Plant plays a significance role in the treatment of the wastewater in relation to the water purification which brings about the physical effect due to the plant. The plant provides large surface area for the growth and attachment of microorganisms. The physical component of the plant stabilize the surface of the bed, slow down the flow of water and thus helps in sediment settling and increasing the visibility of the water.

Hollow vessels of the plant tissues enable to transport oxygen from the leaves to the root zone and to the surrounding soil [1][5]. Because of this the active decomposition of aerobic micrbial take place and the uptake of pollutants from the water system to take place.

The role of wetland plants in a constructed wetland systems is divided into 6 categories:

A. **Physical -** Macrophytes stabilise the surface of plant beds, provide good conditions for physical filtration, and provide a huge surface area for attached microbial growth. Growth of macrophytes decreases the velocity of flow of wastewater which further results in sedimentation and there is increase in contact time between effluent and surface area plant thus, there is increase in the removal of Nitrogen.

B. **Soil Hydraulic Conductivity** - Soil hydraulic conductivity is improved with the emergent plant bed system. The root mass creates macropores in constructed wetland soil system which allows for increase in percolation of water, thus increasing effluent and plant interactions with each other.

C. **Organic Compound Release -** Plants releases a wide variety of organic compounds through their root systems, with rates increase up to 25% of the total photo synthetically fixed carbon. The carbon released act as a source of food for denitrifying microbes[6]. Decomposion of plant biomass provides a durable, readily available carbon source for the microbial populations.

D. **Microbial Growth -** Macrophytes are above and below the ground and biomass provides a large surface area for growth of microbial biofilms. These biofilms are responsible for a maximum of the microbial processes that take place in constructed wetland system, including Nitrogen reduction [6]. The Plants create and maintain the layer of humus that is like a thin biofilm. When the plants grow and die, the leaves and stems falling to the surface of the substrate create number of layers of organic debris. This accumulation of partially decomposed biomass creates a porous substrate layers that provide a substantial amount of attachment surface for microbial organisms. The water quality improvement in constructed and natural wetlands is related to and dependent upon the high conductivity of the humus layer and the large surface area for microbial attachment.

E. **Creation of aerobic soils -** Macrophytes provides transfer of oxygen through the hollow plant tissue and leakage from root systems to the rhizosphere where aerobic degradation of organic matter and nitrification take place.fig.3 Wetland plants adapted with the suberized and lignified layers of the hypodermis and outer cortex to minimise the rate of oxygen leakage.

The high Nitrogen removal of Phragmites is most likely attributable to the characteristics of its root growth. Phragmites allocates 50% of plant biomass to the root and rhizome systems. Increased root biomass allows for greater oxygen transport into the substrate, creating a more aerobic environment favouring nitrification reactions. It is evident that the rate of nitrification is most likely the rate limiting factor for overall Nitrogen removal from a constructed wetland system [11].

F. **Aesthetic values -** The macrophytes provides a site-specific aesthetic values by providing the habitat for wildlife and making wastewater treatment systems pleasing.

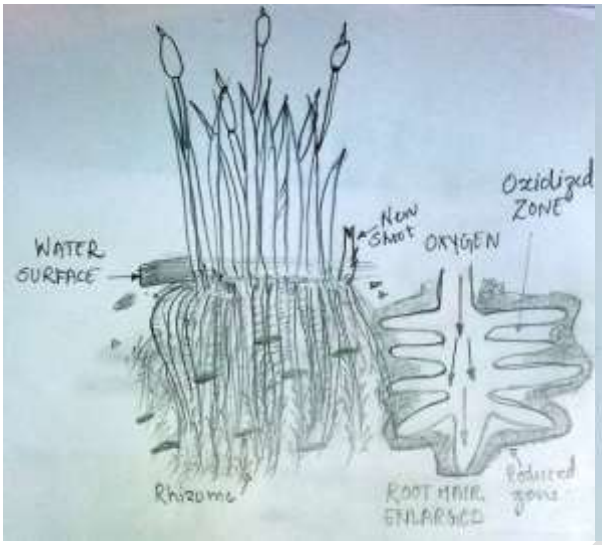

Fig.3 Roots of marsh plant

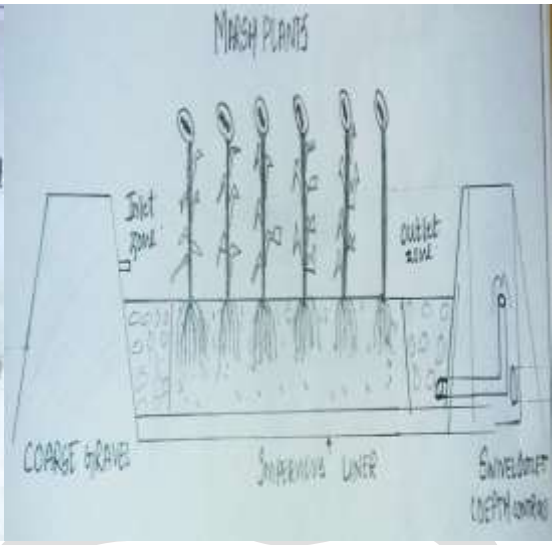

Fig.4 configuration of sub-surface flow system.

SELECTION OF WETLAND PLANT

Depending on the conditions of various types of plant griwn are :common reed (Phragmites australis), rush (Typha latifolia), iris, as shown in fig. 3 these plant are stable towards the climatic changes and the type of medium in which it is grown. The Floating and submerged plants are used in the aquatic plant treatment system. A wide range of aquatic plants have proved their ability to assist in breakdown of wastewater. The Water Hyacinth (Eichhornia crassipes), and Duckweed (Lemna) are common floating aquatic plants which have shown their ability to reduce concentrations of BOD, TSS and Total Phosphorus and Total Nitrogen. But due to prolonged presence of Eichhornia crassipes and Lemna it can result in deterioration of the water quality so these plants have to be removes from the system. The floating plants produces a massive layer that will obstruct penentration of light to the lower layer of the water which affect the life of the living water organisms. This system is colonised rapidly with one or only a few initial individuals. The system needs to be closely monitored to prevent attack from these nuisance species. Loss of plant cover will impair the treatment effectiveness. Maintenance cost of a floating plant system is high. Plant biomass should be regularly harvested so as to ensure significant nutrient removal. Plant growth also needs to be maintained at optimum rate to maintain treatment efficiency. The Common Reed (Phragmites spp.) and Cattail (Typha spp.) are examples of emergent species which are used in constructed wetland treatment systems. Plant selection is quite similar for SF and SSF constructed wetlands. Emergent wetland plants grow best in both types of the systems. These emergent plants play a vital role in the removal and retention of nutrients in a constructed wetland. Although emergent macrophytes are less efficient in lowering Nitrogen and Phosphorus contents by direct uptake due to their lower growth rates (compared to floating and submerged plants), their ability to uptake Nitrogen and Phosphorus from sediment sources through rhizomes is higher than from the water.

Fig.5 Different types of plants used in constructed wetland system (Silviya Lavrova et.al.,)

WETLAND MONITORING AND MAINTENANCE

Monitoring and maintenance of the wetland is one of the main parameter on which the functioning of the wetland depends. With continuous monitoring of the data obtained with the maintenance will result in success of the system. The maintenance can be like managing the plant of only desirable species and removing the unwanted weeds , this will result in the better efficiency of the filter medium and the overall performance will be boosted up. [3]

The effectiveness of the wetland also depends on the effectiveness of the pre-treatment, the rate of loading, the information obtain after monitoring will serve as a record for the proper running of the system. The CWTS system could be rather easy to design and construct, but it needs to be closely monitored and maintained.

Sustaining a dense plantation of desirable vegetation within the wetland is important to ensure that the treatment efficiency is effective. Aggressive plant species comes out to be less competitive and cause gradual changes in wetland vegetation. Some undesirable plant species or weeds may introduced to the wetland from the nearby vegetation. Natural succession of wetland plants will take place. However, there are some aquatic weeds which may require maintenance by removing it manually. The weed invasion can dramatically reduce the ability of wetlands to meet the design objectives. For example, Pondweed (Azolla), Duckweed (Lemna), Water Fern (Salvinia molesta) and Water Hyacinth (Eichhornia crassipes) can form dense mats, exclude light and reduce dissolved oxygen in the water column, and increase the movement of nutrients through the system. Water level management is also crucial to control weed growth.

Floods cause the plants to be scoured from the wetland and completely destroy the area. If a large area of plants is damaged then, re-establishment have to be carried out. Small areas generally recovers naturally while larger areas above 5 m2 may require replanting.

Plant viability is important to water quality improvement in wetlands. Visible signs of plant distress or pest attack have to be investigated on an regular basis. Some common pest insects like Lepidopterrous Stem Borers on Scirpus grossus, aphids on Phragmites karka and Leaf Roller on Phragmites karka. Severe infestation can lead to severe stunting and death of plants. Biopesticides or narrow spectrum-pest specific insecticides can be used if pest population exceeds a certain threshold value. Other pests include the Golden Apple Snail Pomacea sp, which feeds actively on wetland plants.

Water levels are important in wetlands with effects on hydrology and hydraulics. Water level should be monitored using water level control structures to ensure successful plant growth. A recirculation system should be in place to allow water from outlet points to be fed back to the wetlands to supplement catchment flows during dry periods. Suspended solids from effluents and litter fall from plants causes the accumulation in time and gradually reduce the pore space which need to be flushed to prevent short-circuiting. Monitoring of mosquito populations should be undertaken to avoid diseases, which can result in a local health problem.

CONCLUSION

The use of constructed wetlands to treat wastewater is relatively new in India. However, due to the impressive results achieved by the various researchers in this field have prompted a great expectations in the use of constructed wetland in treatment of wastewater. The wetlands can be used in as a sustainable technology, by clearly defining the objectives and the goal which we want to achieve with proper monitoring of the performance.

This system also creates an aesthetic environment as it provides the greenery in the area where it is being used and finally the water will be less polluted and will be safer even if they are disposed-off in the open and the unhygienic conditions will be removed and will serve as a habitat for flora and fauna.

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REFERENCES:

[1] *Armstrong, W., Armstrong, J. & Beckett, P.M. 1990. Measurement and modeling of oxygen release from roots of* Phragmites australis. *In:* Use of Constructed Wetlands in Water Pollution Control *(eds Cooper, P.F & Findlater, B.C.). Pergamon Press, Oxford, UK. pp. 41-53.*

[2] Babatunde A. O., Zhao Y. Q., O'Neill M. and O'Sullivan B. (2008). Constructed wetlands forenvironmental pollution control; A review of developments, research and practice in Ireland.*Environment International*, 34(1), 116-126.

[3] *Beharrel, M., Lim, W.H. & Gan, J. 2002. Good practices in wetland management and conservation. In:* Proceedings of a workshop on the Asian wetlands: bringing partnerships into good wetland practices. *(eds Ahyaudin, A., Salmah, C.R., Mansor, M., Nakamura, R., Ramakrishna, S & Mundkur, T.). pp. 582-594.*

[4] Brix Hans, "Use of constructed wetlands in water pollution control: Historical development, present status and future perspectives", *Water Science and Technology*, Vol 30 (8), pp.209-223, 1994,[7]

[5] *Brix, H. & Schierup, H.H. 1990. Soil oxygenation in constructed reed beds: the role of macrophyte and soil-atmosphere interface oxygen transport.* Water Research *29 (2): 259-266.*

[6] *Brix, H. 1997. Do macrophytes play a role in constructed treatment wetlands?* Water Science and Technology *35(5): 11-17.*

[7] Gross A, Sklarz MY, Yakirevich A, Soares MIM (2009), "A recirculating vertical flo constructed wetland for the treatment of domestic wastewater", *Desalination* (246), pp. 617-624.,[10]

[8] Hoffmann Heike, Winker Martina, Christoph Platzer, Elizabeth Von , "Technology review of constructed wetlands: Subsurface flow CW for greywater and domestic waste water treatment", Sustainable sanitation-Eco-san program, www.gtz.de/ecosan, 2011,

[9] https://en.wikipedia.org/wiki/Wetland

[10] Padma Vasudevan, Paul Griffin, Allen Warrin, Alka Thapilayil, Mamta Tandon, "Localised domestic waste water treatment part 1- Constructed Wetlands", *Journal of Scientific and Industrial Research,* Vol 70, pp. 583-594, 2011.

[11] *Sikora, F.J., Tong, Z., Behrends, L.L., Steinberg, S.L. & Coonrod, H.S. 1995. Ammonium removal in constructed wetlands with recirculating subsurface flow: removal rate and mechanisms (eds Kadlec, R.H. & Brix, H.).* Water Science and Technology *32(3): 193-202.*

[12] Solano M. L., Soriano P. and Ciria M. P. (2003). Constructed wetlands as a sustainable solution for wastewater treatment in small villages. *Biosystems Engineering*, 87(1), 109-118.

[13] Soukup A., Williams R. J., Cattell F. C. R. and Krough M. H. (1994). The function of a coastal wetland as an efficient remover of nutrients from sewage effluent: A case study. *Water Science and Technology*, 29(4), 295-304.

[14] U.S. EPA. 2000. Guiding principles for constructed treatment wetlands: providing for water quality and wildlife habitat. *U.S. Environmental Protection Agency. Washington, D.C. 41 pp.*

[15] Silviya Lavrova and Bogdana Koumanova. Nutrients and Organic Matter Removal in a Vertical-Flow Constructed Wetland. Applied Bioremediation - Active and Passive Approaches

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CONTROLLING OF POWER THEFT AND REVENUE LOSSES BY USING WIRELESS TECHNIQUES

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Abstract— In these days, generation of electricity is not met up to the need of men. There is large number of power thefts from domestic and industrial supply lines. This Paper is to limit such thefts, by letting the Monitoring and Control Room to know the theft and also the location of theft. Monitoring and Control Room is kept known about the situation of the system at every instant. This wireless system is used to overcome the theft of electricity via bypassing the energy meter and hence it also controls the revenue losses and utility of the electricity authorised agency. There is always a contract between the consumer and the supplier that the consumer will pay for the electricity consumed by him. But in India near about 32 % of the electricity is consumed but not paid for it i.e. it is being stolen by the consumer hence the need of a system arises that would overcome this theft of electricity but mostly the electricity is being stolen via bypassing the energy meter hence this system recognizes such type of theft of electricity. Power consumption and losses have to be closely monitored so that the generated power is utilized in a most efficient manner. The system prevents the illegal usage of electricity. At this point of technological development the problem of illegal usage of electricity can be solved electronically without any human control. The implementation of this system will save large amount of electricity, and there by electricity will be available for more number of consumers then earlier, in highly populated country such as INDIA.

Keywords— G.S.M, Zigbee, PIC-Microcontroller, PC, Digital Energy Meter,Power Theft, Power Monitoring.

INTRODUCTION

The theft of the electricity is the major concern of the transmission and distribution losses in the supply of the electricity [2] worldwide. Mainly the electricity is being stolen via bypassing the energy meter therefore this wireless system utilizes to overcome this type of the theft of the electricity and is very beneficial for the authorised agency to control its revenue loss as all of us know that the cost of fuel is increasing day by day hence the intensity of stealing the electricity and using it as a substitute is also increasing therefore it is needed much to design a system that can detect the theft of the electricity [4].

There are two types of techniques to deliver the information to the authorised agency to control the theft of the electricity via bypassing the energy meter [12].

a. Wired techniques-

1. Electrical cables 2.Coaxial cable 3.Optical fibres

b. Wireless techniques-

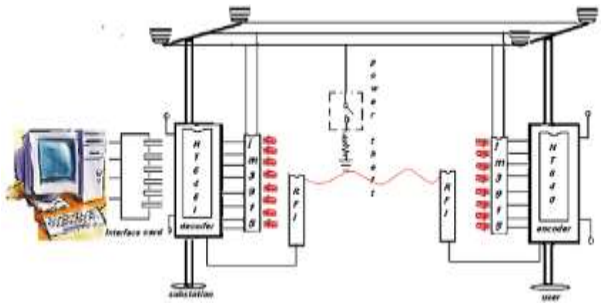
1. ZIGBEE technology 2.GSM technique 3.WI-FI 4.Wi-max, Infrared rays 5. Bluetooth

Here this system utilizes the technique named zigbee, G.S.M., because all the problems are associated with the wired techniques. There are a lot of problems related with the wired techniques such as installation problem, complexity and cost also matters in the case of long haul. The main problem associated is about the rural areas where it's really very much difficult to install the wired system to convey the information. Wired networks require lot of setup and maintenance cost.

In this paper we implemented using zigbee technology because of its effective communication, self-healing networks, low power Consumption, zero traffic and we selected other communication network to be GSM to send SMS to authorities in case of theft, because GSM has a built in transport layer encryption, which is supported by most network providers. GPRS offers a number of security enhancements over existing GSM security. The standards themselves also offer technical features, which a network operator may choose to use. Aside of that, a different form of security might be desired in addition to the provided transport layer security.

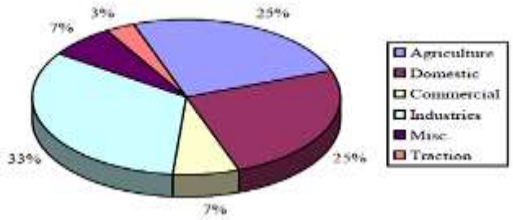
II. FACTORS THAT INFLUENCE ILLEGAL CONSUMERS

There are many factors that encourage people to steal electricity, of which socio- economic factors influence to a great extent in stealing electricity. A common notion in many people is that, it is dishonest to steal something from their neighbour but not from the state or public owned utility company [9].



"Fig 1: Block Diagram of Power Theft Detection System"

In addition, other factors that influence illegal consumers are:
Higher energy prices deject consumers from buying electricity. In light of this, rich and highly educated communities also steal electricity to escape from huge utility bills. Growing unemployment rate show severe lower illiteracy rate in under developed communities has greater impact on illegal consumers, as they might not beware of the issues, laws and offenses related to the theft. Weak economic situation in many countries has implied its effect directly on common man [10]. In view of socio economic conditions of the customer electricity theft is proportional to the tariff of electricity utilization. Countries with weak enforcement of law against electricity theft have recorded high proportion of theft. Corrupt political leaders and employees of the utility company are responsible for billing irregularities.



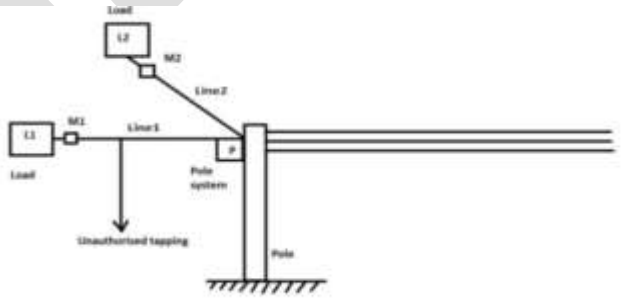
"Fig 2: Electricity consumption in different sectors in India"

III. METHODS OF POWER THEFT

Methods used to commit theft fall into the e following broad categories:
i. Connection of supply without a meter following disconnection for non-payment or by "squatters" occupying empty properties.
ii. By passing the meter with a cable. It coveted into the supply side of the metering installation (i.e. the meter terminals, the metering cables, the cut-out or the service cable).
iii. Interfering with the meter to slow or stop the disc, including use of electrical devices which stop the meter or cause it to reverse (so-called 'black boxes)**.**
iv. Interfering with the timing control Equipment used for two rate tariffs to obtain a cheaper rate. Methods (iii) and (iv) usually involve removal of official (certification) seals and/or company seals. There effect on the customer's economic situation [8]-[10].

IV. POWER MONITORING SYSTEMS

Consider a distribution system shown in conceptual diagram. Two single phase loads L1 and L2 are supplied from two different phases. M1 and M2 are the energy meters that measure power consumed by these loads over a period. Pole based system (P) have been installed to detect power theft [7]. There are three different types of systems to monitor power sent.



"Fig 3: Conceptual diagram L1, L2 Single phase loads M1, M2 Digital energy meter"

.i. Pole based system: It consists of Wireless data receiver, Micro-controller, Digital energy meter. Digital energy meter will measure power sent over each line for a certain time period.

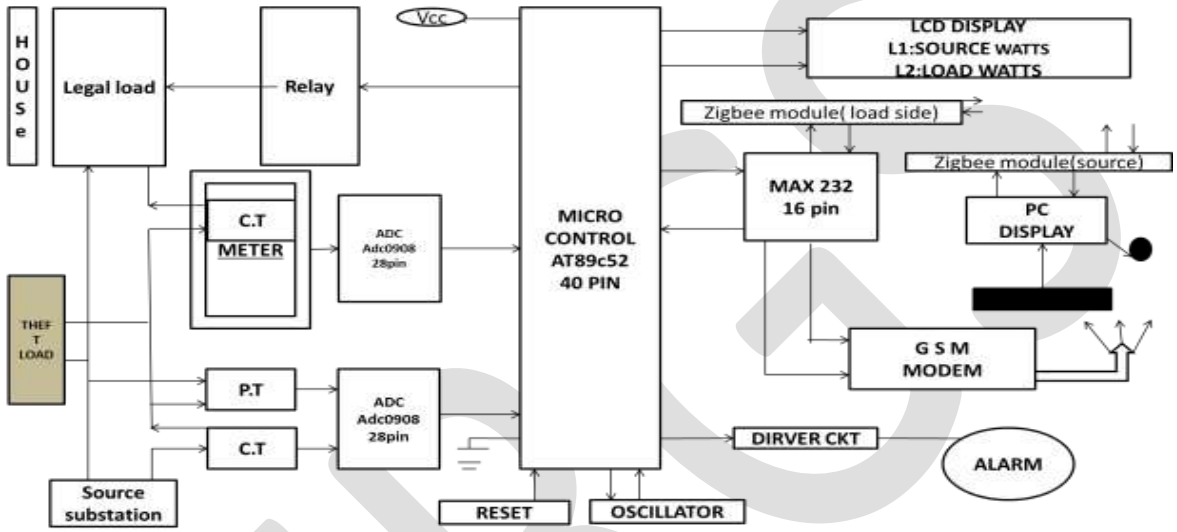
ii. **Pole Side Energy Meter**: One energy meter is installed in a pole based system. This meter is capable to measure a power sent over each line connected to that pole

iii. **Load Side Energy Meter (M1, M2):**

Meter is installed on load side to measure a power consumed by load over a time. Also it has an additional feature of transmitting that data to receiver using wireless technique ZIGBEE network.

iv. Power theft detection: Suppose there is tapping done by any unauthorized person on the line to connect his appliance. Over a certain period there will be difference between meter reading and pole based reading.

V. PROPOSED SYSTEM BLOCK DIAGRAM:



"Fig 4: Block Diagram of Proposed System"

Microcontroller: - This is the main control section. It processes all the input data, take decision and operate proper relays to control the switching.

User Interface: - This unit provides the facility to user to change certain parameter like max current, unit id, no of max load etc.

Display driver and LCD display: - The display driver is used to control the LCD display. LCD display is interfaced with controller through display driver which is used to show the different parameters.

Buzzer driver and buzzer: - The buzzer is used to generate different warning tones. Buzzer driver is used to drive the buzzer.

Voltage Transformers: The voltage transformer is one in which "the secondary voltage is substantially proportional to the primary voltage and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections..

Current Transformers: A current transformer is defined as "as an instrument transformer in which the secondary current is substantially proportional to the primary current (under normal conditions of operation) and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections. **Signal Control Unit: -** This unit converts analog signal to digital signal. The analog signal of C.T, P.T gets converted into digital signal through signal control unit which gives input to the microcontroller digital signal.

G.S.M Modem:-

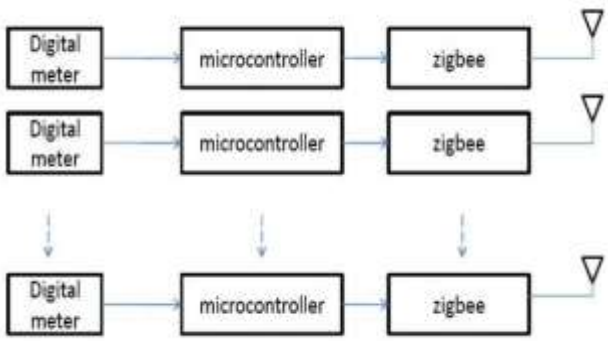
The active signal of max 232 sends to GSM (Global Service Mobile) and this signal is send to the number which is set in the program in the form of S.M.S (Short Message Service).

VI. IMPLEMENTATION OF PROPOSED SYSTEM

We can detect power theft wirelessly. Illegal usage of electricity can be solved electronically without any human control, using Radio frequency (RF) Technology. Electric Power is transforming from transmitter to the receiver at that time if load is apply in between transmission of power and if difference is find between the transforming and receiving power then there is stealing of power from unauthorized person. i.e., whenever energy is passing from supplier to the receiver at that time if the total amount of power is not received by the receiver then there is possibility of theft of energy.

A. Automatic Meter Reading To Use Prepaid Energy Meter System

Now a day utility company personnel goes at every house to take the readings of meters for billing purpose. It will create problem when consumer is out of Town or home is locked due to other reasons. This system of wireless meter reading is based on the same principle of wireless data transmission that is used in power theft detection [5]-[6] Utility company personnel will have a device consists of wireless data receiver with microcontroller and display.



"Fig 5: Block Diagram of Base Station Unit"

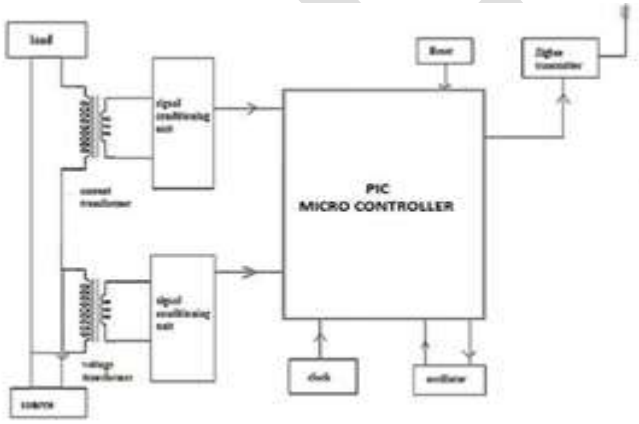
The Base station unit will consists of a zigbee module attached with a Transceiver micro-strip antenna and a microcontroller attached to digital meter. The frequency of communication will be in 900 MHZ. the data will transmitted to the central station at regular intervals. The end station consists of an ARM micro controller receiving data from different PIC micro controllers through Zigbee receiver. The data thus received is processed and calculated the exact amount of power consumed by specific customer [1].

B.Zigbee Module Used To Receive And Send Data With Long Distance

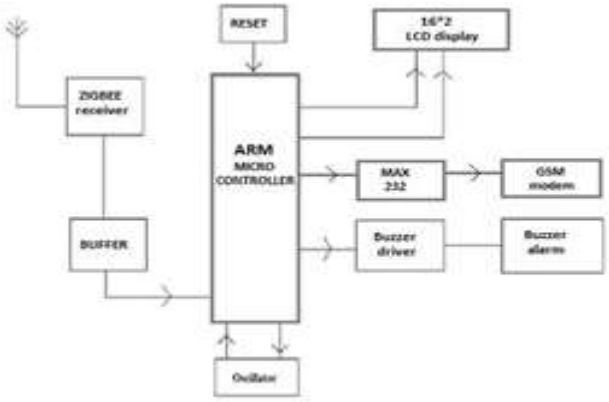
In this paper we implemented using Zigbee technology because of its effective communication, self-healing networks, low power consumption, zero traffic and they can handle over 60000 devices and more over Zigbee communication installation require no special permissions in most of the places. It uses unlicensed 2.4 GHz ISM band which is available worldwide. ZIGBEE has range between 10 m to 2 km and it works well with networks such as Wi-Fi [12].

It consists of Load, current transformer, voltage transformer, PIC micro controller, and a Differential Relay. The household load [3] supplied is connected in series to the AC supply mains through a switch which is operated by the action of a relay. Current transformer is used to measure the current required for the user and the voltage transformer is used to measure the voltage of operation for the user. The measured values are given to the PIC micro controller which has inbuilt ADC with RISC architecture to convert the analog values to the digital values. These values are stored in microcontroller registers and the information is transmitted to the receiver, whenever there is a request for the data from the remote controlling station. Oscillator is provided to the microcontroller for the clock signal and the reference voltage is given for the each of the IC used.

The receiver part of this prototype consists of an ARM micro controller, Zigbee receiver LCD display and alarm to pop out the ft case, and also an external GSM modem to inform theft case to authorities via SMS.



"Fig 6: Transmitter Block Diagram"



"Fig 7: Receiving Block Diagram"

C**. To Use Arm Type Micro-Control Advanced Version of Pic Micro control**

i.8051, PIC and AVR have Harvard architecture (separate memory spaces for RAM and program memory). ARM has von Neumann architecture (program and RAM in the same space).

ii. ARM has a 16 and/or 32 bit architecture. The others are byte (8-bit) architecture.

iii. 8051 and PIC have limited stack space - limited to 128 bytes for the 8051, and as little as 8 words or less for PIC. Writing a C compiler for these architectures must have been challenging, and compiler choice is limited.

iv.8051, AVR and ARM can directly address all available RAM. PIC can only directly address 256 bytes and must use bank switching to extend it, though using a C compiler conceals this. You still pay a speed penalty though.

v. 8051 and PIC need multiple clock cycles per instruction. AVR and ARM execute most instructions in a single clock cycle.

vi. 8051 and AVR are sufficiently similar that an AVR can usually replace an 8051 in existing products with practically no hardware change. Some AVRs are made with 8051 pin outs to drop right in. The Reset polarity is the main difference.

CONCLUSION

In this prolonged discussion it clearly explains the impact of electricity theft in day to day life and how this illegal activity affects the country's economic growth. Overall scenario provides the working nature of the existing system and also the proposed idea. In the traditional electrical system, countries like India, no more monitoring system for supervise the distribution line and individual consumer. The proposed architecture describes the smart system that automatically updates the usage level and also figure out the hot need of the energy conservation in the high demand time. Population burst and severe economic degrade leads to the illegal activity like electricity theft. This updated phenomenon gives the solution to the energy theft. Every year due to electricity theft hundreds of crore of money have lost in India. To avoid such inconvenient and unwanted situation so many operations have been done in the past era. This proposed idea has somewhat polished and advanced technique compare to the previous techniques. SMS alert is one of the latest trends that it reduces the processing time and very much useful to save the energy for the future need.

REFERENCES:

[1] Liting Cao Jingwen Tian Yanxia Liu 2008. "Remote Wireless Automatic Meter Reading System Based on Wireless Mess Networks and Embedded Technology", Fifth IEEE International Symposium on Embedded Computing, pp: 192-197.

[2] S. N. Singh, "Electric Power Generation, Transmission and Distribution", 2nd ed. Prentice-Hall of India Private Limited, 2003[8]

[3] D. Casadei, G. Grandi, R. K. Jardan, and F. Profumo, " Control strategy of a power line for household supply," in Proc. IEEE Power Electronics Specialist Conf., vol. 2, 1999, pp. 607–612.

[4] "India struggles with power theft," Business News, BBC, [Online].

[5] Abdollahi, M. Dehghani, and N. Zamanzadeh , "SMS-based reconfigurable automatic meter reading system," IEEE International Conference on Control Applications (CCA 2007), Oct, 2007, pp. 1103 – 1107.

[6] Jägerlind, "Improvements for the automatic meter reading process in electricity distribution companies," Master Thesis, Dep. Industrial Info and Control Systems, Royal Institute of Technology, Stockholm, Sweden 2006.

[7] A. R. Devidas, M. V. Ramesh, "Wireless Smart Grid Design for Monitoring and Optimizing Electric Transmission in India," IEEE 2010 Fourth International Conference on Sensor Technologies and Applications.

[8] *C.* J. Bandim, E. R. Alves ., A. V. Pinto, F. *C.* Souza, M. R. B. Loureiro, C. A. Magalhges and F. Galvez-Durand, "Identification of Energy Theft and Tampered Meters Using a Central Observer Meter: A Mathematical Approach", Transmission and distribution conference and exposition, 2003 IEEE PES, vol. 1, pp. 163-168,2003.

[9] Sagar Patil, Gopal Pawaskar, Kirtikumar Patil, "electrical power theft detection and wireless meter reading",IJIRSET, Vol. 2, Issue 4, April 2013.

[10] J. R. Galvan, A. Elices, A. Munoz, T. Czernichow, and M. A. Sanz-Bobi, "System for Detection of Abnormalities and Fraud in Customer Consumption" in Proc. of the Electric Power Conference, Nov. 1998. [JRG 1998].

[11] I. H. Cavdar, "A Solution to Remote Detection of Illegal. Electricity Usage via Power Line Communications", IEEE Transactions on power delivery, June2007Vol. 19 [IHC 2007].

[12] Virendra Pandey, Simrat Singh Gill, Amit Sharma, "Wireless Electricity Theft Detection System Using Zigbee Technology" IJRITCC , Volume: 1, Issue: 4, MAR 2013.

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Malware Detection System for Android Mobile Applications

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Abstract- With day to day increase in the number of mobile applications there is an analogous increment in the mobile threats. For such kinds of threats to mobile devices there should be some security mechanism to be implemented. In this proposed system in order to improve the security of the mobile apps one methodology is proposed which will evaluate the mobile applications security based on the cloud computing platform and data mining. Here also a prototype system named Malware detection system is presented to identify the mobile app's virulence or benignancy. Compared with traditional method, such as permission pattern based method, Malware combines the dynamic and static analysis methods to comprehensively evaluate an Android app. In the implementation, Android Security Evaluation Framework (ASEF) and Static Android Analysis Framework (SAAF) are adopted , the two representative dynamic and static analysis methods to evaluate the Android apps and estimate the total time needed to evaluate all the apps stored in one mobile app market.

As mobile app market serves as the main line of defense against mobile malwares, the evaluation results show that it is practical to use cloud computing platform and data mining to verify all stored apps routinely to filter out malware apps from mobile app markets.

Keywords- Android app, mobile malware detection, cloud computing, data mining.

1. INTRODUCTION

MOBILE THREATS

These years witness an explosive increase in mobile apps. According to Mary Meeker's report [1] on Mobile Internet trends, more and more PC client software's are migrating to the mobile device. According to Gartner's statistical prediction [1], the amount of total downloads of mobile apps in 2013 will be about 81 billion. Among these, there are about 800 000 Android apps in Google Play market, and the total download is about 48 billion as of May 2013[3]. In contrast with Apple AppStore, there are different sources for Android apps download, such as wandoujia, AppChina, Baidu mobile assistant, etc. While these markets give a good supply and bring more convenience for Android users, they will also bring mobile threats as different market places have different malware detection utilities and methods. Some sophisticated malwares can escape from detection and spread even via such Android markets.

For some years, Smartphone's are growing in popularity rapidly; more and more people and companies have the possibility to use these devices. Nowadays there are many different devices which can be considered Smartphone's, and there are also many different operating systems (OS). For instance, Apple's iOS, many different Smartphone's using Google Android as OS, Blackberry OS Smartphone's, Windows Mobile Phones, and some others[2]. These devices also have become much more powerful than traditional mobile phones. Having a powerful processor with dedicated graphic chip and several hundred MB RAM is not uncommon anymore (e.g. HTC Sensation or Apple Iphone 4). But security mechanisms on these devices are not as sophisticated as they are on traditional computer systems. Companies are eager to secure their computer systems with proper security mechanisms (anti-virus, firewall, up-to-date operating system, etc.), but these techniques are not yet utilized to their full potential on Smartphone's. One reason for this is that only few such software is available, but an even bigger obstacle is that many existing security mechanisms require severe changes to the Smartphone's operating system. Another reason why such software is not used widely is the limited battery capacity of the devices and the fact that available security applications like virus scanning consume a considerable amount of this capacity.

One big benefit of shifting the security functionality into the cloud is the almost indefinite processing power and "battery" capacity. This makes it possible to run very resource intense security services that would not be feasible on the phone. If the phone is replicated in the cloud, this also allows the developer of a security service to extend this service without changes on the phone. The security service can examine the phone not only from inside its system (similar to an application on the phone), but it can also monitor the replica itself which runs the cloud (e.g. look at the connections the replicated phone attempts to make). This can further improve the chances of finding malicious software and open up possibilities that would not be feasible on the device itself. For example, detecting a root kit could be impossible on the phone itself, but a security service which only scans the replica's files without executing the replica, might be able to detect the root kit[2]. But the shifting of the security functionality into the cloud could also be problematic, if not all parts of the phone can be replicated into the cloud.

2. LITERATURE REVIEW

Security analysis of Android apps is a hot topic. More and more researchers use static analysis and dynamic behavior analysis, and even integrate it with machine learning techniques to identify malware.

Barrera et al.[3] made an analysis on permission based security models and its applications to Android through a novel methodology which applies Self- Organizing Map (SOM) algorithm preserving proximity relationships to present a simplified, relational view of a greatly complex dataset. The SOM algorithm provides a 2-dimensional visualization of the high dimensional data, and the analysis behind SOM can identify correlation between permissions. They discover insights on how the developers use the allowed permission model in developing and underlining the permission model's strengths as well as its shortcomings through their methodology. Based on their results, they proposed some enhancements to the Android permission model.

Enck et al. [4] (TaintDroid) built a tool that warns users about applications that request blacklisted sets of permissions. They took both dangerous functionality and vulnerabilities into consideration and applied a wide range of analysis techniques. They designed and implemented a Dalvik decompiler, ded, which can recover application's Java source code only using its installation image. Besides, they analyzed 21 million LOC retrieved from the top 1100 free applications in the Android market using automated tests and manual inspection. Their results show the wide misuse of privacy sensitive information, the evidence of telephone misuse, wide including of ad libraries in Android application, and the failing to securely use Android APIs of many developers.

Dai, Fei, Guo [5] has proposed a system in which a mobile malware behavior analysis method based on behavior classification and self-learning data mining is proposed to detect unknown or metamorphic mobile malware. The network behavior of mobile malware is analyzed according to the behavior characteristic and divided into different categories. An improved Naïve Bayesian anomalous network behavior analysis method based on behavior classification is proposed to detect the different types of network behavior of mobile malware. An incremental self-learning method is used to adjust the proposed behavior-classification based Naïve Bayesian Classifiers to adapt the variable network behavior of mobile malware.

Wenhui hu [6] has proposed a system in which they identified three library-centric threats in the real-world Android application markets: (i) the library modification threat, (ii) the masquerading threat and (iii) the aggressive library threat. He proposed Duet, a library integrity verification tool for Android applications at application stores. This is non-trivial because the Android application build process merges library code and application specific logic into a single binary file. Their approach uses reverse-engineering to achieve integrity verification. They implemented a full working prototype of Duet.

Asaf shabtai [7] proposed a system where they applied Machine Learning (ML) techniques on static features that are extracted from Android's application files for the classification of the files. Features are extracted from Android's Java byte-code (i.e., .dex files) and other file types such as XML-files. Their evaluation focused on classifying two types of Android applications: tools and games. Successful differentiation between games and tools is expected to provide positive indication about the ability of such methods to learn and model Android benign applications and potentially detect malware files. The results of an evaluation, performed using a test collection comprising 2,285 Android .apk files, indicate that features, extracted statically from .apk files, coupled with ML classification algorithms can provide good indication about the nature of an Android application without running the application, and may assist in detecting malicious applications. This method can be used for rapid examination of Android .apks and informing of suspicious applications.

Aubrey-Derrick Schmidt [8] contributed twofold. First, they performed static analysis on the executables to extract their function calls in Android environment using the command readelf. Function call lists are compared with malware executables for classifying them with PART, Prism and Nearest Neighbor Algorithms. Second, they presented a collaborative malware detection approach to extend these results. In their work, they employed collaboration for security approach to extend Malware detection results. Therefore, a set of entities is enabled to work on a common task without predefined roles in a hierarchical manner. The collaborative scheme is used to interact with other mobile devices in order to exchange detection data and system information. It can be considered as an operation mode whenever a mobile device is relying on the remote server but cannot access it.

Tianyang Li [9] proposed an offline phishing detection system named LARX (acronym for *L*arge-scale *A*nti-phishing by *R*etrospective data-e*X*ploration). LARX uses network traffic data archived at a vantage point and analyzes these data for phishing attacks. All of LARX's phishing filtering operations use cloud computing platforms and work in parallel. As an offline solution for phishing attack detection, LARX can be effectively scaled up to analyze a large volume of trace data when enough computing power and storage capacity are provided. In this project, they proposed LARX, acronym for *L*arge-scale *A*nti-phishing by *R*etrospective data-

e*X*ploration, an offline phishing attack forensics collection and analysis system. First, they used traffic archiving in a vantage point to collect network trace data. Secondly, they leveraged cloud computing technology to analyze the experimental data in a way similar to the"divide and conquer" scheme. They used two existing cloud platforms, Amazon Web Services and Eucalyptus. A physical server is also used for comparison. All of LARX's phishing filtering operations are based on a cloud computing platform and work in parallel. Finally, as an offline solution, they concluded that LARX can be effectively scaled up to analyze a large volume of network trace data for phishing attack detection.

3. PROPOSED WORK

It is a system to check whether an Android app is virulence or benignancy based on some customized tools in cloud platform. Proposed system is an automatize system which can be used to analyze Android apps. The main Objectives are as follows:

i. In this work, a methodology is proposed to evaluate the security of Android mobile apps based on cloud computing platform.
ii. In this work ASEF and SAAF are adopted, the two representative dynamic analysis method and static analysis methods, to evaluate the Android apps and estimate the total time needed to evaluate all the apps stored in a mobile app market.

4. CONCLUSION

This work strongly focuses on the issue of malware analysis of mobile application. By this work the user will be able to analyze and test the presence of malware in the apk before its installation. The user can also verify the apk after installation by using some tools. By this the user will be protected from malware attacks.

REFERENCES

1. Jianlin Xu, Yifan Yu, Zhen Chen_, Bin Cao, Wenyu Dong, Yu Guo, and Junwei Cao, MobSafe: Cloud Computing Based Forensic Analysis for Massive Mobile Applications Using Data Mining, TSINGHUA SCIENCE AND TECHNOLOGY ISSN 1007-0214 10/10, pp418-427 ,Volume 18, Number 4, August 2013.
2. Dennis Titze, 'Cloud based Security services for smartphones',Master's Thesis informatics, May 15, 2012, pp-1-85.
3. D. Barrera, H. G. Kayacik, P. C. van Oorschot, and A. Somayaji, "A methodology for empirical analysis of permission-based security models and its application to Android, in Proc.", 17th ACM Conference on Computer and Communications Security, Chicago, USA, 2010, pp. 73-84.
4. W. Enck, D. Octeau, P. McDaniel, and S. Chaudhuri, "A study of android application security", in USENIX Security Symposium, San Francisco, USA, 2011,pp. 1-6.
5. Dai-Fei Guo1, Ai-Fen Sui1, Yi-Jie Shi, "Behavior Classification based Self-learning Mobile Malware Detection", JOURNAL OF COMPUTERS, VOL. 9, NO. 4, APRIL 2012, pp. 851-857.
6. Wenhui Hu, Damien Octeau, and Patrick McDaniel, "Duet: Library Integrity Verification for Android Applications", in Proc. 2nd ACM conference on Data and Application Security and Privacy, San Antonio , TX, USA, February, 2012, pp. 317-326.
7. Asaf Shabtai Yuval Fledel, Automated Static Code Analysis for Classifying Android Applications Using Machine Learning, IEEE 2010 International Conference on Computational Intelligence and Security, Nanning, China, December 2010, pp.321-332.
8. A. D. Schmidt, R. Bye, H. G. Schmidt, J. Clausen, O. Kiraz, K. A. Yuksel, S. A. Camtepe, and S. Albayrak, "Static analysis of executables for collaborative malware detection on Android in Communications", ICC'09, IEEE International Conference on, Dresden, Germany, 2009, pp. 1-7.
9. T. Li, F. Han, S. Ding, and Z. Chen, LARX: Large-scale Anti-phishing by Retrospective Data-Exploring Based on a Cloud Computing Platform, in Proc. 20th International Conference on. IEEE. Computer Communications and Networks (ICCCN), Maui, Hawaii, USA, 2011, pp. 1-5.

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Design of Rectangular Microstrip Patch Antenna with I-shaped DGS for Satellite Communication

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Abstract—The paper presents the designs of s-band antenna for communication at 4Ghz.One of the antenna is Rectangular Microstrip Patch Antenna(RMPA) and another antenna is Rectangular Microstrip patch antenna with I shaped DGS,basic property of the antenna like simulated design, Return loss, directivity, Radiation Pattern and bandwidth are discussed. When the antenna designed with I shaped DGS its performance enhance greatly its losses decreases up to 114.12% and bandwidth of the antenna with DGS increases up to 5.819% and size of the antenna with DGS is also reduced, it is very good achievement in Microstrip patch antenna for satellite communication.

Keywords—Rectangular Microstrip Patch Antenna (RMPA), DGS(Defect Ground Structure),bandwidth, return loss, directivity.

I INTRODUCTION

Microstrip antennas for commercial systems require low-cost materials, simple and inexpensive fabrication techniques. Antennas are the essential communication link for aircrafts and ships. Antennas for cellular phones and all types of wireless devices link us to everyone and everything. With mankind's activities expanding into space the need for antennas will grow to an unprecedented degree.

Antennas will provide the vital links to and from everything out there Most of the rapid advances in microstrip antennas took place in the 1980s.Firstly; these were driven by defence and space applications. Then this technology is growing rapidly in the commercial sector. Specifications for defence and space applications antennas typically emphasize maximum performance with little constraint on cost. On the other hand, commercial applications demand low cost components, often at the expense of reduced electrical performance.[1]

The parameters of antenna such as Reflection coefficient, Gain, VSWR and Band width, with and without DGS are measured using Network Analyzer. The main focus of this paper is to improve bandwidth so that patch antenna is used for wide band applications and study effect of DGS on antenna parameters. In this paper simple RMPA is designed and its performance parameters are compared with RMPA having defected ground plane. The antenna is simulated at 2.4 GHz using CAD-FEKO simulation software .This work mainly includes modification of antenna ground plane called as Defected Ground Structure (DGS) [2].

The phased antenna array is used as the receiving antenna in a commercial reader system; experimental results indicate that the coverage of the RFID system with the phased array antenna is superior to with a conventional broader beam width microstrip patch antenna. Different parameters of antenna like VSWR return loss and radiation pattern are calculated using MATLAB coding and hence their graphs are plotted in accordance with the simulated results using SONNET software. Moreover the antenna achieved and measured demonstrates a good agreement between simulation and typical results. [3]

The antenna having the property of high harmonics rejection at unwanted frequencies at 2.0131GHz, and 2.457GHz, 2.565GHz as the designed frequency is 1.3 GHz and return loss is decreased about 43.17%by the DGS structure. It is also used to remove the harmonics and reduce the size of antenna. [4]

In the paper, the design of a microstrip-fed monopole antenna with a wide slot ground plane for uwb applications is presented. A wide slot ground plane is inserted in the ground plane and etched. The substrate used is fr4 epoxy with a thickness of 1.6mm. The size of the antenna is 30*30mm, hence it's a compact one..[5]

In the paper, E-shaped microstrip patch antenna with slot is proposed for ISM BAND application. The proposed antenna project is about microstrip antenna with meandered ground plane. The design adopts contemporary techniques; coaxial probe feeding, E-shape patch structure and slotted patch. shows an comparative impedance bandwidth and its gain table for various shape arrangement. The entire project is design and simulated in an soft HFSS software. [6]

When human body is presented near the antenna the antenna performance such as S11 and bandwidth are affected, the result demonstrates that the new antenna has negligible effect compared with that of the rectangular patch antenna In this paper we present a new patch antenna as a hexagonal patch operating in the Industrial Scientific Medical(ISM) frequency band at 2.45 GHz, the proposed antenna is verifying using to different numerical techniques which are Finite Element Method FEM and Method of Moment MoM, the compression results give us good agreement. [7]

The proposed antenna gives a bandwidth of 4.84 to 6.56 GHz for S11<-10dB. The antenna has the dimensions of 20 mm by 15 mm by 0.8 mm on FR4 substrate. Rectangular slot and step have been used for bandwidth improvement A novel miniature wideband rectangular patch antenna is designed for wireless local area network (WLANs) applications and operating for 5-6 GHz ISM band, and wideband applications. [8]**.**

This paper attempts to design a triple band h-slot antenna by using feed line technique. These bands cover GSM mobile phone system (0.9 and 1.8 GHz) and ISM band which is used for Bluetooth and wireless local area network bands applications. The CST microwave studio software is used as a tool for simulation. This antenna is an attractive candidate for important applications like mobile phone communication systems, mobile phone jammer application [9]

In this paper, a compact slot antenna fed by microstrip-line for 3G/Bluetooth/Wi-MAX and UWB applications with 3.6 GHz band-notched function is presented.The proposed antenna is designed and simulated. Also the antenna is fabricated. The simulated results and measured data show an impedance bandwidth about 7.75 GHz (from 1.9 to 9.65 GHz) for UMTS (1:920-2:170 GHz)/Bluetooth(2:4-2:484 GHz)/WiMAX (2:5-2:96 GHz) and UWB (3:1-9:65 GHz) applications with good radiation characteristics.[10]

II ANTENNA DESIGNS

The antenna physical sizes are an important factor in the design process [9] owing to the miniaturization of the modern mobile terminals. Any technique to miniaturize the size of the MPA has received much attention. Designing requires selection of suitable dielectric constant and substrate height of an antenna as these are basics to design an antenna; these are chosen according to the design frequency our designed frequency band is 4Ghz, here the chosen material is RT duroid 5800 .Here designing of antenna is done using CST-Microwave Studio simulation software and the parameters are displayed by the figures. Designing of the patch has to be taken into consideration, the space available on the fuselage where the antenna has to be installed.

1. Substrate Height =3.5 mm
2. Dielectric Constant=2.2
3. Loss Tangent=.0009

designing of RMPA and its iteration done and their respective results are shown by Graph or figure. The Length and Width of Microstrip Patch Antenna has been calculated by the formula given in References books [11],and all other parameter like cut width, cut depth, continue straight path length and width are calculated by iteration on simulation software and dimensions are stored for best simulation results.

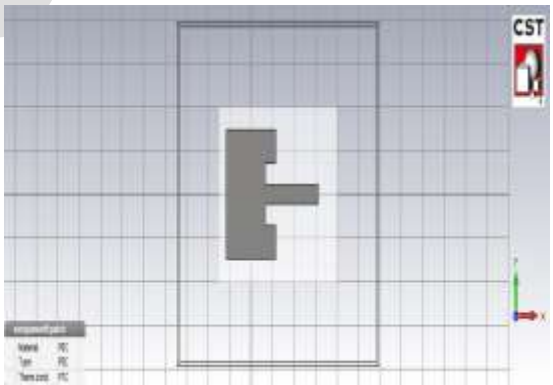

Figure 1Simple RMPA with cut width=14mm, for S-band Communication

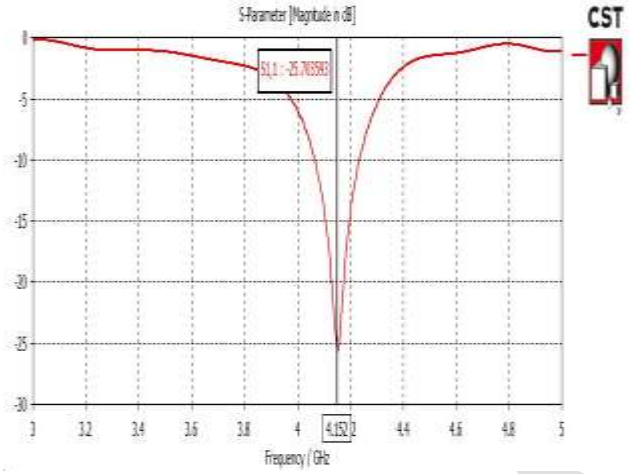

Figure 2.Simulated Return Loss vs. Frequency of Simple RMPA with cut width 14mm is -25.70dB at 4.152GHz

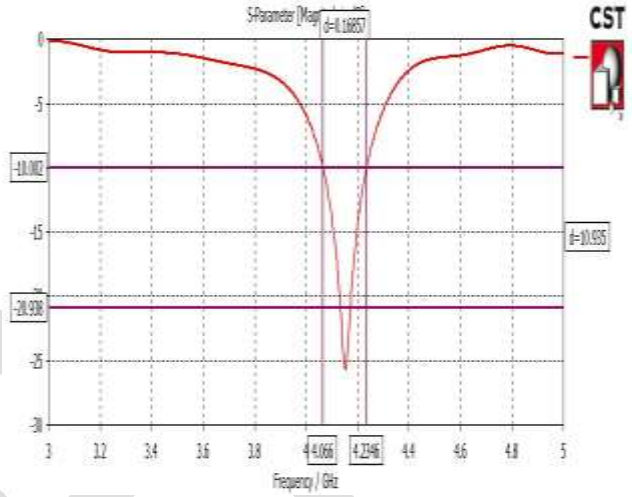

Figure 3.Bandwidth of Simple RMPA with cut width 14mm is 168.57MHz

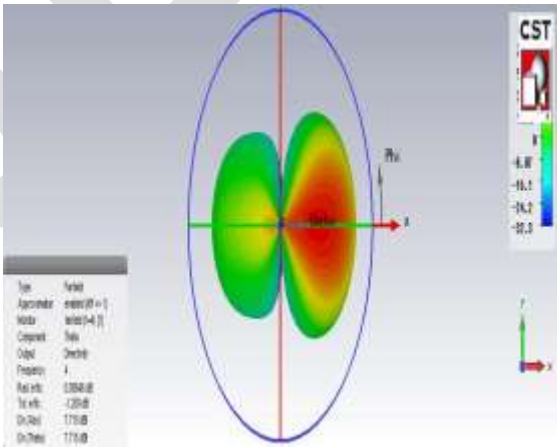

Figure 4. Total Directivity of Simple RMPA with cut width 14mm is 7.715dBi

TABLE I. PARAMETER OF SIMPLE RMPA AT CUT WIDTH 14MM FOR –SATELLITE COMMUNICATION

Frequency(4GHz)	Return loss(dB)	Bandwidth(MHz)	Total Directivity(dBi)
4.152	25.70	168.57	7.715

As it is very clear from the Fig. 1, Fig. 2, Fig. 3, Fig. 4, and Table I that, antenna is working on 4.152GHz and giving return loss 25.70dB, Directivity 7.715dbi, bandwidth of 168.57MHz which is very good for working of an antenna. Now cut width depth increased to 16 mm has been introduced into the simple microstrip patch antenna as shown in Fig. 6. This width is lowering the losses continuously, which is very important aspect to design this antenna system.

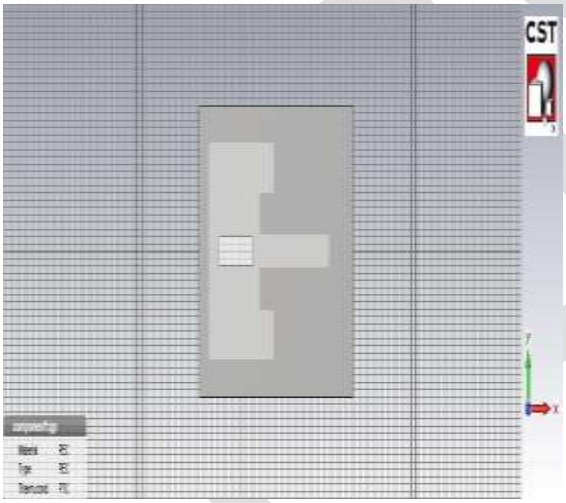

Figure 6.RMPA with I shaped DGS used for S-band Communication

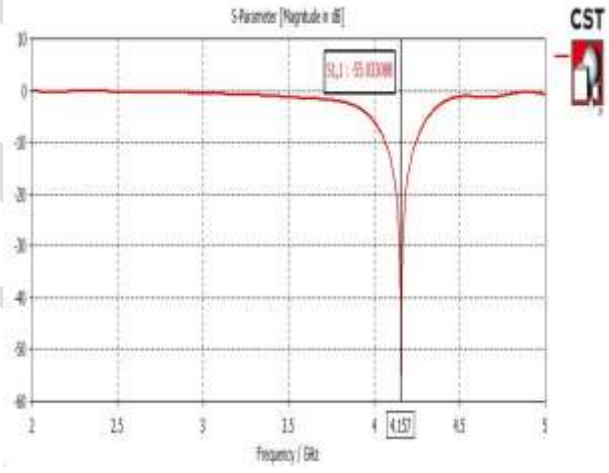

Figure 7.Simulated Return-loss of RMPA with I shaped DGS is 55.03dB at 4.157GHz

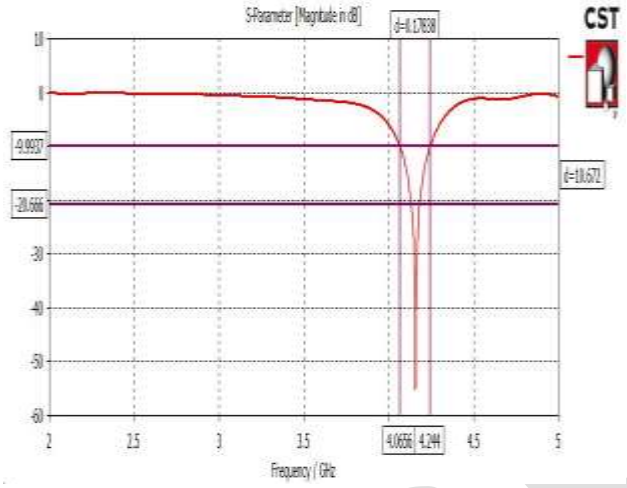

Figure 8. Bandwidth of RMPA with I shape DGS is 178.38 MHz

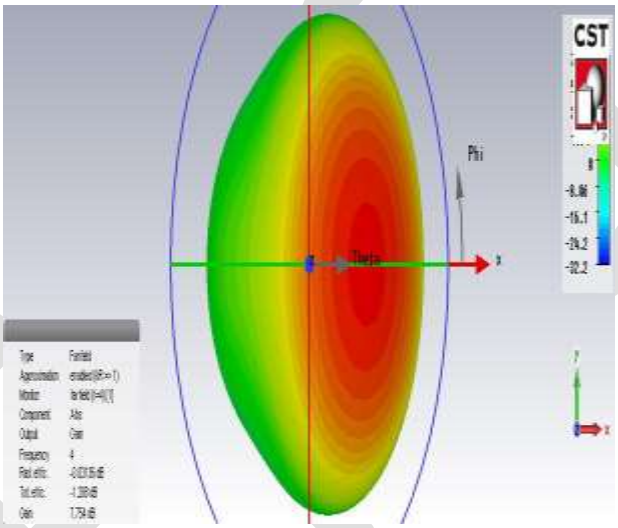

Figure 9.Total directivity of RMPA with I shape DGS is 7.754dbi

TABLE II. PARAMETER OF SLIT -SLOT RMPA FOR ISM-BAND COMMUNICATION

Frequency(4GHz)	Return-Loss(dB)	Bandwidth(MHz)	Total Directivity(dBi)
4.157	55.03	178.38	7.754

III .CONCLUSION

The paper concludes from above figures and tables that the when cut width increases to 16mm from 14mm Antenna characteristics has been improved like return loss are decreased,bandwidth are almost same and, due to this improvement in parameters maximum output is achieved. In this paper improvement in return loss in great amount this will give the maximum output and bandwidth is also increases in great extent, the great satisfaction on patch antenna designing system.

IV. RESULT

Comparative study of both the antenna is done as shown, in Fig. 6 and Fig. 1 the size is reduced. From Fig. 2 and Fig. 7 the Return-loss of antenna is decreased about 114.12%Antenna directivity is increased from7.754dbi to 7.735dbi same clear from Fig. 4 and Fig. 9, antenna total efficiency are almost same as shown in figure 4 and 9, bandwidth is increased to 178.38MHz from 168.57 due to decrement of losses up to 114.12%, shown in Fig. 3 and Fig. 8 and, all these results can be justified from Table I and Table II .the bandwidth of these antennas are too much higher for satellite communication this is main important advantage of this antenna.

REFERENCES:

1] John D. Kraus. *Antennas*. 2nd Edition.McGraw Hill International, 1988.

[2] P.A. Nawale1, Prof. R.G. Zope2Rectangular Microstrip Patch Antenna For 2.4 GHz Communication Using Defected Ground Structure.in International Journal of Advance Foundation and Research in Computer (IJAFRC) Volume 2, Issue 1, January 2015.

[3] Ei Thae Aye , Chaw Myat New "Rectangular Microstrip Patch Antenna for RFID Application using 2.45GHz frequency range" in International Journal of Scientific and Research Publications, Volume 4, Issue 6, June 2014

[4]Hemant Kumar Gupta,P.K.Singhal " Patch Antennas Designs with Different Shaped Defect Ground Structure Pattern in Efficient Rectenna Design for Wireless Power Transmission" in IJECCT open access journal (Malayisa) Vol. No.3 Issue No.1.

[5] L.T. Akhil Bright,and Mrs. A. Kayalvizhi " DESIGN OF A MICROSTRIP-FED MONOPOLE ANTENNA WITH A WIDE SLOT GROUND PLANE FOR UWB APPLICATIONS**"** Electrical Engineering: An International Journal (EEIJ), Vol. 1, No. 1, June 2014

[6] Vidya deshmukh & abhilasha mishra "analysis & designing of e-shape microstrip antenna with slot for ism band" in Internatonal Journal of research in engineering and technology Vol 2 issue 7 Jun 2014 pp 41-48.

[7]Ahmed Al-Shaheen NEW PATCH ANTENNA FOR ISM BAND AT 2.45 GHz at ARPN Journal of Engineering and Applied Science Vol.7 issue 1 2012.

[8] Mohamed Nabil Srifi*, Mourad Meloui and Mohamed Essaaidi "Rectangular Slotted Patch Antenna for 5-6GHz Applications" at International Journal of Micorwave and Optical Technology Vol.5 No.2 march 2010.

[9]Omar Noori, Jalel Chebil, Md. Rafiqul Islam and Sheroz Khan Design of a Triple-Band h Slot Patch Antenna in 2011 IEEE international RF and Microwave conference(RFM 2011),12-14 decemeber 2011 seremban,malaysia.

[10] Mohamed Mamdouh M. Ali1, Ayman Ayd R. Saad2, and Elsayed Esam M. Khaled1 "A Microstrip-fed Printed Slot Antenna for 3G/Bluetooth/WiMAXand UWB Applications with 3.6GHz Band Rejection" in PIERS Proceedings, Stockholm, Sweden, Aug. 12{15, 2013.

[11] C.Balinies,"Antenna Theory", Wiley, 2nd addition chapter -14 ISBN 0-471-59268-4., (1997).

[12]http://www.cst.com/content/products/mws/overview.aspx © 2012 CST Computer Simulation Technology.

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PREDICTIVE MODEL TO MONITOR VARIATION OF STRESS –STRAIN RELATIONSHIP OF 3/8 GRAVEL CONCRETE WITH WATER CEMENT RATIO [0.45] AT DIFFERENT LOAD

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Abstract- Stress- strain relationship are normally established in concrete to monitor various rate of compression of strength, higher concrete strength has been generated from other type of aggregates size, but the application of locally occurring 3/8 gravel has not been thoroughly evaluated to determine its strength rate, the effectiveness of these materials are determined on the way it is used in construction projects, the study of monitoring it stress –strain relationship were carried out to express the developed compressive strength applying these local material, the rate of its effective in construction will determined it economic values to maximize cost in project, when it has attained higher concrete strength like others. The study of monitoring these relationship were carried out through experimental set up, the generated values were also calibrated to generate model equation, the resolved equations generated theoretical values, these results were compared with measured values, both parameters express best fits validating the model, the stress – strain relationship express its values base on the mix proportions, designed variations including curing methods and age. These condition influences the behaviour of the stress –strain relationship as it is express in all the graphical representation.

Keywords*:* predictive model, stress-strain relationship,3/8 gravel, and load

1. Introduction

It has been observed that when concrete is subjected to loading, it display a linear stress-strain connection to elastic range. The ratio through linear portion of the relationship known to the slope is known as the modulus of elasticity (Boris, 2009). The elastic limit is "the maximum stress which a material is competent of sustaining without any divergence from proportionality of stress to strain (Hooke's law)." As it is express from previous section, the modulus of elasticity is the ratio stuck between stress and the reversible strain. When a load is applied to concrete, it will distort depend on the extent of the load thus its rate of application. The value of strain is of immense significance since it represents the inflexibility of the structural design, thus the stress at which the concrete will observe lasting deformation if exceeded. Most structures are subject matter to cyclic loading thus imperative to know the elastic portion for design purposes, particularly the quantity of steel required for reinforcement (Boris, 2009). According to the Canadian Portland Cement Association (CPCA), the elastic modulus of concretes will be influenced by the properties of different aggregate types with different elastic moduli. Previous researchers have express Stress-Strain relation curves for aggregate, concrete, and cement paste, this are for stress-strain relations on cement paste, aggregate and concrete, it has been observed that aggregate has a substantially at larger elastic modulus compared to concrete and cement paste, so it is could be guessed that aggregate and aggregate content has a important pressure on the elastic modulus of concrete. Parrot (1979) generating an equation that can predict the elastic modulus of concrete; it must be Mechanical properties of High-Strength Concrete (HSC) can be divided in two groups as short-term mechanical properties and long-term mechanical properties (Eluozo and Ode 2015a, Eluozo and Ode 2015b, Eluozo and Ode 2015c). The ascending branch of stress-strain is more linear and steeper for HSC. Strain at maximum strength is greater and descending part becomes steeper compared to NSC. Stress-strain behaviour of HSC depends on material parameters such as aggregate type and experimental parameters that include age at testing, strain rate and interaction between specimen and testing machine. The stress-strain model used for NSC cannot be extended for use in HSC as the nature of loading curve changes significantly. Steeper rise and sudden

drop in strength after maximum value presents difficulty in numerical modelling of stress-strain behaviour of HSC. Aïtcin (1998) suggests that HSC behaves like a real composite material and parallels can be drawn to the stress-strain behaviour used in rock mechanics (Ode 2004). Smooth river gravel produces weaker concrete. Smallest size of coarse aggregate produces highest strength concrete owing to its high specific surface area. Addition of silica fume decreases the requirement of low w/c to achieve high compressive strength. Iravani (1996) noted that effect of silica fume on strength development of HSC is most prominent during 7 to 28 days after mixing. Hence, most of the empirical formulations express modulus of elasticity as a function of compressive strength. The equation suggested in ACI-318 overestimates elastic modulus of HSC and ACI 363 (ACI, 2010) suggest a different equation for HSC based on studies done by Carrasquillo *et al.* (1981) that have been shown to produce conservative values for normal-density concrete (Shah and Ahmad, 1994): Data on Poisson's ratio of concrete is very limited, especially for HSC. Poisson's ratio of HSC is constant in the linear zone but increases in the non-linear zone as a function of axial strain. In the linear range, Poisson's ratio is not affected by compressive strength, curing method and age of concrete (Logan *et al.*, 2009 Ephraim and Ode 2006).

2. Materials and Method

3/8 gravel concrete like any other materials is to a certain extend elastic as such stresses and strain induced in any structural members. The standard procedure for making and testing concrete cylinders for static young modulus of elasticity as per ASTM C469 (1975) were adopted in this investigation. Capped 3/8 gravel concrete cylinders of 30cmx 15cm Diameter were made with 1:1:6:2:9 mix proportion by weight and recommended water cement ratio of 0.45, cured and tested after 28 days under compression in a compression machine. Demech mechanical strain garage was used to measured strain at middle of the specimen height. Strains recorded were taken immediately after loading. The modulus of elasticity E is the proportionality constant defined as the ratio of stress to strain. The relationship between Ec and Fcu normal dense concrete according to British standard is given as $E_{c=9.1}\ f^{1/3}[KN/mm^3]$

3. Results and Discussion

Results and discussion are presented in tables including graphical representation of compressive strength of concrete.

Table: 1 Stress relationship at Different Load

Load [KN	Stress [N/mm]
30	**1.69**
60	**3.396**
90	**5.093**
120	**6.791**
150	**8.489**
180	**10.187**
210	**11.885**
240	**13.582**
270	**15.28**
300	**16.978**
310	**17.544**
320	**18.11**
330	**18.676**

340	**19.242**
350	**19.808**
380	**20.374**
400	**22.637**

Table: 2 Predictive and Measured Values of Stress Relationship at Different Load

Load [KN	Predictive Values Stress N/mm^2	Measured Values Stress N/mm^2
30	**1.61**	**1.64**
60	**3.385**	**3.398**
90	**5.0902**	**5.097**
120	**6.809**	**6.891**
150	**8.515**	**8.689**
180	**10.206**	**10.197**
210	**11.882**	**11.885**
240	**13.544**	**13.552**
270	**15.192**	**15.283**
300	**16.825**	**16.988**
310	**17.366**	**17.444**
320	**17.906**	**18.111**
330	**18.444**	**18.576**
340	**18.98**	**19.842**
350	**19.515**	**19.408**
380	**21.109**	**20.574**
400	**22.17**	**22.537**

Table: 3 Strain relationships at Different Load

Load [KN	Vertical Strain X [1.99E10-5] N/mm^2
30	**1.10E-05**
60	**1.90E-05**
90	**2.10E-05**
120	**3.10E-05**
150	**4.00E-05**
180	**4.10E-05**
210	**4.30E-05**
240	**4.50E-05**
270	**6.20E-05**
300	**7.31E-05**
310	**7.51E-05**

320	8.21E-05
330	8.30E-05
340	8.40E-05
350	8.60E-05
380	1.26E-05
400	1.28E-05

Table: 4 Predictive and Measured Values of Strain Relationship at Different Load

Load [KN	Predictive Values vertical Strain	Measured Values Vertical Strain
30	2.90E-06	1.10E-06
60	1.24E-05	1.50E-05
90	2.59E-05	2.14E-05
120	3.76E-05	3.50E-05
150	4.75E-05	4.50E-05
180	5.56E-05	4.90E-05
210	6.90E-05	5.30E-05
240	6.64E-05	5.50E-05
270	6.91E-05	6.60E-05
300	7.00E-05	7.11E-05
310	6.99E-05	7.13E-05
320	6.96E-05	7.21E-05
330	6.91E-05	7.30E-05
340	6.84E-05	7.40E-05
350	6.75E-05	7.60E-05
380	7.56E-05	5.26E-05
400	6.00E-05	5.28E-05

Table: 5 Strain relationships at Different Load

Load [KN	Horizontal Strain X [1.99E-05]
30	6.60E-05
60	5.70E-05
90	6.10E-05
120	9.40E-05
150	1.12E-05
180	1.13E-05
210	1.25E-05
240	1.36E-05
270	1.83E-05
300	2.56E-05

310	**2.70E-05**
320	**3.03E-05**
330	**2.66E-05**
340	**2.68E-05**
350	**3.18E-05**
380	**4.92E-05**
400	**5.20E-05**

Table: 6 Predictive and Measured Values of Strain Relationship at Different Load

Load [KN	Predictive Values Horizontal Strain	Measured Values Horizontal Strain
30	**7.32E-05**	**6.70E-05**
60	**6.52E-05**	**5.90E-05**
90	**5.68E-05**	**5.90E-05**
120	**6.28E-05**	**7.40E-05**
150	**4.10E-05**	**3.12E-05**
180	**3.49E-05**	**3.23E-05**
210	**3.09E-05**	**1.25E-05**
240	**2.97E-05**	**2.66E-05**
270	**3.18E-05**	**2.83E-05**
300	**3.80E-05**	**3.56E-05**
310	**4.11E-05**	**3.27E-05**
320	**4.48E-05**	**4.03E-05**
330	**4.88E-05**	**3.96E-05**
340	**5.36E-05**	**5.68E-05**
350	**5.90E-05**	**5.18E-05**
380	**7.91E-05**	**6.92E-05**
400	**9.60E-05**	**8.90E-05**

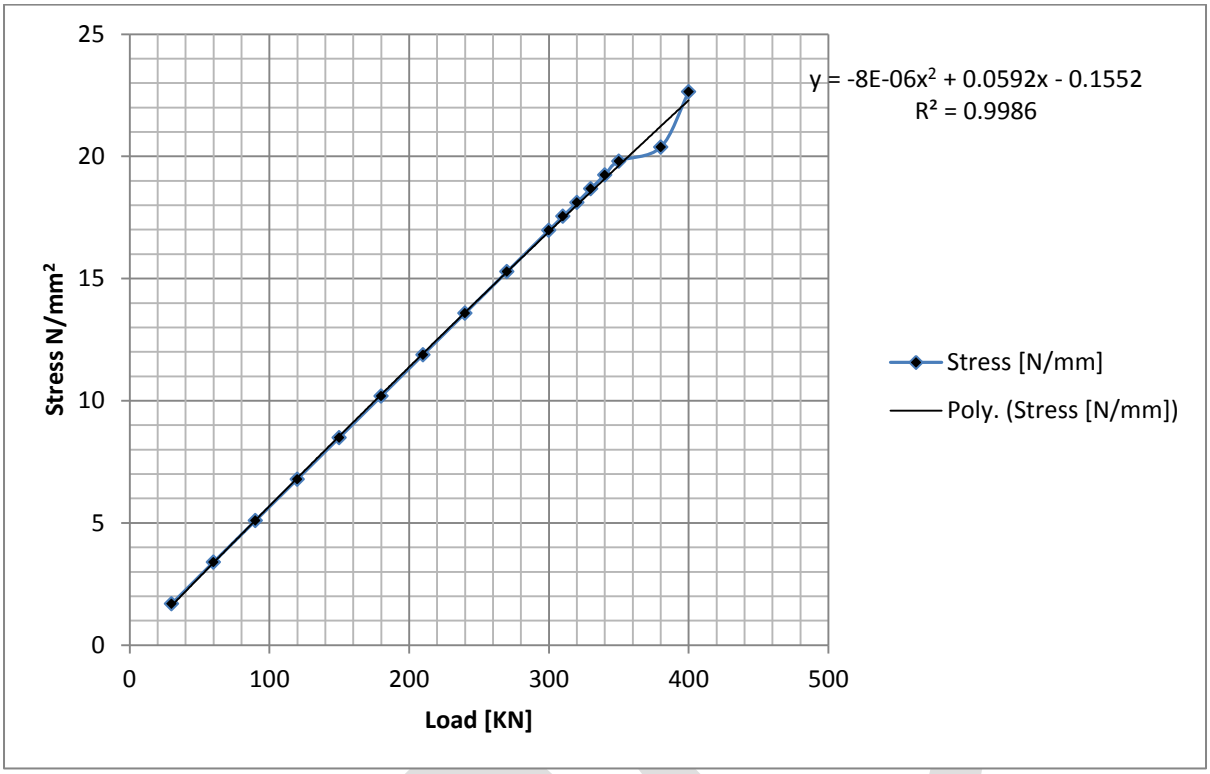

Figure 1: Stress relationships at Different Load

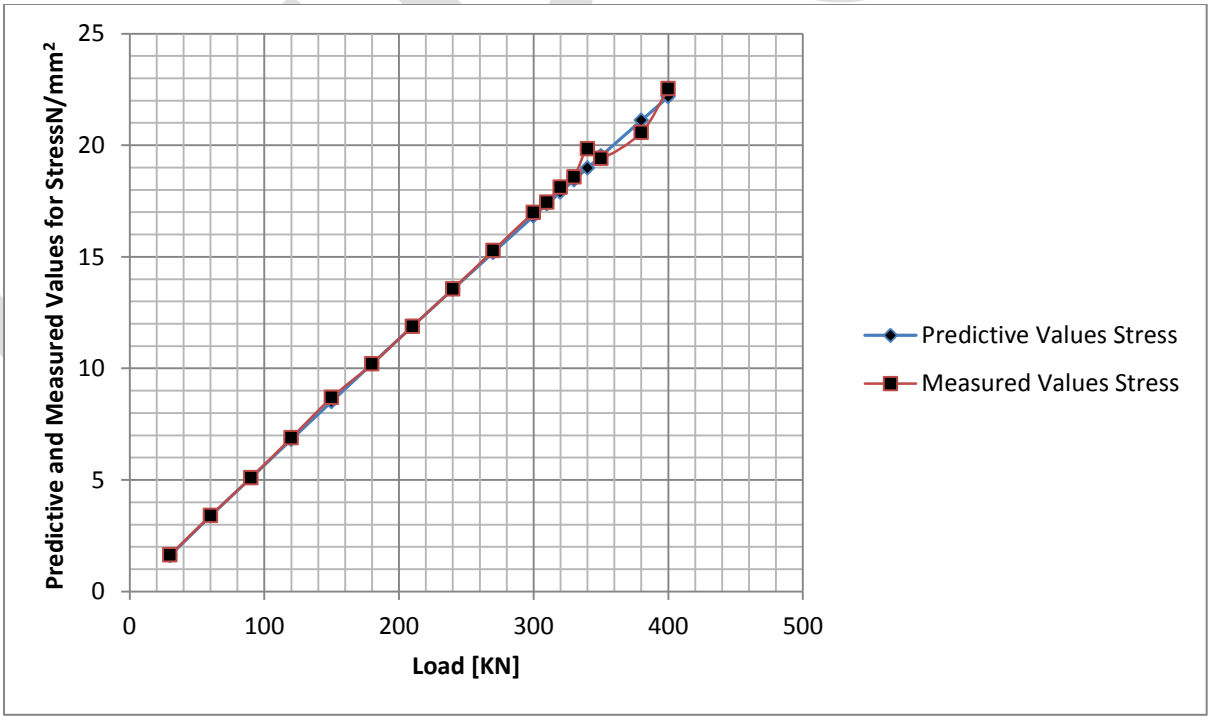

Figure 2: Predictive and Measured Values of Stress Relationship at Different Load

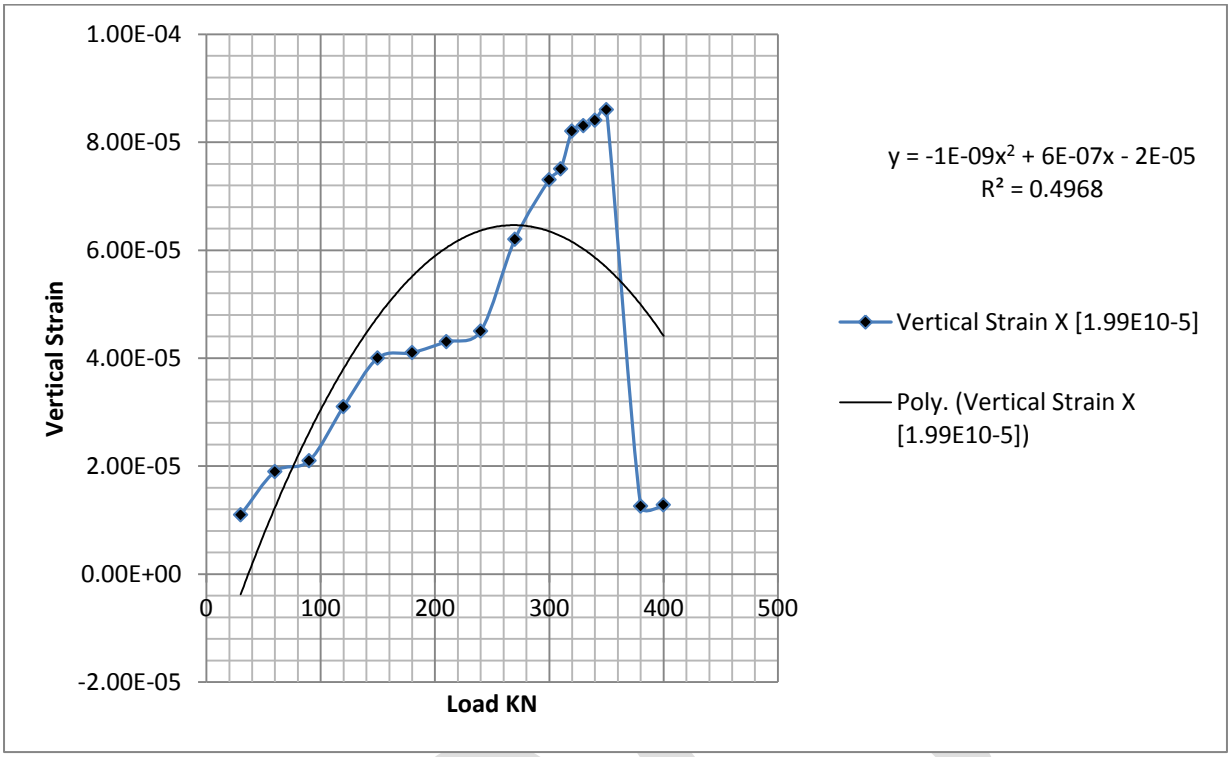

Figure 3: Figure 1: Strain relationships at Different Load

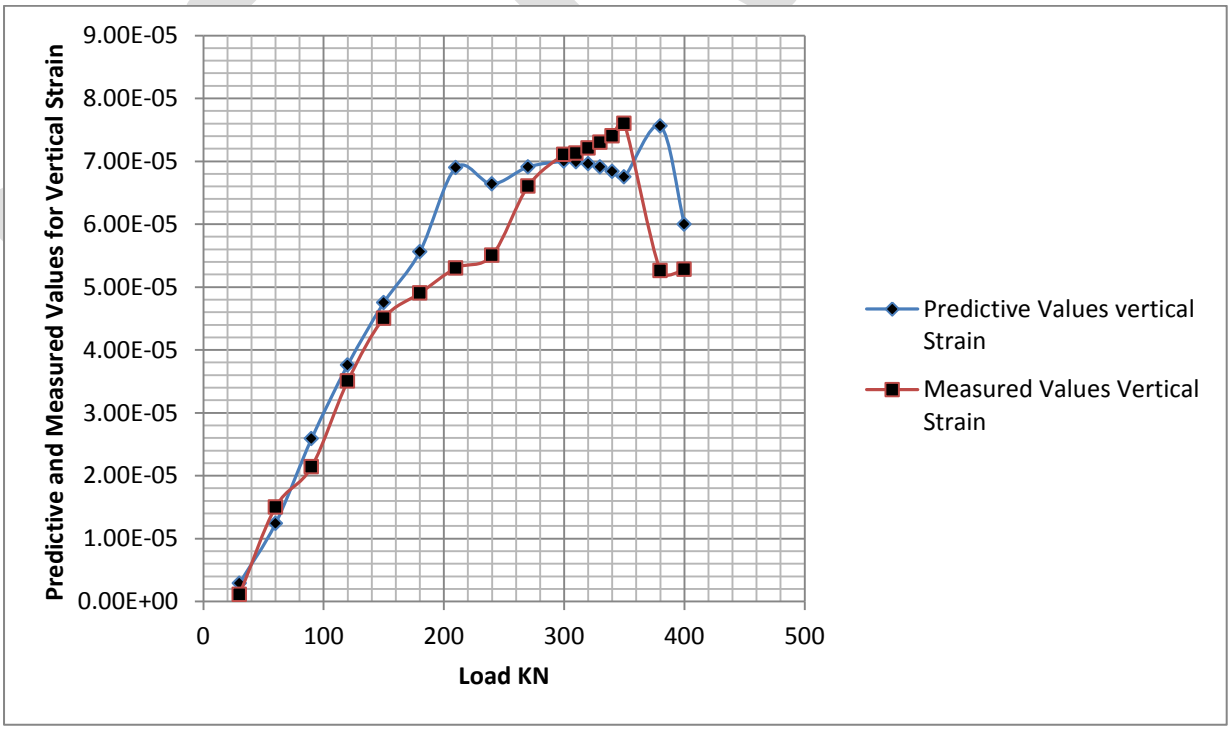

Figure 4: Predictive and Measured Values of Strain Relationship at Different Load

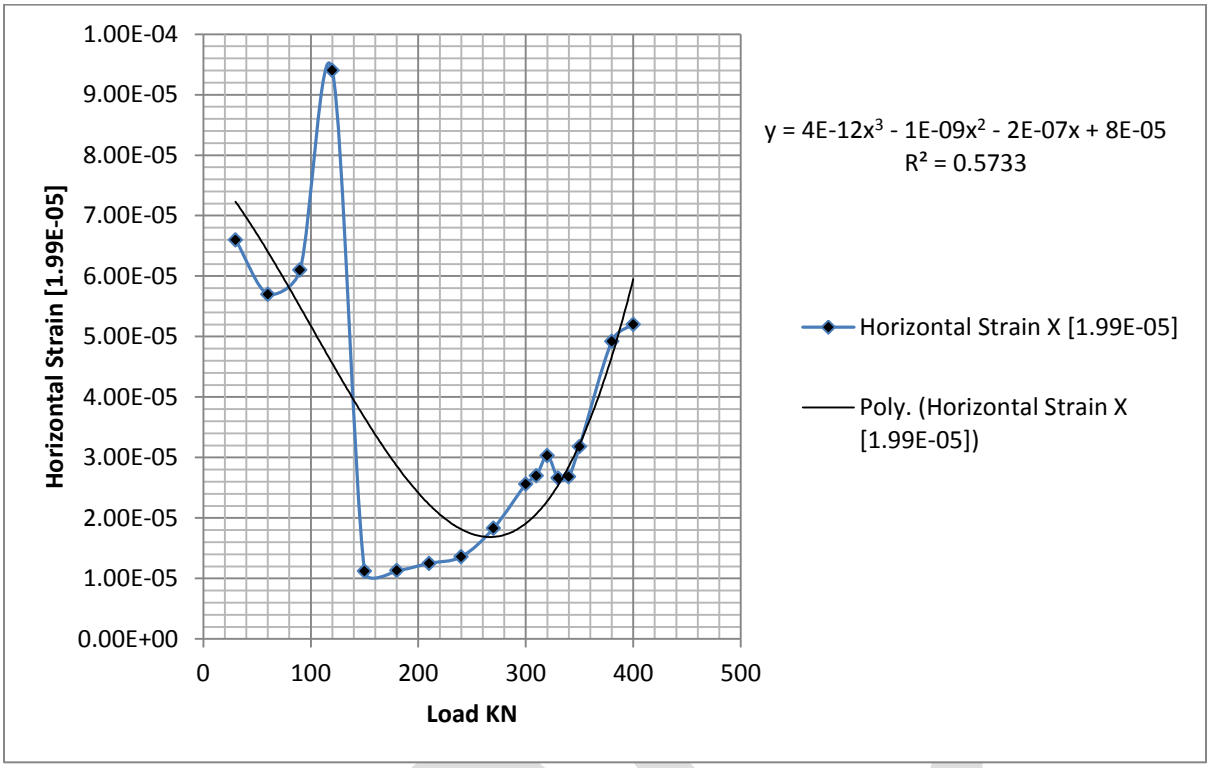

Figure 5: Strain relationships at Different Load

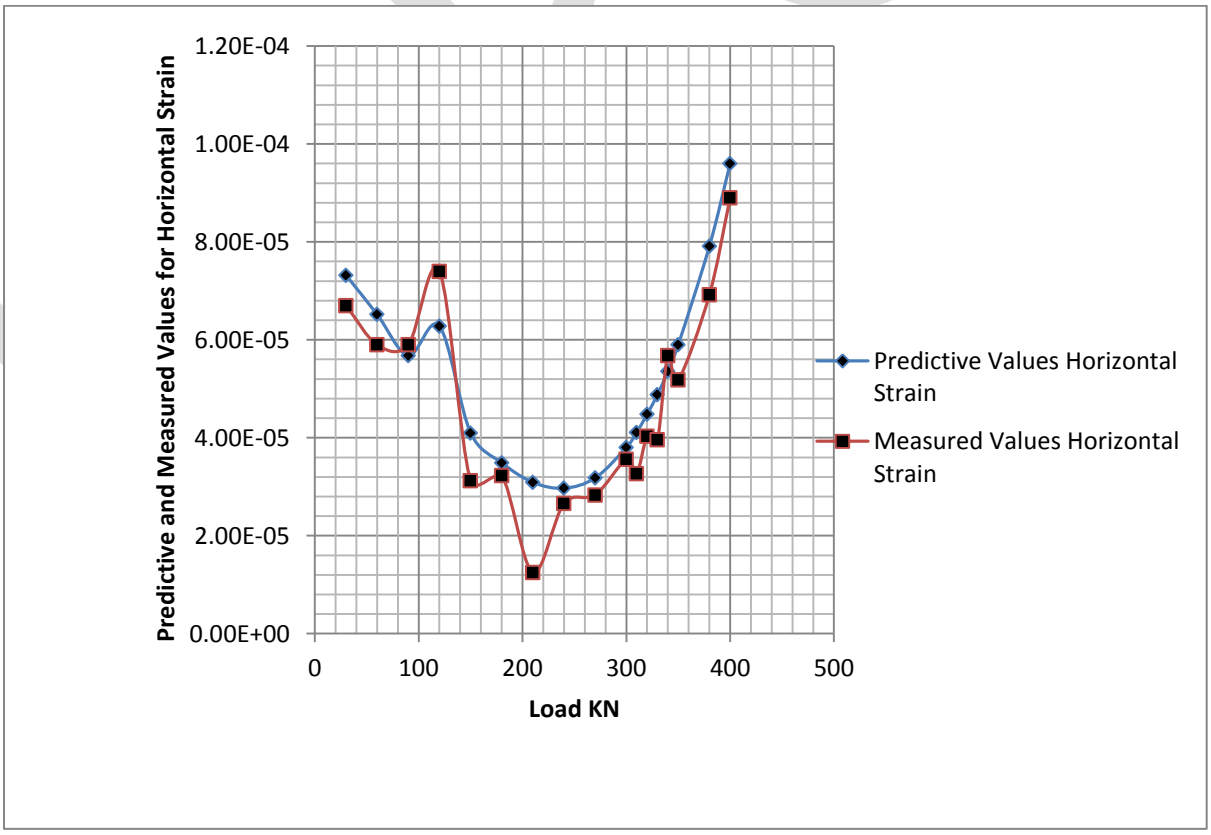

Figure 6: Predictive and Measured Values of Strain Relationship at Different Load

The figure express the relationship of stress and strain in compressive strength of concrete using locally occurring 3/8 gravel to developed high concrete strength. Figure one express the behaviour of stress in linear condition to the point it attain it optimum recorded at 400KN..in figure two, resolving the expressed model equation theoretical measured values developing linear exponential loading to the optimum level recorded at 400KN while figure three experiences linear increase and suddenly develop vacillation where the strain decreased at 400KN, Figure four express it predictive and measured values in the same vein exponential conditions were observed thus sudden declined in strain were recorded at 400KN. Figure five developed fluctuation in it developed strain at different loading point between 200KN, sudden increase in strain were experienced to the optimum level at 400KN, similar condition were observed in figure six where the predictive and measured express best fits in the same trend fluctuating to the optimum level at 400KN.

Conclusion

The stress - strain relationship for locally occurring 3/8 gravel for high concrete strength were developed to express the stress – strain relationship, the expression were subjected at different loading point to the optimum at 400KN. The expression of the stress and strain at different loading condition were monitored through experimental application, the results were calibrated, these resulted generated mathematical model equations resolved to generated theoretical values from the calibrations. The theoretical values were compared with other measured values for validation, both parameters express faviourable fits, the effect on the stress and strain are base on the on the size of the locally occurring 3/8 gravel, the mix design thus variations of water cement ratios, the deposited porosity of the concrete and the compaction relation to the permeability's, others includes mix design variation through water cement ratios and type of curing and age.

REFERENCES:

[1] Boris H 2009; Strength, modulus of elasticity, creep and shrinkage of concrete used in Florida Master of Engineering University of Florida

[2] Manish K.1, A.M. ASCE; Zhaoyu Ma Moses M 2012; Department of Civil, Structural and Environmental Engineering, University at Buffalo, State University of New York

[3] Aïtcin, P. C. (1998). "High-performance concrete." Taylor & Francis.

[4] Beushausen, H., and Alexander, M. (2010). "Strength of Concrete: Influencing factors, design principles, code requirements." *Concrete technology for structural engineers*, <http://www.comsiru.uct.ac.za/Workshop%20Downloads/Concrete%20Technology%20Worksh op%202010%20Lecture%202%20-%20Concrete%20Strength.pdf>. (September 10, 2012).

[5] Carrasquillo, R. L., Nilson, A. H., and Slate, F. O. (1981). "Properties of high-strength concrete subject to short-term loads." *Journal of the American Concrete Institute*, 78(3), 171-178.

[6] Dewar, J. (1964). "The indirect tensile strength of concrete of high compressive strength." Cement and Concrete Association.

[7] Ode .T. 2004, Structural properties of concrete made with locally occurring 3/8 gravel, M.Tech Thesis pp 6

[8] Ephraim M.E. Ode .T. (2006) Specification for structural Application of concrete with 10mm (3/8) All – in Gravel Aggregate NEAM Vol 1 No 1

[9] Eluozo, S.N. Ode .T. (2015) Mathematical model to monitor stiff clay compression index in wet land area of Degema Volume 6, Issue 12, pp. 59-72, Article ID: IJARET_06_12_007

[10] Eluozo, S.N. Ode .T. (2015) Mathematical model to predict compression index of uniform loose sand in coastal area of Degema, Rivers State of Nigeria. International Journal of Advanced Research in Engineering and Technology Volume 6, Issue 12, pp. 86-103, Article ID: IJARET_06_12_009

[11] Eluozo. S. N and Ode T, Modeling and Simulation of Compression Strength for Firm Clay in Swampy Area of Ahoada East. *International Journal of Advanced Research in Engineering and Technology*, **6**(12), 2015, pp. 73-85.

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PERFORMANCE CHARACTERSTICS ASSESSMENT OF TALL STRUCTURE UNDER LATERAL FORCES

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Abstract— Presently the Buildings are made to fulfill our basic aspects, better serviceability for fast growing population. It is not an issue to construct a building any how it is important to construct an efficient building which will serve its purpose for many years without showing any failure. Most of the countries like India, China, etc having greater ratio of population to land which leads to problem involved in expansion of structure along horizontal direction . Hence it is essential to construct high rise buildings, so it is very important to design a building which is capable to resists lateral forces. The present Paper work deals with "**PERFORMANCE CHARACTERSTICS ASSESSMENT OF TALL STRUCTURE UNDER LATERAL FORCES**". In this paper the tube in tube, Framed tube with Shear wall, Framed tube with X-Bracing are compared to each other.

Keywords— Tube in tube structure, Staad –pro, lateral force analysis, Shear wall system**,** Design Seismic Base Shear, X Bracing.

INTRODUCTION

A) INTRODUCTIONS TO TUBE IN TUBE STRUCTURE**:** Modern high-rise buildings of the framed-tube system exhibit a considerable degree of shear-lag with consequential reduction in structural efficiency. Despite this drawback, framed-tube structures are widely accepted as an economical system for high-rise buildings over a wide range of building heights. This is because in the framed-tube system the lateral load resisting elements are placed on the outer perimeter. The "tube" comprises closely spaced columns that are connected at each floor level by deep spandrel beams. Such buildings are usually equipped with service cores, which may house the lifts, emergency stairways, electrical and mechanical zones and other services. These cores referred to as the internal tubes are often designed to provide added lateral stiffness to the building; they also interact with each other as well as with the external tube. Framed-tube structures with multiple internal tubes, or tubes-in-tube structures, are widely used due to their high stiffness in resisting lateral loads and the availability of the internal tubes in supporting the vertical loads. The use of multiple internal tubes reduces the effect of shear-lag in the tubes and offers additional lateral stiffness to the overall structure. The tube-tube interaction coupled with the existence of negative shear-lag in the tubes complicates the estimation of the structural performance and the accurate analysis of tubes in framed-tube system. Existing models for approximate analysis not only ignore the contribution of the internal tubes to the overall lateral stiffness but also neglect the negative shear-lag effects in the tubes. Thus, these models cater only for the structural analysis of the external tube but fail to consider the shear-lag phenomenon of the internal tubes.

B) INTRODUCTIONS TO SHEAR WALL**:** Shear wall is one of the most commonly used lateral load resisting element in high rise building. Shear wall (SW) has high in plane stiffness and strength which can be used simultaneously to resist large horizontal load and support gravity load. The scope of present work is to study and investigate the effectiveness of RC shear wall in medium rise building. Reinforced concrete shear walls are used in Bare frame building to resist lateral force due to wind and earthquakes. They are usually provided between column lines, in stair wells, lift wells, in shafts. Shear wall provide lateral load resisting by transferring the wind or earthquake load to foundation. Besides, they impart lateral stiffness to the system and also carry gravity loads. But bare frame with shear wall still become economically unattractive. If the structural engineers consider property the non-structural element in structural design along with other elements like shear wall gives better results.

C) INTRODUCTIONS TO SHEAR WALL**:** The most effective and practical method of enhancing the seismic resistance is to increase the energy absorption capacity of structures by combining bracing elements in the frame. The braced frame can absorb a greater degree of energy exerted by earthquakes. Bracing members are widely used in steel structures to reduce lateral displacement and dissipate energy during strong ground motions. This concept extended to concrete frames. The various aspects such as size and shape of building, location of shear wall and bracing in building, distribution of mass, distribution of stiffness greatly affect the behaviors of structures. Bracing system improves the seismic performance of the frame by increasing its lateral stiffness and capacity. To the addition of bracing system load could be transferred out of the frame and into the braces, by passing the weak columns. The stiffness added by the bracing system is maintained almost up to the peak strength. Stiffness is particularly important at serviceability state, where deformations are limited to prevent damage.

Description of building model

In this paper, we have analyzed three different structure i.e. Tube in tube structure, Framed structure with Shear wall, Framed X bracing of having common geometry with G+21 storey models and there loading condition are taken from IS code. We take taken Live, Dead, Wind and seismic. The general features of the building model and beam sections used in the building are shown in the

Table No1

Sr no.	**features**	**Tube in tube structure**	**Framed structure With Shear wall**	**Framed structure with X bracing**
1.	Layout	As shown in plan	As shown in plan	As shown in plan
2.	No.of storey	G+21	G+21	G+21
3.	Total heigh of the building	91.7	91.7	91.7
4.	Floor to floor height	4.1m	4.1m	4.1m
5.	External wall	0.3m (including plaster)	0.3m (including plaster)	0.3m (including plaster)
6.	Shear wall	0.3m	0.3m	0.3m
7	Slab thickness	0.2m	0.2m	0.2m
8.	Material used	M35	M35	M35
9.	Dead load	6.5 KN/ m^2	6.5 KN/ m^2	6.5 KN/ m^2
10.	Live load	4 KN/ m^2	4 KN/ m^2	4 KN/ m^2
11.	Wind load	0.675 KN/ m^2	0.675 KN/ m^2	0.675 KN/ m^2
12.	Seismic analysis	Static base shear method	Static base shear method	Static base shear method
13.	Columns size	C1-1.5 X 1.5 C2-0.6 X0.6	C1-1.5 X 1.5 C2-0.6 X0.6	C1-1.5 X 1.5 C2-0.6 X0.6
14.	Beam size	B1-0.5 X 1(**Spandrel beam**) B2- 0.3 X 0.6	B1- 0.3 X 0.65	B1- 0.3 X 0.65
15.	Seismic zone	III	III	III

Modeling of loads

In this paper the basic loads considered are dead load, live loads, earthquake loads and wind loads. The values of Dead loads (DL) are calculated from the unit weights as specified in IS 875 (Part 1): 1987. The live load (LL) intensities for the various areas of residential buildings are obtained from IS 875 (Part 2): 1987. The summary of dead load and live loads considered for the building is given in Table 1. In load combinations involving Imposed Loads (LL), IS 1893 (Part I):2002 recommends for loads up to and including *4* KN/m^2, *50%* of the imposed load to be considered for seismic weight calculations. However to be conservative, in the present study, *50%* imposed loads are considered in load combinations. The earthquake loads are assigned *X* and Z directions as *ELx* and *ELz* respectively as per IS 1893(Part 1):2002. Load combinations for the analysis of the structure in shown in table no 2.

SR NO	LOAD COMBINATION
1	1.5 Dead Load +1.5 Live Load
2	1.2 Dead Load +1.2 Live Load+ 1.2 wind load X^+
3	1.2 Dead Load +1.2 Live Load+ 1.2 wind load X^-
4	1.2 Dead Load +1.2 Live Load+ 1.2 wind load Z^+
5	1.2 Dead Load +1.2 Live Load+ 1.2 wind load Z^-
6	0.9 Dead load +1.5 Live load
7	0.9 Dead Load +1.5 wind load X^+
8	0.9 Dead Load +1.5 wind load X^-
9	0.9 Dead Load +1.5 wind load Z^+
10	0.9 Dead Load +1.5 wind load Z^-
11	1.5 Dead Load +1.5 wind load X^+
12	1.5 Dead Load +1.5 wind load X^-
13	1.5 Dead Load +1.5 wind load Z^+
14	1.5 Dead Load +1.5 wind load Z^-
15	1.2 Dead Load +1.2 Live Load+1.2Earthqueke load X
16	1.2 Dead Load +1.2 Live Load+1.2Earthqueke Z

Analytical model considered for Analysis

In this paper we have studied the two different structure one is R.C.C tube in tube structure, Framed structure with shear wall, Framed structure with X-Bracing using same grade of the concrete and beam position. Features and plan are shown in the tables no 1. Building is modeled using STAAD-PRO. Using this software we have generated structure with beam, column and shear walls. And we also have studied different parameters of both the structures and observe the following results. Design data are used as describe in the table 1**.**

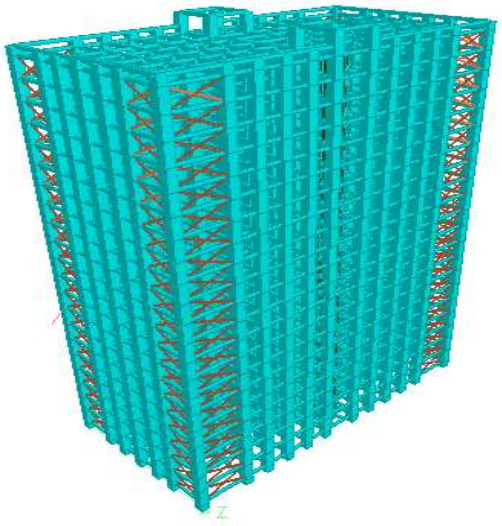

Fig. Framed structure with X-Bracing

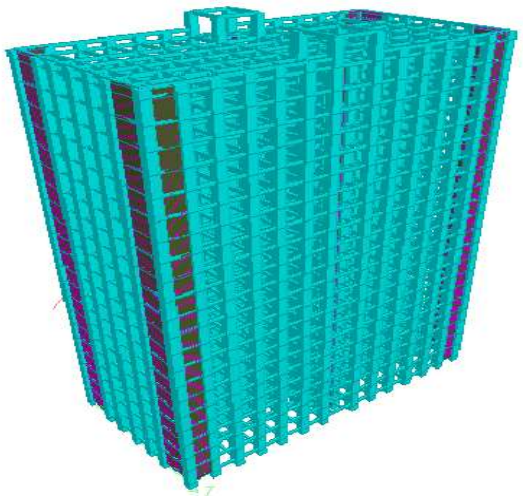

Fig. Framed structure with Shear wall

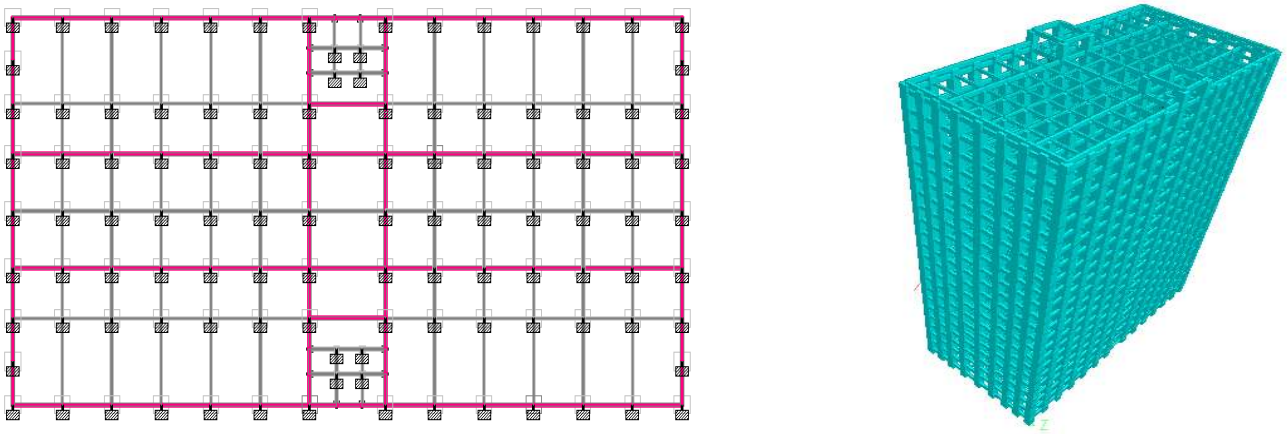

Fig. Tube forming structure

Model 1:

Tube structure constructed in outer periphery of building and also constructed internal of structure to resist lateral forces generated from earthquake and wind forces.

Model 2:

Building has RC X bracings in outrigger patterns in all corners in every storey in all the four sides.

Model 3:

Building has RC Shear wall is providing in all corners in every storey in all the four sides.

RESULT AND DISCUSSION

In this paper the results of all the building models are presented. Analysis were carried out using STAAD-PRO and different parameters studied such as storey displacement, member deflection with considering lateral forces the graph and table are shown below.

Table no.1 Comparison between Tube in tube, Shear wall, X-Bracing structure in Deflection.

Storye no.	Height from ground floor	Deflection (in mm)		
		Tube in tube structure	Framed structure with Shear wall	Framed structure with X-Bracing
1.	4.1	1.212	0.322	1.746
2.	8.2	12.745	4.362	18.412
3.	12.3	30.646	11.764	46.703
4.	16.4	51.265	21.398	81.886
5.	20.5	73.029	32.527	121.529
6.	24.6	95.245	44.628	164.002
7.	28.7	117.574	57.325	208.169
8.	32.8	139.814	70.339	253.215
9.	36.9	161.814	83.455	298.530
10.	41	183.436	96.501	343.624
11.	45.1	204.541	109.334	388.078
12.	49.2	224.987	121.826	431.508
13.	53.3	244.623	133.859	473.550
14.	57.4	263.294	145.326	513.858
15.	61.5	280.837	156.122	552.096
16.	65.6	297.087	166.150	587.944
17.	69.7	311.873	175.318	621.104
18.	73.8	325.028	183.539	651.104
19.	77.9	336.381	190.739	678.324
20.	82	345.775	196.869	702.010
21.	86.1	353.137	201.973	722.481
22.	90.2	360.642	206.420	740.569
23.	94.3	362.142	211.503	757.389

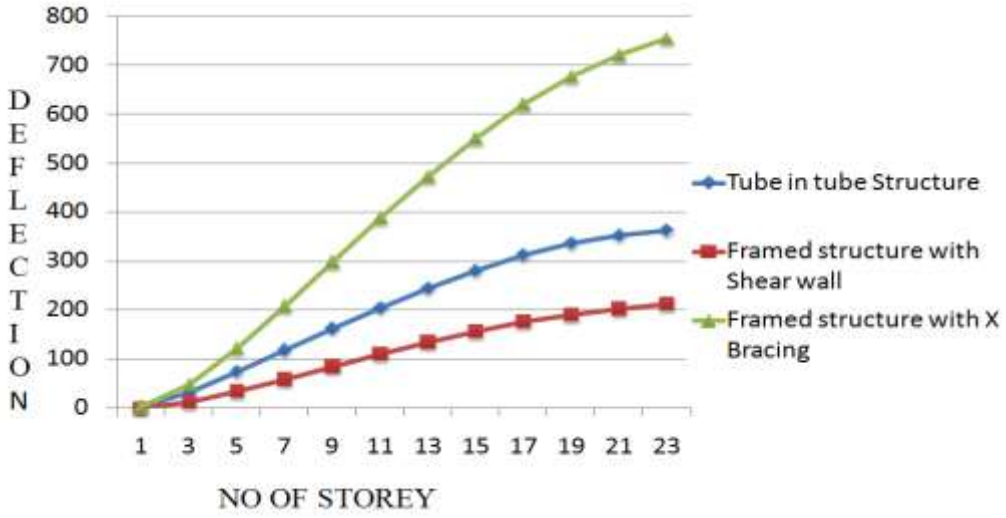

Fig. Comparison of Deflection with Tube in tube, Framed structure with Shear wall and Framed structure with X-Bracing

Table no.2 Comparison between Tube in tube, Shear wall, X-Bracing structure in Displacement.

Storye no.	Height from ground floor	shear displacement (in mm)		
		Tube in tube structure	Framed structure with Shear wall	Framed structure with X-Bracing
1.	4.1	1.450	0.317	2.083
2.	8.2	15.257	5.187	22.095
3.	12.3	36.710	14.097	55.905
4.	16.4	61.439	25.660	98.119
5.	20.5	87.552	39.012	145.701
6.	24.6	114.212	53.533	196.684
7.	28.7	141.009	68.769	249.704
8.	32.8	167.701	84.384	303.180
9.	36.9	194.103	100.123	358.179
10.	41	220.051	115.779	412.314
11.	45.1	224.380	131.177	465.680
12.	49.2	269.916	146.166	517.816
13.	53.3	293.481	160.605	568.288
14.	57.4	315.886	174.363	616.677
15.	61.5	336.937	187.313	662.581
16.	65.6	356.433	199.338	705.618
17.	69.7	374.172	210.325	745.432
18.	73.8	389.952	220.325	781.703
19.	77.9	403.579	228.797	814.159
20.	82	414.892	236.154	842.628
21.	86.1	423.860	242.332	867.276
22.	90.2	430.987	247.854	889.217
23.	94.3	434.564	253.801	909.101

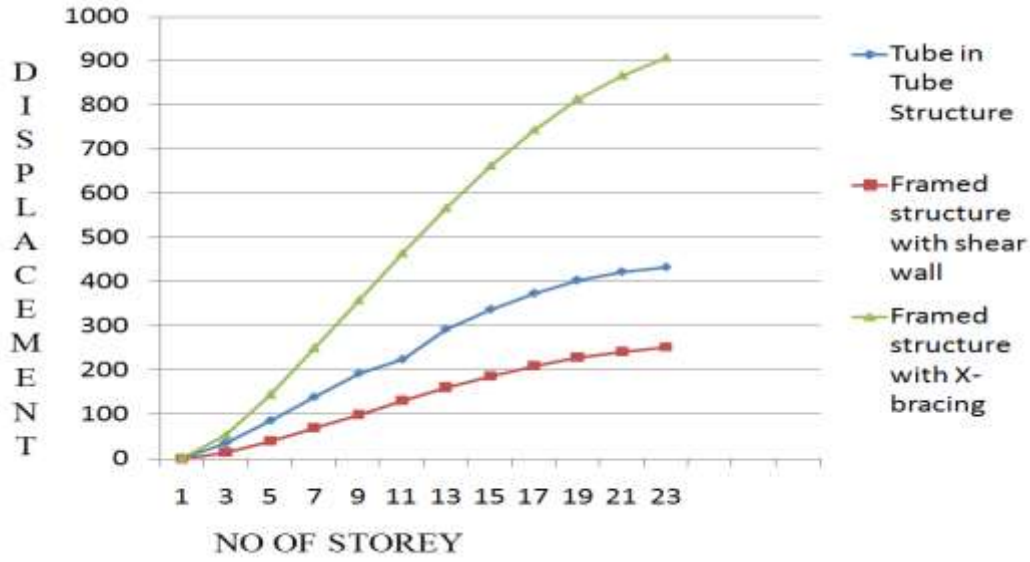

Fig. Comparison of Displacement with Tube in tube, Framed structure with Shear wall and Framed structure with X-Bracing

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CONCLUSIONS

The response of a tall building under wind and seismic load as per IS codes of practice is studied Seismic analysis with static base shear method and wind load analysis with IS code method are used for analysis of a G+21 storey RCC high rise building as per IS 1893(Part1):2002 and IS 875(Part3):1987codes respectively. The building is modeled as 3D space frame using STAAD.pro software. Below are some conclusions.

1. We have compared both the structure with same parameters; results are found as per the graphs indicating that for high-rise structure, and analyze difference between displacement and deflection.
2. A provision of deep spandrels beam in tube in tube structure gives it more strength compared to Farmed structure with X-Bracing and less than framed structure with Shear wall.
3. The lateral Displacement and Deflection of the building studied are reduced by the use of Tube and tube, Shear wall and X-bracing.

REFERENCES:

[1] IS 875 (Part 1, Part 2, Part 3):1987, "Code of practice for design loads (other than earthquake) for buildings and structures", Part 1, Dead loads, Part 2 Live loads, Part 3 Wind loads, Bureau of Indian standards, New Delhi, 1989.
[2] IS 456: 2000, "Plain and reinforced concrete - Code of practice", Bureau of Indian standards, New Delhi, 2000.
[3] IS1893:2002, " Indian Standard Criteria of practice for Earthquake Resistant Design of Structures" Bureau of Indian Standards, New Delhi, India.
[4] P. Agarwal, and M. Shrikhande, "Earthquake Resistant Design of Structures," Prentice-Hall of India, 2006.
[5] S.K. Ahirwar, S.K. Jain, and M. M. Pande, "Earthquake loads on multistory buildings as per IS1893-1984 and IS: 1893-2002: a comparative study," Proceedings of the 14th World Conference on Earthquake Engineering, Beijing, China, October 12-17 (2008).
[6] Dr. S.R. Karve & Dr. V.L. Shah - "Illustrated design of Reinforced concrete Buildings'. Krishna
[7] Kulkarni J. G., Kore P. N., Tanawade S. B. " Seismic Response Of Reinforced Concrete Braced Frames" International Journal of Engineering Research and Applications (IJERA) Vol. 3, Issue 4, Jul-Aug 2013, pp.1047-1053.

[8] Umesh. R .Biradar, Shivraj Mangalgi "Seismic Response of Reinforced Concrete by using different Bracing Systems" International Journal of Research in Engineering and Technology (IJRET) Vol. 3, Issue 09 Sept. 2014 eISSN: 2319-1163 | pISSN: 2321-7308

[9] **S**. I. Khan, Prof. P. O. Modani "Seismic Retrofitting of RC Building by Using Different Bracing Systems" International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 7, July – 2013

[10] Himalee Rahangadle, S. R. Satone, "Design and Analysis of Multistoried Building with Effect of Shear wall", International journal of Engineering Reserch and Applications, Vol 3, Issue 3, pp-223-232, ISSN:2248-9622.

[11] Anand. N., Mightraj. C., Prince Arulraj G., "Seismic Behaviour of RCC shear wall Under Different Soil Conditions", Indian Geotechnical Conference-2012, GEO trendz , IGS Mumbai chapter ant IIT Bombay.

[12] Fazlur R.Khan, "100, Storey John Hancock Centre, Chicago: A Case Study Of The Design Process", Engineering Strcture,1983, Vol.5,January

[13] Staad pro user guide.

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Soil analysis of nearby area of Kaliasote dam Bhopal (M.P.), India

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Abstract : The aim of this study was to analyze the soil nutrients with time on the area of Kaliasote Dam during season 2006-2007. A total of 10 samples were taken from different sites of Bhopal (M.P.) The soil parameters analyzed included the soil pH, electrical conductivity, water holding capacity, total nitrogen, organic carbon and phosphorous. Results showed that soil parameters varied a little during the whole year.

Key words: Soil nutrients, Bhopal, Kaliasote dam, Soil testing , water holding capacity, organic carbon, pH .

Introduction

The term "soil testing" refers to the full range of chemical, physical and biological tests that may be carried out on a submitted sample of soil, though in the present context only nutritional aspects will be considered. Soil testing has a long history in Australian agriculture, and has contributed significantly to the development of modern scientifically-based production systems. More recently, it has become an important, but all too often a misused, tool for turf producers and turf managers. The present paper explains the principles on which good soil testing is based, how the results should be interpreted, and what can realistically be expected of a soil test in turf situations.

Why Test Soil?

Soil testing may be carried out for various purposes. Its main uses include:

1) Assessment of land capability for various forms of agriculture,

2) Identifying and quantifying soil constraints (e.g. salinity),

3) Monitoring of soil fertility levels.

4) Providing guidelines as to the type and amount of fertiliser to be applied for optimum plant growth on the particular site and

5) As a diagnostic tool to help identify reasons for poor plant performance.

Basic Requirements

There are three basic steps that must be followed if meaningful results are to be obtained from soil testing. These are:

1) To take a representative sample of soil for analysis,

2) To analyze the soil using the accepted procedures that have been calibrated against fertiliser experiments in that particular region and

3) To interpret the results using criteria derived from those calibration experiments.

Soil analysis provides information which can be used to improve soil fertility through management. The extent to which soil fertility can be improved depends on the inherent properties of the site – soil texture, mineralogy, slope and climate. Soil structure is also key to plant performance as it affects the ability of plant roots to access available nutrients. Soil analysis is important in organic farming for nutrient management planning (e.g. rotational plans, making best use of manures, fertilizer application), to prevent long term nutritional and health problems (crop and livestock), prevention of pollution and for derogations for use of restricted inputs.

A one-off soil analysis simply provides a snapshot of nutrient availability at a particular time.

Soil analysis should be repeated at regular intervals to identify trends in nutrient availability and adjust nutrient management accordingly. The soil analysis itself is only the first step. Specialist interpretation and recommendations are equally important. Soil analysis should be interpreted in rotational context. Large quantities of nutrients can be exported when selling a single crop, e.g. potash in potatoes. Interpretation should take account of the local conditions and crop; it may not be cost effective to set the same targets for lowland as for upland sites. Use annual soil analysis from one or two representative fields alongside nutrient budgets to track soil fertility changes over time.

Taking a Representative Sample

Sampling is possibly the most neglected step in soil testing, and the greatest source of error in the whole process. To appreciate just how crucial it is to ensure that a representative sample is submitted for analysis, consider the fact that a hectare of soil to a depth of 10 cm weighs roughly 1500 tonnes, while the sample submitted for testing typically amounts to about 0.5 kg (or about 0.00003% of the surface soil on 1 ha – just 1 part in 3 million). If such a tiny fraction is to be representative of the target area, then your sampling needs to be spot on. Otherwise, the test results will be of little or no value.

How do we take a representative sample when the actual soil can vary tremendously across what might look like a uniform area topographically? First, take a minimum of 10-15 soil cores across the defined area in a random pattern, each to the required depth (usually 0-10 cm). These should then be bulked, making up a composite sample from that area. Any parts of the area that are obviously different (e.g. a gully, a low moist depression, an area where the growth is visibly different, or a raised area with shallow soil) should each be sampled separately. These sampling areas should be clearly defined and recorded for re-sampling to establish trends in future years. Bulking areas that are obviously different to save money may simply generate results that are worthless.

Soil samples are usually drawn from the surface 0-10 cm, but it needs to be kept in mind that this may not always be the best approach. For example, in the case of a shallow soil with two distinct layers in the surface 0-10 cm, more meaningful results would be obtained if each layer were sampled separately rather than taking a two-layer composite sample. In other cases, we may want to know something more about what is happening (e.g. salinity levels, pH) at greater depths in the soil, in which case those deeper layers should be sampled separately.

Essential Nutrients : In addition to carbon, hydrogen and oxygen which form the basis of all organic compounds, healthy turf grass requires sufficient amounts of 14 essential nutrient elements. These essential elements are divided into **macronutrients** (required in larger quantities because of their structural roles in the plant) and **micronutrients** (required in smaller quantities because they tend to be involved in regulatory roles in the plant). Nitrogen (N), phosphorus (P) and potassium (K) are the primary macronutrients, and the ones most often in short supply in soils. The elements N, P and K are therefore the most likely to require replenishment in the form of applied fertiliser. Deficiencies of the secondary macronutrients—calcium (Ca), magnesium (Mg) and sulphur (S)—are less commonly encountered. The micronutrients required are iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), molybdenum (Mo), boron (B), chlorine (Cl) and nickel (Ni); but in practice the main micronutrient deficiencies that concern us with turf grasses are iron and manganese.

Any of the above essential elements may also be present in excessive amounts, which can result in toxic effects (e.g. B and Mn). Other elements or groups of elements (e.g. sodium, bicarbonate) may also contribute to the toxic effects seen, for example, in saline or sodic soils. Sodium (Na) has been demonstrated to be an essential element for some plants with a special photosynthetic pathway, but in practice problems result from excessive amounts of Na, not deficiencies.

Results and discussion :

Pre monsoon during 2006-07

S.No	Parameters	SAMPLING STATIONS									
		1	2	3	4	5	6	7	8	9	10
1	Soil pH	5.5	5.8	5.9	5.9	5.6	5.7	5.8	5.4	5.4	5.1
2	Electrical Conductivity	0.17	0.10	0.18	0.19	0.15	0.12	0.18	0.16	0.17	0.16
3	Water holding capacity	36	34	15	20	16	18	16	19	18	16
4	Total Nitrogen	0.10	0.09	0.13	0.16	0.18	0.16	0.14	0.13	0.14	0.16
5	Org. Carbon	0.4	0.8	0.15	1.7	1.2	0.59	1.4	1.5	1.7	1.5
6	Phosphorous	0.17	0.16	0.15	0.18	0.15	0.14	0.16	0.13	0.12	0.18

During Monsoon 2006-07

S.No	Parameters	SAMPLING STATIONS									
		1	2	3	4	5	6	7	8	9	10
1	Soil pH	5.3	5.6	5.7	5.7	5.4	5.5	5.6	5.2	5.2	4.9
2	Electrical Conductivity	0.18	0.18	0.19	0.20	0.16	0.14	0.19	0.17	0.18	0.17
3	Water holding capacity	33	31	14	18	15	19	15	17	17	15
4	Total Nitrogen	0.16	0.13	0.12	0.15	0.17	0.17	0.13	0.12	0.13	0.15
5	Org. Carbon	0.39	0.9	0.13	1.6	1.3	0.63	1.3	1.4	1.6	1.4
6	Phosphorous	0.16	0.15	0.14	0.17	0.14	0.15	0.15	0.12	0.12	0.17

Post Monsoon during 2006-07

S.No	Parameters	SAMPLING STATIONS									
		1	2	3	4	5	6	7	8	9	10
1	Soil pH	5.4	5.7	5.8	5.8	5.5	5.6	5.7	5.3	5.4	5.0
2	Electrical Conductivity	0.20	0.21	0.23	0.22	0.21	0.19	0.21	0.19	0.18	0.17
3	Water holding capacity	34	32	14	19	15	17	15	18	17	15
4	Total Nitrogen	0.15	0.15	0.13	0.16	0.17	0.16	0.14	0.13	0.14	0.16
5	Org. Carbon	0.32	0.7	0.1	1.6	1.2	0.60	1.4	1.5	1.6	1.5
6	Phosphorous	0.18	0.18	0.15	0.17	0.15	0.14	0.16	0.13	0.12	0.17

Sampling Stations

1. Near Guest House
2. At down site of Kamla Nagar
3. At downhill towards MANIT
4. At sluice gate
5. Near temple site
6. Near spill of Kaliasote dam
7. Near middle centre of reservoir
8. Near Barkheri Khurd
9. Near Bhoj University site
10. Near spill of reservoir

REFERENCES:

[1] Anon. (2000). Fertiliser recommendation for agricultural and horticultural crops (RB209). HMSO.

[2] Balzer F. M. (2000). Ganzheitliche standortgemaesse dynamische Bodenbeurteilung. 2nd ed. Verlag Ehrenfreid-Pfeiffer, Ellenberg.

[3] Baker, Dale E., and Amacher, M.C. (1981). The development and interpretation of a diagnostic soil-testing program. *Pennsylvania State University Agricultural Experiment Station Bulletin* 826. State College, PA.

[4] Baker, Dennis E., and Eldershaw, V.J. (1993). Interpreting soil analyses – for agricultural land use in Queensland. *DPI Project Report Series QO93014*. Department of Primary Industries, Brisbane, Qld.

[5] Bruce, R.C., and Rayment, G.E. (1982). Analytical methods and interpretations used by the Agricultural Chemistry Branch for soil and land use surveys. *DPI Bulletin QB82004*. Department of Primary Industries, Brisbane, Qld.

[6] Carrow, R.N., Stowell, L., Gelernter, W., Davis, S., Duncan, R.R., and Skorulski, J. (2003). Clarifying soil testing: I. Saturated paste and dilute extracts. *Golf Course Management* **71**(9):81-85.

[7] Carrow, R.N., Waddington, D.V., and Rieke, P.E. (2001). *Turfgrass Soil Fertility and Chemical Problems: Assessment and Management*, Ann Arbor Press, Chelsea, MI.

[8] Graham E.R. (1959) An explanation of theory and methods of soil testing. *Missouri Agricultural Research Station Bulletin* 734.

[9] Haby, V.A., Russelle, M.P., and Skogley, E.O. (1990). Testing soils for potassium, calcium and magnesium. ***In*** R.L. Westerman (ed.). *Soil Testing and Plant Analysis*, 3rd Edition. Soil Science Society of America Book Series No. 3. SSSA, Madison, WI.

[10] Piper, C.S. (1942). *Soil and Plant Analysis.* University of Adelaide, South Australia.

[11] Peverill, K.I., Sparrow, L.A., and Reuter, D.J. (Eds.) (1999). *Soil Analysis: An Interpretation Manual*, CSIRO Publishing, Collingwood, Victoria.

[12] Rayment, G.E., and Higginson, F.R. (1992). *Australian Laboratory Handbook of Soil and Water Chemical Methods.* Australian Soil and Land Survey Handbooks Vol. 3. Inkata Press, Sydney, NSW.

[13] Reuter, D.J., Robinson, J.B., and Dutkiewicz, C. (Eds.) (1997). *Plant Analysis: An Interpretation Manual* (Second Edition), CSIRO Publishing, Collingwood, Victoria.

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DEFLATE COMPRESSION ALGORITHM

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Abstract— This specification defines a lossless compressed data format that compresses data using a combination of the LZ77 algorithm and Huffman coding, with efficiency comparable to the best currently available general-purpose compression methods. The data can be produced or consumed, even for an arbitrarily long sequentially presented input data stream, using only an a priori bounded amount of intermediate storage. The format can be implemented readily in a manner not covered by patents.

Keywords— LZ77, Huffman Coding, Deflate, GZip, Zlib, Compression, Decompression, Lossy Compression, Lossless Compression

I. INTRODUCTION

The DEFLATE compressed data format consists of a series of blocks, corresponding to successive blocks of input data. Each block is compressed using a combination of the LZ77 algorithm and Huffman coding . The LZ77 algorithm finds repeated substrings and replaces them with backward references (relative distance offsets). The LZ77 algorithm can use a reference to a duplicated string occurring in the same or previous blocks, up to 32K input bytes back.

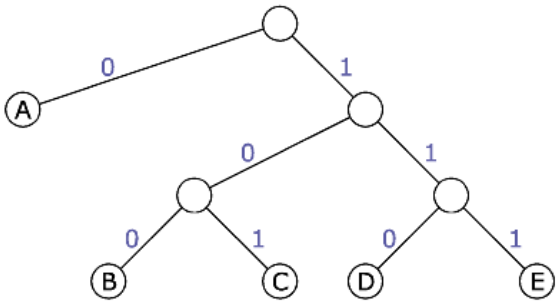
II. PURPOSED SYSTEM

HUFFMAN CODE

The algorithm as described by David Huffman assigns every symbol to a leaf node of a binary code tree. These nodes are weighted by the number of occurences of the corresponding symbol called frequency or cost.

The tree structure results from combining the nodes step-by-step until all of them are embedded in a root tree. The algorithm always combines the two nodes providing the lowest frequency in a bottom up procedure. The new interior nodes gets the sum of frequencies of both child nodes.

Code Tree according to Huffman



The branches of the tree represent the binary values 0 and 1 according to the rules for common prefix-free code trees. The path from the root tree to the corresponding leaf node defines the particluar code word

Huffman codes are part of several data formats as ZIP, GZIP and JPEG. Normally the coding is preceded by procedures adapted to the particular contents. For example the wide-spread DEFLATE algorithm as used in GZIP or ZIP previously processes the dictionary based LZ77 compression.

LEMPEL-ZIV-77 (LZ77)

Developement:

Jacob Ziv and Abraham Lempel had introduced a simple and efficient compression method published in their article "A Universal Algorithm for Sequential Data Compression". This algorithm is referred to as LZ77 in honour to the authors and the publishing date 1977.

Fundamentals:

LZ77 is a dictionary based algorithm that addresses byte sequences from former contents instead of the original data. In general only one coding scheme exists, all data will be coded in the same form:

- Address to already coded contents
- Sequence length
- First deviating symbol

If no identical byte sequence is available from former contents, the address 0, the sequence length 0 and the new symbol will be coded.

Example "abracadabra":

	Addr.	Length	deviating Symbol
abracadabra	0	0	'a'
a bracadabra	0	0	'b'
ab racadabra	0	0	'r'
abr acadabra	3	1	'c'
abrac adabra	2	1	'd'
abracad abra	7	4	"

Because each byte sequence is extended by the first symbol deviating from the former contents, the set of already used symbols will continuously grow. No additional coding scheme is necessary. This allows an easy implementation with minimum requirements to the encoder and decoder.

Restrictions:

To keep runtime and buffering capacity in an acceptable range, the addressing must be limited to a certain maximum. Contents exceeding this range will not be regarded for coding and will not be covered by the size of the addressing pointer.

Compression Efficiency:

The achievable compression rate is only depending on repeating sequences. Other types of redundancy like an unequal probability distribution of the set of symbols cannot be reduced. For that reason the compression of a pure LZ77 implementation is relatively low.

A significant better compression rate can be obtained by combining LZ77 with an additional entropy coding algorithm. An example would be Huffman or Shannon-Fano coding. The wide-spread Deflate compression method (e.g. for GZIP or ZIP) uses Huffman codes for instance.

Compression algorithm (deflate)

The deflation algorithm used by gzip (also zip and zlib) is a variation of LZ77 (Lempel-Ziv 1977, see reference below). It finds duplicated strings in the input data. The second occurrence of a string is replaced by a pointer to the previous string, in the form of a pair (distance,length). Distances are limited to 32K bytes, and lengths are limited to 258 bytes. When a string does not occur anywhere in the previous 32K bytes, it is emitted as a sequence of literal bytes. (In this description, `string' must be taken as an arbitrary sequence of bytes, and is not restricted to printable characters.)

Literals or match lengths are compressed with one Huffman tree, and match distances are compressed with another tree. The trees are stored in a compact form at the start of each block. The blocks can have any size (except that the compressed data for one block must fit in available memory). A block is terminated when deflate() determines that it would be useful to start another block with fresh trees. (This is somewhat similar to the behavior of LZW-based _compress_.)

Duplicated strings are found using a hash table. All input strings of length 3 are inserted in the hash table. A hash index is computed for the next 3 bytes. If the hash chain for this index is not empty, all strings in the chain are compared with the current input string, and the longest match is selected.

The hash chains are searched starting with the most recent strings, to favor small distances and thus take advantage of the Huffman encoding. The hash chains are singly linked. There are no deletions from the hash chains, the algorithm simply discards matches that are too old.

To avoid a worst-case situation, very long hash chains are arbitrarily truncated at a certain length, determined by a runtime option (level parameter of deflateInit). So deflate() does not always find the longest possible match but generally finds a match which is long enough.

Deflate() also defers the selection of matches with a lazy evaluation mechanism. After a match of length N has been found, deflate() searches for a longer match at the next input byte. If a longer match is found, the previous match is truncated to a length of one (thus producing a single literal byte) and the process of lazy evaluation begins again. Otherwise, the original match is kept, and the next match search is attempted only N steps later.

The lazy match evaluation is also subject to a runtime parameter. If the current match is long enough, deflate() reduces the search for a longer match, thus speeding up the whole process. If compression ratio is more important than speed, deflate() attempts a complete second search even if the first match is already long enough.

The lazy match evaluation is not performed for the fastest compression modes (level parameter 1 to 3). For these fast modes, new strings are inserted in the hash table only when no match was found, or when the match is not too long. This degrades the compression ratio but saves time since there are both fewer insertions and fewer searches.

Decompression algorithm (inflate)

The real question is, given a Huffman tree, how to decode fast. The most important realization is that shorter codes are much more common than longer codes, so pay attention to decoding the short codes fast, and let the long codes take longer to decode.

inflate() sets up a first level table that covers some number of bits of input less than the length of longest code. It gets that many bits from the stream, and looks it up in the table. The table will tell if the next code is that many bits or less and how many, and if it is, it will tell the value, else it will point to the next level table for which inflate() grabs more bits and tries to decode a longer code.

How many bits to make the first lookup is a trade off between the time it takes to decode and the time it takes to build the table. If building the table took no time (and if you had infinite memory), then there would only be a first level table to cover all the way to the longest code. However, building the table ends up taking a lot longer for more bits since short codes are replicated many times in such a table. What inflate() does is simply to make the number of bits in the first table a variable, and set it for the maximum speed.

inflate() sends new trees relatively often, so it is possibly set for a smaller first level table than an application that has only one tree for all the data. For inflate, which has 286 possible codes for the literal/length tree, the size of the first table is nine bits. Also the distance trees have 30 possible values, and the size of the first table is six bits. Note that for each of those cases, the table ended up one bit longer than the ``average'' code length, i.e. the code length of an approximately flat code which would be a little more than eight bits for 286 symbols and a little less than five bits for 30 symbols. It would be interesting to see if optimizing the first level table for other applications gave values within a bit or two of the flat code size.

Ok, you want to know what this cleverly obfuscated inflate tree actually looks like. You are correct that it's not a Huffman tree. It is simply a lookup table for the first, let's say, nine bits of a Huffman symbol. The symbol could be as short as one bit or as long as 15 bits. If a particular symbol is shorter than nine bits, then that symbol's translation is duplicated in all those entries that start with that symbol's bits. For example, if the symbol is four bits, then it's duplicated 32 times in a nine-bit table. If a symbol is nine bits long, it appears in the table once.

If the symbol is longer than nine bits, then that entry in the table points to another similar table for the remaining bits. Again, there are duplicated entries as needed. The idea is that most of the time the symbol will be short and there will only be one table look up. (That's whole idea behind data compression in the first place.) For the less frequent long symbols, there will be two lookups. If you had a compression method with really long symbols, you could have as many levels of lookups as is efficient. For inflate, two is enough.

So a table entry either points to another table (in which case nine bits in the above example are gobbled), or it contains the translation for the symbol and the number of bits to gobble. Then you start again with the next ungobbled bit.

You may wonder: why not just have one lookup table for how ever many bits the longest symbol is? The reason is that if you do that, you end up spending more time filling in duplicate symbol entries than you do actually decoding. At least for deflate's output that generates new trees every several 10's of kbytes. You can imagine that filling in a 2^15 entry table for a 15-bit code would take too long if you're only decoding several thousand symbols. At the other extreme, you could make a new table for every bit in the code. In fact,that's essentially a Huffman tree. But then you spend two much time traversing the tree while decoding, even for short symbols.

So the number of bits for the first lookup table is a trade of the time to fill out the table vs. the time spent looking at the second level and above of the table.

Here is an example, scaled down:

The code being decoded, with 10 symbols, from 1 to 6 bits long:

A: 0
B: 10
C: 1100
D: 11010
E: 11011
F: 11100
G: 11101
H: 11110
I: 111110
J: 111111

Let's make the first table three bits long (eight entries):

000: A,1
001: A,1
010: A,1
011: A,1

100: B,2
101: B,2
110: -> table X (gobble 3 bits)
111: -> table Y (gobble 3 bits)

Each entry is what the bits decode to and how many bits that is, i.e. how many bits to gobble. Or the entry points to another table, with the number of bits to gobble implicit in the size of the table.

Table X is two bits long since the longest code starting with 110 is five bits long:

00: C,1
01: C,1
10: D,2
11: E,2

Table Y is three bits long since the longest code starting with 111 is six bits long:

000: F,2
001: F,2
010: G,2
011: G,2
100: H,2
101: H,2
110: I,3
111: J,3

So what we have here are three tables with a total of 20 entries that had to be constructed. That's compared to 64 entries for a single table. Or compared to 16 entries for a Huffman tree (six two entry tables and one four entry table). Assuming that the code ideally represents the probability of the symbols, it takes on the average 1.25 lookups per symbol. That's compared to one lookup for the single table, or 1.66 lookups per symbol for the Huffman tree.

There, I think that gives you a picture of what's going on. For inflate, the meaning of a particular symbol is often more than just a letter. It can be a byte (a "literal"), or it can be either a length or a distance which indicates a base value and a number of bits to fetch after the code that is added to the base value. Or it might be the special end-of-block code. The data structures created in inftrees.c try to encode all that information compactly in the tables.

III. COMPARITIVE STUDY

A comparative study was performed between Deflate compression algorithms to that of Lempel-Ziv-Welch (LZW) data compression algorithm and the results showed that the deflate algorithm is efficient in both compression rate as well as the speed at which the compression is done.

Table 1: Compression techniques comparison

Data File Size (bytes)	Compression using		Compression Ratio using	
	Deflate (bytes)	LZW (bytes)	Deflate (%)	LZW (%)
17768	723	14740	95.93	17.04
53298	1135	29416	97.87	44.81
94038	24771	89956	73.66	4.34
99734	1637	43064	98.36	56.82
120054	1756	4780	98.54	96.02
186658	47403	156336	74.60	16.24

Below shown graph illustrates the comparison of compression ratio of Deflate algorithm to that of LZW algorithm.

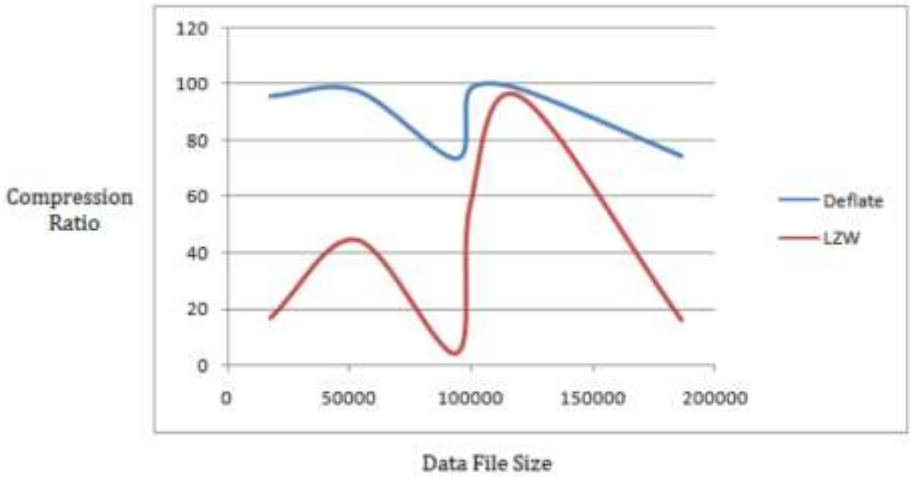


FIG 5: COMPARISON GRAPH

X-AXIS -> DATA FILES SIZE

Y-AXIS -> COMPRESSION RATIO

IV. ADVANTAGES

Compression of files offer many advantages. When compressed, the quantity of bits used to store the information is reduced. Files that are smaller in size will result in shorter transmission times when they are transferred on the Internet. Compressed files also take

up less storage space. File compression can zip up several small files into a single file for more convenient email transmission. As compression is a mathematically intense process, it may be a time consuming process, especially when there is a large number of files involved. Some compression algorithms also offer varying levels of compression, with the higher levels achieving a smaller file size but taking up an even longer amount of compression time. It is a system intensive process that takes up valuable resources that can sometimes result in "Out of Memory" errors. With so many compression algorithm variants, a user downloading a compressed file may not have the necessary program to un-compress it.

V. CONCLUSION

In conclusion, data compression is very important in the computing world and it is commonly used by many applications, including the suite of SyncBack programs. In providing a brief overview on how compression works in general it is hoped this article allows users of data compression to weigh the advantages and disadvantages when working with it.

REFERENCES:

[1] Sharma, M.: 'Compression Using Huffman Coding'.International Journal of Computer Science and Network Security, VOL.10 No.5, May 2010.
[2] Huffman, D. A., "A Method for the Construction of Minimum Redundancy Codes", Proceedings of the Institute of Radio Engineers, September 1952, Volume 40, Number 9, pp. 1098-1101.
[3] Ziv J., Lempel A., "A Universal Algorithm for Sequential Data Compression", IEEE Transactions on Information Theory, Vol. 23, No. 3, pp. 337-343.
[4] Howard, P.G.; Vitter, J.S. Arithmetic coding for data , compression Proceedings of the IEEE, Volume: 82 , , Issue: 6 , June 1994
[5] Liu Bin, Tian Jinwen, Zhang Tianxu, An Image Lossless Compression Algorithm Based on Integer Haar Wavelet Transform and DPCM, Journal of Huazhong University of Science & Technology, Sep. 1999.
[6] P. Deutsch, DEFLATE Compressed Data Format, Aladdin Enterprises Category: Informational May 1996.
[7] Huffman, D. A., "A Method for the Construction of Minimum Redundancy Codes", Proceedings of the Institute of Radio Engineers, September 1952, Volume 40, Number 9, pp. 1098-1101.
[8] Jagadish H. Pujar, Lohit M. Kadlaskar. "A New Lossless Method Of Image Compression And Decompression Using Huffman Coding Techniques", Journal Of Theoretical And Applied Information Technology, Vol. 2, No. 3, Pp 18-22.
[9] Detlev Marpe, Gabi Blättermann, Jens Ricke, and Peter Maab. "A Two-Layered Wavelet-Based Algorithm for Efficient Lossless and Lossy Image Compression", IEEE Transactions On Circuits And Systems For Video Technology, Vol. 10, No. 7, Pp 1094-1102, 2000.
[10] R M Capocelli, R Giancarlo and I J Taneja, "Bounds on the redundancy of Huffman codes", IEEE Transactions on Information Theory, IT-32, pp 854-857, 1986.
[11] A Turpin and A Moffat, "Housekeeping for Prefix Coding", IEEE Transactions on Communications, 48, pp.622- 628, 2000.
[12] D. Huffman, "A method for the construction of minimum redundancy codes", Proc. Of the Institute of Radio Engineers, Vol 40, pp 1098-1101, 1952

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Survey on Round Robin and Shortest Job First for Cloud Load Balancing

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Abstract— Load Balancing is play import role in cloud computing related to performance. Cloud computing efficiency and performance depend of Load Balancer. Two type of load balancer used in cloud computing first is static load balancer in which number of recourse, cloudlet, VM, and datacenter are fixed, Second is dynamic load balancer in which number of recourse, cloudlet, VM, and datacenter are changed at run time. There are many loads balancing algorithm such as FCFS, Round Robin and Priority based. In This paper we used combination of Round Robin and Shortest job First algorithm. This combination improves efficiency and performance of load balancing in cloud computing environment. We implement proposed algorithm with the help of CloudSim 3.0 under VM scheduling policies.

Keywords— **Virtual** Machine, CloudSim, Load Balancing, Cloudlet, Task Scheduling, Round Robin, Shortest Job First

INTRODUCTION—

Cloud computing is surely an attracting technology in the field of computer science. In Gartner's report [1], it says how the cloud will bring changes towards the IT industry. The cloud can be changing our life by providing users with new types of services. Users get service from the cloud without paying attention to the details [2]. NIST gave some sort of definition of cloud computing being a model for which allows ubiquitous, convenient, on-demand network usage of a shared share of configurable computing resources (e. gray the gadget guy., networks, servers, storage space, applications, and services) which can be rapidly provisioned along with released with minimum management effort or service agency interaction[3]. More and more people look closely at cloud computing [4, 5]. Cloud computing can be efficient and scalable yet maintaining the stability of processing countless jobs in the cloud computing environment is usually a very complex dilemma with load managing receiving much awareness for researchers.

Considering that the job arrival pattern is just not predictable and the capacities of each and every node in your cloud differ, regarding load balancing difficulty, workload control is important to improve system performance and gaze after stability. Load balancing schemes based on whether the system dynamics are very important can be possibly static and dynamic [6]. Static schemes tend not to use the system information and therefore are less complex whilst dynamic schemes provide additional costs to the system but can transform as the system status changes. A dynamic scheme is utilized here for it is flexibility. The model includes a main controller and balancers to collect and analyze the information. So, the dynamic control has little influence around the other working nodes. The system status then gives a basis for deciding on the best load balancing.

Layers of cloud computing—

Cloud computing can be viewed as a collection of services, which can be presented as a layered cloud computing architecture, as shown in fig.. The services offered through cloud computing usually include IT services referred as to SaaS (Software-as-a-Service) which is shown on top of the stack. SaaS allows users to run applications remotely from the cloud.

Infrastructure-as-a-Service (IaaS) refers to computing resources as a service. This includes virtualized computers with guaranteed processing power and reserved bandwidth for storage and Internet access.

The data-Storage-as-a-service (dSaaS) provides storage that the consumer is used including bandwidth requirements for the storage.

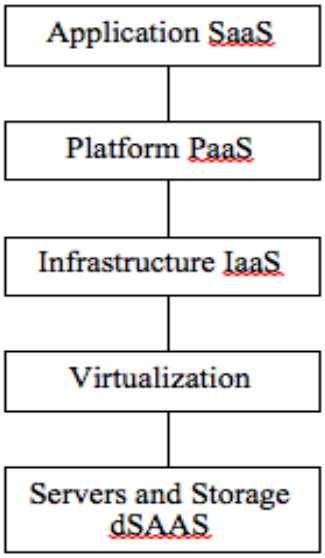

Figure1. Layered architecture of cloud computing

An example of platform-as-aService (Paas) cloud computing is shown in fig. the PaaS provides integrated development environment (IDE) including data security, backup and recovery, application hosting and scalable architecture.

According to Chappell there are three categories of cloud services, as illustrated in fig. Fig 2 shows the cloud services SaaS, where the entire application is running in the cloud. The client contains a simple browser to access the application. A well- known example of SaaS is salesfoorce.com.

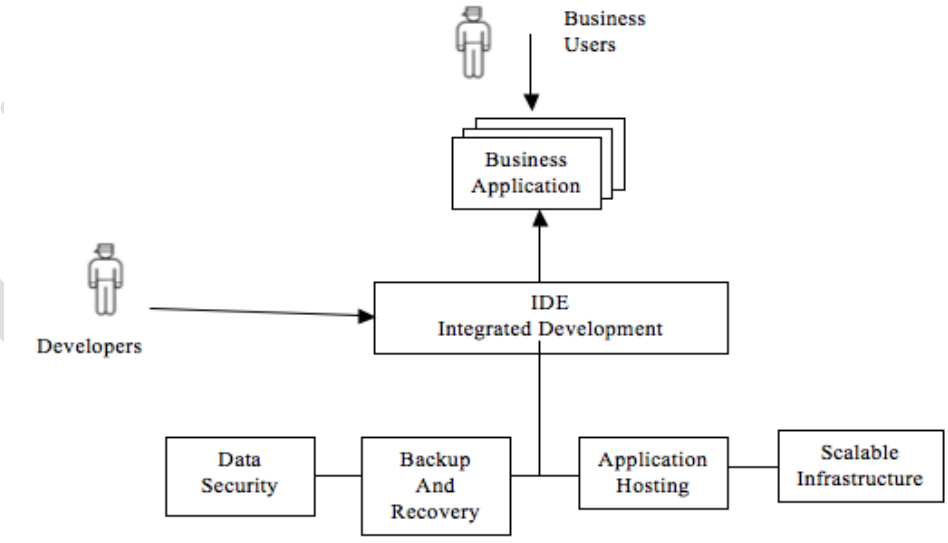

Figure 2. The concept of Platform-as-a-Service.

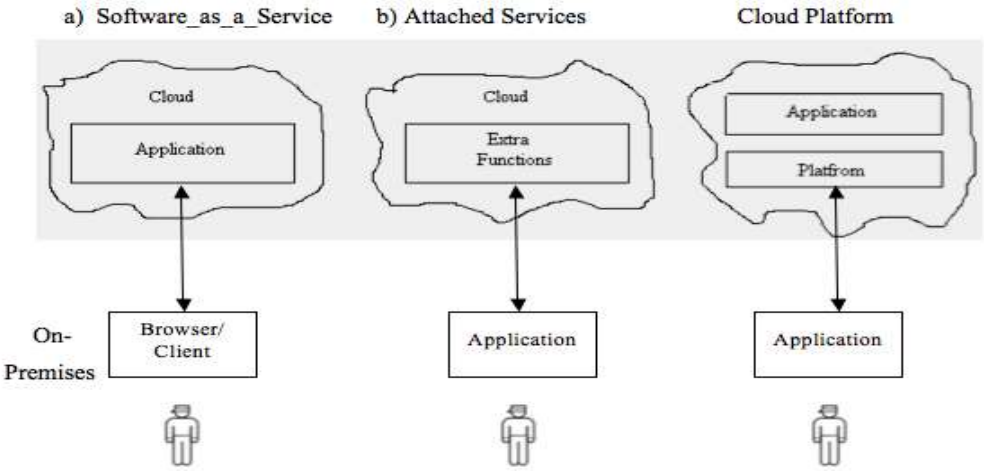

Figure 3. Type of CloudServices.

Fig. 3 illustrates other types of cloud service, where the application runs on the client; however it accesses useful function and services provided in the cloud. An example of this type of cloud services on the desktop is apple's iTunes.
Many load balancing algorithms, such as Round Robin, Both equally Spread Current Execution Algorithm, and Colony algorithm. Nishant et al. used the ant colony optimization method in nodes load balancing. Randlesgave any compared analysis involving some algorithms with cloud computing by simply checking the overall performance time and cost. They concluded that this ESCE algorithm in addition to throttled algorithm is greater than the Round Robin the boy wonder algorithm. Some of the classical load balancing methods act like the allocation method within the operating system, one example is, the Round Robin algorithm and also the First Come 1st Served (FCFS) rules. The Round Robin algorithm is used here because it truly is fairly simple.

Literature Review—

Two important problems proposed by Xiaoming Nan et al. [14] are: to minimize the response time and minimize the resource cost. Categorize resources on the basis of two pricing schemes: the Reservation Scheme and the On-Demand Scheme; Charges in the Reservation Scheme being lower than the latter. The authors in [14] thus try to optimize the cost by selecting the best type and no. of resources depending on the basis of above price schemes. Also the author tries to minimize the response time by proposing an Optimal Analytical solution for it. The Resource Cost Minimization problem is a NP-Hard problem and thus a greedy algorithm is proposed for it which gives a close to optimal solution.

C.H.Hsu and T.L.Chen et al. [13] categorize various services in different QoS classes. The incoming requests are then processed on the basis of these QoS classes. The scheduling of these requests is done in the FCFS and priority method with the conclusion of the priority method outperforming the FCFS.

Jaspreet Kauret al. [8] divides the cloud service into three consecutive phases: schedule, computation and transmission. Improper resource assignment in the phases will result in resource wastage and decreased QoE/QoS. Authors in proposed the concept of optimizing the resource allocation based on the concept of single class service case and the multiple-class service case in the queuing model. Authors in further refine the concept studied in by embedding priority service scheme in the basic queuing model studied in . In each case authors in [andformulate and solve the resource allocation optimization problems to minimize the mean response time and minimize the resource cost, respectively

Problem Domain—

In Current Scenario, with an environment of cloud the task is divided and disseminated into same size of small jobs i.e. Cloudlets. These Cloudlets as well as Virtual Machines are scheduled according to the various scheduling policy for e.g. FCFS, Round Robin etc. Generally in Cloud Computing scenario user submit the task to be performed / executed. Cloud Coordinator (CC) [2] divides the task

into equal sized cloudlets and passes it to Data Center (DC).Normally it takes a lot of time because the cloudlets are processed one at a time in FCFS manner as and when they reach to VM. VM executes the cloudlets present in the queue as they reach the VM's. Basically this default job scheduled policy is extremely Time- Consuming, Cost insensitive and inefficient.

Existing System—

Round Robin Algorithm for Load Balancing:

1. *Creates same size of Cloudlets.*
2. *CC divides the assigned Cloud task into same size of cloudlets.*
3. *Create Broker and User assigns the task to Cloud Coordinator (CC).*
4. *CC sends cloudlets to VMM and VMM sends the list of the needed resources to the RsP.*
5. *Request for the execution of the Cloudlet is sent to the VM by VMM from the Host.*
6. *Cloudlet scheduling is done in VM according to FCFS scheduling policy.*
7. *Sends the executed job as Cloudlets in a wrap file to the VMM.*
8. *VMM further passes the executed Cloudlets as wrapped file format to CC.*
9. *CC combines all executed Cloudlets in wrapped file form combine to form the whole task.*
10. *CC sends the executed task in authenticated file format to the user/client.*
11. *PRINT the Result.*

Figure 4. Round Robin algorithm

FCFS Algorithm for Load Balancing:

1. *Creates same size of Cloudlets.*
2. *CC divides the assigned Cloud task into same size of cloudlets.*
3. *Create DataCenters(DC).*
4. *Create Broker and User assigns the task to Cloud Co-ordinator(CC).*
5. *CC sends the cloudlets to VMM and VMM sends the list of the needed resources to the RsP.*
6. *RsP requests the resources from RP.*
7. *RP provides the access to use resources of DC.*
8. *RsP grants the access to VMM.*
9. *VMM creates the VM on the basis of resources and parameters.*
10. *VMM sends the cloudlet ID list to VM by BindCloudletToVmId ().*
11. *VMM sends the actual cloudlet to VM.*
12. *VM matches the Cloudlet ID with the sequence of Cloudlet list.*
13. *If both ID matches then, VM sends the acknowledgement to VMM. Or, VM sends Retransmitmessage or shows SUCCESS.*
14. *Request for the execution of the Cloudlet is sent to the VM by VMM from the Host.*
15. *Cloudlet scheduling is done in VM according to FCFS scheduling policy.*
16. *VM sends the executed job as Cloudlets in a wrap file to the VMM.*
17. *VMM further passes the executed Cloudlets as wrapped file format to CC.*
18. *CC combines all executed Cloudlets in wrapped file form combine to form the whole task.*
19. *CC sends the executed task in authenticated file format to the user/client.*
20. *PRINT the Result.*

Figure 5. First Come First Serve algorithm

CloudSim—

CloudSim [12] is the many efficient tool you can use with regard to modeling regarding Cloud. during your current lifecycle of an Cloud, CloudSim allows VMs for you to be managed coming from hosts that will inside turn are usually managed by datacenters.

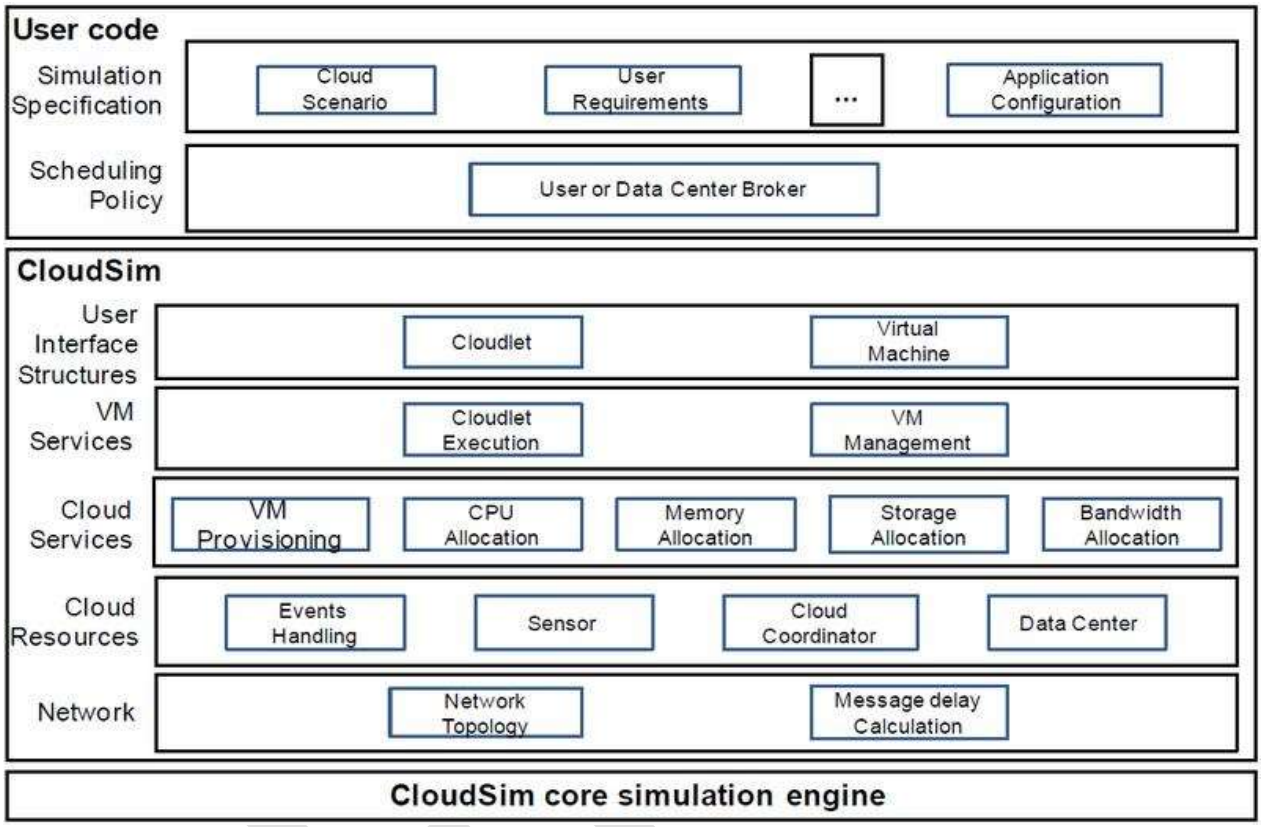

Figure 6. CloudSim Architecture

CloudSim offers architecture inside four uncomplicated entities. These types of entities offer consumer to set-up the basic cloud computing environment as well as measure your effectiveness involving fill up balancing algorithms. Datacenters entity features the responsibility of providing Infrastructure level solutions for the Cloud Users. They act as a home to help a lot of Host Entities or maybe a lot of instances hosts' entities aggregate to help application form the solitary Datacenter entity .Hosts with Cloud are usually Physical Servers .

Proposed System—

We will implement combination of load balancing algorithms like Round-Robin and less resources first. And will produce better result with existing system because in round robin algorithm not consider priority factor or less resources first at the time of load balancing. And also compare proposed algorithm with existing load balancing algorithm like FCFS, Round Robin and central queue.

Our aim is implement FCFS, Round Robin and Round Robin with Priority scheduling policy for VM using Cloudsim3.0.we will also implement combination of load balancing algorithms like Round-Robin with priority and less resources first . This synopsis aims towards the establishment of performance qualitative analysis on existing VM load balancing algorithm and then implemented in CloudSim and java language.

We also consider the following parameter in our Result

- User
- Cloudlet

- Datacenter
- Virtual Machine Manager (VMM)
- Virtual Machine (VM)

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CONCLUSION

Proposed algorithm will improve performance and efficiency of Datacenters. Cloud simulation will be used effective cloud simulator. This approach can be easily implemented in the cloud simulator. A virtual machine is a virtual form of computer hardware within software. Virtual machine is a software implementation that executes programs as if they were actual physical machines. We also give the detailed review on existing scheduling algorithm. The proposed Round Robin VM Load Balancing and existing Round Robin algorithm implemented Java language for implementing VM scheduling algorithm in CloudSim toolkit. Assuming the application is deployed in one datacenters having virtual machine.

REFERENCES:

[1] Soumen Santra and Dr. Kalyani Mali "A New Approach to Survey on Load Balancing in VM in Cloud Computing: using CloudSim" IEEE International Conference on Computer, Communication and Control (IC4-2015).
[2] RituKapur "A Cost Effective approach for Resource Scheduling in Cloud Computing"IEEE International Conference on Computer, Communication and Control (IC4-2015).
[3] Kaur s and SupriyaKinger, "Analysis of Load Balancing Techniques in Cloud Computing", International Journal of Computers & Technology, volume 4, No. 2, March- April 2013, pg 737- 741.
[4] Poojaand Mishra, "Analysis of Variants in Round Robin Algorithms for Load Balancing in Cloud Computing", (IJCSIT) International Journals of Computer Science and Information Technologies, Volume 4 (3), 2013, pg. no. 416- 419.
[5] KunalMahurkar, Shraddha Katore and SurajBhaisade, Pratikawale, "Reducing Cost of Provisioning in Cloud Computing", International Journal of Advance in Computer Science and Cloud Computing, Volume- 1, Issue- 2, nov.- 2013, pg. 6- 8.
[6] Dr. RakeshRathi1, Vaishali Sharma and Sumit Kumar Bole, "Round Robin Data Center Selection in Single Region for Service Proximity Service Broker in Cloud Analyst" , International Journal of Computer & Technology, Volume 4 no. 2, March- April 2013, pg. no. 254- 260.
[7] BhatiyaWickremansinghe, Rodrigo N. Calheiros and Dr. RajkumarBuyya, "CloudAnalyst: A CloudSim- based Visul Modeller for Analysing Cloud Computing Environments and Applications", IEEE Computer Society, 2010, pp. 446-452.
[8] Jaspreet Kaur, "Comparison of load balancing algorithm in a Cloud", International Journal of Engineering Research and Applications (IJERA), vol. 2, Issue 3, May- June 2012, pp. 1169- 1173.
[9] Syed Tauhid Zuheri1, Tamanna Shamrin2 and Rusia Tanbin3, Firoj Mahmud4, "An Efficient Load Balancing Approach in Cloud Environment by using Round Robin Algorithm", International Journal of Artificial and Mechatronics, volume 1, issue 5, 2013, pp 96-99.
[10] B. Santosh Kumar1 and Dr. Latha Parthiban2, "An Implementation of Load Balancing Policy for Virtual Machines Associated with a Data Centre", International Journal of Computer Science & Engineering Technology (IJCSET), volume 5 no. 03, March 2014, pp. 253- 261.
[11] Sonika Matele1, Dr. K James2 and Navneet Singh3, "A Study of Load Balancing Issue Among Multifarious Issues of Cloud Computing Environment", International Journals of Emerging Technolog Computational and Applied Science (IJETCAS), volume 13- 142, 2013, pg. 236- 241.
[12] J.Li, M. Qiu and X.Qin, "Feedback Dynamic Algorithms for Preempt able Job Scheduling in Cloud Systems", IEEE, 2010.
[13] C.H.Hsu and T.L.Chen, "Adaptive Scheduling based on QoS in Heterogeneous Environment", IEEE, 2010.
[14] X.Nan,Y.He,andL.Guan,"OptimizationofWorkloadSchedulingfor Multimedia Cloud Computing", in theProc. IEEE International Symposiumon Circuits and Systems (ISCAS), pp. 1–4, 2013.
[15] X. Nan, Y. He, and L. Guan, "Towards Optimal Resource Allocation For Diffentiated Multimedia Services in Cloud Computing Environment", in theProc. IEEE International Conferenceon Acoustic, Speech and Signal Processing (ICASSP), pp. 1–5, 2014.
[16] B. R. Raman, R. Calheiros and R.N., "Modeling and Simulation of Scalable Cloud Environment and the CloudSim Toolkit: Challenges and Opportunities'', IEEE publication, pp. 1-11, 2009. October, 2014.
[17] X. Nan, Y. He, and L. Guan, "Optimal resource allocation for multimedia cloud based on queuing model", in theProc.IEEE International Workshopon Multimedia Signal Processing (MMSP), pp. 1–6, 2011.

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The Role of Algae in Bioremediation of Textile Effluent

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Abstract—Dyes present in the effluent of textile industries are recalcitrant molecules difficult to be degraded biologically. The textile industry accounts for two thirds of the total dyestuff market. During dyeing process approximately 10-15% of the dyes used are released into the wastewater. In the present study Potential of Spirogyra sp. and Oscillatoria sp. for biodegradation of blue dye and red dye were investigated. Degradation was assayed using decolorization study, physico-chemical analysis and products formed during degradation were characterized through FTIR spectra as well as UV Spectrophotometry analysis. This present study was also including study of phytotoxicity and toxicity assay of untreated and treated dye effluents.

Keywords— Blue dye; FTIR analysis; *Oscillatoria sp.*; Physico-chemical parameters; Red dye; *Spirogyra sp.*;

INTRODUCTION

Dyes are the synthetic chemical compounds having aromatic structure and recalcitrant to biodegradation due to xenobiotic nature. Dyes are toxic to aquatic flora and fauna as they reduce the light penetration and obstruct photosynthesis process in aquatic system. Synthetic dyes are one of the toxic pollutants released by various industrial sources such as textile and dyeing industries, paper, paint, plastics, petroleum, electroplating and cosmetic industries.[27] It is estimated that total colorant production in world is 800,000 tons per year and at least 15% of the dyestuff is released into the environment through wastes. Millions of untreated effluents are discharged from textile industries which directly mixes into rivers and lakes and alters the pH, BOD, COD and colour of the water resources.[26] Various physico-chemical methods such as flocculation, sedimentation, precipitation, coagulation and reverse osmosis are commonly used for the treatment of textile dyeing effluents, but these conventional methods are generally cost effective, less efficient and disposal of the secondary pollutants are difficult. Biotechnological approaches are suggested by scientists and industrialists to remove the pollutants from wastewater using microorganisms often in combination with physicochemical processes. Eco-friendly microbial decolourization and detoxification has emerged as a viable attractive alternative to these physicochemical methods.[21][28]

Now-a-days, many investigators have made search for the feasibility of using low cost and efficient adsorbents. The use of biomass as adsorbents for the removal of dyes also offers a potential alternative to existing methods for detoxification. Bioremediation is a pollution control technology where the biological systems are used to drive the degradation or transformation of various toxic chemicals into less harmful forms. This natural process is expected to clean up the environment in an effective way, being an alternative to conventional remediation methods.[2][7] The main objective of this study is to investigate the effect of Spirogyra sp. and Oscillatoria sp. for decolorization and to reduce the physico-chemical levels of the solution containing a textile dye.

MATERIALS AND METHODS

Algal biomass:- The algae (without isolation) collected from natural pond. According to its morphology and microscopic observations it has been identified as *Spirogyra sp.* and *Oscillatoria sp.* belonging to green algae and blue green (brown green). Plate 4-12 shows the microscopic image of both algal sp. The algae *Spirogyra sp.* and *Oscillatoria sp.* were grown in several glass jars, containing growth medium (Bold Basal Medium) in order to obtain stock algal cultures to be used in the experiments.

Dye effluent collection:- The areas adjoining to the industrial complex at Nandesari, Gujarat will be selected for the project study. After survey, two sides were selected for sample collection. The selected places were Sarika dye chem (A1) and Megha dye chem (A2). The collected samples were analyzed for pH, Color, Total Suspended Solid (mg/l), Total Dissolved Solid (mg/l), Biochemical Oxygen Demand (mg/l), Chemical Oxygen Demand (mg/l), Chloride (mg/l), Sulphate (mg/l), Total Chromium (Cr) (mg/l), Copper (mg/l), Iron (mg/l), Manganese (mg/l) and Nickel (mg/l).(Table-2)

Dye analysis:- Dye analysis was performed at GREEN CIRCLE,INC [Recognised By Ministry of Environment and Forests. New Delhi under EPA 1986 and GPCB approved Environmental Auditor – (Schedule - 2)].

The Blue & Red dye effluent used in this study. The absorbance was measured with a UV spectrophotometer at 220 nm. Decolorization was determined by absorbance reduction. The percentage of decolorization was performed by using the calculation as follow:

$$\textbf{Percentage of decolorizaton} = \frac{\text{Initial Absorbance} - \text{Final Absorbance}}{\text{Initial Absorbance}} \text{x}100$$

Batch decolorization operation:- Experimental Set was conducted in 250 ml Erlenmeyer flasks containing respective dye solution by using diff. algal biomass (1% W/V, 2% W/V and 3% W/V) and diff. pH 4, 6, 8 & 10 (in 3% W/V algal biomass cond.) condition for 14 days duration.(Plate 2 & 3)

FTIR Analysis of decolorized samples:- In experiment, after 14 days incubation the biodegraded dye samples were characterized by FTIR spectroscopy (Perkin- Elmer, Spectrum one). The analysis results were compared with the control dye. The FTIR analysis was done in the mid IR region (400-4000 cm^{-1}) with 16 scan speed.

UV Spectrophotometry:- In experiment, after 14 days incubation the UV and visible spectra of the samples were measured by UV-1800 Series. Quartz cells (1 cm square) having 1.0 cm path length were used for the determination. Hydrogen discharge tungsten filament lamp was used as a source of light and maximum absorbance was recorded. (Instrument Type: UV-1800 Series, Measuring Mode: Absorbance Slit Width: 1.0 nm, Light Source Change Wavelength: 340.0 nm and S/R Exchange: Normal

Phytotoxicity Studies:- In experiment, after 7 days incubation the phytotoxicity study was carried out at room temperature using plant seeds of *Triticum sp.* by using pot method. The plant seeds were tested with both the dyes (untreated Blue and Red dye effluent) and its phytotoxic nature was analysed. Then the seeds were tested with the dye degraded metabolites and toxicity was analysed. In the experiments, analysis of Germination (%), length of root and plant height were recorded after 7 days.

Toxicity assay:- In experiment, untreated and treated effluents were tested for their effect on the agriculturally important soil bacterial flora. *Azotobacter sp.* and *Rhizobium sp.* were inoculated on Nutrient medium containing agar. Wells were made on the respective media containing plates and filled with untreated and treated dye effluent sample. The plates were incubated at 30^0C for 48 hours. Zone of inhibition surrounding the well represented the index of toxicity.

RESULTS

Physico-chemical characterization of textile dye effluents

The dye effluents of blue and red dyes shows turbid solutions of blue and brown color of sample respectively. These samples are odourless. The pH values of the effluents are 7.68 and 7.23 for blue and red dye respectively, which indicates the neutral nature of the effluents. The BOD and COD values are very high in both the textile dye effluent samples. The heavy metals such as chromium, copper, iron, manganese and nickel content in the textile dye effluent of both the samples were very high. Hence all the textile dye effluent samples collected from study area indicates high level of pollution.(Table -1).

The pH of the solution significantly affects the adsorption of dyes by algal biomass. Figure (1) shows % decolorization of Blue dye and Red dye at pH 4, 6, 8 & 10 respectively. At pH 10, the more effective dye adsorption capacity of algae was observed. At pH 10, *Spirogyra sp.* and *Oscillatoria sp.* showed about 78.29% and 76.48% decolorization respectively of blue dye for 14 days duration. Where as in case of red dye, 64.21% and 62.63% decolorization were monitored by *Spirogyra sp.* & *Oscillatoria sp.* respectively for the same period.

Figure (2) shows % decolorization of Blue dye and Red dye by different algal biomass (1.0%, 2.0% & 3.0%). There was an increased in the decolorization rate with an increase in algal biomass. The results obtained from present investigation revealed that the ability of *Spirogyra sp.* and *Oscillatoria sp.* in biodecolorization of both dyes. The 3.0% algal concentration of Spirogyra and Oscillatoria sp. showed about 78.28% and 74.30% decolorization of blue dye in 14 days duration. Where as in case of red dye, 63.68% and 59.73% decolorization were monitored by *Spirogyra sp.* & *Oscillatoria sp.* respectively for the same period.

Bioremoval of heavy metals- chromium, copper, iron, manganese and nickel from textile effluents

In all the samples the metal content were very high compared with standards of APHA Manual. The inoculation of textile dye effluent samples with Spirogyra sp. and Oscillatoria sp., significant decrease in copper, chromium, nickel, iron and manganese content were observed in all the samples even upto below detectable limit. At the same time treatment showed significance reduction in sulphate, chloride and chemical oxygen demand content. (Table - 1)

FTIR Analysis of Decolorized Sample

Figure 04-11 shows IR spectra of Control and Decolorize blue & Red dyes. Comparison of FTIR spectrum of the control dye with after complete decolorization clearly indicated the biodegradation of Blue dye and Red dye by both species. The results of FT-IR analysis of both parent dye and sample obtained after decolorization showed various peaks. The FT-IR spectra of Blue parent dye displayed peaks at 3316, 2118, 1637, 578, 552, 504, 564, 534, 524, 505, 522, 524 and 508 cm^{-1}, for OH stretching (alcohol, phenol) vibration, ≡C-H stretching (terminal alkynes) vibration, N-H bending (primary amines) vibration, C-X (X= Cl, Br) stretching (Chloroalkanes, bromoalkanes) vibration, respectively. However the FT-IR spectra of degradation product displayed peaks at different positions indicating the breakdown of Blue dye and the result of red parent dye displayed peaks at 3310, 2126, 1637 and 670 cm^{-1}, for OH (alcohol, phenol) stretching vibration, ≡ C-H stretching (terminal alkynes) vibration, N-H bending (primary amines) vibration, C=O stretching (ketone) vibration, C-H stretching (vinyl) vibration C-X(X= Cl, Br) stretching (chloroalkanes, bromoalkanes) vibration, respectively. The FT-IR spectra of degradation product displayed peaks at different positions indicating the breakdown of red dye.

UV-Visible analysis

UV Spectroscopy of unreated blue dye effluent showed peaks at 737, 223, 490 and 220.5 nm. After treatment of blue dye with *Spirogyra sp.* showed peaks at 736, 615, 720 and 492 nm. Whereas treatment of blue dye with *Oscillatoria sp.* showed peaks at

739, 615, 222, 726, 488 and 219 nm. In case of untreated red dye effluent showed peaks at 285 and 265 nm. After treatment of red dye with Spirogyra sp. showed peaks at 348, 282, 274, 234, 338, 280, 260 and 217 nm Whereas treatment of red dye with Oscillatoria sp. showed peaks at 348, 282, 274, 234, 337, 280, 260 and 217 nm with different absorption value. These obtained results of UV-Visible analysis proving that both dyes changed to other compound.(Figure 12-17)

Phytotoxicity Assay

Phytotoxicity test was performed in order to assess the toxicity of the untreated and treated dye samples (Plate- 2). Triticum sp. seeds treated with untreated Blue and Red dye showed 60% and 30% germination, the mean plant height of 14.67 ± 1.12 cm & 13.72 ± 0.90 cm, respectively and the mean root length for both dyes 3.42 ± 0.66 cm & 2.9 ± 0.05 cm, respectively. Whereas the blue dye Sample treated with both *Spirogyra sp.* and *Oscillatoria sp.* showed 90 % & 90 % germination, the mean plant height of 15.77 ± 1.09 cm & 15.50 ± 0.91 cm, respectively and the mean root length for both samples 4.39 ± 0.61 cm & 4.05 ± 0.25 cm, respectively. The Red dye Sample treated with both *Spirogyra sp.* and *Oscillatoria sp.* showed 50 % & 50 % germination, the mean plant height of 16.97 ± 0.08 cm & 15.7 ± 1.25 cm, respectively and the mean root length for both samples 4.72 ± 0.41cm & 4.5 ± 0.62 cm, respectively. Phytotoxicity result indicates that the effluent treated with both *Spirogyra sp.* and *Oscillatoria sp.* gives better Wheat plant % germination, Plant height(cm) and Root height(cm). (Table-2)

Toxicity assay

No zone of inhibition observed in surrounding the wells containing decolorized dye water, indicated that the biodegraded or decolorized product was non toxic to beneficial soil bacteria.

CONCLUSIONS

In this research study, both algae has sufficient biodegradation potential for removing blue dye and red dye from its aqueous solution under optimized conditions. It has been also found that *Spirogyra sp.* has more potential to biodegradation than *Oscillatoria sp.* Keeping in view of this research study, concludes that both species of algae can be used for removing blue and red dye from its aqueous solution. Knowledge from present work may be employed on large scale at actual contamination sites. Our future study aims to find out the mechanism of this biodegrdation of blue dye and red dye by *Spirogyra sp.* and *Oscillatoria sp.*

OBSERVATION TABLES AND FIGURES

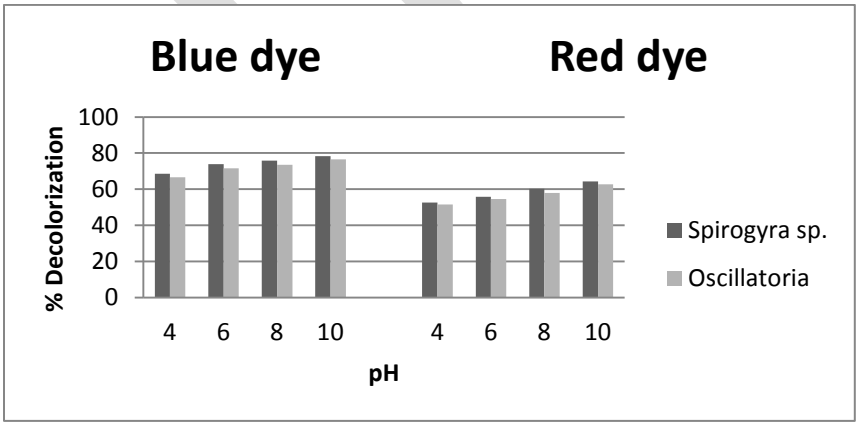

Fig.1 : % Decolorization of Blue and Red dye under different pH Conditions in set 1

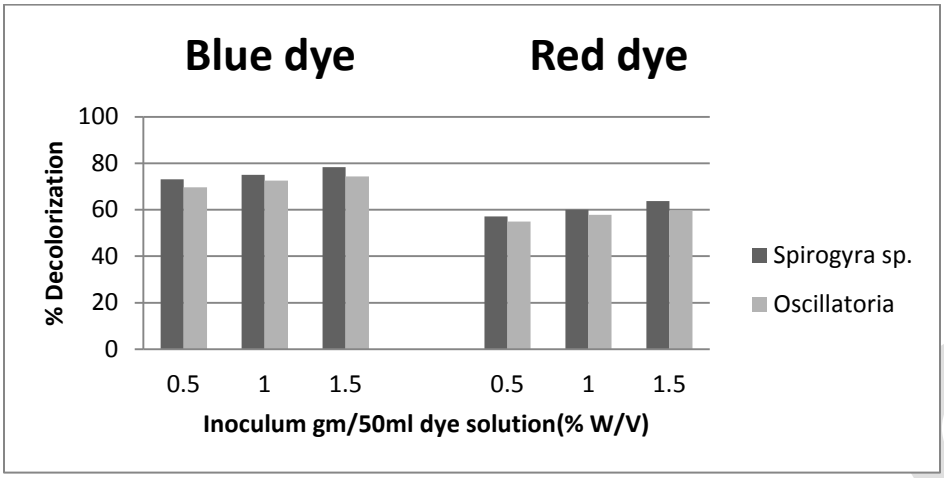

Fig.2 : % Decolorization of Blue and Red dye under different inoculum Condition in set 1

Set-2:- Fig. 4-11 Shows FTIR analysis & Fig. 12-17 Shows UV-Visible analysis results

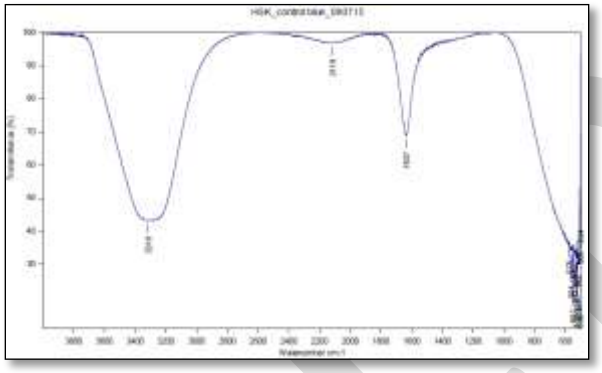

Fig.4 (Untreated Blue dye effluent)

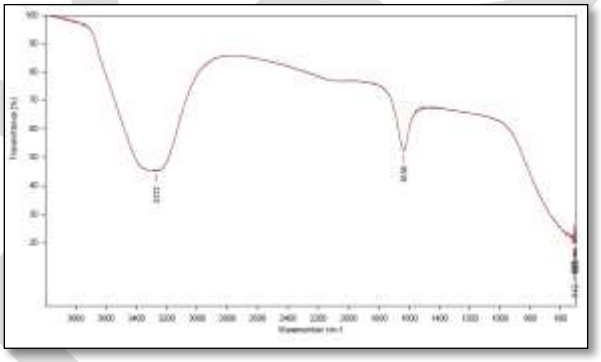

Fig.5 (Blue dye treated with *Spirogyra sp.*)

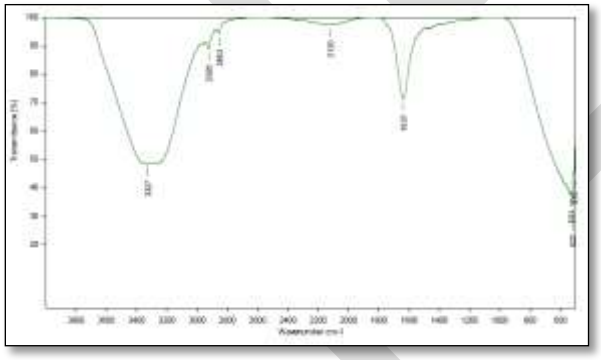

Fig.6 (Blue dye treated with *Oscillatoria sp.*)

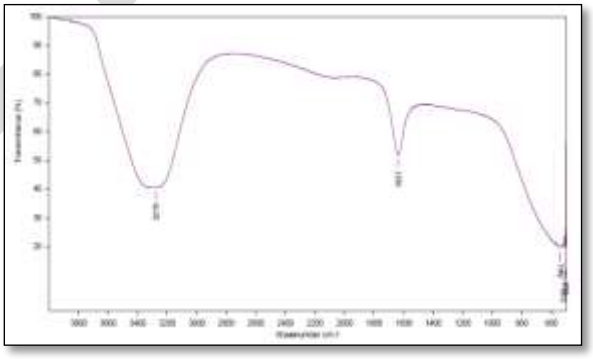

Fig.7 (Blue dye treated with *both* algal sp.)

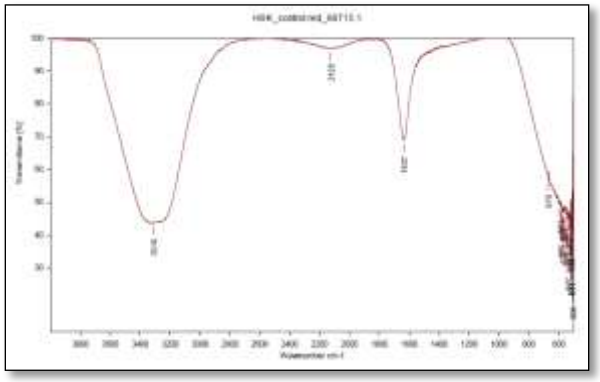

Fig.8 (Untreated Red dye effluent)

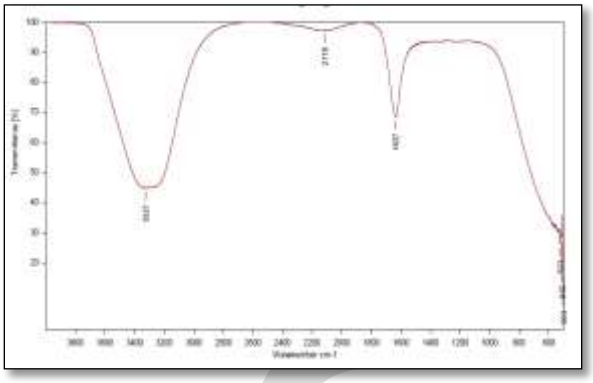

Fig.9 (Red dye treated with *Spirogyra sp.*)

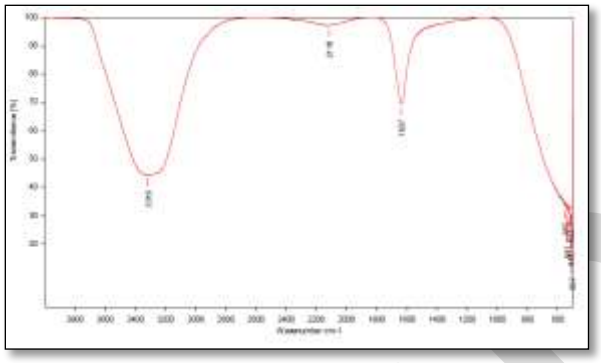

Fig.10 (Red dye treated with *Oscillatoria sp.*)

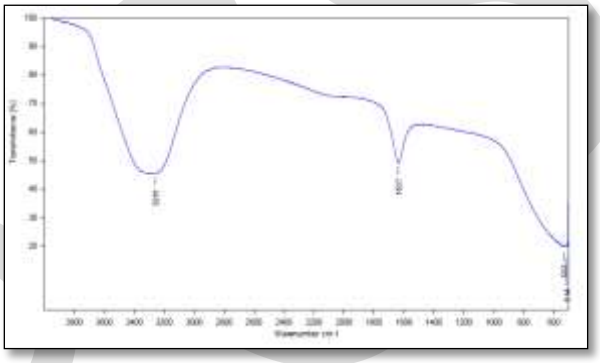

Fig.11 (Red dye treated with *both* algal sp.)

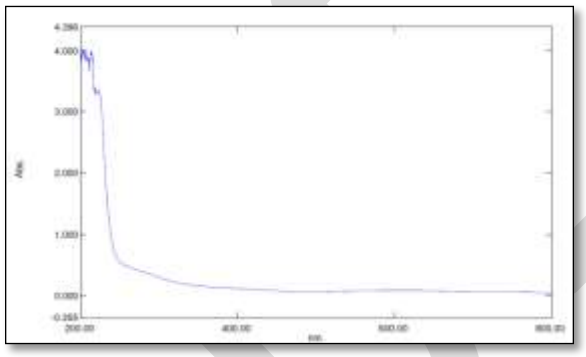

Fig.12 (Untreated Blue dye effluent)

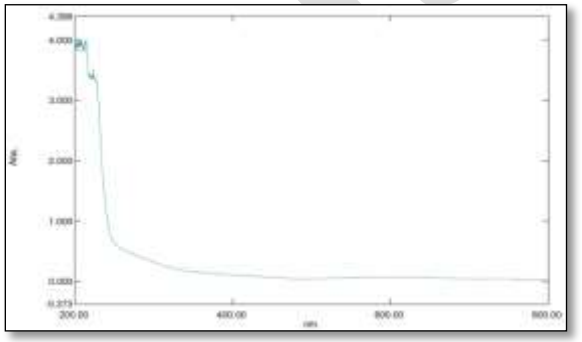

Fig.13 (Blue dye treated with *Spirogyra sp.*)

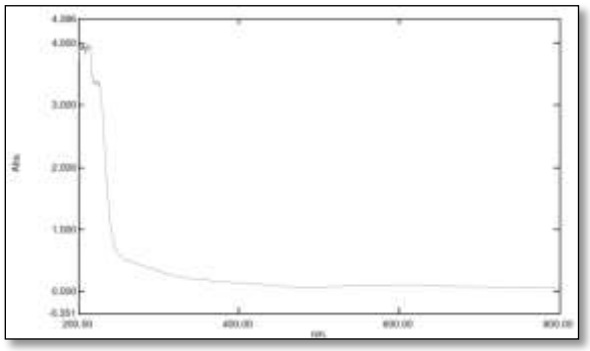

Fig.14 (Blue dye treated with *Oscillatoria sp.*)

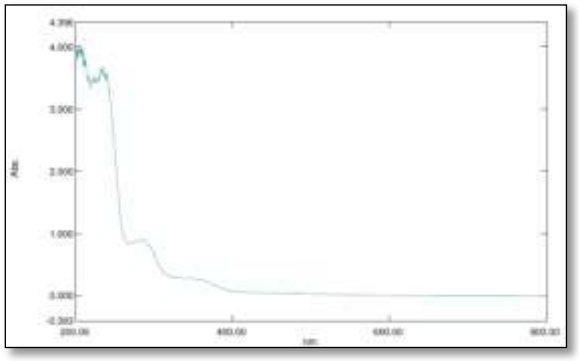

Fig.15 (Untreated Red dye)

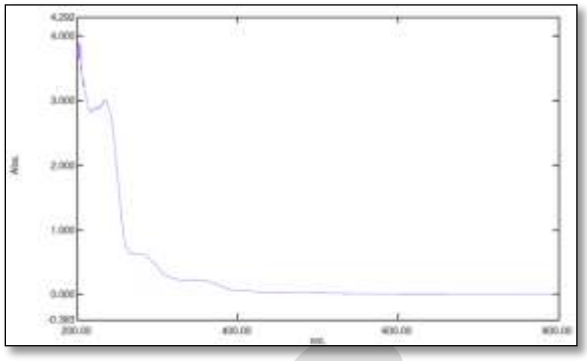

Fig.16 (Red dye treated with *Spirogyra sp.*)

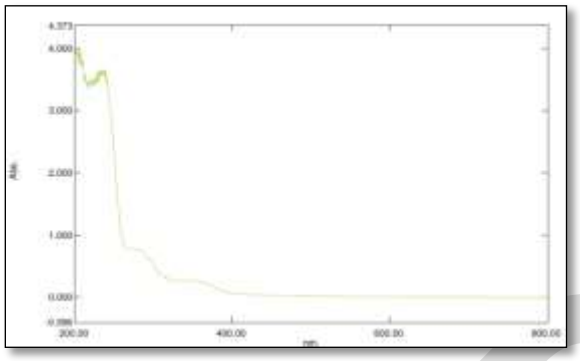

Fig.17 (Red dye treated with *Oscillatoria sp.*)

Plate-1: Phytotoxicity study
(S:- *Spirogyra sp.*, O:- *Oscillatoria sp.*)

Table-1: Physico-chemical analysis of untreated and treated effluent.

No.	Parameter	Unit	$R_{original}$	$B_{original}$	R_1	R_2	B_1	B_2	R_{12}	B_{12}
1	pH	-	7.23	7.68	6.83	6.81	8.61	8.85	6.12	8.46
2	Sulphate	mg/L	708	240	206	362	233	199	550	337.5
3	Chloride	mg/L	3480	840	3122	2989	832	758	1139	1343
4	Chemical Oxygen Demand	mg/L	2640	960	2200	2553	920	800	2352	880
5	Copper(Cu) PPM	mg/L	0.56	0.84	BDL	BDL	BDL	BDL	BDL	BDL
6	Chromium(Cr)PPM	mg/L	0.76	BDL	BDL	BDL	BDL	BDL	BDL	BDL
7	Nickel(Ni)PPM	mg/L	1.60	0.26	0.0353	BDL	BDL	BDL	0.0491	BDL
8	Iron(Fe)PPM	mg/L	1.26	0.52	0.3597	0.5439	0.341	0.486	0.4166	0.2722
9	Manganese(Mn)PPM	mg/L	0.27	1.02	0.243	BDL	BDL	BDL	BDL	BDL

R:- Red dye effluent, B:- Blue dye effluent

1:- treatment with Spirogyra sp., 2:- treatment with Oscillatoria sp., 12:- treatment with both Spirogyra sp. and Oscillatoria sp.

Table -2: Phytotoxicity study of *Triticum astivum* (1:- *Spirogyra sp.*, 2;- *Oscillatoria sp.*)

DYE	% Dry Matter	% Water	% Germination	Plant height(cm)	Root height(cm)
Control Blue	50 %	44.93 %	60 %	14.67 ± 1.12	3.42 ± 0.66
Blue 1	55.07 %	50 %	90 %	15.77± 1.09	4.39 ± 0.61
Blue 2	53.98 %	46.02 %	90 %	15.50 ± 0.91	4.05 ± 0.25
Control Red	46 %	36 %	30 %	13.72 ± 0.90	2.9 ± 0.05
Red 1	64%	54 %	50 %	16.97 ± 0.08	4.72 ± 0.41
Red 2	50.27 %	49.73 %	50 %	15.7 ± 1.25	4.5 ± 0.62

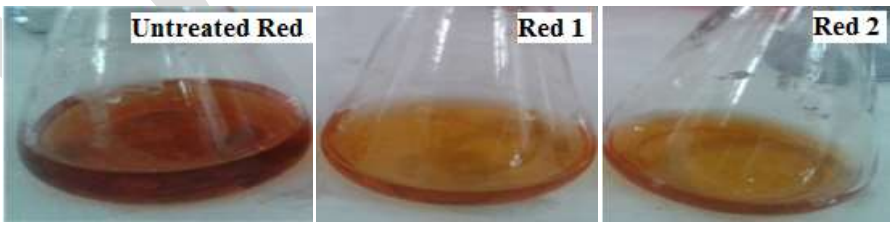

Plate-2: Untreated and treated effluent of red dye after decolorization

Plate-3: Untreated and treated effluent of blue dye after decolorization

1:- treatment with Spirogyra sp., 2:- treatment with Oscillatoria sp.

Plate.4

Plate.5

Plate.6 (Before)

Plate.7 (After)

Plate.8 (After)

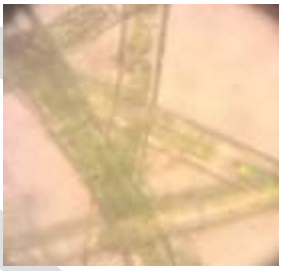

Plate.9 (After)

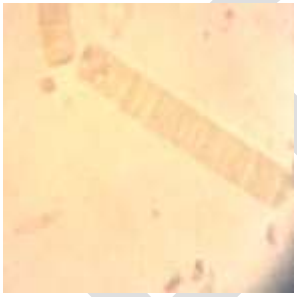

Plate.10 (Before)

Plate.11 (After)

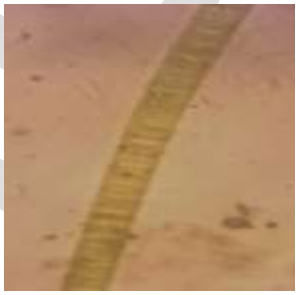

Plate.12 (After)

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REFERENCES:

1) **A. Fathi, M. M. Azooz, and M. A. Al-fredan,** "Phycoremediation and the Potential of Sustainable Algal Biofuel Production Using Wastewater," *American Journal of Applied Sciences*, vol. 10, no. 2, pp. 189–194, Feb. 2013.
2) **Wilke, R. Buchholz, and G. Bunke,** "Selective biosorption of heavy metals by algae" vol. 2, no. August, pp. 47–56, 2006.
3) **A.Shyamala, J.Hemapriya, Kayeen Vadakkan and S.Vijayanand** Bioremediation of Methyl Orange, a synthetic textile azo dye by a halotolerant bacterial strain Int.J.Curr.Res.Aca.Rev.2014; 2(8:373-381)
4) D. Gvns, K. V Pradeep, and R. G. Prasuna, "Purification of waste water using Algal species" vol. 1, no. 3, pp. 216–222.

5) **D. Kaplan,** "Absorption and Adsorption of Heavy Metals by Microalgae," pp. 602–611, 2013.J. Cheriaa, F. Bettaieb, I. Denden, and A. Bakhrouf, "Characterization of new algae isolated from textile wastewater plant," vol. 7, no. October, 2009.

6) **Davis, T.A., F. Llanes, B .Volesky, G. Diaz-Pulido, L.J. McCook, A. Mucci.** H-NMR study of Na alginates extracted from *Sargassum sp*. in relation to metal biosorption, Appl. Biochem. Biotech. 2003, 110, 75-90.

7) **H. Y. El-Kassas and L. A. Mohamed,** "Bioremediation of the textile waste effluent by *Chlorella vulgaris*," *The Egyptian Journal of Aquatic Research*, vol. 40, no. 3, pp. 301–308, 2014.

8) **K. Ben Chekroun and M. Baghour,** "The role of algae in phytoremediation of heavy metals : review," vol. 4, no. 6, pp. 873–880.

9) **Kaoutar Ben Chekroun, Mourad Baghour** The role of algae in phytoremediation of heavy metals: A review J. Mater. Environ. Sci. 4 (6) (2013) 873-880 ISSN : 2028-2508

10) **Kirk T.S., Ronald B.C. and Stefan S.** Biodegradation of aromatic compounds by microalgae article first published online: 17 JAN 2006 DOI: 10.1111/j.1574-6968.1999.tb133

11) **Mckay, G., Otterburn, M. S. & Sweeney, A. G.** Kinetics of colour removal from effluents using activated carbon. J Soc Dyes Chem 1998, 96: 576

12) **Mohamed S. & Mohamed T.** Decolorization of Malachite Green and Methylene Blue by Two Microalgal Species October 2012, Volume 3, No.5 International Journal of Chemical and Environmental Engineering 297-302

13) **N. Daneshvar, M. Ayazloo, A.R. Khataee and M. Pourhassan** Biodegradation of the Textile Dye Malachite Green by Microalgae *Cosmarium sp.* International Center For Science & high Technology and Environment Science

14) **N. Kuyucak and B. Vole sky.** Biosorbents forrecovery of metals from industrial solutions. *Biotechnol Left. 1998,* 10 (2), 137-142

15) **Nilanjana Das, R Vimala and P Karthika** Biosorption of heavy metals- An overview Indian Journal of biotechnology Vol 7, April 2008, pp 159-169

16) P. H. Rao, R. R. Kumar, B. G. Raghavan, V. V Subramanian, and V. Sivasubramanian, "Application of phycoremediation technology in the treatment of wastewater from a leather-processing chemical manufacturing facility," vol. 4738, no. January, pp. 7–14, 2011.

17) **P. Ramachandran, R. Sundharam, J. Palaniyappan, and A. P. Munusamy,** "Potential process implicated in bioremediation of textile effluents : A review," vol. 4, no. 1, pp. 131–145, 1976.

18) **Pandey A. and Dubey V.** Biodegradation of Azo Dye Reactive Red BL by *Alcaligenes Sp.* AA09 International Journal of Engineering and Science ISSN: 2278-4721, Vol. 1, Issue 12 (December 2012), PP 54-60

19) **Pandit R.J. , Patel B , Kunjadia P.D , Nagee A** Isolation, characterization and molecular identification of heavy metal resistant bacteria from industrial effluents, Amala-khadi- Ankleshwar, Gujarat International Journal Of Environmental Sciences Volume 3, No 5, 2013 doi: 10.6088/ijes.2013030500037

20) **Pearce, C.I., J.R. Lloyd and J.T. Guthrie**. The removal of color from textile wastewater using whole bacterial cells: A review. Dyes Pigments. 2003, 58: 179-196

21) Q. Wei, Z. Hu, G. Li, B. Xiao, H. Sun, and M. Tao, "Removing nitrogen and phosphorus from Sewage– An Experimental Study At Laboratory Scale Using Microalgae," pp. 2090–2095.

22) **Subramaniyan V. and Chockaiya M.** Treatment of Dye Industry Effluent Using Free and Immobilized Cyanobacteria Journal of Bioremediation and Biodegradation 2012, 3:10 http://dx.doi.org/10.4172/2155-6199.1000165

23) **Tsezos M**." Immobilization of Ions by Naturally Occuring Materials as Alternatives to Ion Exchange Resins " Immobilisation of Ions by Biosorption " Ellis Horwood Publishers. 1986, Editors H. Eccles , S. Hont, London, UK.

24) **Usman A., M. Riaz Khan, M.Mahfooz, M.Ali, S.H.Aslam and A.Rehman** Decolorization and Degradation of textile Azo dyes by *Corynebacterium sp.* Isolated from industrial effluent. Journal of Zoology , vol. 43(1), pp. 1-8, 2011

25) **Vivekanandan N., Vishwanathan M., Shanmugam V. and Thangavel B** Degradation and detoxification of reactive azo dyes by native bacterial communities Vol. 7(20),pp. 2274-2282, 14 May, 2013 DOI: 10.5897/AJMR 12.1539 ISSN 1996-0808 ©2013 Academic Journals http://www.academicjournals.org/AJMR

26) **Volesky B, Holan ZR**. Biosorption of heavy metals. Biotechnol.Progress. 1995, 11(3): 235-250

27) **Volesky B**. Biosorbents for metal recovery. Trends Biotechnol. 1987, 5:96-101

28) **Y. Miao,** "Biological remediation of dyes in textile effluent : a review on current treatment technologies," pp. 1–10, 1992.

29) **Y.M.Varsha, Naga Deepthi CH and Sameera Chenna** An Emphasis on Xenobiotic Degradation in Environmental Clean up Jaiswal, J Bioremed Biodegrad 2011, S11 http://dx.doi.org/10.4172/2155-6199.S11-001

30) **Youssef, A.S., F.M. El-Sherif and A.S. El-Assar**, Studies on the decolorization of malachite green by the local isolate *Acremonium kiliense*. Biotechnology. 2008, 7: 213-223.

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Performance Analysis of DSR Routing Protocol With and Without the Presence of Various Attacks in MANET

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Abstract— In the present age mobility has become so pervasive that it influences all networking. New communication technologies are evaluated by accessing their potential role in the Internet. Mobile Ad-Hoc Networks (MANETs) has become one of the most prevalent areas of research in the recent years because of the challenges it pose to the related protocols. It enables users to communicate without any physical infrastructure regardless of their geographical location, because of this feature, this is called infrastructure-less network. MANETS are more vulnerable to various types of attacks like blackhole, grayhole, flooding etc than wired networks due to open medium, dynamically changing network topology, cooperative algorithms, lack of centralized monitoring and lack of clear line of defense. The security issues in MANET are mostly concentrated in two parts establishing secure route and securely data transmission. This paper is a simulation based study of DSR on demand MANET routing protocol by using Network Simulator tool NS 2 in the presence of various routing attacks as mentioned above. Basically we emphasis on three performance matrices i.e. packet delivery ratio, average end to end delay and average throughput and based on this we analyze the performance of the DSR routing protocol.

Keywords— MANET, Routing Protocol, DSR, NS2, Routing Attacks, Blackhole, Grayhole, Rushing attack.

I. INTRODUCTION

A mobile ad hoc network (MANET), sometimes called a wireless ad hoc network or a wireless mesh network of mobile nodes, comprises of mobile computing devices (nodes) that uses wireless transmission for communication, without the presence of any established infrastructure or administration such as an access point in wireless local area network or a base station in cellular network [1]. The nodes are free to move randomly and organize arbitrarily thus, the topology of the wireless network may change rapidly and unpredictably. Unlike traditional mobile wireless networks, MANETs do not rely on any central coordinator. Mobile nodes can communicates to each other directly via wireless links if nodes are within each other radio range, while nodes are far apart, should rely on other nodes to relay messages as routers. In mobile ad hoc network each node acts both as a host (capable of sending and receiving) and a router (forwards the data intended for some other node). Hence such networks sometime call as multi-hop wireless ad hoc networks.

To manage multi-hop behavior of MANET there is a need of routing protocol. Establishing an optimal and efficient route between the communicating parties is the primary concern of the routing protocols of MANET. But one of the main challenges in MANET is to design the robust security solution that can protect MANET from various routing attacks. Here we analyze DSR routing protocol performance.

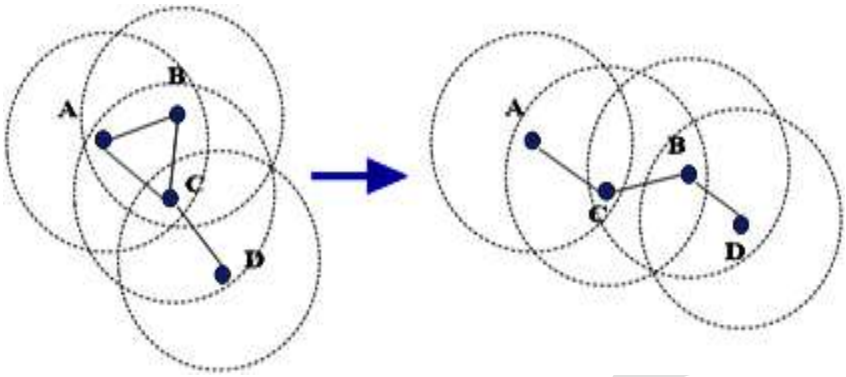


Fig. 1 MANET Dynamic Topology

II. ROUTING ATTACKS IN MANET

Mobile ad hoc network is not free from different active and passive attacks [2]. A passive attack does not disrupt the normal operation of the network, gathering information is the primary aim. On the other hand active attacks disrupt the normal functioning of the network by altering or destroying data. In this paper we emphasis on three types of attacks blackhole, grayhole, and rushing attack.

BLACKHOLE ATTACK

The goal of the malicious node in this attack is to drop all packets that are directed to it instead of forwarding them as intended. It uses its routing protocol in order to advertise itself as having the shortest route to the target node or to any packet that it wants to intercept. The malicious node advertises its availability of new routes without checking its routing table [3, 8]. In this way the malicious node will always have availability of routes while replying to the route request and hence intercept the data packet. As a result of the dropped packets, the amount of retransmission consequently increases leading to congestion.

GRAYHOLE ATTACK

Grayhole attack is an extension of blackhole attack in which a malicious node's behavior is exceptionally unpredictable. There are three behaviors of Grayhole attacks [4]. In first, the malicious node may drop packets from certain nodes while forwards all other packets. In second type, a node may behave maliciously for a certain time, but later on it behaves just like other ordinary nodes. Third type of attack is the combination of both attacks i.e. the malicious node may drop packets from specific nodes for certain time only, later it behaves as a normal node. Due to these characteristics, detection of grayhole attacks is not an easy task.

RUSHING ATTACK

The working principal of this attack is same as an effective denial-of-service attack. In this attack, the route request (RREQ) packet sent by the source node to the malicious node is flooded throughout the network by this malicious node quickly enough to prevent other nodes from reacting to the same RREQ[3,4]. The other nodes that receive the duplicate RREQ from the attacker simply ignore them. Hence, any route discovered by the source node will have the malicious node as an intermediate point in the route. Most of the current on-demand ad hoc routing protocols are vulnerable to this attack due to the fact that most of them use duplicate suppression during the route discovery process.

III. MANET ROUTING PROTOCOL

Routing protocols in MANET specifies how nodes communicate with each other, routing information that enables them to select routes between any two nodes on a network. So the communication in the network depends on the efficiency and optimality of the routing algorithm. According to root finding methodology two types of strategies we preferred Proactive Routing and Reactive Routing [5].

In proactive routing all routes to each destination are maintained in up to date table like in "Destination Sequenced Distance Vector" routing protocol where as in reactive routing protocol route is only found when it is asked by the source node and route is maintained unless it is asked to terminate by the source node or after time exceed like in Dynamic Source Routing protocol.

DYNAMIC SOURCE ROUTING PROTOCOL

The Dynamic Source Routing (DSR) is an on demand routing protocol that is based on the concept of source routing in which source is responsible for providing information of whole path [6]. It is designed especially for use in multihop ad hoc networks of mobile nodes. DSR is composed of the two mechanisms of Route Discovery and Route Maintenance, which work together to allow nodes to discover and maintain source routes to arbitrary destinations in the network. DSR has a unique advantage by virtue of source routing [9].

In Route Discovery phase source finds path to destination by broadcasting RREQ packet. Each node retransmits the RREQ packet if it has not forwarded a copy of it, provided that the Time-To-Live has not been exceeded. Each RREQ carries a sequence number generated by the source node and the path it has traversed. In this protocol intermediate node uses cache that stores all possible information extracted from the source route contained in a data packet. When destination receives the RREQ packet, it sends a RREP packet to source node, listing the route taken by request packet. Source node selects route with lowest latency. In route maintenance, whenever a link break, the RERR packet propagates to the original source, which in turn initiates a new route discovery process. DSR also allows piggy-backing [10].

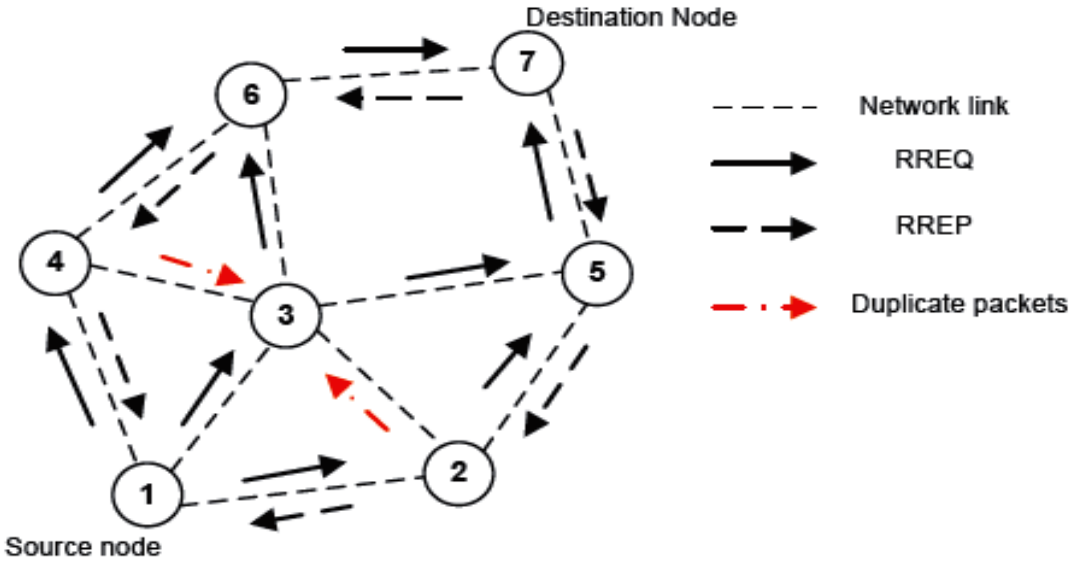


Fig. 2 Route Discovery in DSR

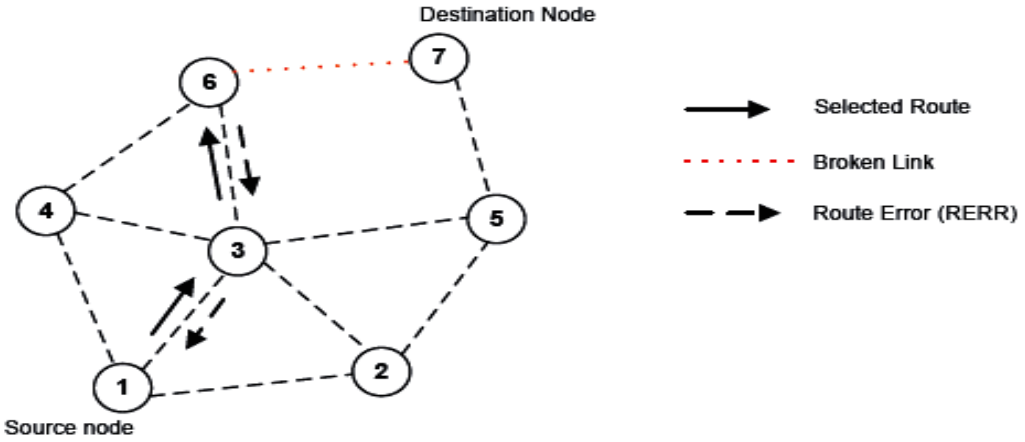


Fig. 3 Route Maintenance in DSR

IV. SIMULATION MODEL

Network Simulator is event driven object oriented simulator [7]. It uses Object Oriented Tool Command Language (OTcl) to interpret user simulation scripts and Tcl language is fully compatible with the C++.The overall goal of simulation study in this paper is to analyze the performance of DSR on demand based routing protocol with and without the presence of various attacks like blackhole, grayhole and rushing attack. The simulations were performed using Network Simulator 2 (NS2). The source-destination pairs are spread randomly over the network. During the simulation, each node starts its journey from a random spot to a random chosen destination. Once the destination is reached, the node takes a rest period of time in second and another random destination is chosen after that pause time. This process repeats throughout the simulation, causing continuous changes in the topology of the underlying network. Different network scenario for different number of nodes and pause times are generated.

PERFORMANCE METRICS

- Packet Delivery Ratio-The ratio of the data packets delivered to the destination to those generated by the source.
- Average End to End Delay-This metrics represents average end-to-end delay that indicates how long it took for a packet to travel from the source to the application layer of the destination.
- Average Throughput-This metrics represents the average number of bits arrived per second at destination and measured in bps.

SIMULATION PARAMETERS

Table 1shows mobility scenarios that are generated by using a random way point model by varying 25 to 150 nodes moving in simulation area of 1000m x 1000m. This simulation used the following parameters.

Table1 Simulation Parameters

Simulator	NS-2 (Version 2.35)
Simulator Time	500 (s)
Number of Nodes	25, 50, 75, 100, 125, 150

Simulation Area	1000 x 1000m
Routing Protocol	DSR
Traffic	CBR (Constant Bit Rate)
Pause Time	10 (ms)
Packet Size	512 bytes
Movement Model	Random Way Point
Movement Model	Random Way Point

PERFORMANCE ANALYSIS UNDER BLACKHOLE ATTACK

Fig 4 shows that packet delivery ratio of DSR with blackhole attack and without blackhole attack. It is observed from the graph that the performance of packet delivery ratio in DSR is better as compare to blackhole attack. Due to this attack packets got dropped and it causes decrease in delivery ratio of packets.

Fig 5 shows the average end to end delay of DSR routing protocol. The graph shows that delay with blackhole attack is much higher than without blackhole because the packets are dropped by malicious node and DSR adjust its changes in it during node restart and node pausing thus increases the delay.

Fig 6 shows the average throughput of DSR routing protocol in the presence and absence of blackhole attack. It is observed that average throughput of DSR under blackhole is less than normal DSR. When the numbers of nodes are increased, the performance of protocol is reduced but then it maintained constant up to the number of nodes 125 then it slightly increase due to effect of blackhole.

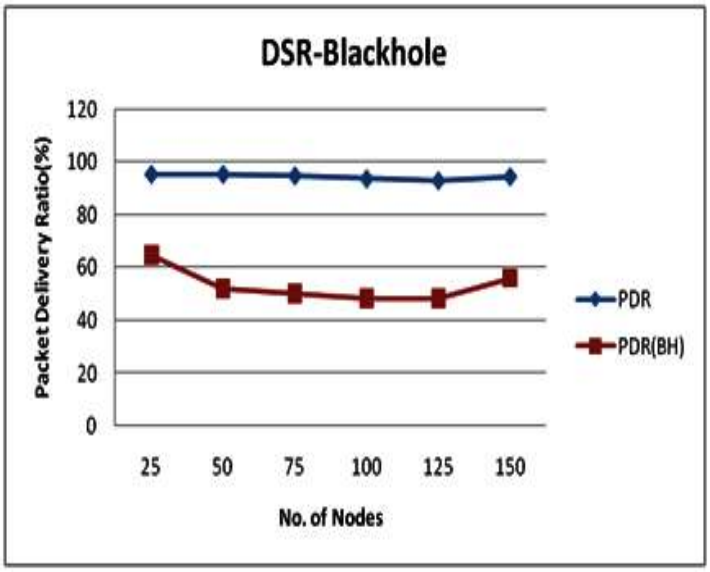


Fig. 4 Packet delivery ratio in DSR with and without blackhole attack

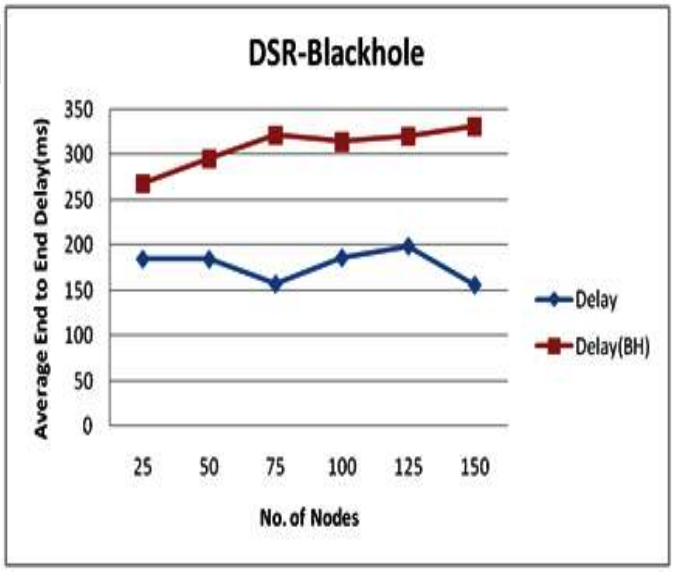
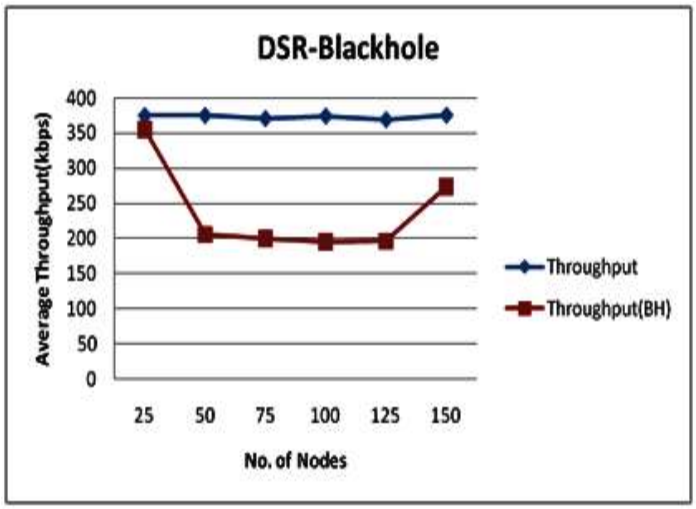


Fig. 6 Average throughput of DSR with and without blackhole attack



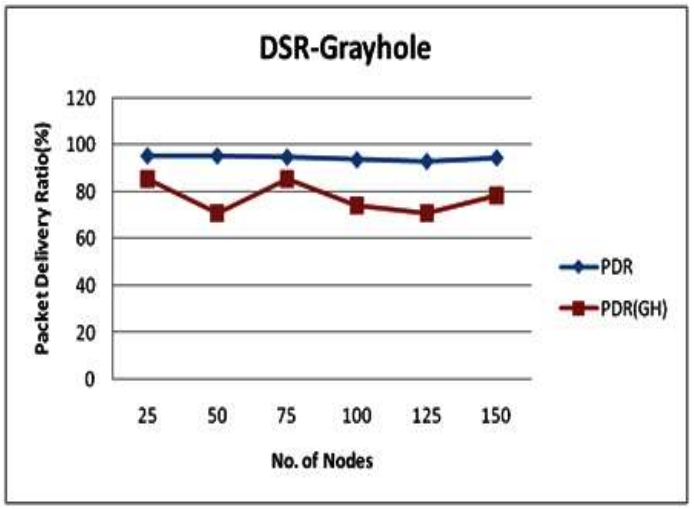


Fig. 5 Average end to end delay in DSR with and without blackhole attack

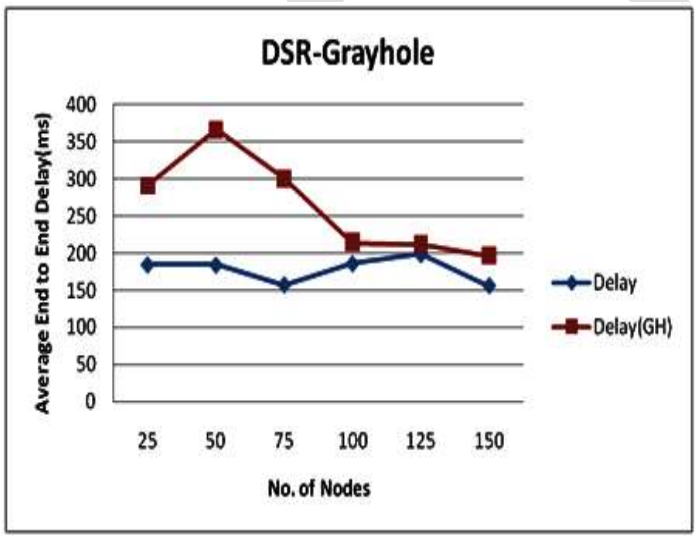
Fig.7 Packet delivery ratio of DSR with and without grayhole attack

PERFORMANCE ANALYSIS UNDER GRAYHOLE ATTACK

Fig. 7 shows the DSR with and without grayhole attack. It is observed that packet delivery ratio of DSR under grayhole attack decreases because grayhole attack drops the packets arbitrary so many packets do not reach to destination.

Fig. 8 shows the effect of grayhole on average end to end delay of DSR. Delay of DSR with grayhole is higher than without grayhole because it adds additional delay in route discovery phase.

Fig. 9 shows that with increasing density of nodes in network, difference between average throughput of DSR with and without grayhole attack is high and throughput under grayhole is less because attacker node discards many packets attracted by it.



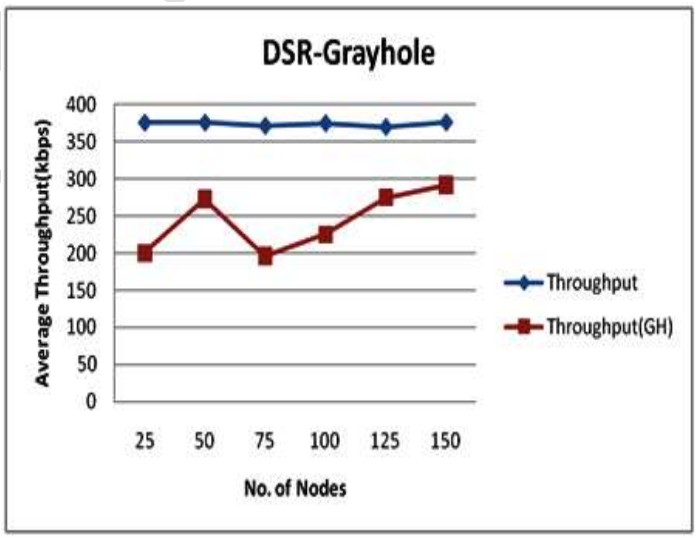


Fig. 8 Average end to end delay of DSR with and without grayhole

Fig. 9 Average throughput of DSR with and without grayhole attack

Performance analysis under rushing attack

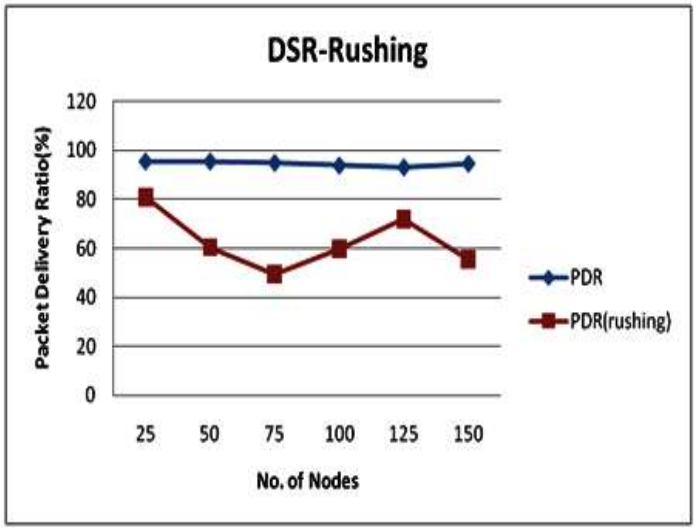


Fig. 10 Packet delivery ratio of AODV with and without rushing attack

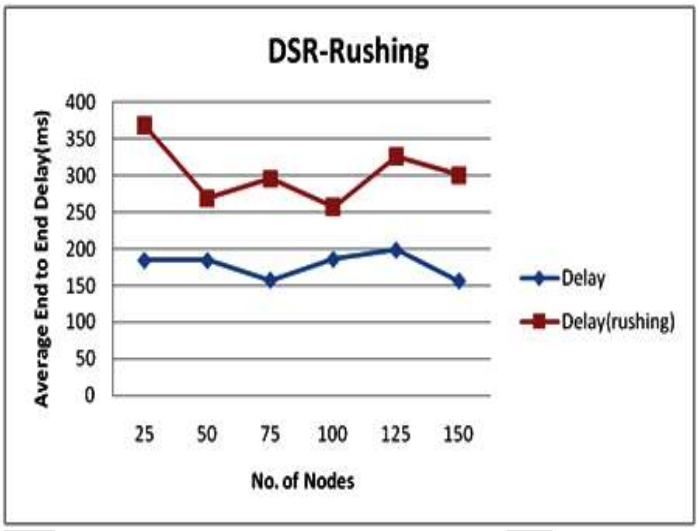


Fig. 11 Average end to end delay of AODV with and without rushing attack

Fig 10 shows the packet delivery ratio of AODV with and without rushing attack. Graph shows that packet delivery ratio of AODV with rushing is less than normal AODV because some packets are dropped by byzantine attack.

Fig 11 shows the impact of rushing attack on average end to end delay of AODV routing protocol. Graph shows that end to end delay of AODV with rushing attack is higher than AODV without attack because it is also used Jellyfish attack which produces delay before the transmission and reception of data packets in the network.

Fig 12 shows the average throughput of AODV with and without rushing attack. It shows that throughput of AODV is higher than throughput of AODV with rushing attack due to property of byzantine attack in which attacker drop packets so received packets are less than original AODV.

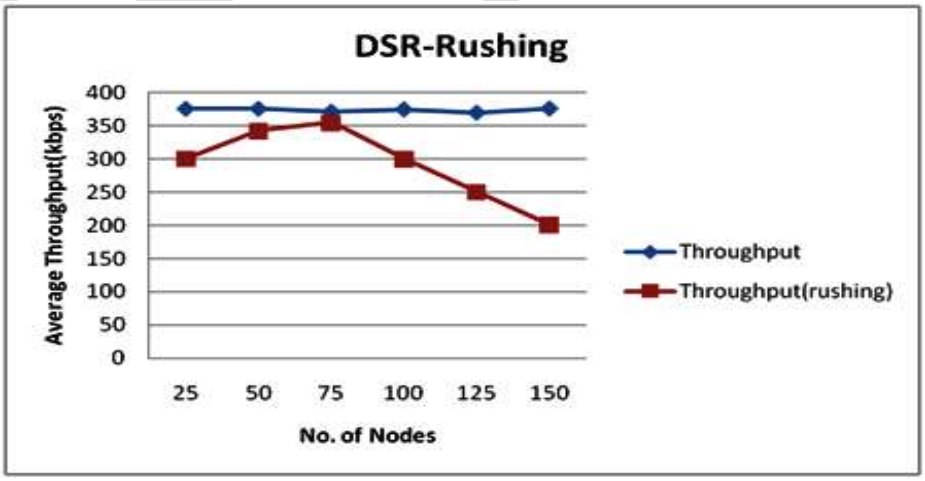


Fig. 12 Average throughput of AODV with and without rushing attack

V. ACKNOWLEDGMENT

I would like to express my deep sense of respect and gratitude towards “Dr. Bala Buksh”, Professor Department of Computer Science

& Engg., who has been the guiding force behind this work. Without his unconditional support it wouldn't have been possible.

VI. CONCLUSION

MANET can be deployed easily in a situation where a traditional network is not possible due to its special characteristics such as flexibility and dynamic nature. The aim behind this research paper is to analyze the effect of many attacks under CBR traffic in different scenarios for DSR MANET routing protocol. Based on investigations and data analysis of simulation results, it is concluded that without the presence of any routing attack DSR perform well in lightly loaded networks. But the presence of blackhole, grayhole, and rushing attack at the time of routing effects on overall performance of DSR protocol by decreasing packet delivery ratio and average throughput but by increasing average end to end delay.

REFERENCES:

[1] S. Basagni, M.Conti, S. Giordano and I. Stojmenovic, "Mobile Ad Hoc Networking", A John Wiley & Sons, Inc., Publication, 2004, ISBN 0-471-37313-3.

[2] Djamel Djenouri, L Khelladi, and N Badache. A survey of security issues in mobile ad hoc networks. IEEE communications surveys, 7(4), 2005.

[3] A. Pegueno and J. R. Rivera, Extension to MAC 802.11 for performance Improvement in MANET, Masters Thesis at Karlstads University, Sweden, December 2006.

[4] Amara korba, Abdelaziz, Mehdi Nafaa and Ghanemi Salim, "Survey of Routing Attacks and Countermeasures in Mobile Ad Hoc Networks", IEEE 15th International Conference on Computer Modelling and Simulation, 2013.

[5] K. Sanzgiri, B. Dahill, B.N. Levine, C. Shields, and E.M. Belding-Royer. A secure routing protocol for ad hoc networks. In Network Protocols, 2002. Proceedings. 10th IEEE International Conference on, pages 78-87, 2002.

[6] D B. Johnson, D A. Maltz, and Y. Hu, "The Dynamic Source Routing Protocol For Mobile Ad Hoc Network", *Internet-Draft*, July 2004.

[7] NS-2 Network Simulator http://www.isi.edu/nsnam/ns.

[8] Sun, Y. Guan, J. Chen and U.W. Pooch, "Detecting black-hole attack in mobile ad hoc networks", Proc. 5th European Personal Mobile Communications Conference, Apr. 2003, pp. 490-495.

[9] Robinpreet Kaur & Mritunjay Kumar Rai "A Novel Review on Routing Protocols in MANETs", Undergraduate Academic Research Journal (UARJ), ISSN : 2278 – 1129, Volume-1, Issue-1, 2012.

[10] M. Krishnamoorthi, Dr. K. Gokulraj, "A Study on AODV and DSR MANET Routing Protocol", International Journal of Computer Networks & Wireless Communications, Vol. 5, No 4, 2015.

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COMPRESSIVE STRENGTH CALIBRATION OF WASHED AND UNWASHED LOCALLY OCCURRING 3/8 GRAVEL FROM VARIOUS WATER CEMENT RATIOS AND CURING AGE

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Abstract- The compressive strength of locally occurring 3/8 gravel applying different water cement ratios has been evaluated, these were done through experimental techniques by characterizing the sorted locally occurring 3/8 gravel in washed and unwashed sample for analysis, these two conditions were applied to monitor the compressive strength of locally occurring 3/8 gravel for higher performances of concrete formations. Several results were generated from different water cement ratios for washed and washed gravel including its curing age, these results were subjected to calibration, these concept generated several mathematical equations, the equation represents developed values for unwashed and washed concrete compressive strength at different water cement ratios and curing time, from the graphical representation, it has express the rate of compressive strength at different curing time thus different water cement ratios. The results have express the effect that influences some concrete that developed very low compressive strength. These can be attributed to variations from mix proportion and rate of compaction in various samples, impurities may also cause degradations of concrete compressive strength, calibrating these values has definitely express mathematical equations that will be resolved to predict compressive strength of locally sorted 3/8 gravel at different water cement ratios and curing age.

Key words- compressive strength, calibration, local 3/8 gravel, water cement ratio, and time

1. Introduction

The compressive strength of concrete depends on the water to cement ratio, degree of compaction, ratio of cement to aggregate, bond between mortar and aggregate, and grading, shape, strength and size of the aggregate (Roccoand and Elices, 2009; Elices and Rocco, 2008, Abdullahi.2012). Concrete can be visualized as a multi-phase composite material made up of three phases; namely the mortar, mortar/aggregate interface, and the coarse aggregate phase, (Olanipekun, Olusola, and Ata, 2006 Meddah, M.S., Zitouni and Belâabes, 2010),. The coarse aggregate in normal concrete are mainly from rock fragments characterised by high strength. Therefore, the aggregate interface is not a limiting factor governing the strength requirement (Beshr, Almusallam, and Maslehuddin 2003 Abdullahi.2012, Eluozo and Ode 2015a, Eluozo and Ode 2015b, Eluozo and Ode 2015c). The effect of using crushed quartzite, crushed granite, limestone, and marble as coarse aggregate on the on the mechanical properties of high-performance concrete was investigated (Wu, Chen, Yao, and Zhang, 1997 Montgomery, Peck, and Vining.2001). The outcome of the study revealed that the strength, stiffness, and fracture energy of concrete for a given water/cement ratio depend on the type of aggregate. Basalt, limestone and gravel have been used as coarse aggregate to produce normal and high-performance concrete (Özturan, and Çeçen, 1997 Ephraim and Ode, 2006). Normal strength concrete made with basalt and gravel gave similar compressive strength while the concrete containing limestone attained higher strength. The effects of content and particle size distribution of coarse aggregate on the compressive strength of concrete have been investigated (Meddah, Zitouni, and Belâabes 2010).

2. Materials and Method

ELE England made concrete compressive machine was used. It consists of a measuring gauge with two indicator or pointer (black and red). The indicator must be set to zero mark before testing. Load is applied to test specimen through two steel loading platforms, with a fixed upper platform and an upward moving lower platform. The lower platform has marking which help in centralizing a test specimen to receive the concentric load. At failure, the black pointer drops back to zero and red pointer remains in position to give the reading of the failure load, after the reading has been taken, a knob is adjusted to release the lower platform to former position.

3. Results and Discussion

Results and discussion are presented in tables including graphical representation of compressive strength of concrete.

Table: 1 compressive strength of unwashed Mix at [0.45 at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.45	Compressive Strength N/mm^2
7	6
14	7.71
21	7.78
28	10.82
60	9.33
90	5.56

Table: 2 compressive strength of unwashed Mix at [0.50] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.50	Compressive Strength N/mm^2
7	5.03
14	4.74
21	5.78
28	11.26
60	9.33
90	9.11

Table: 3 compressive strength of unwashed Mix at [0.55] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.55	Compressive Strength N/mm^2
7	6.82
14	10.22
21	9.04
28	11.85
60	8.93
90	9.56

Table: 6 compressive strength of unwashed Mix at [0.60] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.60	Compressive Strength N/mm^2
7	10.5
14	11.26

21	**16**
28	**11.52**
60	**8.93**
90	**12.89**

Table: 7 compressive strength of unwashed Mix at [0.65] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.65	**Compressive Strength N/mm^2**
7	**8.89**
14	**8.89**
21	**11.85**
28	**12.45**
60	**17.78**
90	**10.67**

Table: 8 compressive strength of unwashed Mix at [0.70] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.70	**Compressive Strength N/mm^2**
7	**10.69**
14	**11.26**
21	**14.56**
28	**13.63**
60	**17.33**
90	**10.22**

Table: 9 compressive strength of unwashed Mix at [0.75] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.75	**Compressive Strength N/mm^2**
7	**6.67**
14	**9.19**
21	**11.41**
28	**9.93**
60	**11.11**
90	**10.67**

Table: 10 compressive strength of unwashed Mix at [0.80] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.80	**Compressive Strength N/mm^2**

7	5.78
14	8.3
21	9.78
28	10.81
60	11.11
90	11.78

Table: 11 compressive strength of unwashed Mix at [0.85] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.85	Compressive Strength N/mm^2
7	5.33
14	9.63
21	9.93
28	10.52
60	10.67
90	11.12

Table: 12 compressive strength of unwashed Mix at [0.90] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.90	Compressive Strength
7	7.11
14	10.37
21	9.63
28	12.15
60	9.78
90	13.12

Table: 13 compressive strength of unwashed Mix at [0.95] at Different Curing Days

Water Cement Ratio Curing Age Mix U-0.95	Compressive Strength N/mm^2
7	4.4
14	4.89
21	5.11
28	6.22
60	7.56
90	7.34

Table: 14 compressive strength of unwashed Mix at [1.00] at Different Curing Days

Water Cement Ratio Curing Age Mix U-1.00	Compressive Strength N/mm^2
7	4
14	4.44
21	5.78
28	6
60	5.78
90	6

Table: 15 compressive strength of unwashed Mix at [1.05] at Different Curing Days

Water Cement Ratio Curing Age Mix U-1.05	Compressive Strength N/mm^2
7	2.8
14	4.44
21	4.59
28	5.04
60	3.56
90	4.44

Table: 16 compressive strength of unwashed Mix at [1.10] at Different Curing Days

Water Cement Ratio Curing Age Mix U-1.10	Compressive Strength N/mm^2
7	3.11
14	5.33
21	6.08
28	5.18
60	7.11
90	5.34

Table: 17 compressive strength of washed Mix at [0.35] at Different Curing Days

Water Cement Ratio Curing Age Mix W-035	Compressive Strength N/mm^2
7	2.82
14	3.56
21	4.15
28	6.97
60	3.98
90	4.4

Table: 18 compressive strength of washed Mix at [0.45] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.45	Compressive Strength N/mm^2
7	19.34
14	18.29
21	23.56
28	23.11
60	20.89
90	34.67

Table: 19 compressive strength of washed Mix at [0.50] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.50	Compressive Strength N/mm^2
7	16.23
14	17.33
21	22.22
28	23.81
60	22.67
90	26.67

Table: 20 compressive strength of washed Mix at [0.55] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.55	Compressive Strength N/mm^2
7	13.55
14	17.04
21	14.96
28	22.67
60	17.78
90	26.89

Table: 21 compressive strength of washed Mix at [0.60] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.60	Compressive Strength N/mm^2
7	12.89
14	18.08
21	16.3
28	20.59

60	**19.56**
90	**22.89**

Table: 22 compressive strength of washed Mix at [0.\65] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.65	**Compressive Strength N/mm^2**
7	**11.11**
14	**13.63**
21	**13.56**
28	**16.15**
60	**18.89**
90	**24**

Table: 23 compressive strength of washed Mix at [0.70] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.70	**Compressive Strength N/mm^2**
7	**10.37**
14	**12.29**
21	**13.48**
28	**14.22**
60	**10.22**
90	**16.89**

Table: 24 compressive strength of washed Mix at [0.75] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.75	**Compressive Strength N/mm^2**
7	**9.78**
14	**12.59**
21	**14.67**
28	**11.56**
60	**15.56**
90	**20**

Table: 25 compressive strength of washed Mix at [0.80] at Different Curing Days

Water Cement Ratio Curing Age Mix W-0.80	**Compressive Strength N/mm^2**
7	**12.29**
14	**11.41**

21	**12.44**
28	**9.93**
60	**13.33**
90	**13.33**

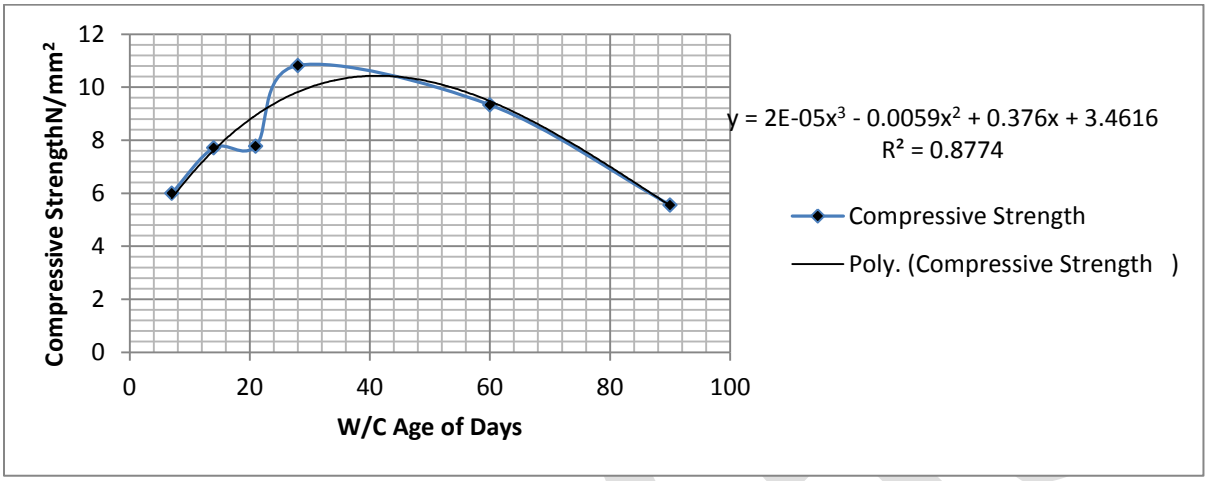

Figure: 1 compressive strength of unwashed Mix at [0.45 at Different Curing Days

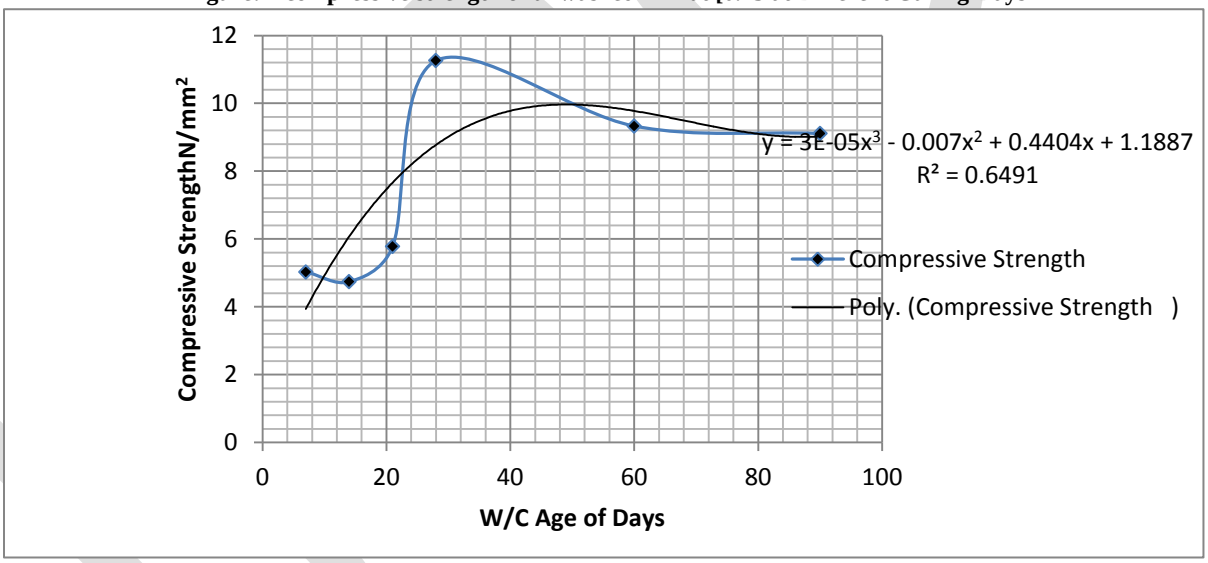

Figure: 2 compressive strength of unwashed Mix at [0.50] at Different Curing Days

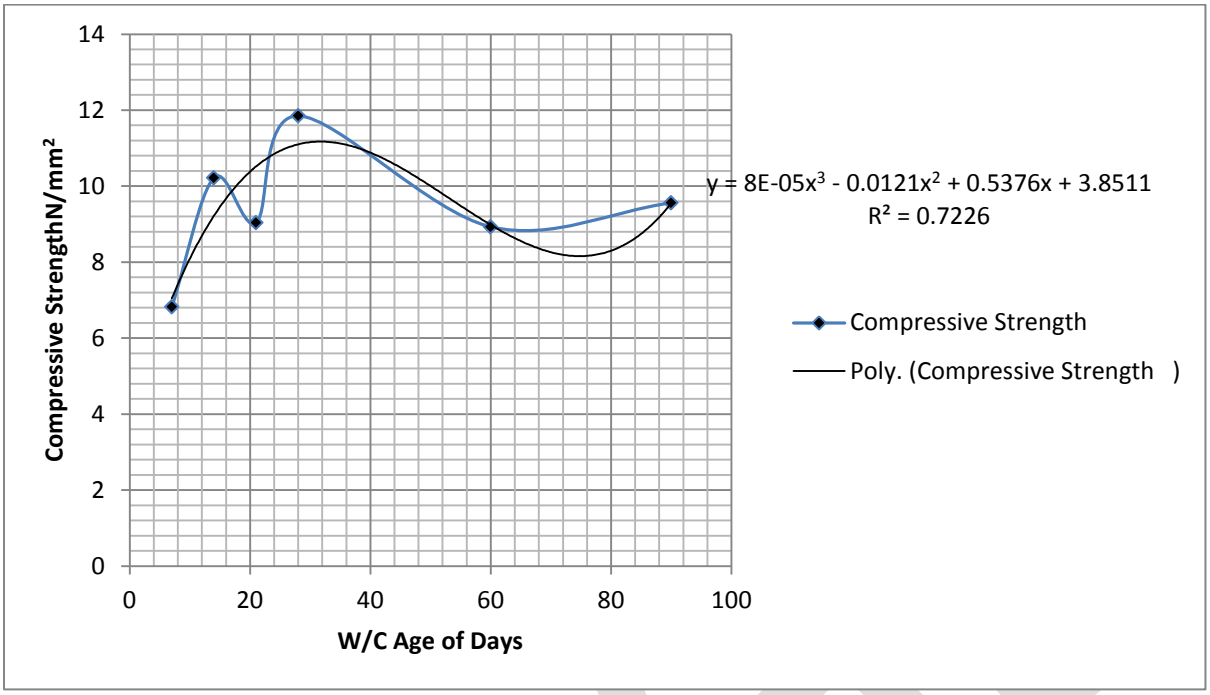

Figure: 3 compressive strength of unwashed Mix at [0.55] at Different Curing Days

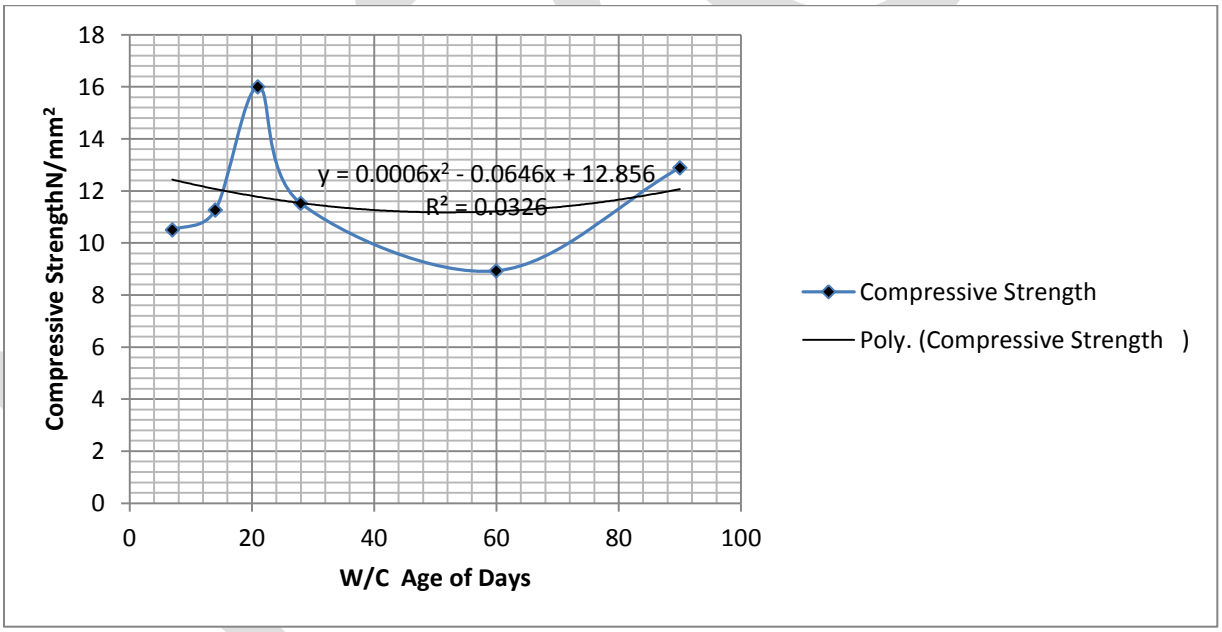

Figure: 4 compressive strength of unwashed Mix at [0.50] at Different Curing Days

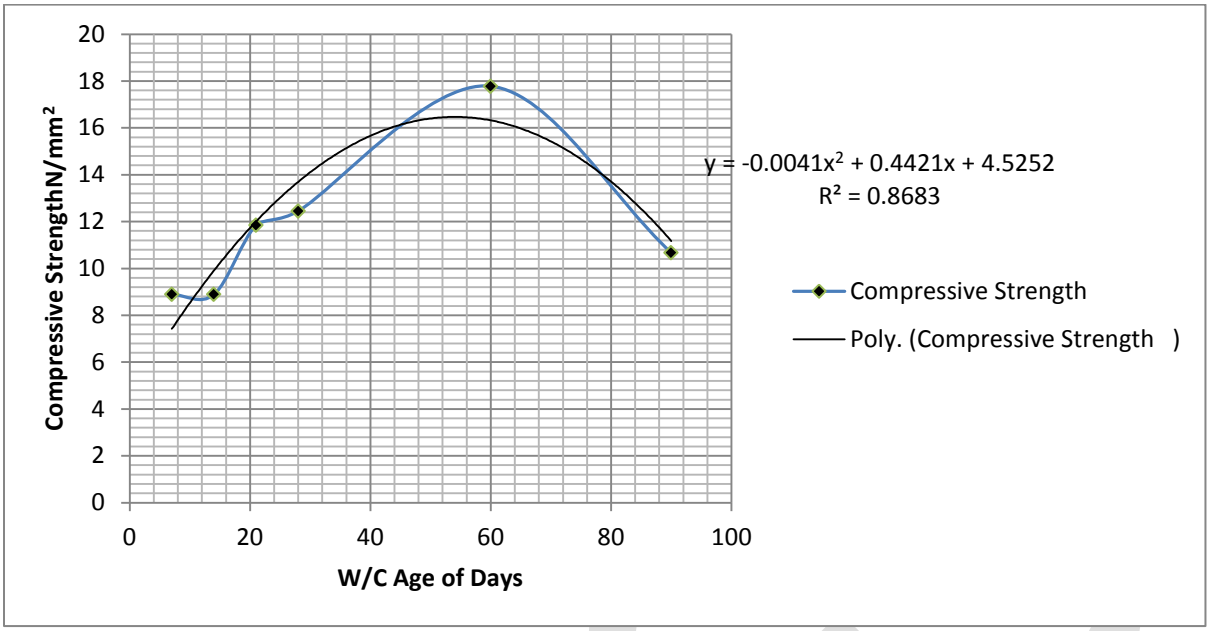

Figure : 5 compressive strength of unwashed Mix at [0.55] at Different Curing Days

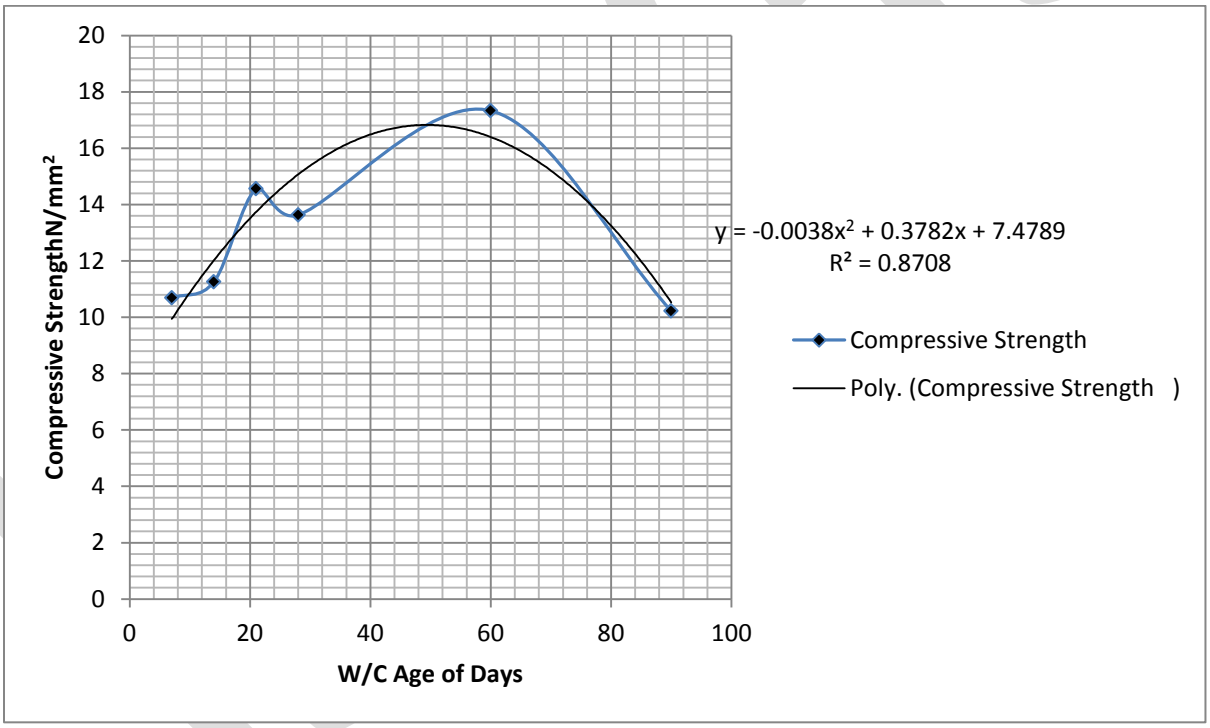

Figure: 6 compressive strength of unwashed Mix at [0.60] at Different Curing Days

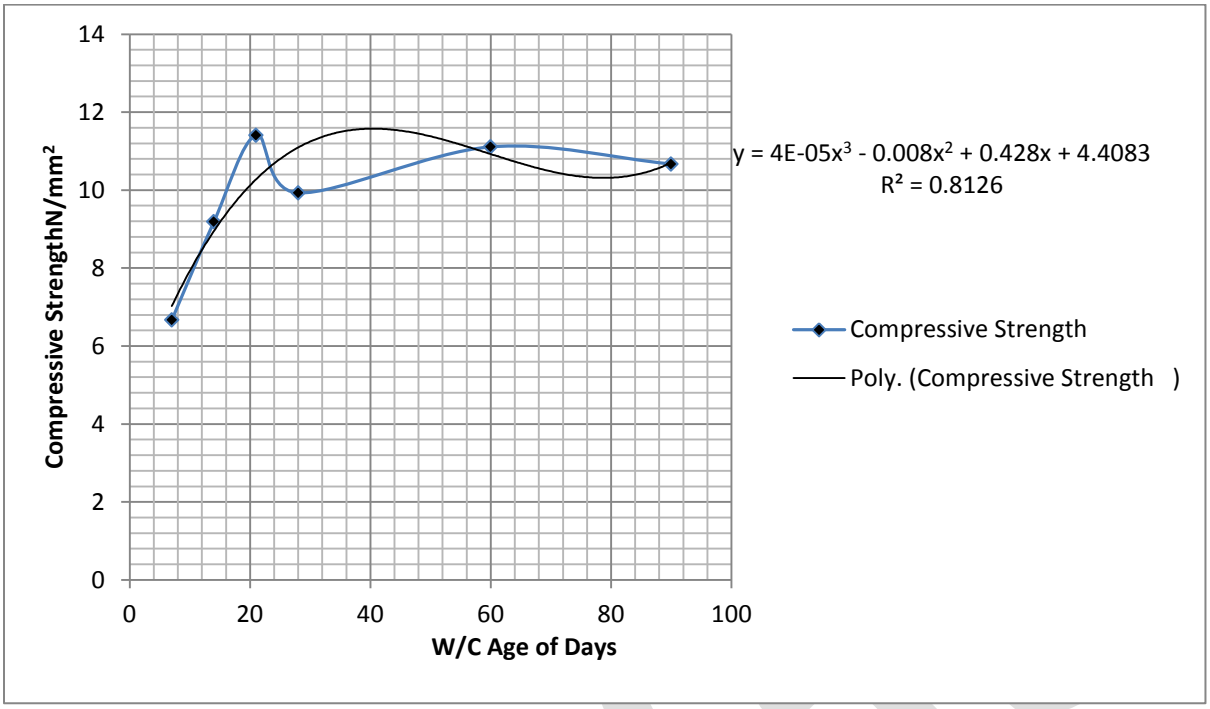

Figure: 7 compressive strength of unwashed Mix at [0.65] at Different Curing Days

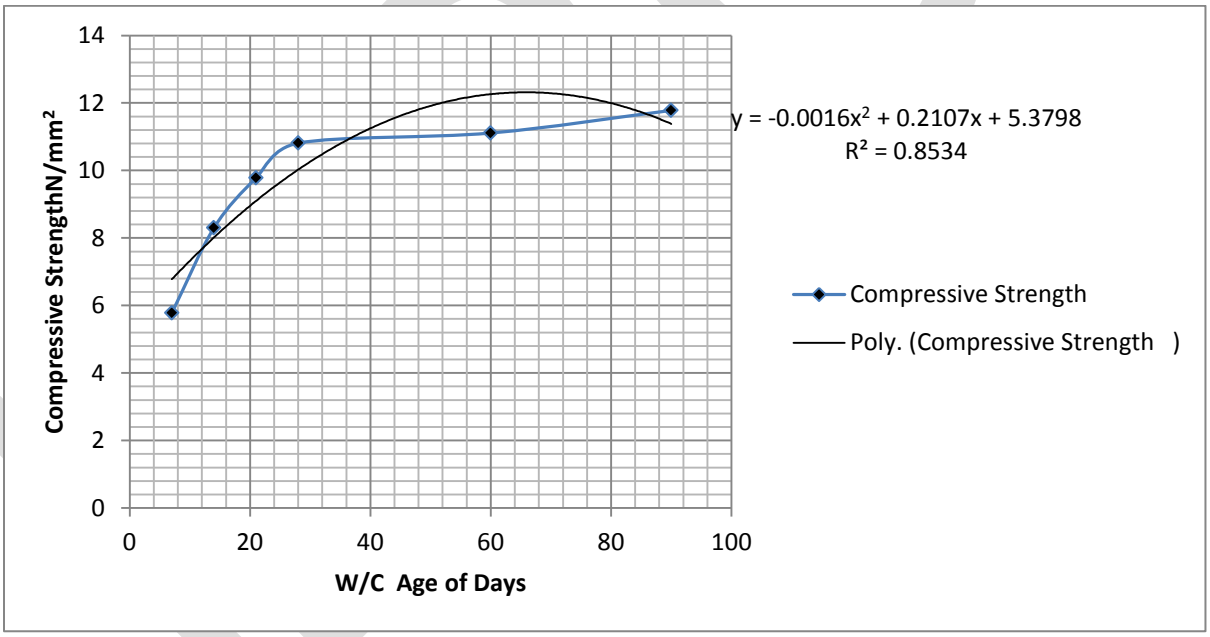

Figure : 8 compressive strength of unwashed Mix at [0.70] at Different Curing Days

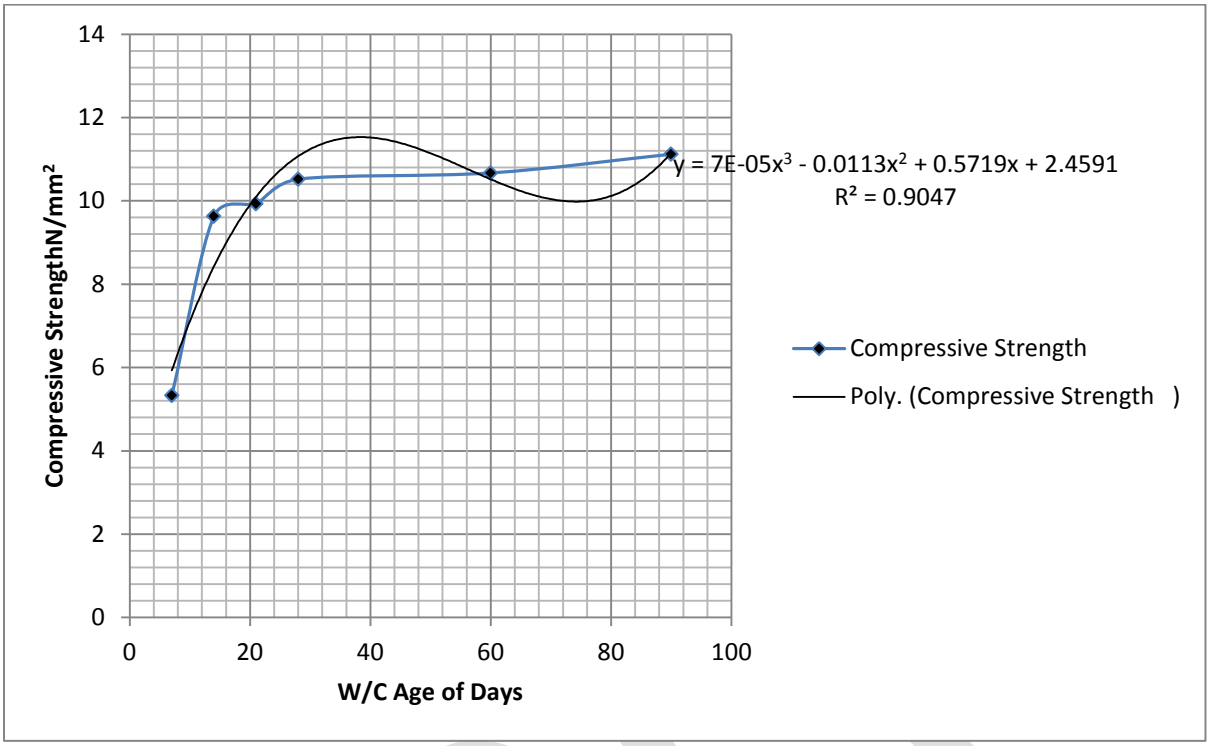

Figure: 9 compressive strength of unwashed Mix at [0.75] at Different Curing Days

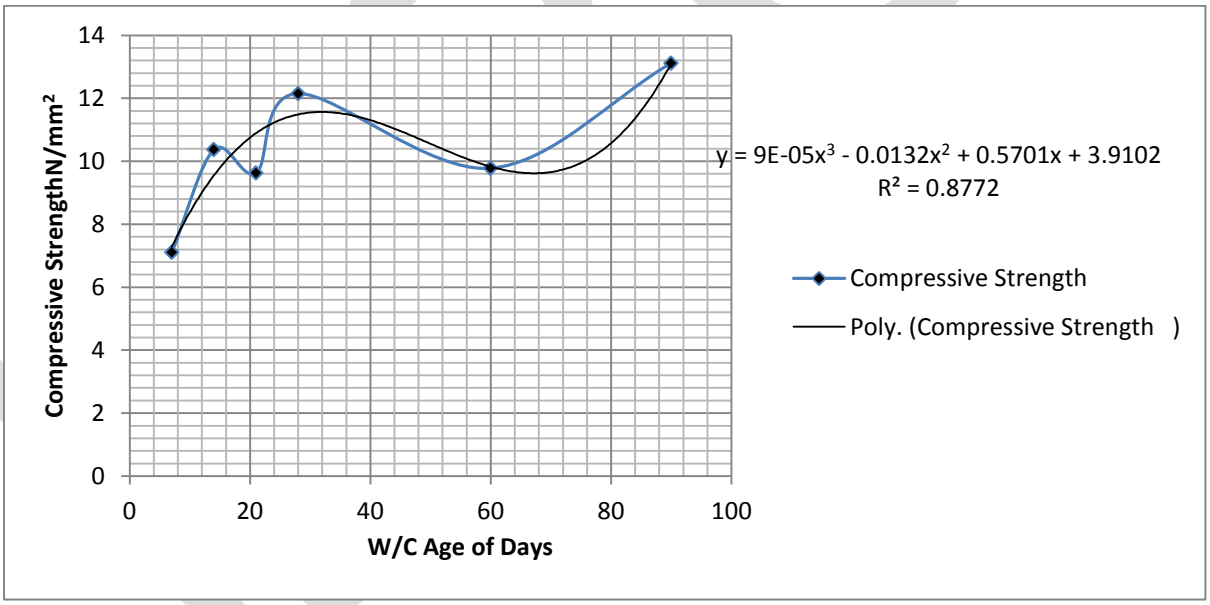

Figure: 10 compressive strength of unwashed Mix at [0.80] at Different Curing Days

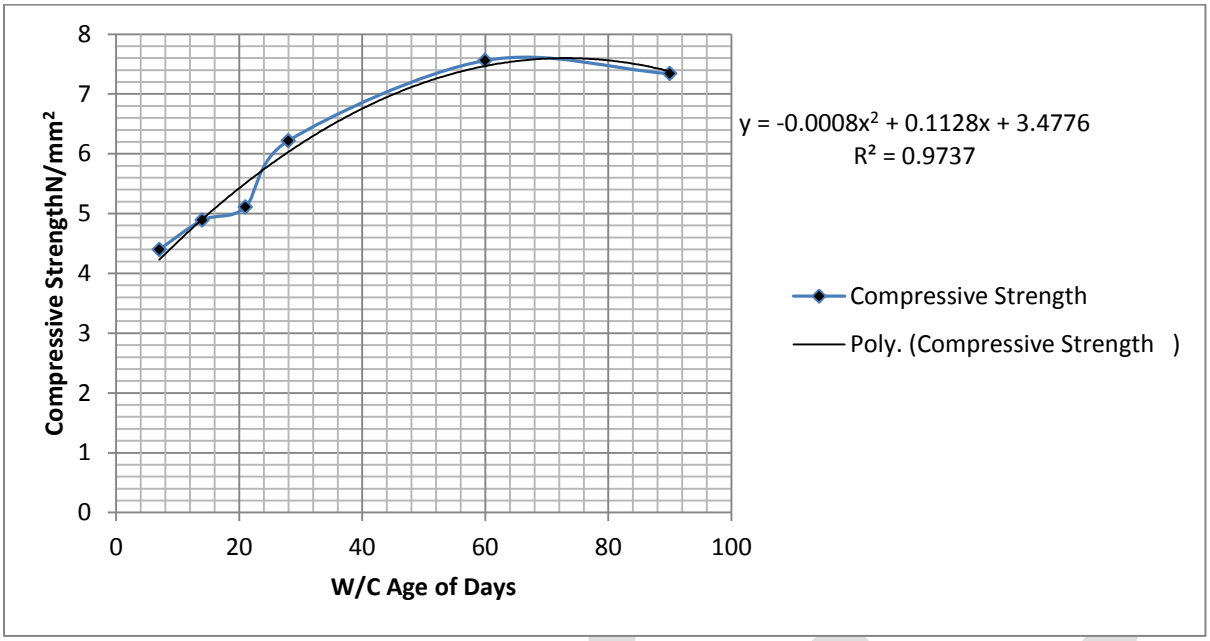

Figure: 11 compressive strength of unwashed Mix at [0.85] at Different Curing Days

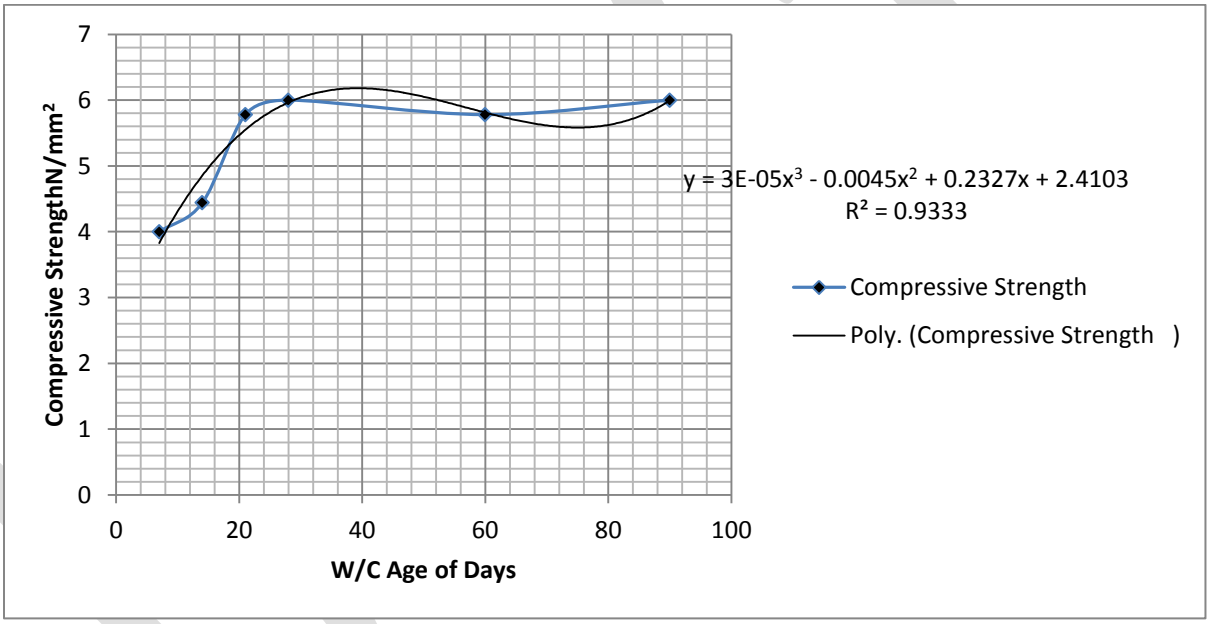

Figure: 12 compressive strength of unwashed Mix at [0.90] at Different Curing Days

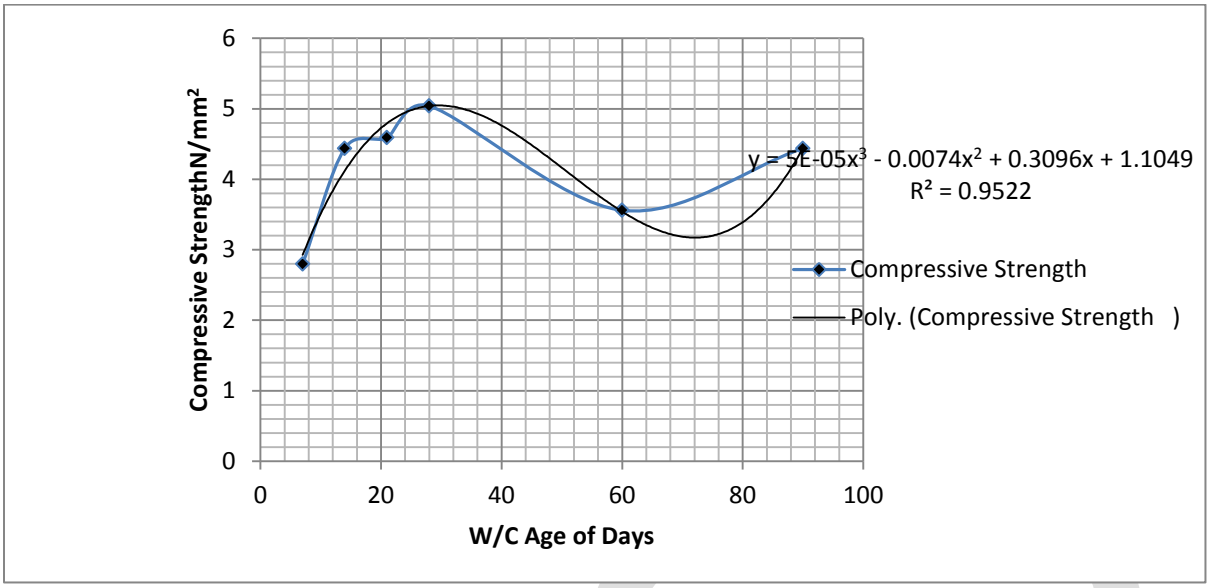

Figure: 13 compressive strength of unwashed Mix at [0.95] at Different Curing Days

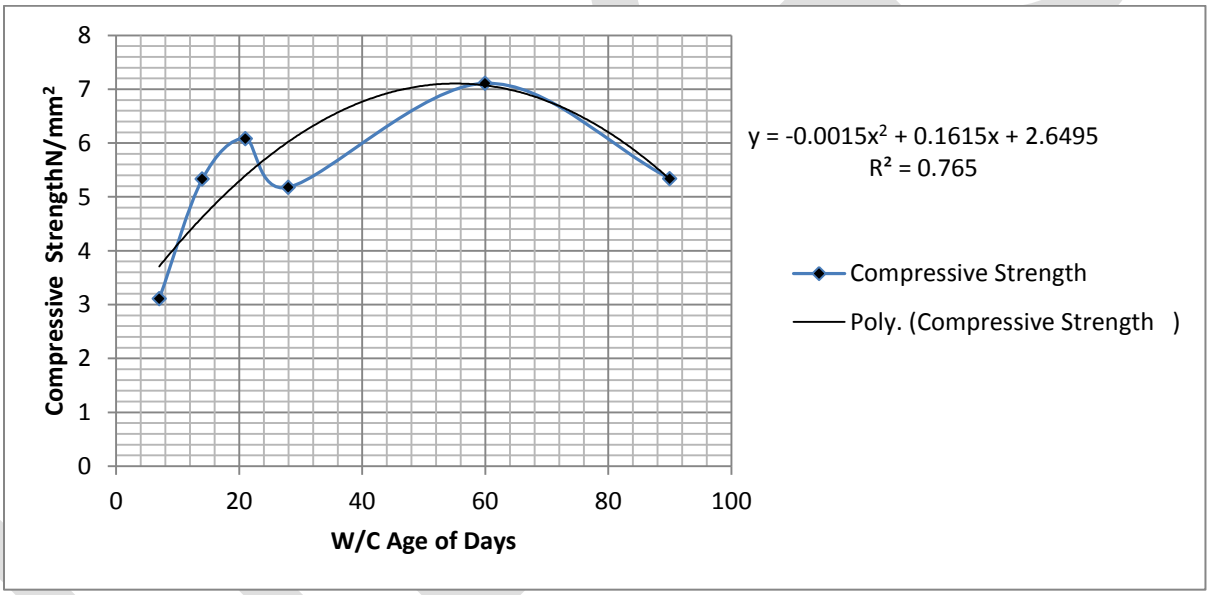

Figure: 14 compressive strength of unwashed Mix at [1.00] at Different Curing Days

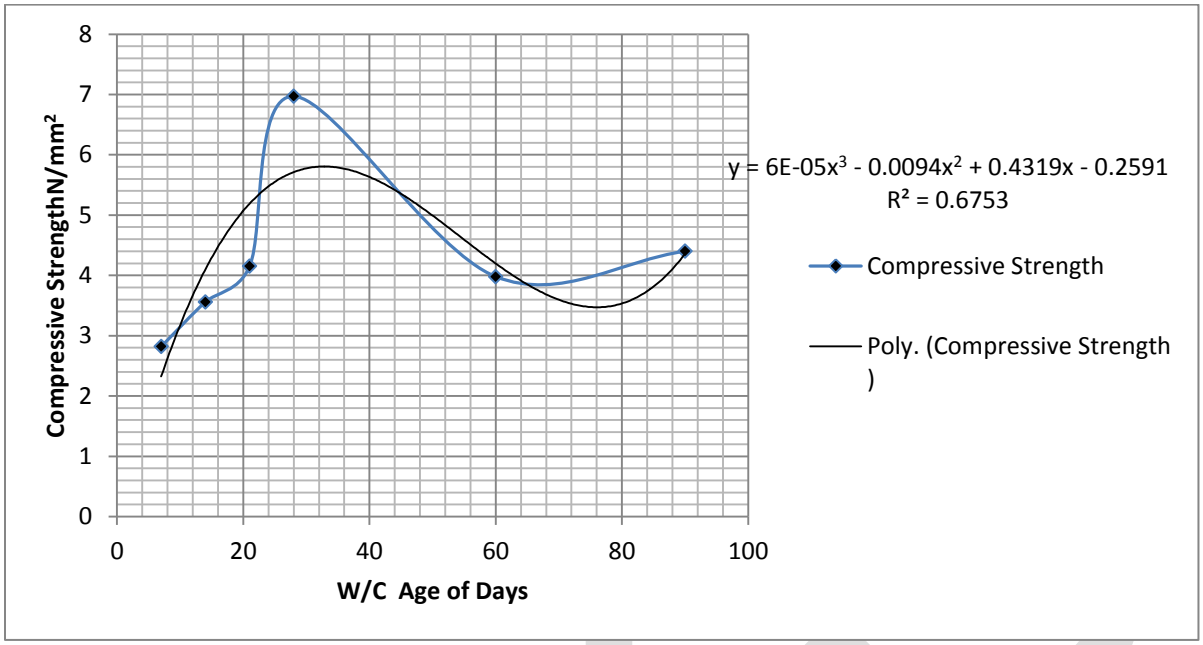

Figure: 15 compressive strength of unwashed Mix at [1.05] at Different Curing Days

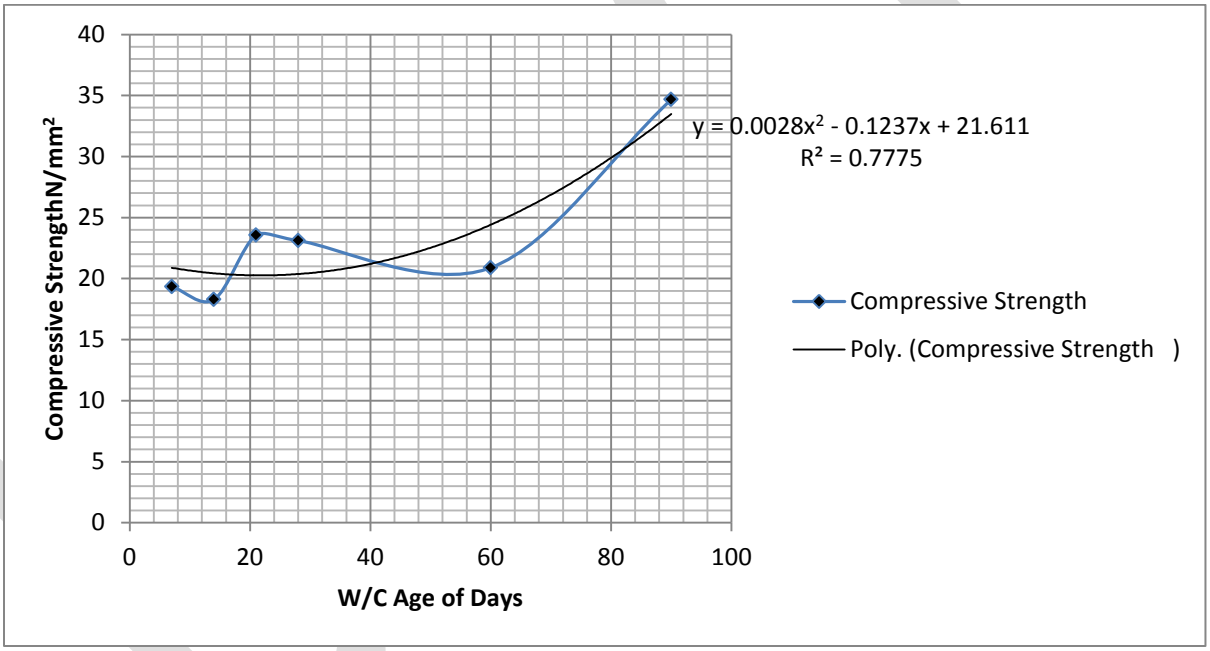

Figure: 16 compressive strength of unwashed Mix at [1.10] at Different Curing Days

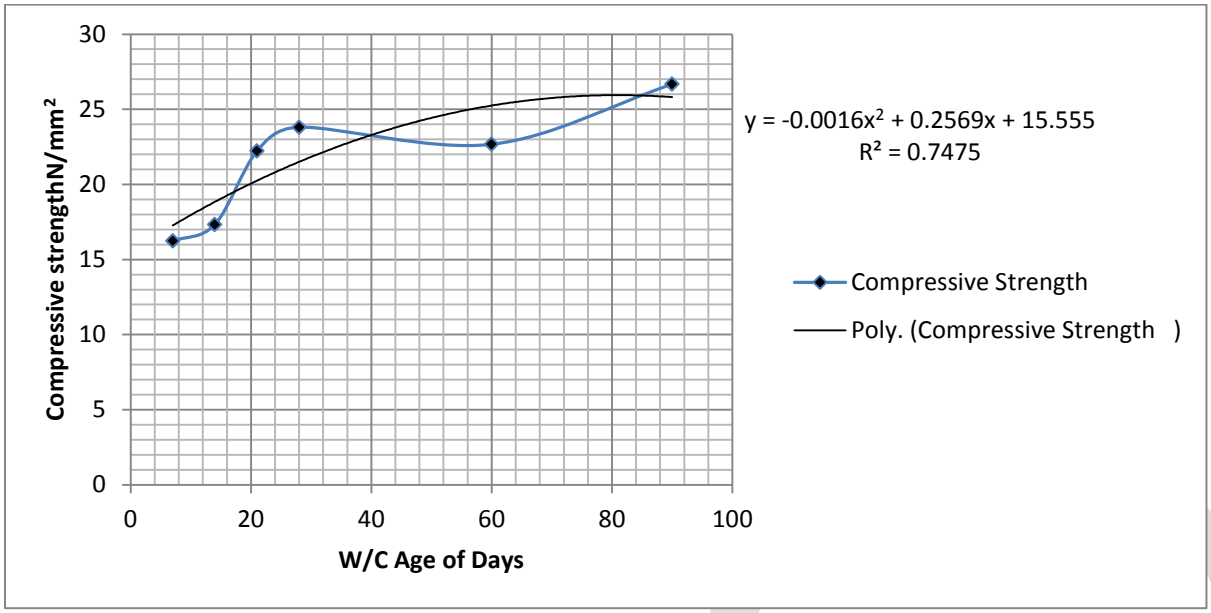

Figure: 17 compressive strength of washed Mix at [0.0.35] at Different Curing Days

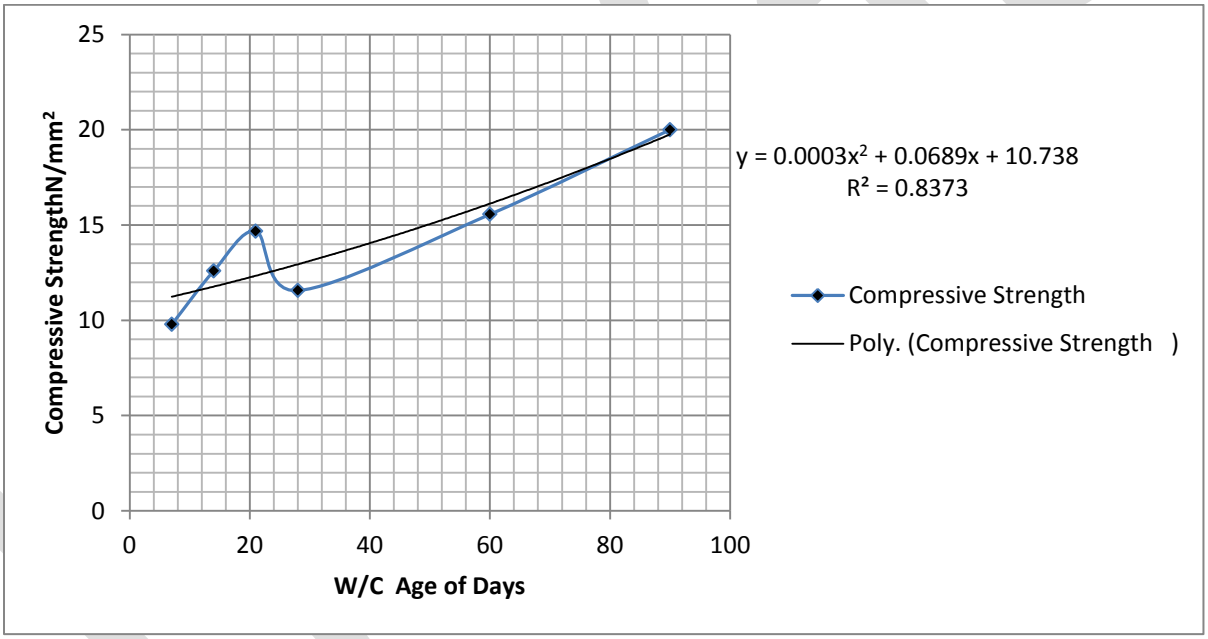

Figure: 18 compressive strength of washed Mix at [0.50] at Different Curing Days

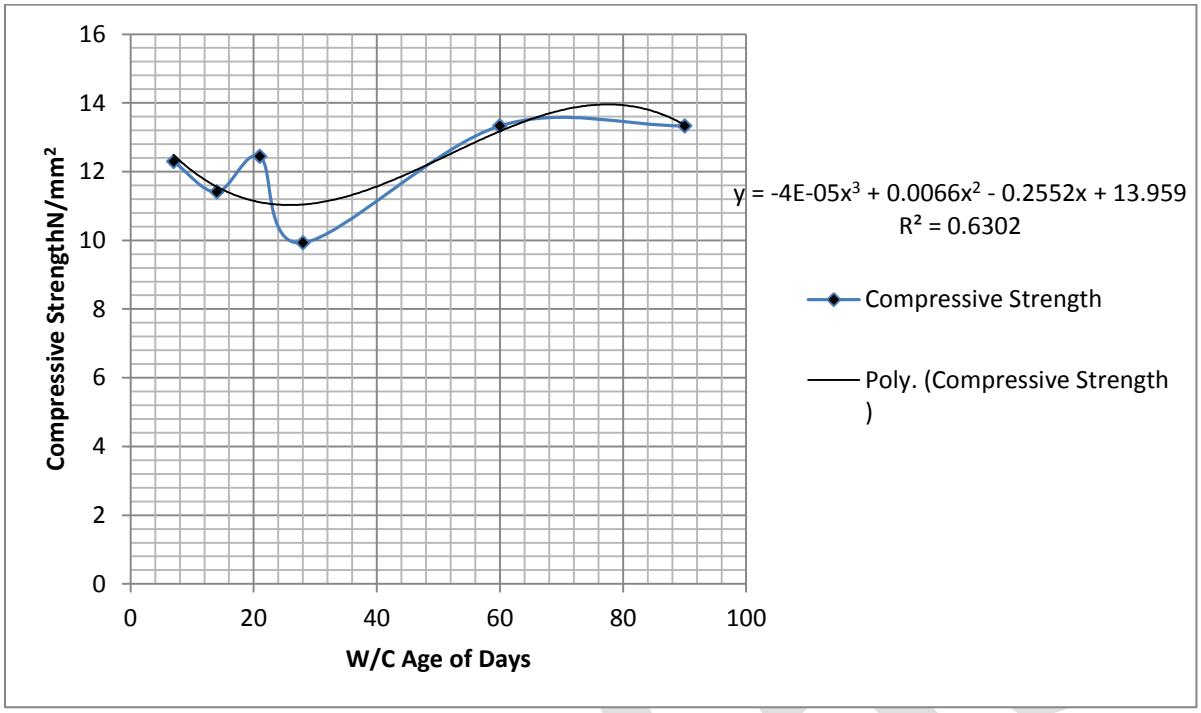

Figure: 19 compressive strength of washed Mix at [0.55] at Different Curing Days

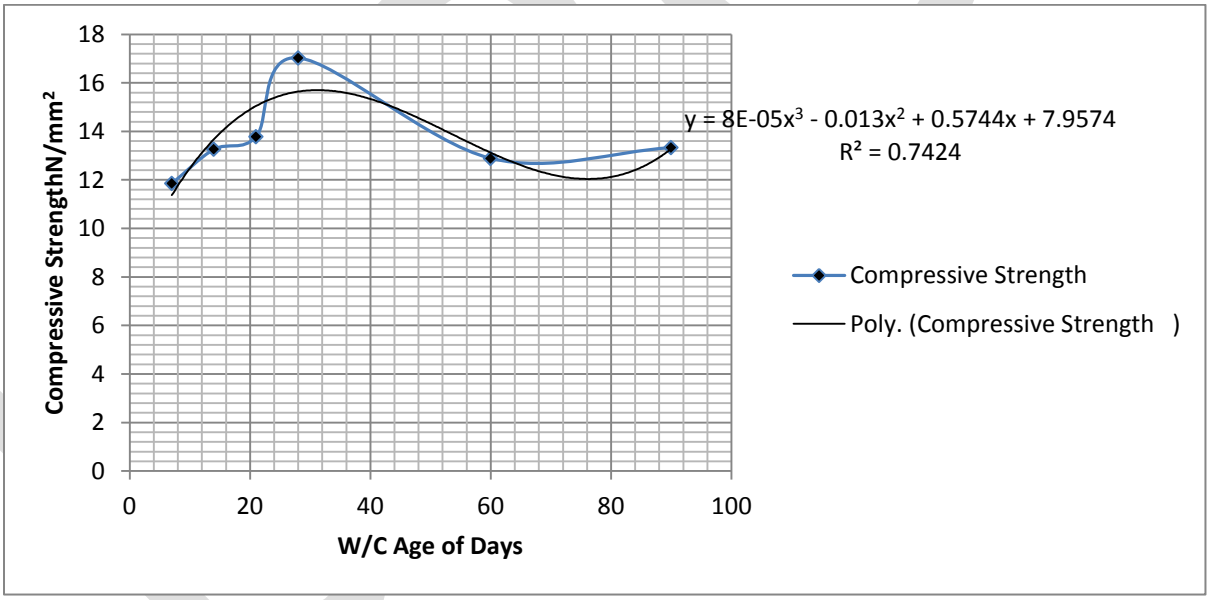

Figure: 20 compressive strength of washed Mix at [0.60] at Different Curing Days

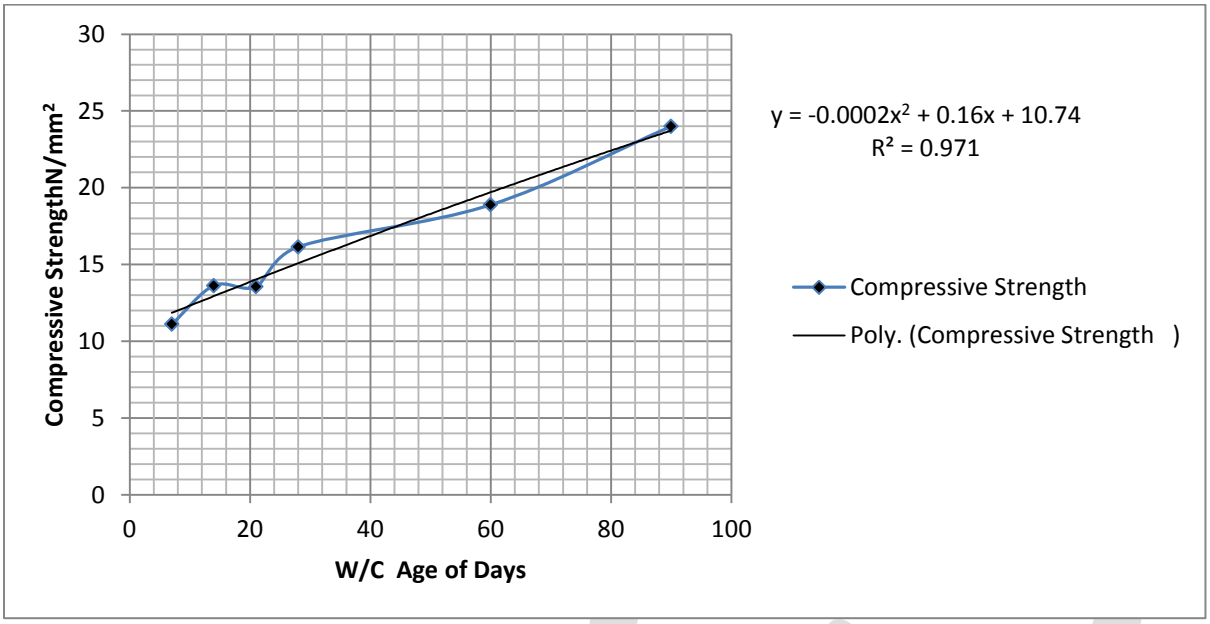

Figure: 21 compressive strength of washed Mix at [0.65] at Different Curing Days

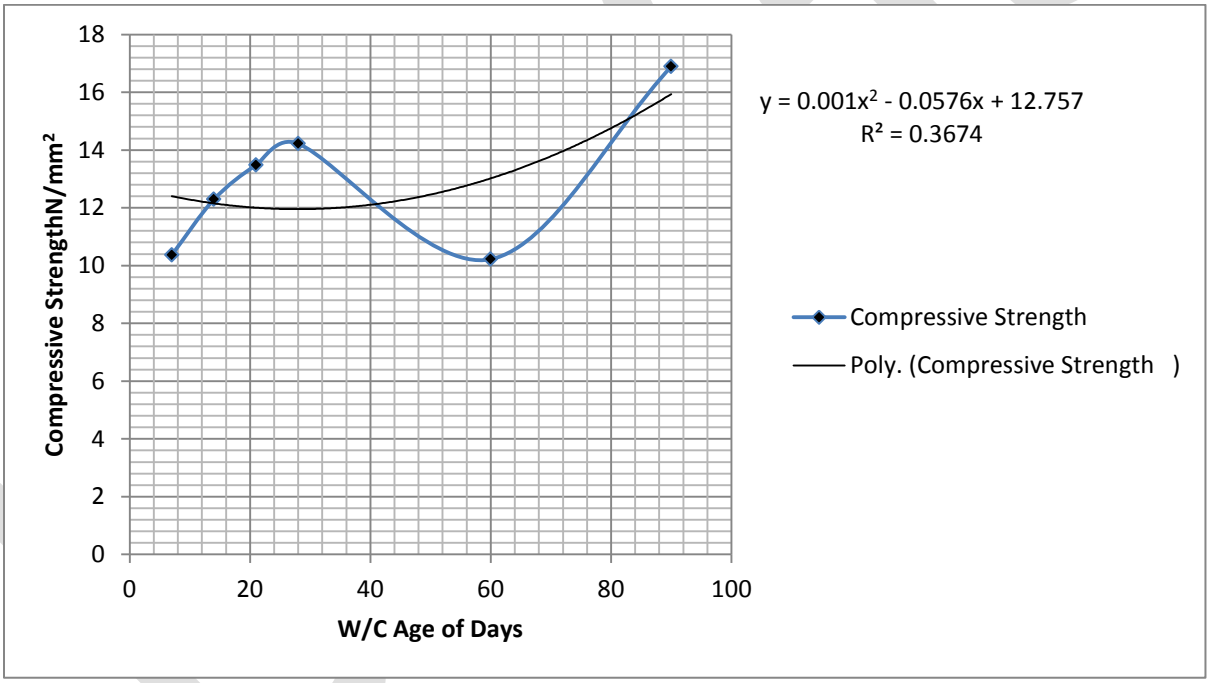

Figure: 22 compressive strength of washed Mix at [0.70] at Different Curing Days

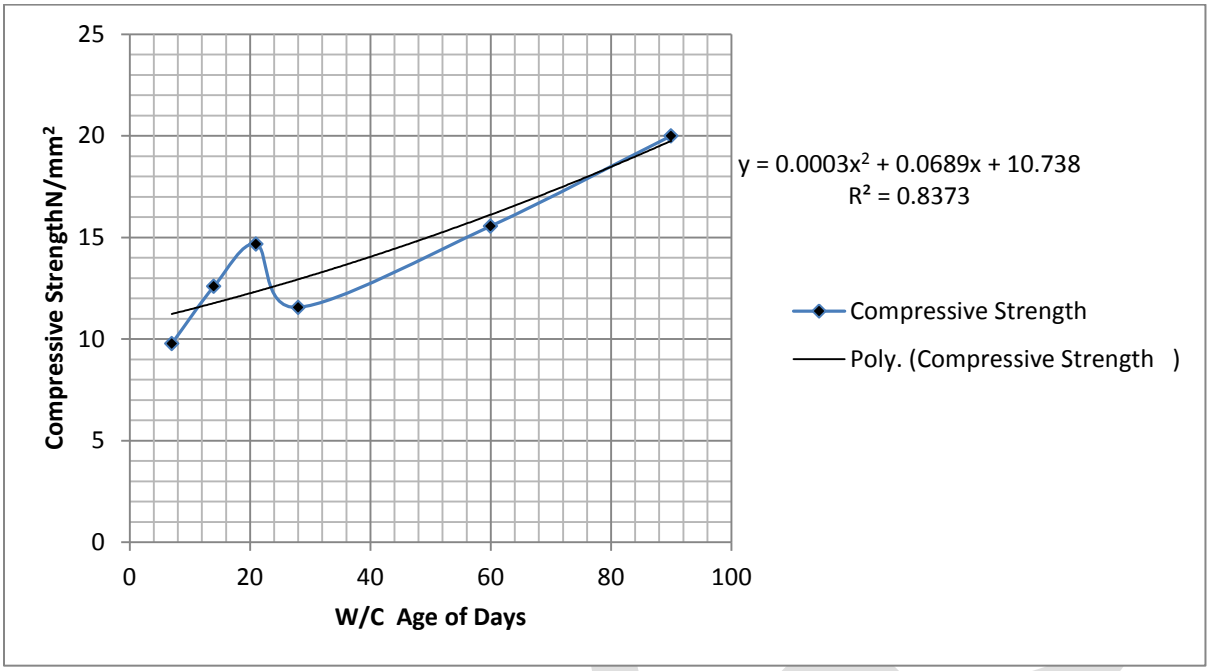

Figure: 23 compressive strength of washed Mix at [0.75] at Different Curing Days

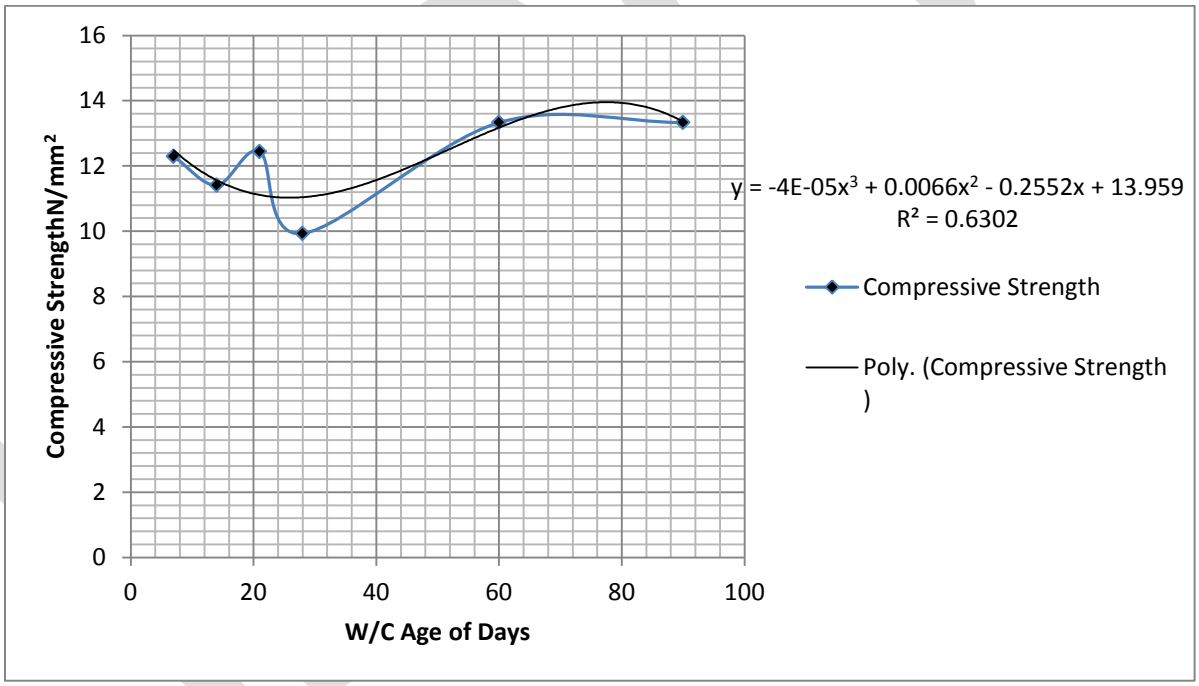

Figure: 24 compressive strength of washed Mix at [0.80] at Different Curing Days

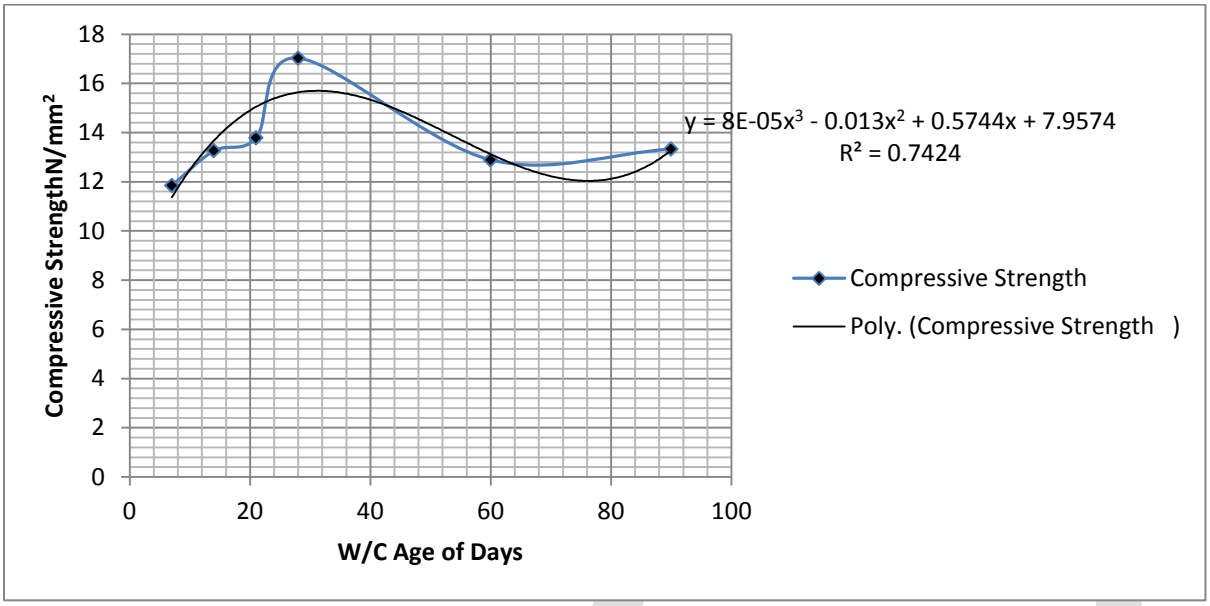

Figure: 25 compressive strength of washed Mix at [0.85] at Different Curing Days

The study express the compression rate of concrete made from unwashed and washed locally 3/8 gravel at different mix ratio, these graphical representation has definitely shows various ways that compression strength are attained in different curing age. Figure one express the compressive strength in gradual process at seven days thus maintained linear state within fourteen and twenty one days, sudden increase were observed at the maximum rate of twenty eight curing days, thus decrease down to the lowest at ninety days. Figure two express fluctuation with gradual increase to the maximum compressive strength at twenty eight days thus declined between sixty and ninety curing days. Figure three express oscillations similar to previous figures, the maximum values at twenty eight days and suddenly decrease down with slight increase at ninety days. Figure four express slight increases within seven and fourteen and suddenly increase to the optimum values at twenty eight days. Thus experiences gradual decrease with fluctuation between sixty and ninety days. figure five express slight vacillation and gradually increase to the maximum values at sixty days, sudden decrease were observe to the lowest at ninety days, figure six in similar condition were observed where slight vacillation were experienced, the maximum values recorded at sixty day with slight decrease at ninety days. Figure seven observed rapid increase to the optimum values recorded at twenty one days fluctuation were experiences to the lowest point recorded at ninety curing days. Figure eight experienced gradual increase with slight fluctuation to the maximum values at ninety days. Figure nine maintained similar condition as gradual increase were also observed with linear increase to the optimum values recoded at ninety curing age. Figure ten experienced fluctuation between seven and twenty eight days thus the optimum values were recorded, suddenly declined down with an increase at ninety days. Figure eleven developed fluctuation within seven and twenty one days thus increase gradually to the optimum point developing slight decrease at ninety day. Figure twelve rapidly increase with slight fluctuation to the optimum values recorded at ninety days. Figure thirteen express fluctuations between seven and twenty days that recorded the optimum values thus experienced decrease with slight increase at ninety curing days. Figure fourteen maintained vacillation between seven and twenty eight days thus observed gradual increase to the maximum values recorded at sixty days with slight decrease at ninety days. Figure fifteen observed gradual increase to the maximum values at twenty eight day, sudden decrease were observed with slight increase at ninety days. Figure sixteen observed fluctuations between seven and twenty eight days and suddenly increase to the optimum values recorded at ninety days. Figure seventeen express vacillation to the point where the maximum values were recorded at ninety days. Figure eighteen maintained similar conditions with fluctuation like the previous, the presented figure observed increase on the trend down to the maximum values recorded at ninety curing days. Figure ninety days developed oscillations between seven to the optimum values at sixty days with slight declined at ninety days. Figure twenty generated serious fluctuation, the optimum values recoded at twenty eight days thus experienced rapid declined between sixty and ninety day. Figure twenty one maintained vacillation between seven and twenty eight days, thus express linear increase to the maximum values at ninety days. Figure twenty two, gradually increase between seven and twenty eight thus developed sudden decrease at sixty days with rapid increase to the optimum values at ninety days. Figure twenty three express gradual increase with slight decrease thus developed exponential phase to the maximum point at

ninety curing age. Figure twenty four generated fluctuation between seven twenty eight were the highest values were recorded thus finally developed slight decrease at ninety days. Figure twenty five developed slight fluctuation from seven to the maximum point at twenty eight days, thus experienced sudden decrease with sixty days with slight increase at ninety days.

4. Conclusion

The compressive strength of locally 3/8 gravel has been express through experimental techniques, these values has shows various curing age, these result were subjected to thorough calibration that has generated different model equations at different mix ratios, the study were able to express the variations of compressive strength as a result of different application of water cement ratios, the locally occurring 3/8 gravel were characterized were the gravel was separated washed and unwashed samples, the result were generated base on these two conditions, graphical representation of these values expressed the variations of compression from different mixed ratios, it was observed that compressive strength are attained base on the rate of impurities in the deposited unwashed locally 3/8 gravel, the water cement ratios applied express lower compression results, these condition generated some compressive results that may not developed good concrete performance, the calibration from the experimental result has definitely generates model equations that will developed predictive values.

The gravel in its naturally occurring form contains some impurities that affect some of the cubes which result to drop in strength. Concrete attain his 95% -97% strength at 28 days. The long time strength is only 0% as such the impurities are responsible for drop. In the study of gravel strength development is not much compared to other forms of aggregate, this form the bases for drop in strength especially when wet carry beyond twenty eight days, it is recommended that air curing should be adopted after twenty eight days because of porosity of materials.

Smooth River gravel produces weaker concrete, while small size of coarse aggregate produces highest strength concrete attaining its high specific surface area. Iravani (1996) works also affirmed this with regards to wet curing and strength development of aggregate types.

REFERENCES:

[1] Abdullahi. M Effect of aggregate type on Compressive strength of concrete international journal of civil and structural engineering volume 2, no 3, 2012

[2] Beshr, H., Almusallam, A.A., and Maslehuddin, M., (2003), Effect of Coarse Aggregate Quality on the Mechanical Properties of High Strength Concrete, Construction and Building Materials, 17(2), pp 97-103.

[3] Elices, M., and Rocco, C.G., (2008), Effect of Aggregate Size on the Fracture and Mechanical Properties of a Simple Concrete, Engineering Fracture Mechanics, 75(13), pp 3839-3851.

[4] Meddah, M.S., Zitouni, S., and Belâabes, S., (2010), Effect of Content and Particle Size Distribution of Coarse Aggregate on the Compressive Strength of Concrete, Construction and Building Materials, 24(4), pp 505-512.

[5] Mindess, S., Young, J.F., and Darwin, D., (2003), Concrete. 2nd ed. Pearson Education, Inc. New Jersey.

[6] Montgomery, D.C., Peck, E.A., and Vining, G.G., (2001,) Introduction to Linear Regression, 3rd ed. John Wiley and Sons, Inc. New York.

[7] Neville, A. M. (1995), Properties of concrete, 4th ed. Addison Wesley Longman, England.

[8] Olanipekun, E.A., Olusola, K.O., and Ata, O.A., (2006), Comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates. Building and environment, 41(3), pp 297 – 301.

[9] Özturan, T., and Çeçen, C., (1997), Effect of Coarse Aggregate Type on Mechanical Properties of Concretes With Different Strength, Cement and Concrete Research, Vol 27, Issue 2, pp 165-170.

[10] Rocco, C.G., and Elices, M., (2009), Effect of Aggregate Shape on the Mechanical Properties of a Simple Concrete, Engineering Fracture Mechanics, 2009, 76(2), pp 286-298.

[11] Wu, K-R., Chen, B., Yao, W., and Zhang, D., (1997), "Effect of Coarse Aggregate Type on Mechanical Properties of High-Performance Concrete", Cement and Concrete Research, 31(10), pp 1421-1425

[12] Ephraim M.E. Ode .T. (2006) Specification for structural Application of concrete with 10mm (3/8) All – in Gravel Aggregate NEAM Vol 1 No 1

[13] Eluozo, S.N. Ode .T. (2015) Mathematical model to monitor stiff clay compression index in wet land area of Degema Volume 6, Issue 12, pp. 59-72, Article ID: IJARET_06_12_007

[14] Eluozo, S.N. Ode .T. (2015) Mathematical model to predict compression index of uniform loose sand in coastal area of Degema, Rivers State of Nigeria. International Journal of Advanced Research in Engineering and Technology Volume 6, Issue 12, pp. 86-103, Article ID: IJARET_06_12_009

[15] Eluozo. S. N and Ode T, Modeling and Simulation of Compression Strength for Firm Clay in Swampy Area of Ahoada East. *International Journal of Advanced Research in Engineering and Technology*, **6**(12), 2015, pp. 73-85.

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In-memory Data Analytics On Top Of Hadoop Environment For Detecting Fraudulent Transactions And Analysing Customer Behaviour

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Abstract— Data is being generated by everything around us at all times. Every digital resource and social media operations produces it. Mobile devices, systems and sensors carry it. Data Analytics is an emerging technology in every area where large amount of data is generated. It helps business organizations to forecast the generated data (structured or unstructured) and to make proper strategies and decisions to prevent any kind of loss to them. Nowadays, online stores, banks continuously generate huge amount of data. Processing of this data takes significant amount of time. Hence, what online stores and banks need is to acquire the capability to process their big data in lesser time. This is easily possible, with the help of high-performance analytics solutions. This paper aims to implement high performance analytics solution using in-memory analytics and hadoop technology which detects fraudulent transactions and does customer behaviour analysis. Use of in-memory analytics reduces the processing and response time and generates faster results. On the other hand, hadoop is to be used for large scale data processing in parallel. Also, Hive is used on the top of hadoop for extracting structured data and analyzing the big data by processing queries and using map-reduce functions internally.

Keywords—Data Analytics; Big Data; In-memory Analytics; Hadoop; Hive; Map-reduce

INTRODUCTION

Big data is arriving from various sources at an alarming velocity, volume and variety, veracity and value. To extract meaningful value from big data, one need optimal processing power, analytics capabilities and skills. In-memory analytics is a technique for querying data when it is stored in a computer's main memory i.e. random access memory (RAM), instead of querying data that resides on secondary storage.

This results in tremendously shortened query processing and response times, allowing business intelligence (BI) and analytic applications to support speedy decision making. If the cost of RAM is neglected, in-memory analytics is becoming feasible for many business organizations. BI and other analytics applications have large supported data in RAM, but earlier 32-bit operating systems provided only 4 GB of addressable memory. Newer 64-bit operating systems, with up to 1 terabyte (TB) addressable memory (and perhaps
more in the future), have made it possible to store and process large volumes of data; potentially an entire data warehouse or data mart in a computer's RAM.

II. Motivation

Traditional analytics approaches such as Business Intelligence, Operation Research and Data Mining are no longer enough to harvest value from big data and automate decision making or provide a feedback loop into systems for future improvement and self-tuning. For data scientists and decision makers, there is often need to analyze the data to visualize it or numerically analyze the data in order to get an insight.

Advanced analytics however, does not stop at this point. The ultimate aim is to exploit and extract complex relationships between data and quantitatively measure the amounts and quality of data. This usually involves machine learning and statistical analysis to make solid mathematical models and abstractions that could be used to predict future behaviour or even optimize and improve the performance for multiple goals algorithmically.

The rate of data generated on digital universe is increasing exponentially. Current tools and technologies are not up to the mark to store and process huge amount of data in lesser time. They are also unable to extract value from these data which is most important. When an enterprise can leverage all the information available with large data rather than just a part of its data then it has a superior advantage over the market competitors. Big Data can help to review insights and make effective decisions. In order to handle big data modified paradigms are required.

In-memory analytics can reduce or minimize the need for data indexing and storing aggregated data in OLAP cubes or aggregate

tables. This reduces IT costs and offers quicker implementation of BI and analytics applications. It is expected that as BI and analytic applications implement in-memory analytics, traditional data warehouses may eventually be used only for data that is not queried frequently.

LITERATURE SURVEY

Analytics can be executed using various analytical approaches. Different predictive models, decision model and descriptive models are used for the analyzing data. A combinational approach for analyzing big data by integrating predictive analytics is helpful to automate the decision making process in business. *Big data* analytics need greater use of predictive analytics to discover hidden patterns and their relationships to visualize and explore data [1].

Descriptive Models	**Decision Models**	**Predictive Models**
Find clusters of data elements with similar characteristics. Focus is on as many variables as possible.	Find optimal and most certain outcome for a specific decision. Focus is on specific decision.	Find causality relationships and patterns between explanatory variables and dependent variables. Focus is on specific variables.
Examples: customer segmentation based on socio-demographic characteristics, life cycle, profitability, product preferences	Examples: critical path, network planning, scheduling, resource optimization, simulation, stochastic modeling	Examples: next customer preference, fraud, credit worthiness, system failure

Table 1. Comparison between various analytics model

For different types of big data, different frameworks are required to run analytics. There are many frameworks for processing big data. Some of them includes Apache Hadoop, Apache Drill and Project Storm. Hadoop runs Map-Reduce function whereas Storm clusters maintain topologies. Apache Drill is a query processing framework which is basically used to scan entire tables [2].

Features	Apache Hadoop	Storm	Apache Drill
Owner	Community	Community	Community
Workload	Batch Processing	Real Time Computation / Stream Analysis	Interactive and Ad-hoc Analysis
Source Code	Open	Open	Open
Low Latency	No	Yes	Yes
Complexity	Less	Less	High

Table 2. Comparison between different analytics frameworks

One study has shown that how to investigate customers' dissatisfaction behavior and how to find types of customers' dissatisfaction behavior for productively responding to that. Management of customers' dissatisfaction behaviours is related to their satisfaction. To predict the behaviour of customers data must be analyzed using qualitative methods. The result drawn from analyzing data by these methods showed that the dissatisfaction of service or product quality and disappointment have different effects on behaviors. Customers who feel greater dissatisfaction with service quality become aggressive and respond in various ways such as replacement, cancellation, refund. These results of customers' dissatisfaction behaviors shows that organization has to manage both service quality and the customer's experience dimension [3]. The time taken by the process to investigate dissatisfaction type may result in loss of customers.

Analysis of customer behavior is another crucial part in order to retain existing customers. In personalization applications, it is necessary to know that how essential the contextual information is when building customer behavioral model. The contextual information is also important to predict customer behavior. The degree of contextual information has to be calculated so that the number of behavioral characteristics can be decided. Three main questions has to be addressed to improve customer behavior's predictability: 1) Does context matter when building models of customers' behavior? 2) To which degree is it possible to extract the contextual information from the data? and 3) How do we use the contextual information for predicting customers' behavior? [4].

Another study describes that sensitivity analysis is another technique to predict customer behavior in precise manner. In this technique, some models for predicting behavior of customers are formed prior to analysis of behavior type. When the outcome of behavioral analysis is produced, it is then matched with the prediction models formed earlier. Then, depending upon sensitivity of outcome i.e. the outcome which is similar to one of the formed models is mapped to that respective model and then the prediction is carried out according to that model. In this approach, only matching of outcome is to be done with given models instead of processing and executing each model for analyzing human behavior [5].

The accuracy ratio in above study has to be calculated precisely and results showed that accuracy ratio is less while matching with predictive models.

SYSTEM ARCHITECTURE

The system is combination of in-memory analytics which helps improve the performance by minimizing overhead of bring data into main memory each time from secondary storage and hadoop framework. Hadoop helps in handling big data by storing smaller chunks and in Hadoop Distributed File System (HDFS).

Below is the architectural block diagram of proposed system:

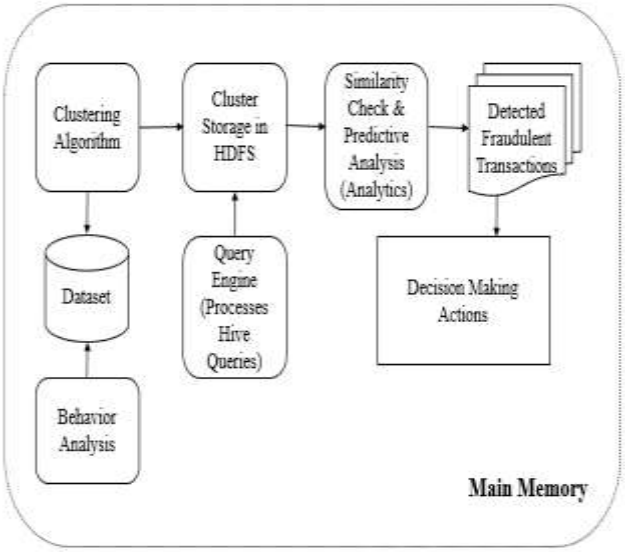


Figure 1. Proposed System Architecture

Mathematical Model

Let S be the system such that,
S = {s, e, X, Y, fmain, DD, NDD, ffriend | ϕ}
Where,
s- initial state
e- end state
X- input of the system
Y- output
Fmain- main algorithm resulting into outcome
DD- deterministic data
NDD- non-deterministic data
ϕ- constraint

In this problem, consider X be the unstructured data as input.
X = D
And D can be defined as D = $\{d_1, d_2, \ldots\ldots, d_n\}$,
Where d_i is dataset and $d_i \in D$

Y can be treated as output.
Y = {T} ^ {C}
And T can be defined as T = $\{t_1, t_2, \ldots\ldots, t_m\}$
Where t_i is detected fraudulent transaction and $t_i \in T$
And C can be defined as C = $\{c_1, c_2, \ldots\ldots, c_m\}$
Where c_i is the type of dissatisfaction by customer and $c_i \in C$

DD: Given data from which comprises of different data sets i.e. $d_1, d_2, \ldots, d_n$. DD → D

NDD: It is the data which is to be determined. NDD → {T} ^ {C}

Functions:
fmain → $d(x_i , x_j)$ and it is given by

$d(x_i, x_j) = [(x_{i1} - x_{j1})^2 + \ldots. + (x_{in} - x_{jn})^2]^{1/2}$

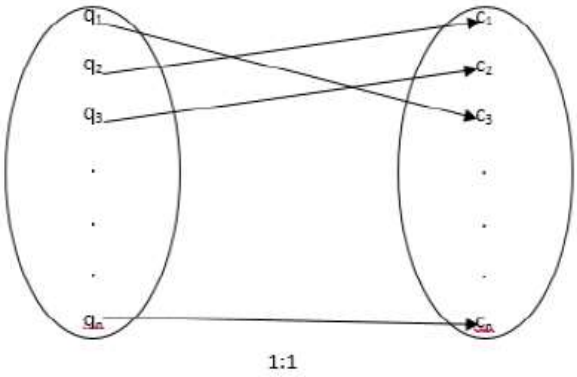
$f_{friend} \rightarrow \forall\ d_i \exists\ G \mid d(g_i, g_j) < d(g_{max}, g_{min})$
where, $G = \{G_1, G_2, \ldots\ldots\ldots, G_n\}$

ϕ- Di ∈ D | D is structured data.

Success: Set of fraudulent transactions and set of behavior type is obtained precisely.

Failure: Set of fraudulent transactions and set of behavior type is not obtained.

Mapping:



Query set Cluster set

Figure 2. Mapping between query set and cluster set

Executional Steps

1. Start
2. Bring entire data into main memory
3. Check if data is structured, if No go to step 4, else step 5
4. Convert unstructured data into structured data
5. Store clusters on HDFS
6. Perform similarity check i.e. calculate intra and inter cluster distance by Euclidean Distance formula
7. Extract odd entry by analyzing results obtained by queries
8. Group odd entries
9. Stop

Algorithm Used

DBSCAN Algorithm for clustering:

1. Create a graph of points which will be the points to be clustered
2. For each core-point p create an edge from p to every point z in the $_{\varepsilon}$-neighborhood of p
3. Assign M to the points of the graph;
4. If N does not contain any core points stop
5. Select a core point p in M
6. Let R be the set of points that can be reached from p by going forward;

i. create a cluster containing R ∪ {p}

ii. M=M/(R ∪ {p})

7. Continue with step 4

CONCLUSION

This paper aims to provide an optimized high performance data analytic technique for detecting fraudulent transactions and analyzing customer behavior. Also, proposed scheme uses in-memory analytic technique which drastically enhances system performance by minimizing overhead of bringing data in main memory from secondary storage. By utilizing hive on top of hadoop and map-reduce framework, obtaining queried results becomes an easy task. Thus, in the proposed scheme using in-memory analytics and hadoop framework we can achieve faster data processing and greater parallelization degree.

FUTURE WORK

Current approach uses offline data set for clustering records, process and analyze data. That means real time data capturing is not done. To address this issue real time data analysis will be the future work for this system. Also, risk analysis can be added as an extra objective which may analyze customer and counterparty risks.

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REFERENCES:

[1] Prof. M.S. Prasada S. Hanumanth Sastry,"Big Data and Predictive Analytics in ERP Systems for Automating Decision Making Process"

[2] Parth Chandarana, M. Vijayalakshmi, "Big Data Analytics Frameworks" in 2014 International Conference on Circuits, Systems, Communication and Information TechnologyApplications (CSCITA).

[3] Hangil Sun,"Research on the Customers Dissatisfaction behavior Types After Product Purchase from the Internet Shopping Mall: Case Analysis for Korea Post Office Shopping" in PICMET 2009 Proceedings, August 2-6, Portland, Oregon USA 2009 PICMET

[4] Cosimo Palmisano, Alexander Tuzhilin, Michele Gorgoglione, "Using Context to Improve Predictive Modeling of Customers in Personalization Applications" in IEEE TRANSACTIONS ON KNOWLEDGE AND DATA ENGINEERING, VOL. 20, NO. 11, NOVEMBER 2008

[5] Alinda Kokkinou, David A. Cranage, "Modeling Human Behavior In Customer Based Processes: The Use Of Scenario-Based Surveys" in Proceedings of the 2011 Winter Simulation Conference

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A Novel Scheme of Transmission Line Faults Analysis and Detection by Using MATLAB Simulation

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Abstract—In this paper is to Analysis and detection the point of the different faults on transmission lines. Faults affect the electrical power system equipments which are connect in transmission line. A fault occurs on transmission line when two or more conductors are contact to each other. Here the implementation is in MATLAB software in transmission line model is designed, simulation and various faults will be occurred by using fault tool box. Mainly the major faults in transmission lines are single line to ground fault. These faults are analysis and detect for discrete wavelet Transform. A proposed model in 100km/33kv transmission line are simulated in MATLAB software to detection the faults. The complete modeling and simulation has been studies and analysis the faults or transients faults by the help of MATLAB Software. In this MATLAB software is used to simulation of different operating and different conditions of fault on transmission line, their faults are L-G fault, LL-G fault, LLL-G fault and three phase short circuit. Here we studies and analysis the whole complete design and detect the faults in simulation of their proposed work in MATLAB software.

Keywords— Transmission line faults, MATLAB Software, L-G fault, LL-G fault, LLL-G fault, discrete wavelet transform

INTRODUCTION

The overhead transmission lines are subjected to many types of faults. It is accurate and quickly faults detection and analysis; direction and distance location under a various types of fault conditions is an important requirement from the fault point of service restoration and flexibility [1]. This methods to find out the fault detection, direction estimation and faults distance location can be classified into the following three categories: power frequency components-based methods, transient signals-based methods and superimposed components-based methods [2].When there is a different types of faults occurs in electrical power system and then in this process of overhead transmission line fault detection and analysis. While their consulting with the electrical power system this terms are bus voltage and RMS current of the transmission line are very important. In this case of three phases electrical power system mainly they are two faults occurs such as three phase balance fault and three phase unbalance fault on transmission line of electrical power system faults are classified are L-G fault, 2L-G fault and 3L-G fault [3]. The high voltage transmission line fault detection and analysis helps to selected and developing for a better to protection purpose and their protection of transmission line. Protected system are circuit breakers and its rating is totally depends on L-L-L fault. The triple line fault current is much higher as compare to other faults current. Simulation is done by using MATLAB simulation in computer and then detection and analysis of over voltage transmission line faults can be easily find out.

The main aim of this paper is to study the general fault types which are balance fault and unbalance faults of overhead transmission line in the electrical power system and perform the detection and analysis is to obtain the result of various parameters, such as (current, voltage, power etc) from their simulation on this types of fault using MATLAB software [4]. In high voltage transmission lines major faults are classified like as L-G fault, LL-G fault, LLL-G fault and three phase faults. These faults can be detect and classified has to used discrete wavelet transform. When during the faults occurs, the grid current and grid voltages undergoes transients waveform. The transients waveform are analysis and comparison by using discrete wavelet transform and the different types of fault can be classified [5]. Detection and Comparison the transients in individual phase currents and zero sequence currents are classified and identifying which faults is occurred. After wavelet transform calculating the energy of highest waveform of fault associated to each phase and ground and thus the fault involving phase is identified. When different types of fault are occur two or more conductors come in contact with each other or ground in three phase systems, faults are classified as L-G, LL-G, LLL-G and three phase faults. For it is at such times that the electrical power system components are the greatest stresses from excessive currents. These faults gradually rise to serious damage on electrical power system equipment [6]. When a major fault which occurring on

transmission lines not only effects the all equipments and it's also effect the electrical power quality. So, it is necessary to determine the types of fault and location of fault on the transmission line and clear the faults as soon as possible in order not to cause some damages. A flash over, lightning strikes to birds, wind, snow and ice load lead to short circuits[7]. When the deformation of insulator materials are also to occurs a short circuit faults. Thus it is essential to detect and compare the fault quickly and separate the faulty part of the overhead transmission line. We locating the ground faults quickly they are more important for safety, economy and electric power quality. Now this transient wavelet or waveform based fault analysis, detect and compare the faults levels of wavelets of each phase and zero sequence currents and thus detecting, comparison and classifying the faults. Figure 1 shows the block diagram of transmission line fault analysis [8].

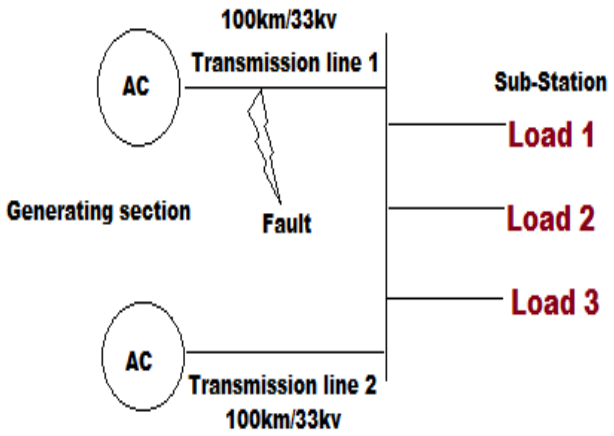


Figure: 1 Show the block diagram of transmission line fault analysis

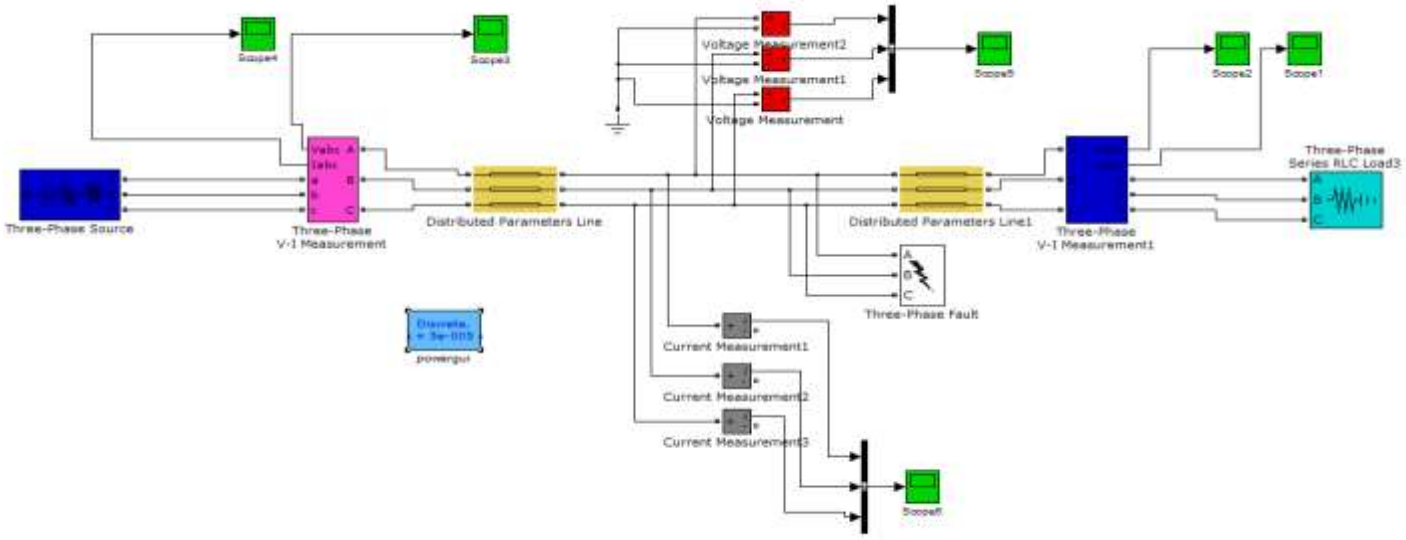
Fault current analysis and detect are most important issue in electrical power system engineering in order that to clear faults quickly and restores electrical power supply as possible as with minimum interruption. When a fault occurs on an electrical high voltage transmission line for its most important to detect and analysis to compare and find its located in order to make for its necessary quality repairs and to restore power as possible as and time needed to determine the faults at a point along with their line will affect the quality of the electrical power delivery.

Wavelet Transform of Transmission line

The advantage of the transform wave is that the analysis and detected be fine adjusted so that high frequency components and low frequency components can be detect and analysis precisely. Results obtained from the transmission line wavelet transform are shown on the time domain and the frequency domain. The transmission line wavelet transform has to be a change in the analysis and detection scale by the factor is called discrete wavelet transform [9].

Modeling and simulation of Transmission Line System

Here we detect and analysis of fault currents will give information about the nature of the fault. Let us consider a faulted transmission line in electrical power system as shown in figure 2. A 33Kv high voltage transmission line system has been simulated to detection and simulation. Figure 1 shows a block diagram of transmission line fault has been used throughout the work. The system consist of one generators of 33Kv is located on high voltage transmission line are three phase simulator used to simulate faults at mid position on high-voltage transmission line. The faulted on transmission line is represented by distributed parameters. As an application of 100 Km transmission line with the parameter of the transmission line simulation diagram shown in figure 2.



In the above figure-2 three phases Voltage-current (V-I) measurement blocks is used to measure V & I sample at source end. The transmission line is one line 100 Km long. Simulation of three phase fault simulator is used to simulate various types of fault. In transmission line faults are classified as L-G fault, LL-G fault and three phase fault.

Simulation Results of Transmission Line

In high voltage transmission line is one of the important components in electric power system. In transmission lines connect the stations (generating station) and load centers. When the generating stations are far away from the load centers and they run over few hundreds of kilometers. It is an accurate faults location on their overhead/high voltage transmission line it is the most important requirement for a permanent fault. Transmission line protection is very important issue in electrical power system because 84-87% of electrical power system faults are occurring in overhead transmission lines [3].

L-G Fault

The L-G faults occur in overhead transmission system are R-G, Y-G and B-G faults. For an example R-G fault is considered here. In this figure shows the voltage and current waveforms of RG or L-G fault system. The R phase signals having more transients than other phases. Approximate and detailed coefficients are calculated, and analysis of energy associated with each phase and ground is tabulated. From the table it is clear that the energy associated with detailed coefficients of R phase and ground are changed and thus this is an R-G fault system.

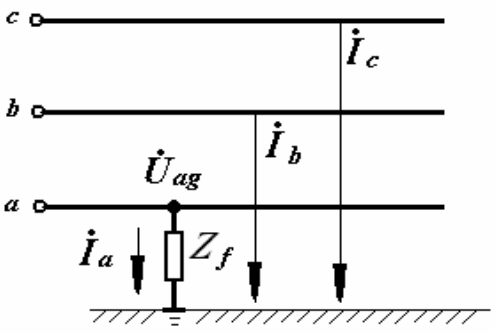


Figure: 3 Single line-to-ground fault

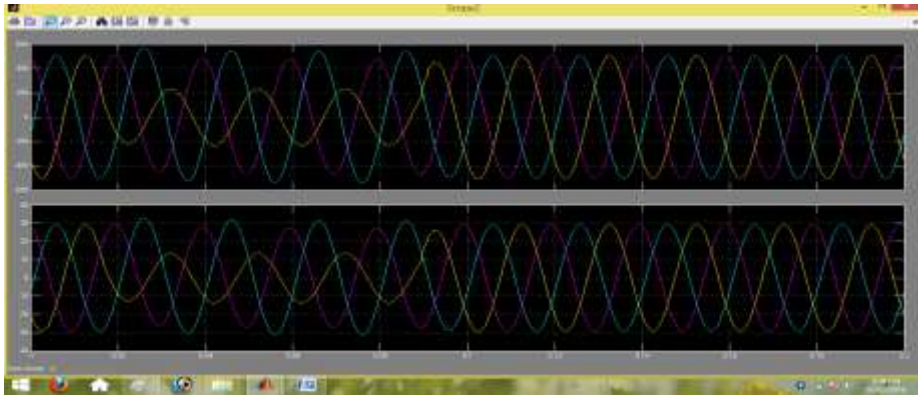


Figure: 4 Output voltage and current waveform Single line to ground

4.2 LL-G Fault

In this figure shows the voltage and current waveforms of RB-G fault system. The R, B and zero signals having more transients fault and than other phases. The detailed coefficients are calculated and energy with associated in each phase and ground is below. From these, table, it is clear that the energy associated with detailed coefficients and analysis of R B phases and ground is changed and thus this is an R-B-G fault system.

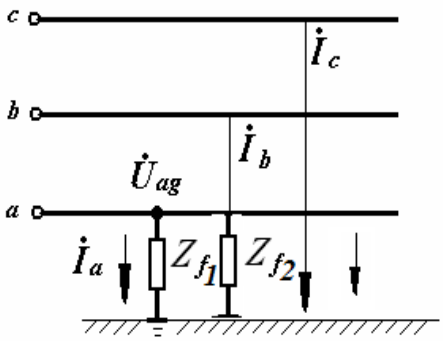


Figure: 5 Double line-to-ground fault

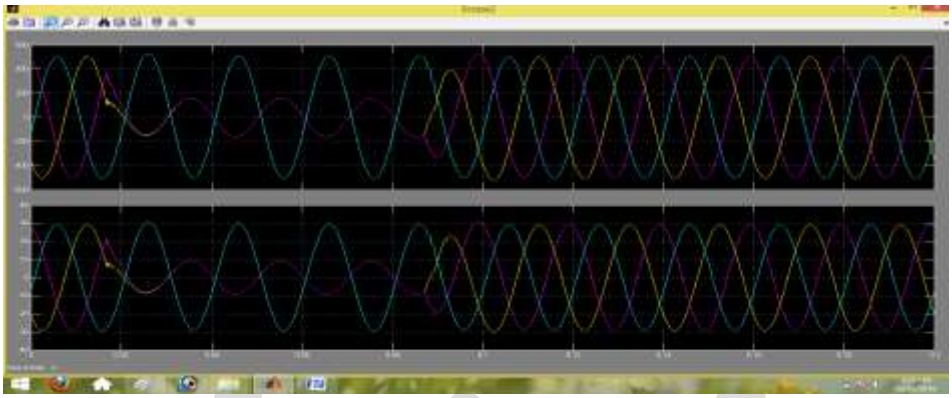


Figure: 6 Output voltage and current waveform Double line to ground

4.3 LLL-G Fault

In three phase faults occurs in overhead transmission system are RYB faults and R-Y-B-G faults. Simulation and modeling results of both fault conditions are discussed. The figure shows the voltage and current waveforms of R-Y-B fault system. In R, Y and B phase signals having more transient waveform and more faults than other phases. Approximate and detailed coefficients are calculated and energy associated with each phase and ground is tabulated below. From the table it is clear that the energy associated with detailed coefficients of R, Y and B phases changed and thus this is an R-Y-B fault system.

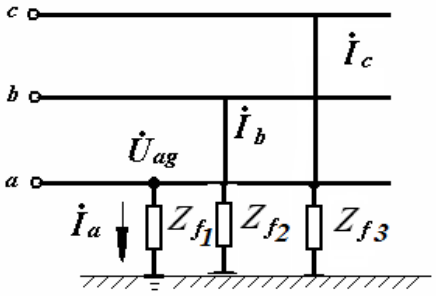


Figure: 7 Triple line-to-ground fault

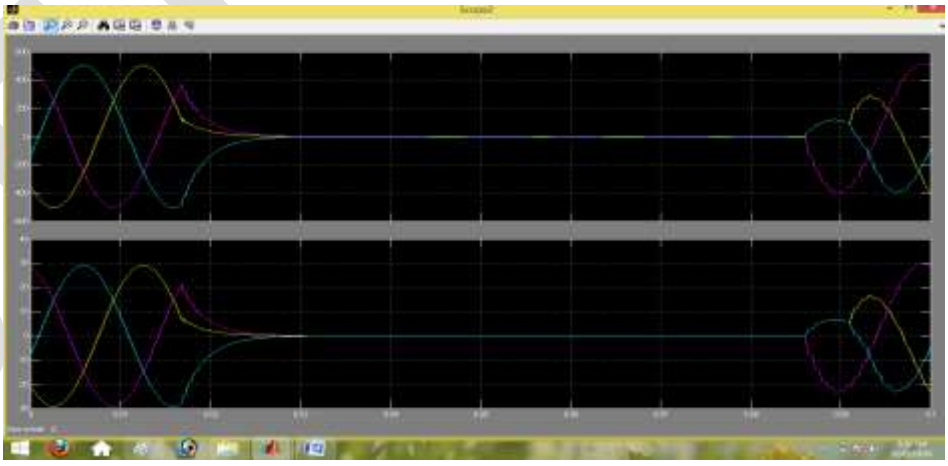


Figure: 5 Output voltage and current waveform Triple line to ground

4.4 Single Line-Ground Fault at Input side

Here we have simulation on L-G fault occurs their one phase is short to the ground and the fault the impedance (Z) is not zero. When the output waveform shows the rise of current on L-G fault occur on overhead transmission line.

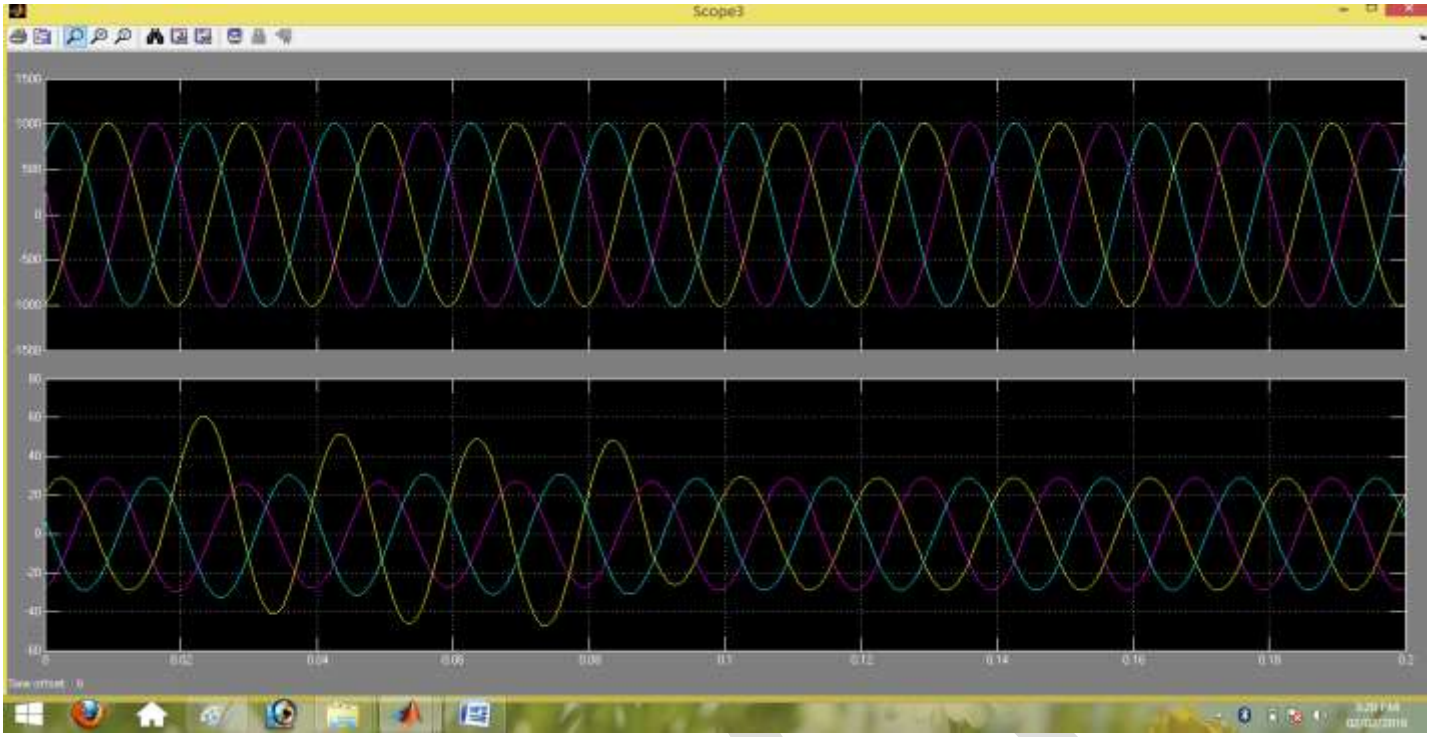


Figure: 6 L-G Fault waveform of current at input side

4.5 Double Line-Ground Fault at Input side

Now modeling and simulation on 2L-G fault occurs their two phases is short to the ground and the fault the impedance, Z is not necessary zero and output waveform shows the rise of current where LL-G fault occur on transmission line.

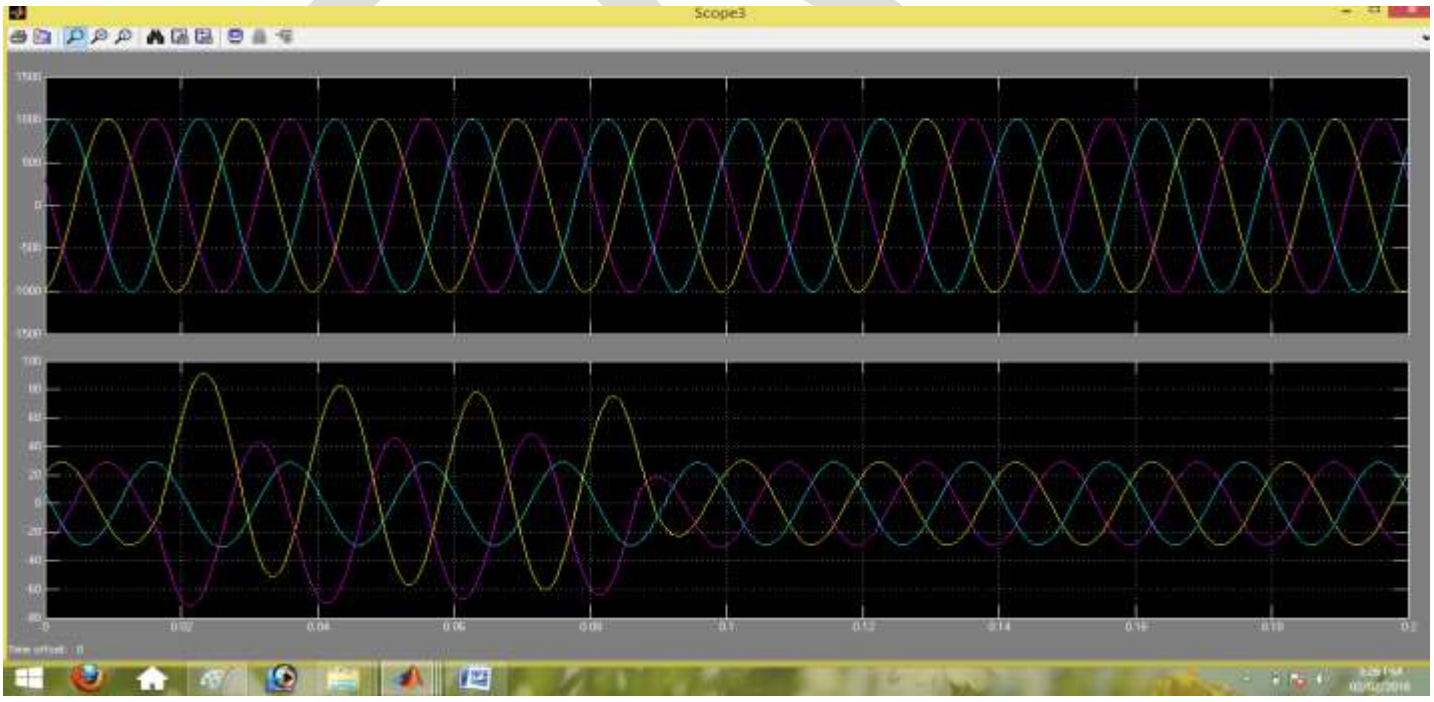


Figure: 7 LL-G Fault waveform of current at input side

4.6 Triple Line-Ground Fault at Input side

A Simulation on 3L-G fault occurs when three phases is shortened to the ground. When the magnitude of the fault current line are higher than the normal input current and the voltage are not change in magnitude. Thus output waveform shows the increasing of current when 3L-G fault occur on transmission line.

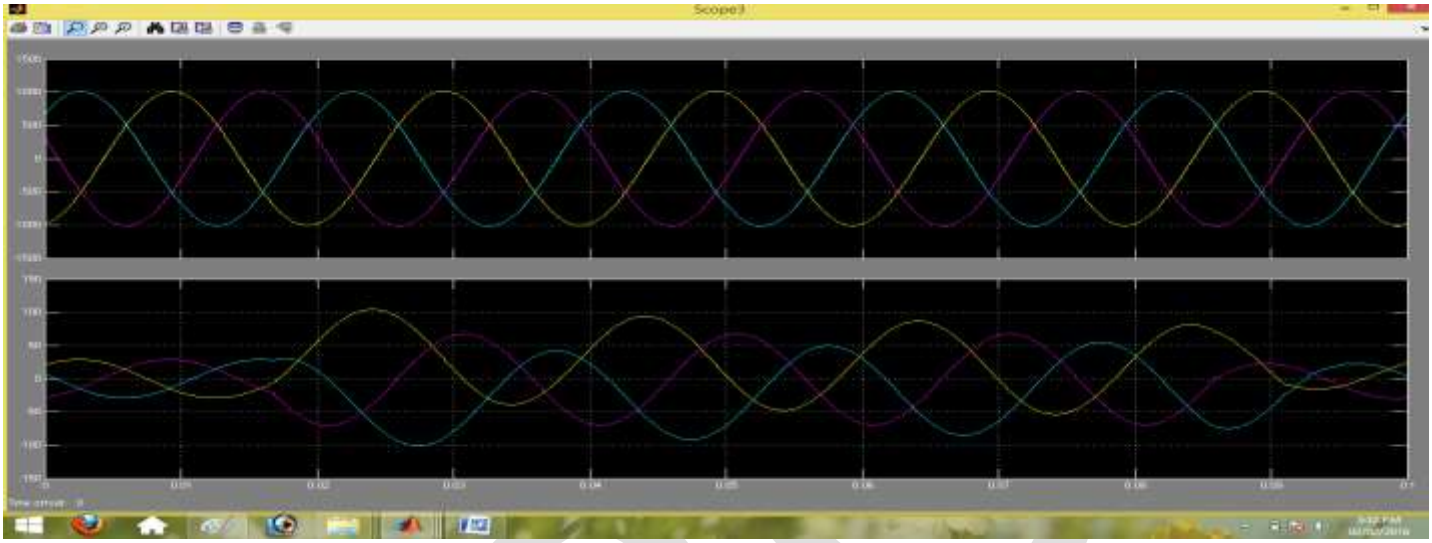


Figure: 8 LLL-G Fault waveform of current at input side

4.7 Without fault

When we applied balance input and there is no fault in their overhead transmission thus output will be normal and balance value of current and voltage. These energies are the reference parameters. Now if there is any/some change in these parameters, then their phase is considered as faulty condition.

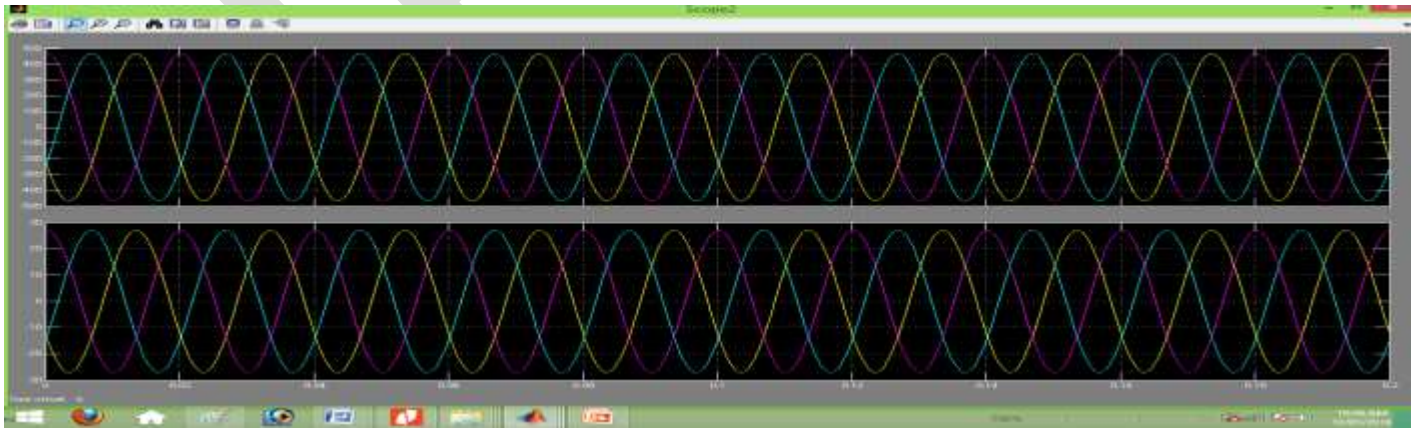


Figure: 9 Voltage and Current waveform of healthy network

4.8 L-G fault waveform

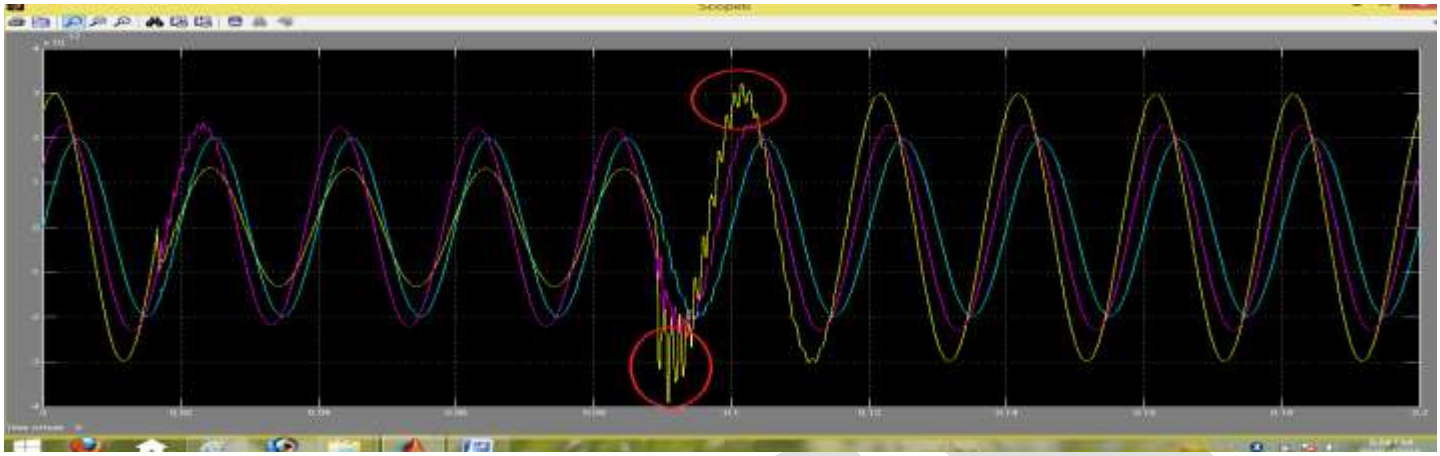


Figure: 10 Fault Current waveform of L-G fault location

4.9 LL-G fault waveform

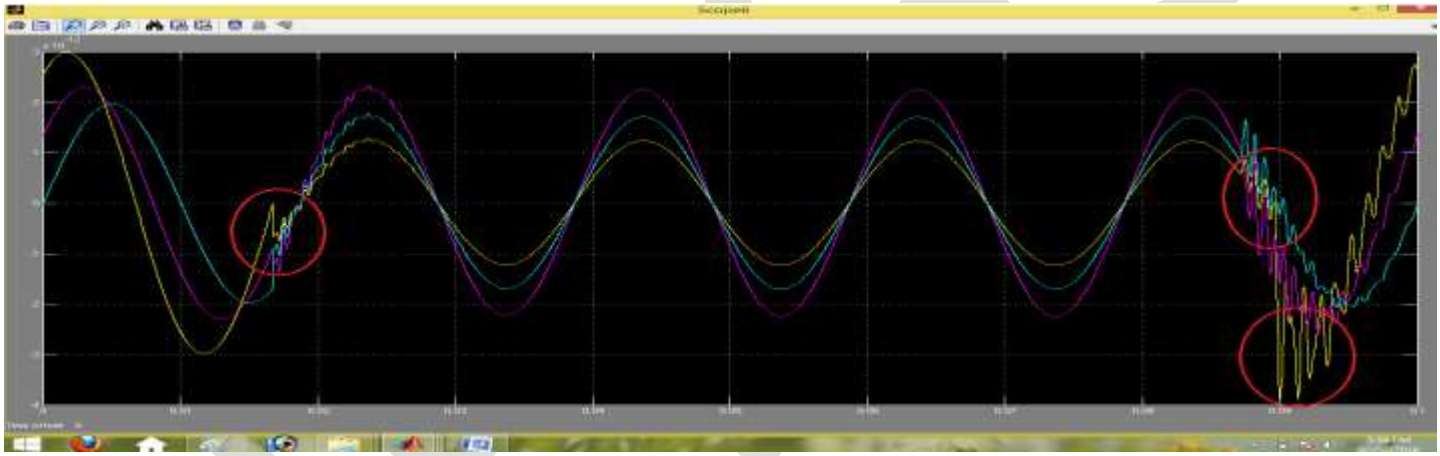


Figure: 11 Fault Current waveform of LL-G fault Location

4.10 LLL-G fault waveform

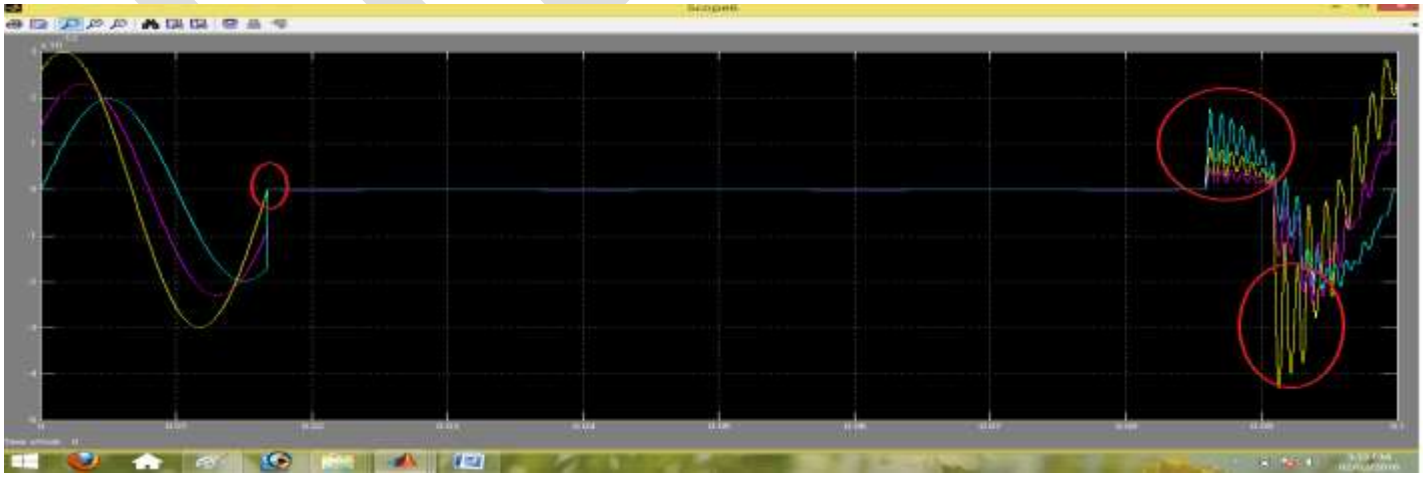


Figure: 12 Fault Current waveform of LLL-G fault Location

Result and Discussion

The earth fault studies have been carried out for various locations along the Overhead transmission line for different types of the faults. In addition to this we detect and analyze the active and reactive power and RMS bus current and voltage of the system at various fault condition. In each case the phase of the 33kv transmission line for voltage and current are changed and also the impedance seen by the transmission line is not change and the complete modeling and experimental work are in MATLAB software.

Conclusion

Modeling and simulation of three phase fault to achieve results of the transmission line parameter is convenient by using MATLAB software along with the sim-power system toolbox in Simulink for detection of faults on 100 km/33 kv supply on transmission line. In this transmission line are line four types of fault namely L-G, 2L-G, 3L-G and three phase faults have been Distance taken at 100 km into consideration into this work and here four fault namely as single line ground fault, Double line to ground faults, Triple line to ground faults and L-L-L faults are analysis and detection has been show on this paper to their proposed work in MATLAB software.

REFERENCES:

[1] Coury, D. V. and Jorge, D.C., 1998. Artificial Neural Network Approach to Distance Protection of Transmission Lines. IEEE Trans. on Power Delivery, Vol.13, No.1, pp. 102-108.

[2] Anamika Yadav, A.S. Thoke, "Transmission line fault distance and direction estimation using artificial neural network" International Journal of Engineering, Science and Technology Vol. 3, No. 8, 2011, pp. 110-121.

[3] Manju, Sooraj Maharana, Chandrakant Sharma," Fault Analysis of Transmission Line Approach to MATLAB Simulation." Taraksh Journal of Web Services Volume 1 Issue 1, 2014.

[4] Swapnil C. Naghate*, Saurabh M. Dhuldhar, Ashvini B. Nagdewate. "Transmission line fault analysis by matlab simulation" IJESRT (Naghate, 4(2): February2015) pp. no. 330-333.

[5] A.NgaopitakkalPongchaisrikul, A.Kundakorn,"Analysis of characteristics of simultaneous faults in electrical power system using wavelet transform in Proc" IEEE International Conf. on Sustainable Energy Technologies pp.249-252,2008.

[6] PrinceJose, Bindu V.R,"Wavelet-Based Transmission Line Fauly Analysis,International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 8, February 2014, pp.55-60.

[7] Shilpi Sahu, Dr. A. K. Sharma," Detection of fault location in transmission Lines using WaveletTransform" Journal of Engineering Research and Applications Vol. 3, Issue 5, Sep-Oct 2013, pp.149-151.

[8] Smriti Kesharwani, Dharmendra Kumar Singh, "Simulation of fault Detection for protection of Transmission line using neural network, International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 5, May 2014.

[9] P. Chiradeja and A. Ngaopitakkul, "Identification of Fault Types for Single Circuit Transmission Line using Discrete Wavelet transform and Artificial Neural Networks" Proceedings of the International MultiConference of Engineers and Computer Scientists 2009 Vol II IMECS 2009, March 18 - 20, 2009, Hong Kong

[10] Eisa Bashier M Tayeb 2013, 'Neural network approach tofault classification for high speed protective relaying' American Journal of engineering research (AJER) volume-02, pp 69-75.

[11] Rajveer Singh 2012, 'Fault detection of electric power transmission line by using neural network',Volume-02, Issue12

[12] T. B. Littler and d. J. Morrow, A.Kundakorn", Wavelets for the Analysis and Compression of Power System Disturbances", IEEE International Conf. on Sustainable Energy Technologies Transactions on Power Delivery, vol. 14, pp. 358-364, Apr. 1999.

[13] D. Das, N.K. Singh and A.K Singh, A.Kundakorn, "A Comparison of Fourier Transform and Wavelet TransformMethods for Detection and Classification of Faults on Transmission Lines", IEEE Power India Conference, NewDelhi Transactions on Power Delivery, Vol. 23, No. 4, October 2008.

[14] Samah. M. El Safty, Hamdy A. Ashour, Hesien El Dessouki and Mohamed. El Sawaf." On-line Fault Detection of Transmission Line Using Artificial Neural Network",Arab Academy for Science and Technology, Alexandria, Egypt.

[15] M.Kenzunovic and I. Rikalo, "Detect and Classify Faults using Neural Nets", IEEE Computer Applications in Power, October 1996, pp 42-47.

[16] P. K. Dash, S. R. Samantaray and G. Panda, "Fault classification and section identification of an advanced series-compensated transmission line using support vector machine," IEEE Transactions on Power Delivery, Vol. 22, No. 1, pp. 67–73, January 2007.

[17] Kim C.H., Aggarwal,"Wavelet transforms in power systems", IET Power Engineering Journal vol. 15, pp. 193-200, Aug. 2009.

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Influence of variable compression ratio on emission using single cylinder four stroke diesel engines

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Abstract – This paper present the influence of variable compression ratio on emission using single cylinder four stroke diesel engine. The measurement is carried out for the compression ratio for 15.5, 17.5 and 18 with varying loads. The performance character such as brake thermal efficiency, specific fuel consumption, exhaust gas temperature, brake power for emission like HC, NOx, CO. The effect of variable compression ratio has a very great effect on emission. The results show that NOx decreases with higher compression ratio but increases with increase in load condition. Up to 25% reduction is seen in NOx with compression ratio 18 and slightly improvement in CO and HC.

Key Words: *Diesel Engine, Variable compression engine, Exhaust Emission, Emission, Diesel, Compression ratio, Performance*

1. Introduction:

Variable compression ratio is a technology to adjust the compression ratio of an internal combustion engine while the engine is in operation. This is done to increase fuel efficiency while under varying loads. Higher loads require lower ratios to be more efficient and vice versa. Variable compression engines allow for the volume above the piston at top dead centre to be changed Variable Compression Ratio (VCR) is becoming increasingly desirable as oil prices increase and car buyers have an increased interest in fuel economy. In addition to this, Global Climate Warming requires measures from international community. To Automobile industry it means stricter limits to car emissions, especially CO2. Variable compression ratio is one cost effective way achieving these targets. Variable compression engines have existed for decades but only in laboratories for the purposes of studying combustion processes. These designs usually have a second adjustable piston set in the head opposing the working piston. (very much like model aircraft 'Diesel' engines). Earlier variable compression engines have been highly desirable but technically unobtainable for production vehicles due to the mechanical complexity and difficulty of controlling all of the parameters.

2. EXPERIMENTAL SETUP:

The setup consists of single cylinder, four stroke, VCR (Variable Compression Ratio) Diesel engine connected to eddy current type dynamometer for loading. The compression ratio can be changed without stopping the engine and without altering the combustion chamber geometry by specially designed tilting cylinder block arrangement. Setup is provided with necessary instruments for combustion pressure and crank-angle measurements. These signals are interfaced to computer through engine indicator for Pø - PV diagrams. Provision is also made for interfacing airflow, fuel flow, temperatures and load measurement. The set up has stand-alone panel box consisting of air box, two fuel tanks for duel fuel test, manometer, fuel measuring unit, transmitters for air and fuel flow measurements, process indicator and engine indicator. Rota meters are provided for cooling water and calorimeter water flow measurement.

The setup enables study of VCR engine performance for brake power, indicated power, frictional power, BMEP, IMEP, brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency, volumetric efficiency, specific fuel consumption, A/F ratio

2.1 Specifications:

VCR Engine test setup 1 cylinder, 4 stroke, Diesel (Computerized).
Engine Make Kirloskar, Type 1 cylinder, 4 stroke Diesel, water cooled, power 3.5 kW at 1500 rpm, stroke 110 mm, bore 87.5 mm. 661 cc, CR 17.5, Modified to VCR engine, CR range 12 to 18.
Dynamometer Type eddy current, water cooled, with loading unit.
Fuel tank Capacity 15 lit with glass fuel metering column.

Overall dimensions: W 2000 x D 2500 x H 1500 mm.
Rotameter: Engine cooling 40-400 LPH; Calorimeter 25-250 LPH

Fig -1: Four Stroke diesel (VCR) engine

3. Result and Discussion:

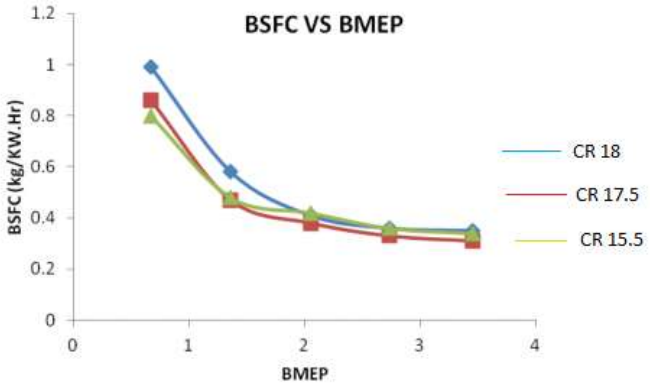

Chart.1: Brake specific consumption for variable compression ratio.

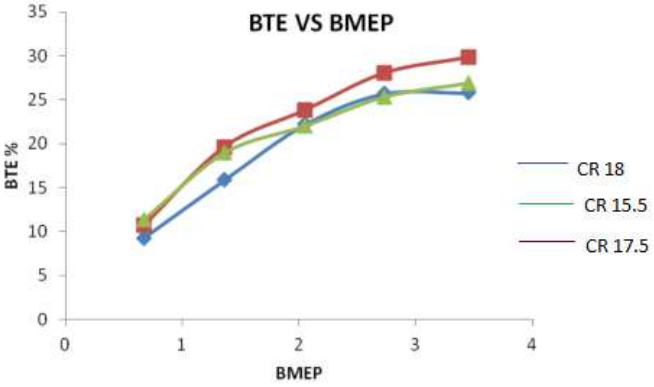

Chart.2: Brake thermal efficiency vs brake mean effective pressure for variable compression.

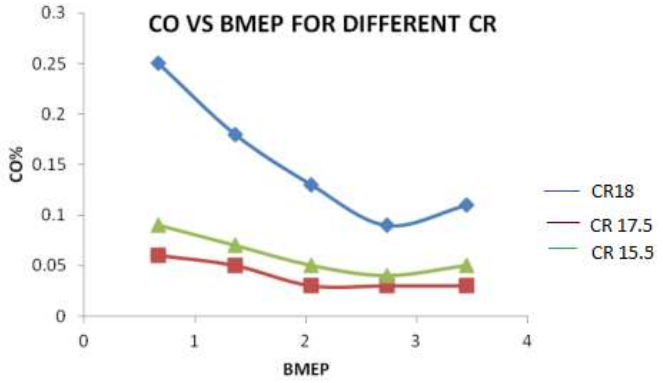

Chart.3: CO emission

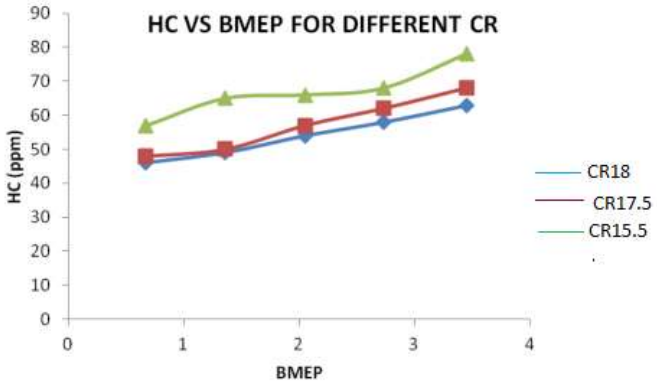

Chart.4: HC emission.

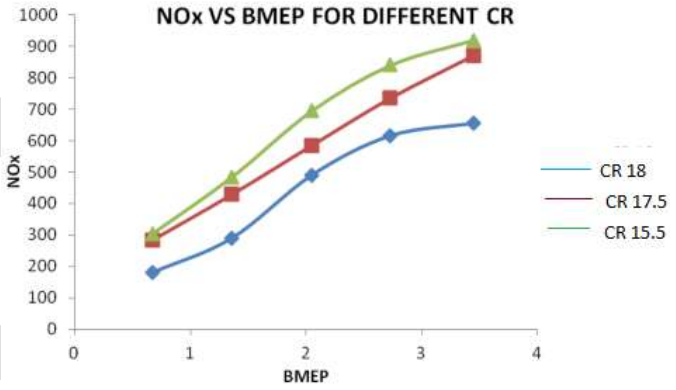

Chart.5: NOx emission.

From the charts 1 and 2 it has been observed that brake specific fuel consumption increases for Compression ratio 18 and thermal efficiency decreases as compared to compression ratio of 17.5 and 15.5.

From the charts 3, 4 and 5 it has been observed that from, NOx decreases with higher compression and increases with load condition. Up to 25% reduction is seen in NOx.

4. CONCULSION:

- From the results we conclude that NOx gives better results during performance.
- Compression was considered the best CR for the performance of single cylinder diesel engine.
- Brake thermal efficiency increases with increase in load.
- Brake specific fuel consumption decreases with increase in load.

REFERENCES:

1) V. Hariram, R. Vagesh Shangar, Influence of compression ratio on combustion and performance characteristics of direct injection compression ignition engine, Alexandria Engineering Journal (2015) 54, 807–814
2) Zhi-Hui Zhang, Rajasekhar Balasubramanian "Influence of butanol addition to diesel–biodiesel blend on engine performance and particulate emissions of a stationary diesel engine", Applied Energy 119 pp. 530–536 (2014).
3) H. U. Mughal, M. M. A. Bhutta, M. Athar, E. M. Shahid and M. S. Ehsan, "The alternative fuels for four stroke compression ignition engines: performance analysis, IJST, Transactions of Mechanical Engineering, Vol. 36, No. M2, pp. 155-16 (2012).
4) Dulari Hansdah, S. Murugan, L.M. Das, "Experimental studies on a DI diesel engine fueled with bioethanol-diesel emulsions, Alexandria Engineering Journal 52, pp. 267–276 (2013).
5) B. Mazumdar, A.K. Agarwal, Performance, Emission and Combustion Characteristics of Biodiesel (Waste Cooking Oil Methyl Ester) Fueled IDI Engine, SAE 2008–01-1384, 2008.
6) K.Naveen, T.Parameshwaran pillai, Azhagiri pon Experimental Investigation of Variable Compression Ratio Diesel Engine using Ziziphus Jujuba oil, International Journal of Innovative Research in Science, Engineering and Technology, *Volume 3, Special Issue 3, March 2014*
7) Subramanian K. A. and Ramesh A., Use of Diethyl Ether Along with Water-Diesel Emulsion in a Di Diesel Engine, SAE Paper number: 2002-01-2720 (2002)
8) Ganesan V. 1998. Internal Combustion Engines. Tata McGrawhill, New Delhi.

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PREDICTIVE MODEL TO MONITOR THE VARIATION OF CONCRETE DENSITY INFLUENCED BY VARIOUS GRADES FROM LOCALLY 3/8 GRAVEL AT DIFFERENT CURING TIME

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Abstract - The densities of concrete were monitored applying locally occurring 3/8 gravel, the material were used to generate various concrete performances in unwashed and washed at different water cement ratios, the study through calibrations developed model at different water cement ratios from washed and unwashed locally occurring 3/8 gravel concrete, the results express various effect from impurities on the density in unwashed than washed concrete, porosity relating to compaction of concrete formation made with this locally occurring 3/8 gravel were observed to have effect on its rate of density of concrete in some samples. While water cement ratios were found to affect the densities of some samples in various curing age, the densities of these concrete at different water cement ratios express various theoretical values that were compared with other measured values, both parameters generated best fits validating the developed theoretical values of densities at different water cement ratios and curing age, these measures can be apply to monitor higher concrete performances.

Keywords: predictive model, concrete density, and locally 3/8 gravel

1. Introduction

Every concrete formations requires curing in order that cement hydration can continue so as to permit for development of strength, these express its durability and other mechanical characteristics Akeem et al 2013. To achieve good concrete, specification on the placing of an appropriate mix must be followed by curing in appropriate environment, particularly during the early stages of hardening. According to Neville (1996), curing is the name given to measures applied for promoting hydration of cement, and its consistency in a controlled temperature and moisture movement from and into the concrete Eluozo and Ode 2015a, Eluozo and Ode 2015b, Eluozo and Ode 2015c). Price (1991) it also refers to curing as the procedure of protecting concrete for a specified stage of days after placement, it also supply moisture for hydration of the cement, these will definitely to supply proper temperature and to protect the concrete from damage by loading or Mechanical disturbance. Curing is designed bases to maintain the concrete moist by preventing loss of moisture throughout the period in which it is gaining strength. Curing can be attain by maintenance of the concrete element completely soaked or as much soaked as possible until the water-filled spaces are substantially declined by hydration products (Gowripalan *et al.*, 1992,adesanya et al 2002). This means that if the dampness of the ambient air is at smallest amount thus high, then it implies that there will be no need for active curing in other to ensure continuing hydration, because there will be slight movement of water within the concrete including ambient air. In most parts of the world like Nigeria, the relative dampness falls below 80 per cent at a certain period in a day, this implies that it may not permit voluntary curing but rather would demand active curing. But if the concrete is not cured and it is allowed to dry through air, it will gain only 50% of the strength of continuously cured concrete (Mamlouk and Zaniewski, 2006). But if concrete is not subjected to thorough curing, mostly at the early days, it will definitely not attained the required properties at preferred level due to a lower degree of hydration, and would suffer from irreparable loss (Ramezanianpour and Malhotra, 1995; Zain *et al*., 2000). Inappropriate curing would involve insufficient moisture and this has been observed to produce cracks, compromise strength, and decline long-term durability (Wojcik and Fitzgarrald, 2001 Ephraim and Ode 2004). It is an established fact that many other factors affect the development of strength of concrete and as a result its toughness other than curing or the curing method applied. These factors include quality and quantity of cement applied in a mix, grading of aggregates, maximum nominal size, shape and surface texture of aggregate (Arum and Alhassan, 2005) water/cement ratios, degree of compaction (Aluko, 2005) and the presence or otherwise of clayey particles and organic matter in the mix (Arum and Udoh, 2005). The scope of discussion in this study is methods of curing concrete (B.S 1990).

2. Materials and method

Standard laboratory experiment where performed to monitor concrete densities at different curing age, the deposition of concrete densities were determined at different water cement ratios, the experimental results are applied to be compared with the theoretical values to determined the validation of the model.

3. Results and Discussion

Results and discussion are presented in tables including graphical representation of water absorption at different water cement ratios.

Table: 1 Predictive and Measured Value for Density [0.45] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.45] KgM^3	Measured Density values for U-MIX [0.45]KgM^3
7	2195.35	2110
14	2218.47	2120
21	2107.38	2110
28	2022.16	2060
60	1220.76	1105
90	2261.34	2140

Table: 2 Predictive and Measured Values for Density [0.50] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.50] KgM^3	Measured Density values for U-MIX [0.50] KgM^3
7	2227.89	2222
14	2210.06	2240
21	2198.49	2180
28	2193.2	2220
60	2248.9	2245
90	2420.12	2410

Table: 3 Predictive and Measured Values for Density [0.55] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.55] KgM^3	Measured Density values for U-MIX [0.55] KgM^3
7	2222.41	2226
14	2235.47	2241
21	2246.18	2250
28	2254.54	2246
60	2262.8	2267
90	2225.9	2227

Table: 5 Predictive and Measured Values for Density [0.50] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.60] KgM^3	Measured Density values for U-MIX [0.60] KgM^3
7	2230.56	2220
14	2276.62	2260
21	2299.3	2296
28	2300.5	2310
60	2091.8	2080
90	1704.5	1660

Table: 6 Predictive and Measured Values for Density [0.55] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.65] KgM^3	Measured Density values for U-MIX [0.65] KgM^3
7	2250.09	2270
14	2268.742	2230
21	2274.94	2270.6
28	2268.7	2220
60	2081.66	2130
90	1670.09	1590

Table: 7 Predictive and Measured Values for Density [0.70] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.70] KgM^3	Measured Density values for U-MIX [0.70] KgM^3
7	2213.41	2215
14	2268.7	2240
21	2286.81	2260
28	2270.15	2320
60	1939.4	1800
90	1634.9	1190

Table: 7b Predictive and Measured Values for Density [0.75] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.75] KgM^3	Measured Density values for U-MIX [0.75] KgM^3
7	2228.9	2227
14	2234.43	2240
21	2237.57	2240
28	2241.3	2250
60	2270.33	2280
90	2257.3	2260

Table: 8 Predictive and Measured Values for Density [0.80] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.80] KgM^3	Measured Density values for U-MIX [0.80] KgM^3
7	2255.28	2245
14	2263.29	2240
21	2269.07	2270
28	2272.58	2270
60	2259.94	2260
90	2205.31	2207

Table: 9 Predictive and Measured Values for Density [0.85] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.85] KgM^3	Measured Density values for U-MIX [0.85] KgM^3
7	2221.08	2224
14	2232.67	2220
21	2242.84	2235
28	2251.51	2246
60	2331.66	2370
90	2264.16	2266

Table: 10 Predictive and Measured Values for Density [0.90] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.90] KgM^3	Measured Density values for U-MIX [0.90] KgM^3
7	2256.96	2260
14	2237.39	2239
21	2229.28	2226
28	2269.42	2250
60	2394.02	2360
90	2762.93	2620

Table: 11 Predictive and Measured Values for Density [0.95] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [0.95] KgM^3	Measured Density values for U- MIX [0.95] KgM^3
7	2241.98	2230
14	2224.53	2216
21	2208.64	2230
28	2194.33	2188
60	2148.86	2139
90	2135.99	2130

Table: 12 Predictive and Measured Values for Density [1.00] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [1.00] KgM^3	Measured Density values for U- MIX [1.00] KgM^3
7	2230.66	2260
14	2256.61	2260
21	2267.87	2260
28	2264.42	2270
60	2061.48	2050
90	1592.22	1760.4

Table: 13 Predictive and Measured Values for Density [0.1.05] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [1.05] KgM^3	Measured Density values for U-MIX [1.05] KgM^3
7	2109.09	2121
14	2210.08	2260
21	2234.48	2240
28	2259.75	2270
60	2116.2	2180
90	1726.8	2130

Table: 14 Predictive and Measured Values for Density [1.10] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for U -MIX [1.10] KgM^3	Measured Density values for U-MIX [1.10] KgM^3
7	2219.66	2230
14	2291.54	2285
21	2327.74	2310
28	2332.39	2430
60	2066.6	2030
90	1646.3	1830

Table: 15 Predictive and Measured Values for W-Density [0.35] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.35] KgM^3	Measured Density values for W-MIX [0.35] KgM^3
7	2128.16	2135
14	2029.44	2040
21	2044.2	2055
28	1635.31	1730
60	-75631	-7896
90	2604	2709

Table: 16 Predictive and Measured Values for Density W-[0.45] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.45] KgM^3	Measured Density values for W-MIX [0.45] KgM^3
7	2449.94	2440
14	2469.52	2470
21	2486.76	2490
28	2539.27	2520
60	2538.72	2520
90	2530.78	2530

Table: 17 Predictive and Measured Values for Density W-[0.45] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.50] KgM^3	Measured Density values for W-MIX [0.50] KgM^3
7	2486.59	2495
14	2501.17	2490
21	2483.79	2550
28	2454.79	2458
60	2444.2	2450
90	2243.8	2290

Table: 18 Predictive and Measured Values for Density W- [0.55] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.55] KgM^3	Measured Density values for W-MIX [0.55] KgM^3
7	2582.41	2592
14	2560.05	2551
21	2540.93	2514
28	2525.04	2572
60	2493.58	2487
90	2525.47	2535

Table: 19 Predictive and Measured Values for Density W- [0.60] of Concrete at Different Age of Days

Age [Days]	Predictive Density values for W -MIX [0.60 W/C] kg/m^3	Measured Density values for W-MIX [0.60] KgM^3
7	2453.44	2457
14	2461.78	2470
21	2470.03	2465
28	2478.18	2474
60	2514.18	2518
90	2546.07	2548

Table: 20 Predictive and Measured Values for Density W- [0.65] of Concrete at Different Age of Days

Age [Days]	Predictive Density values for W -MIX [0.65 W/C] KgM^3	Measured Density values for W-MIX [0.65] KgM^3
7	2444.11	2442
14	2448.74	2471
21	2461.49	2422
28	2429.58	2472
60	2418.46	2442
90	2341.69	2332

Table: 21 Predictive and Measured Values for Density W- [0.70] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.70] KgM^3	Measured Density values for W-MIX [0.70] KgM^3
7	2411.95	2417
14	2427.83	2440
21	2435.16	2427
28	2426.52	2430
60	2241.02	2250
90	1977.83	1890

Table: 22 Predictive and Measured Values for Density W- [0.75] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.75] KgM^3	Measured Density values for W-MIX [0.75] KgM^3
7	2508.82	2560
14	2459.69	2460
21	2437.53	2420
28	2438.19	2440
60	2617.2	2640
90	2590.6	2550

Table: 23 Predictive and Measured Values for Density W- [0.80] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.80] KgM^3	Measured Density values for W- MIX [0.80] KgM^3
7	2448.73	2420
14	2408.89	2418
21	2548.22	2530
28	2366.18	2264
60	2454.02	2440
90	2770.73	2690

Table: 24 Predictive and Measured Values for Density W- [0.85] of Concrete at Different Age of Days

W/C Density Age of Days	Predictive Density values for W -MIX [0.85] KgM^3	Measured Density values for W- MIX [0.85] KgM^3
7	2487.34	2475
14	2493.23	2450
21	2489.33	2470
28	2477.48	2460
60	2379.66	2330
90	2451.19	2440

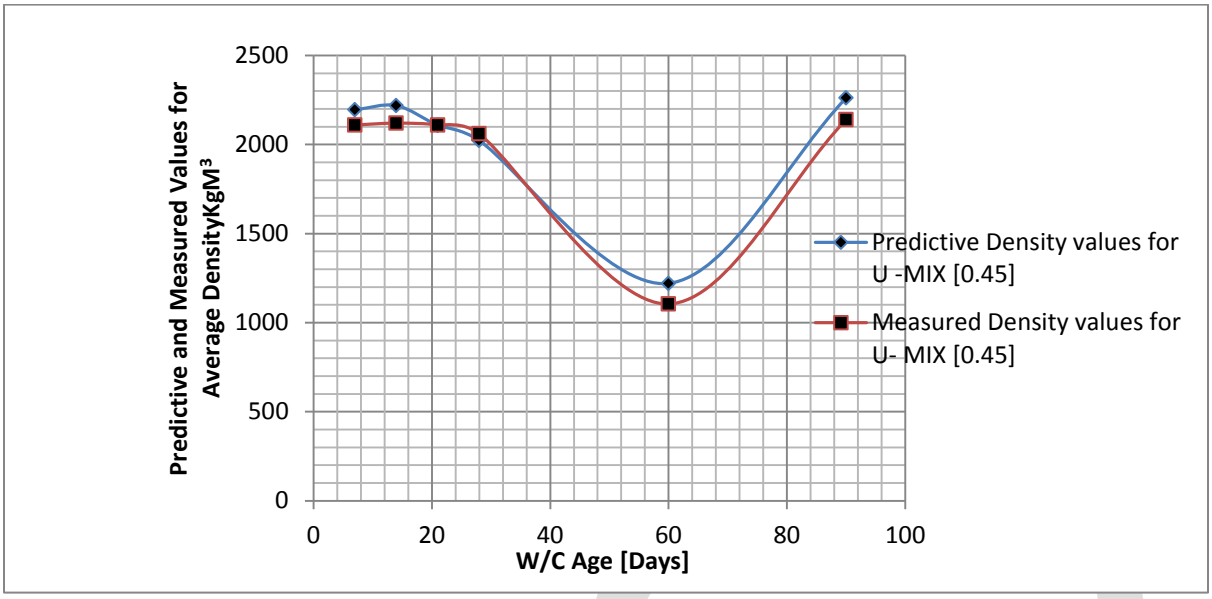

Figure: 1 Predictive and Measured Value for Density U- [0.45] of Concrete at Different Age of Days

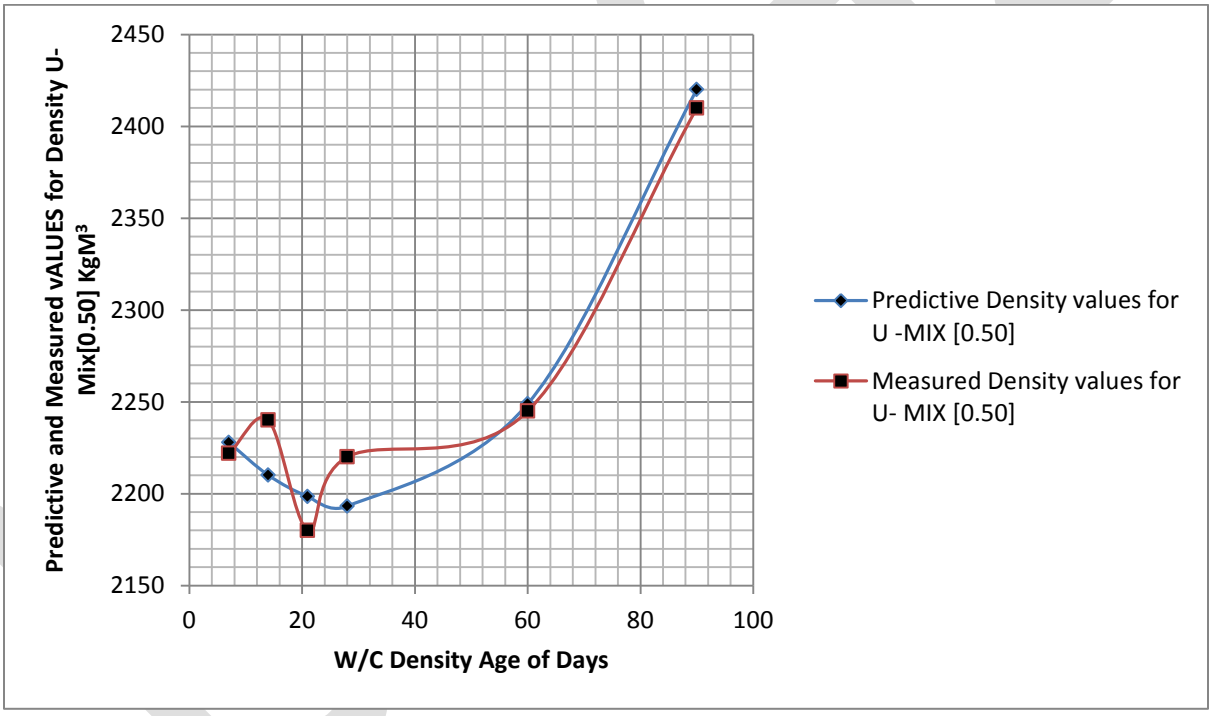

Figure: 2 Predictive and Measured Values for Density U- [0.50] of Concrete at Different Age of Days

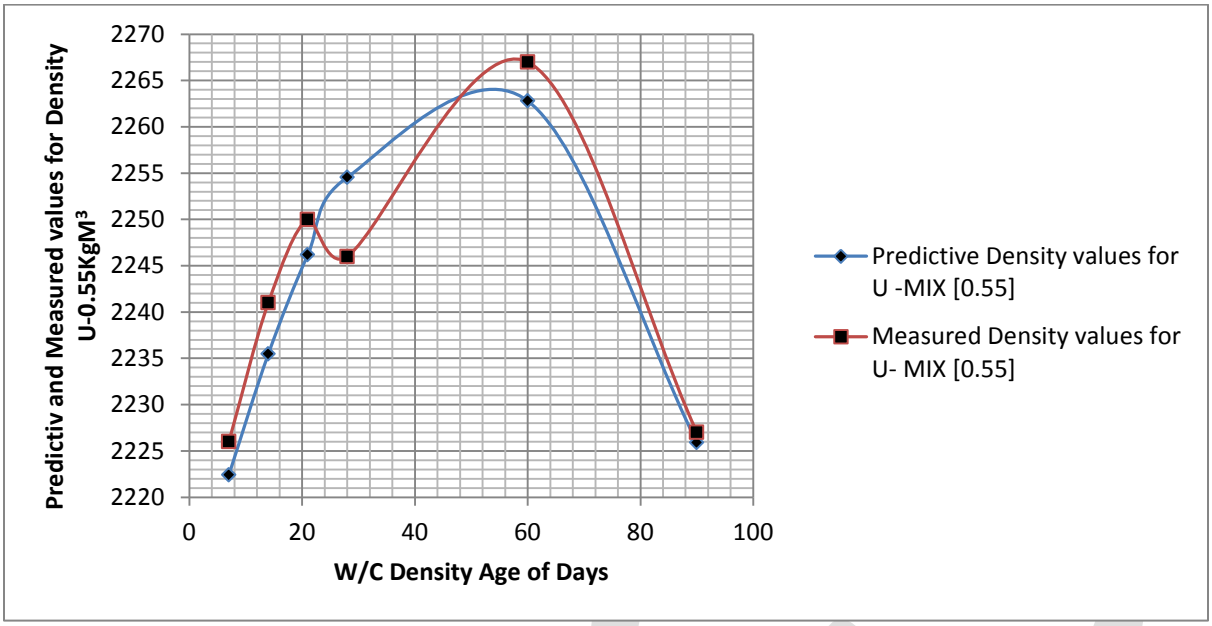

Figure: 3 Predictive and Measured Values for Density U- [0.55] of Concrete at Different Age of Days

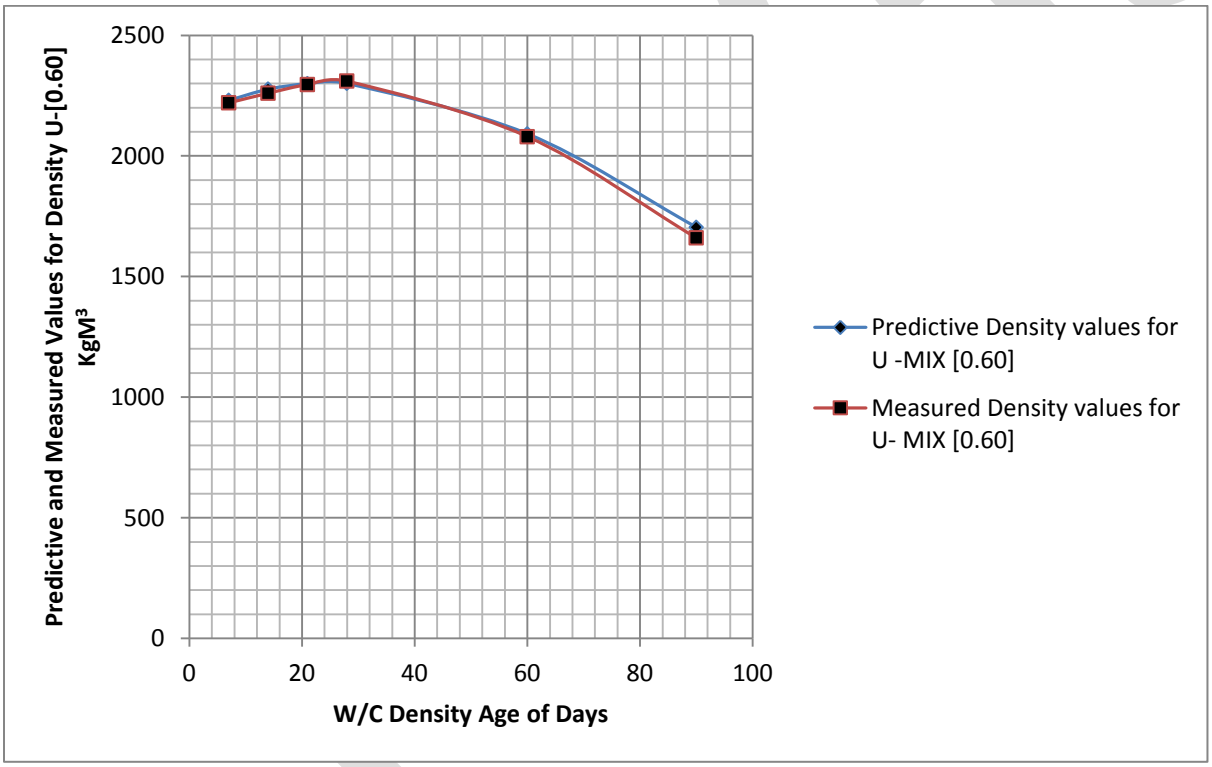

Figure: 4 Predictive and Measured Values for Density U- [0.60] of Concrete at Different Age of Days

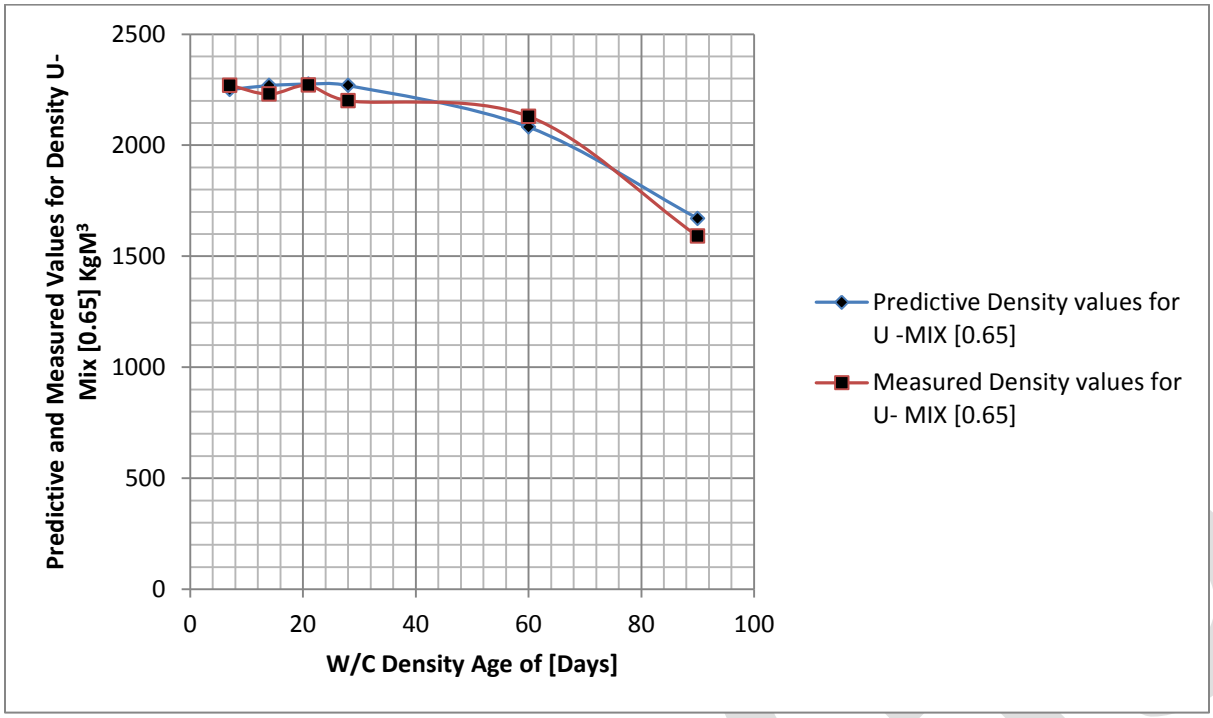

Figure: 5 Predictive and Measured Value for Density U- [0.65] of Concrete at Different Age of Days

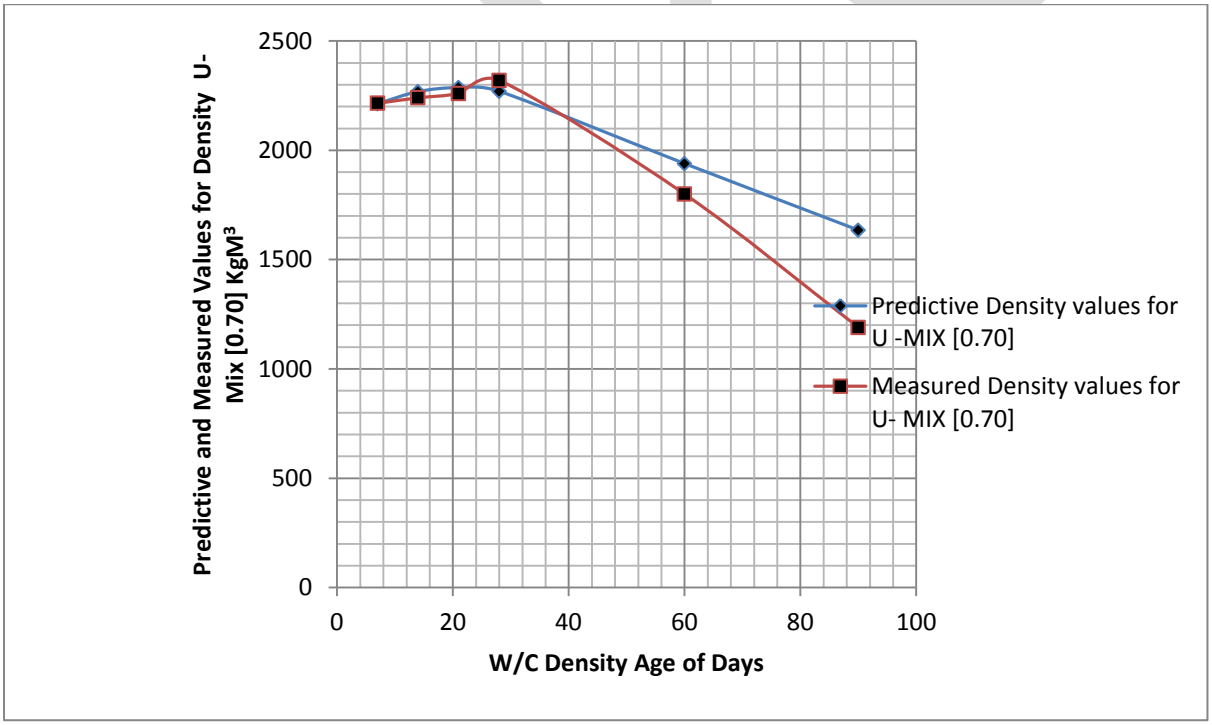

Figure: 7 Predictive and Measured Values for Density U- [0.70] of Concrete at Different Age of Days

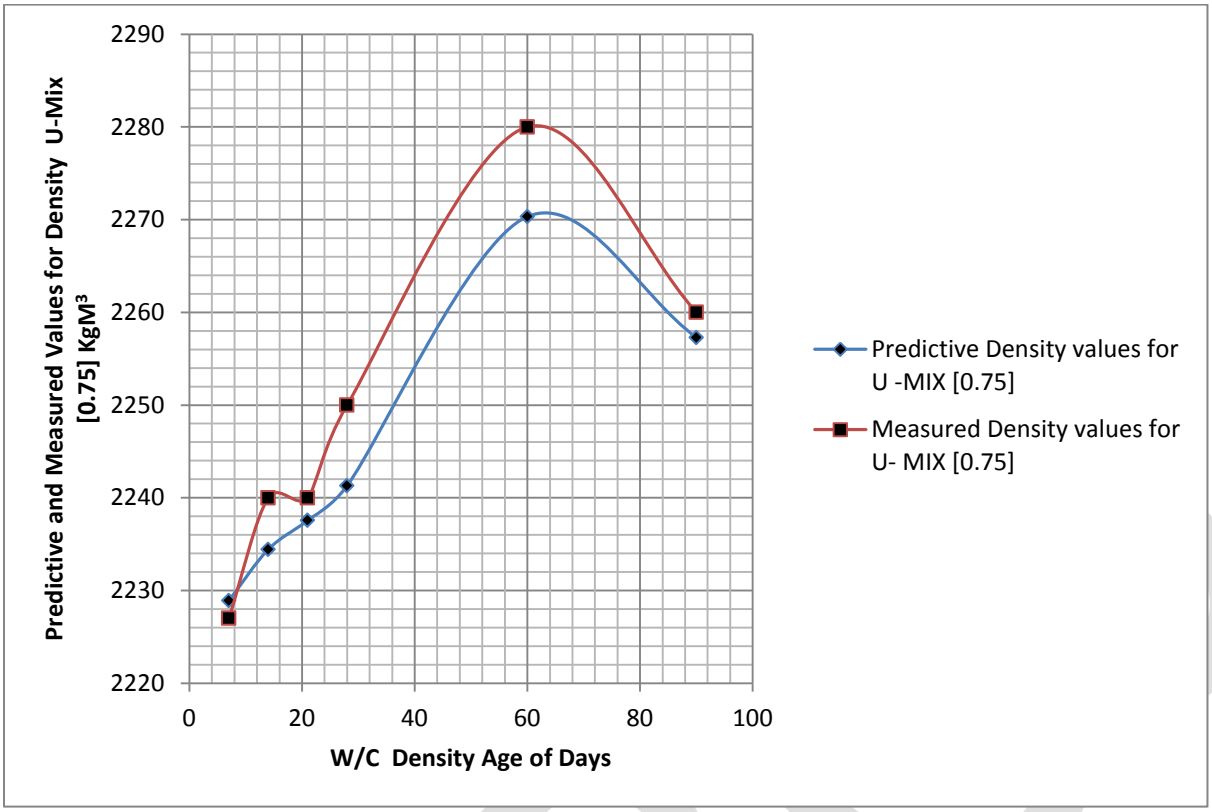

Figure: 8 Predictive and Measured Values for Density U- [0.75] of Concrete at Different Age of Days

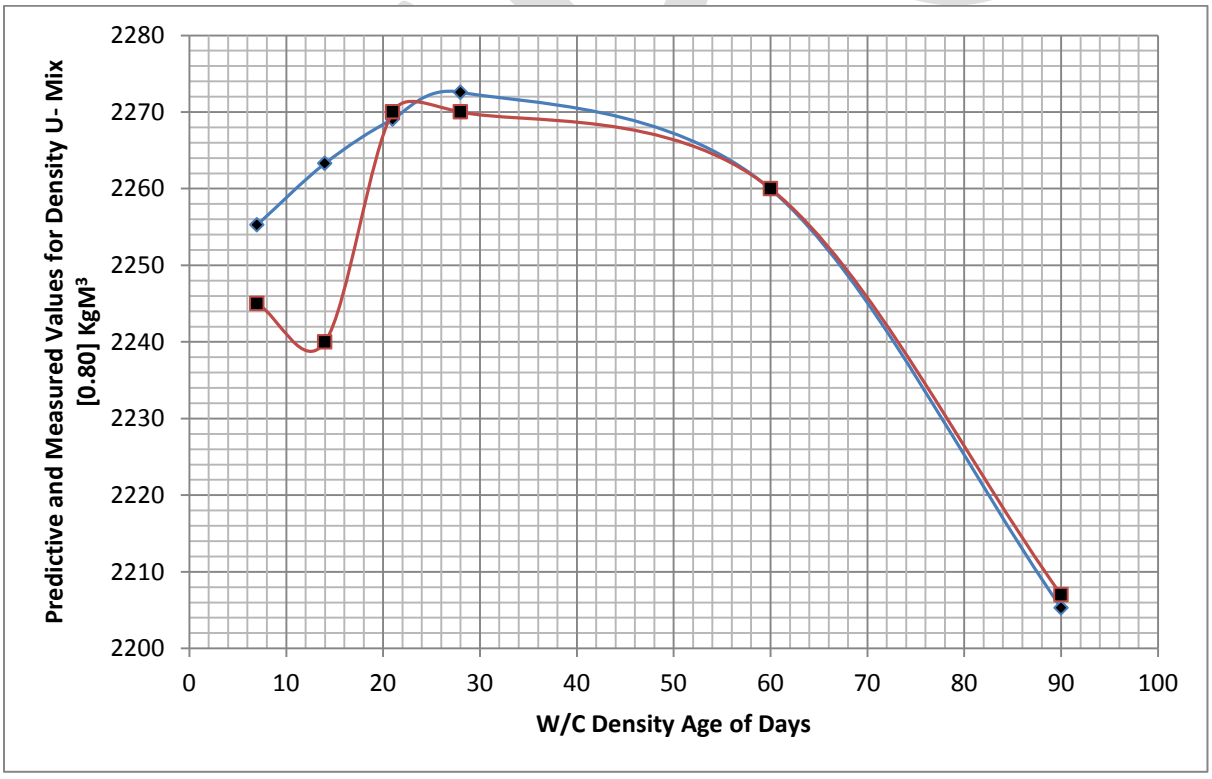

Figure: 9 Predictive and Measured Values for Density U- [0.80] of Concrete at Different Age of Days

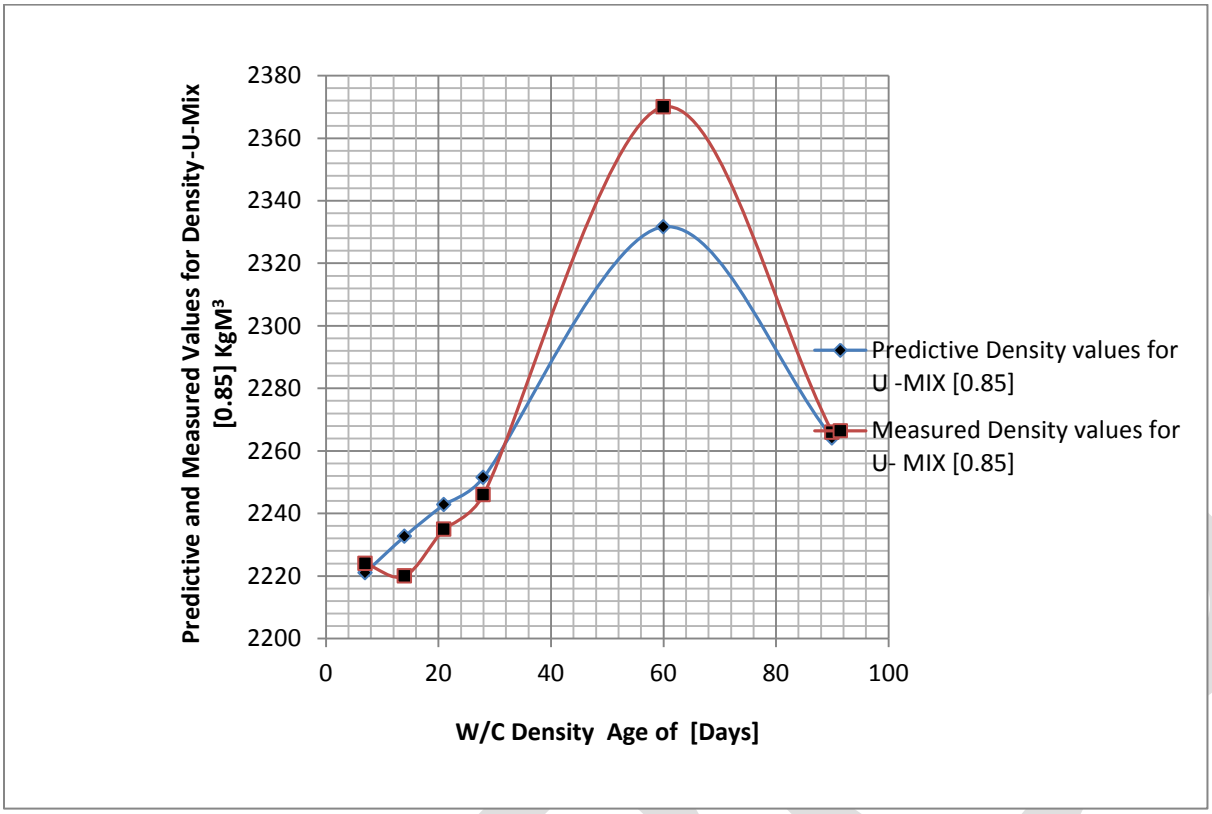

Figure: 10 Predictive and Measured Values for Density U- [0.85] of Concrete at Different Age of Days

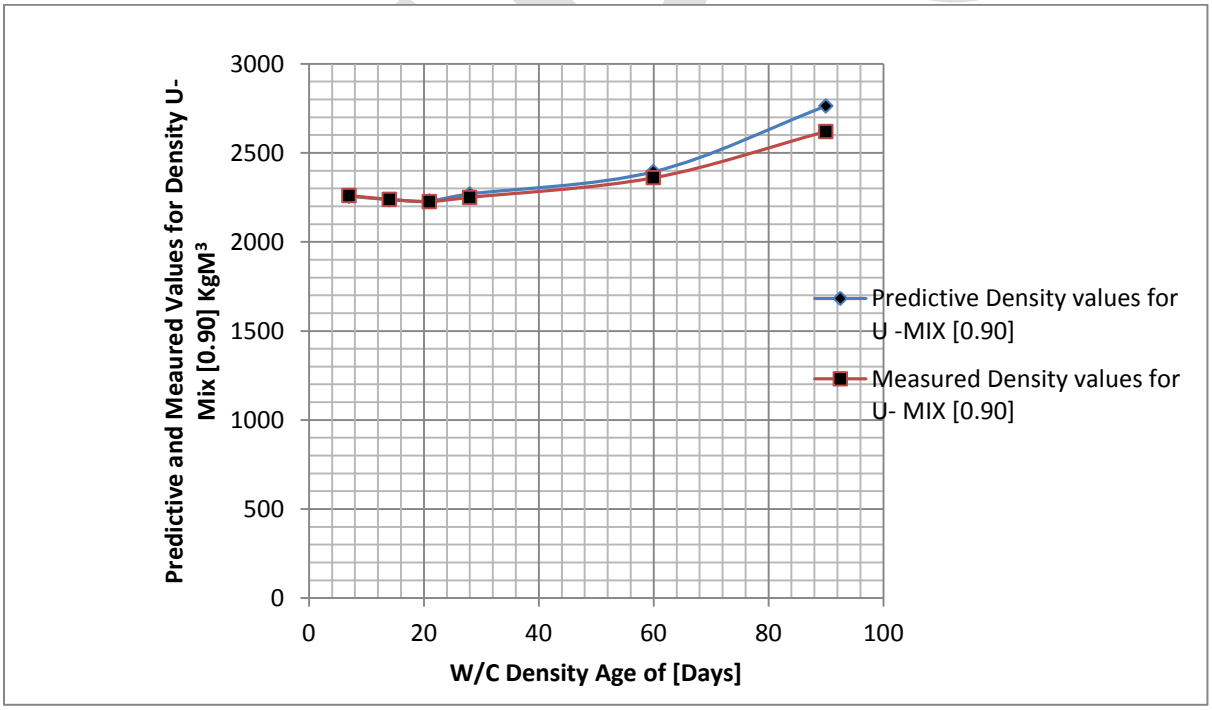

Figure:11 Predictive and Measured Values for Density U- [0.90] of Concrete at Different Age of Days

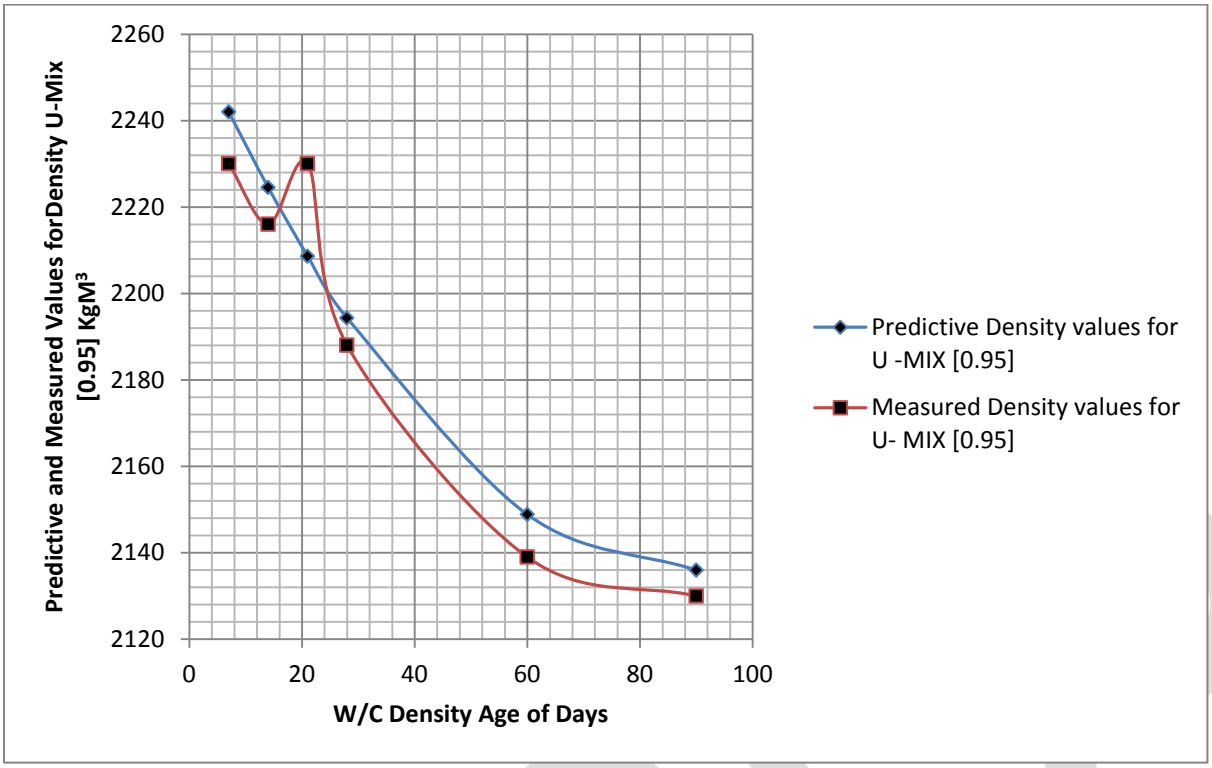

Figure: 12 Predictive and Measured Values for Density U- [0.95] of Concrete at Different Age of Days

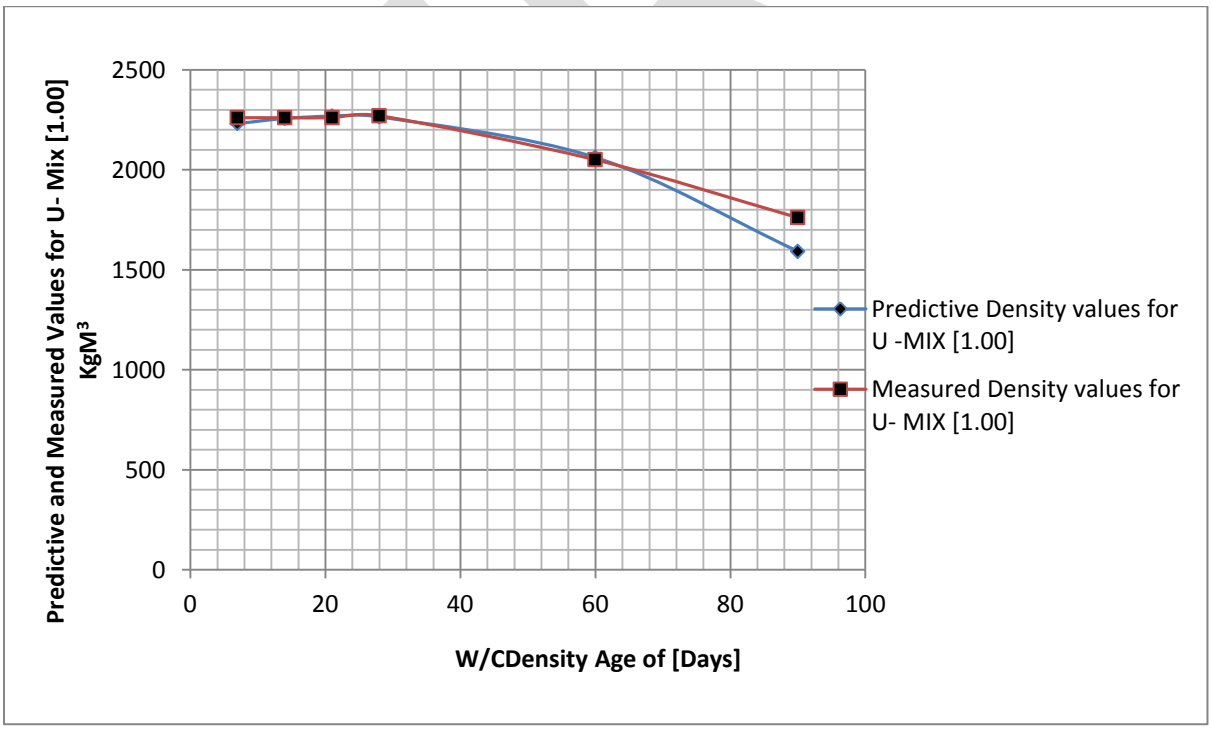

Figure: 13 Predictive and Measured Values for Density U- [1.00] of Concrete at Different Age of Days

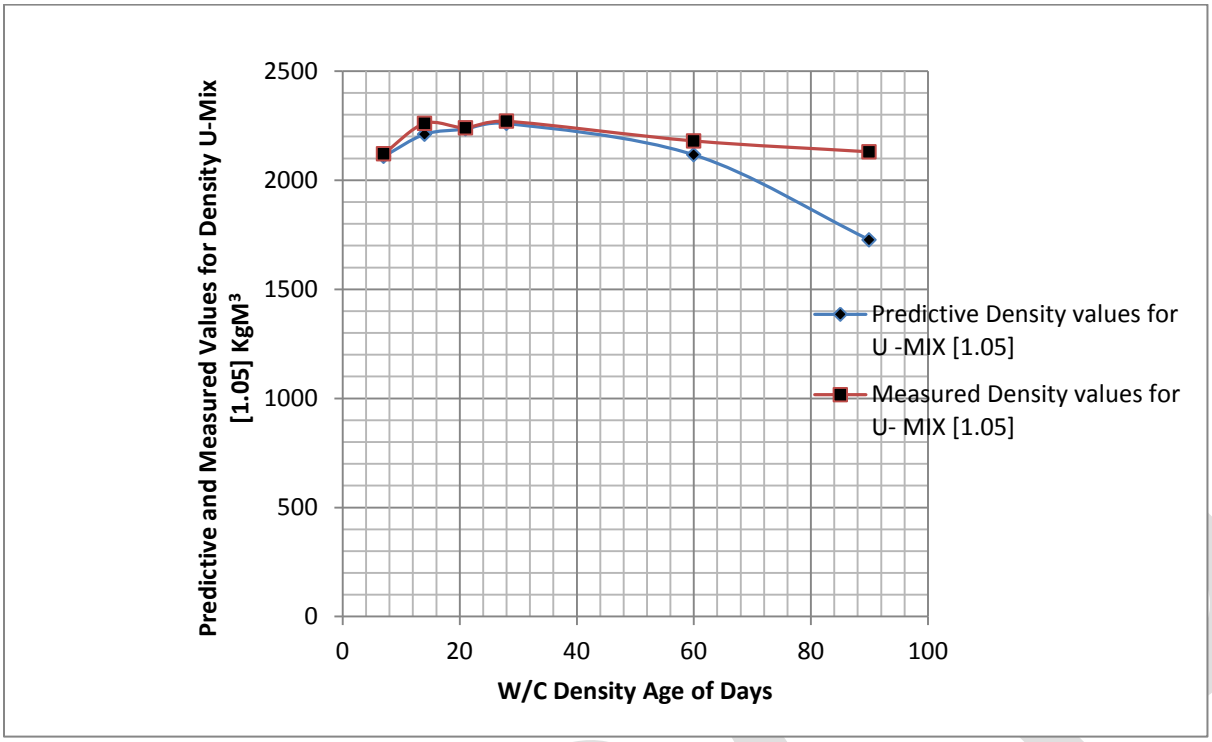

Figure: 14 Predictive and Measured Values for Density U- [1.05] of Concrete at Different Age of Days

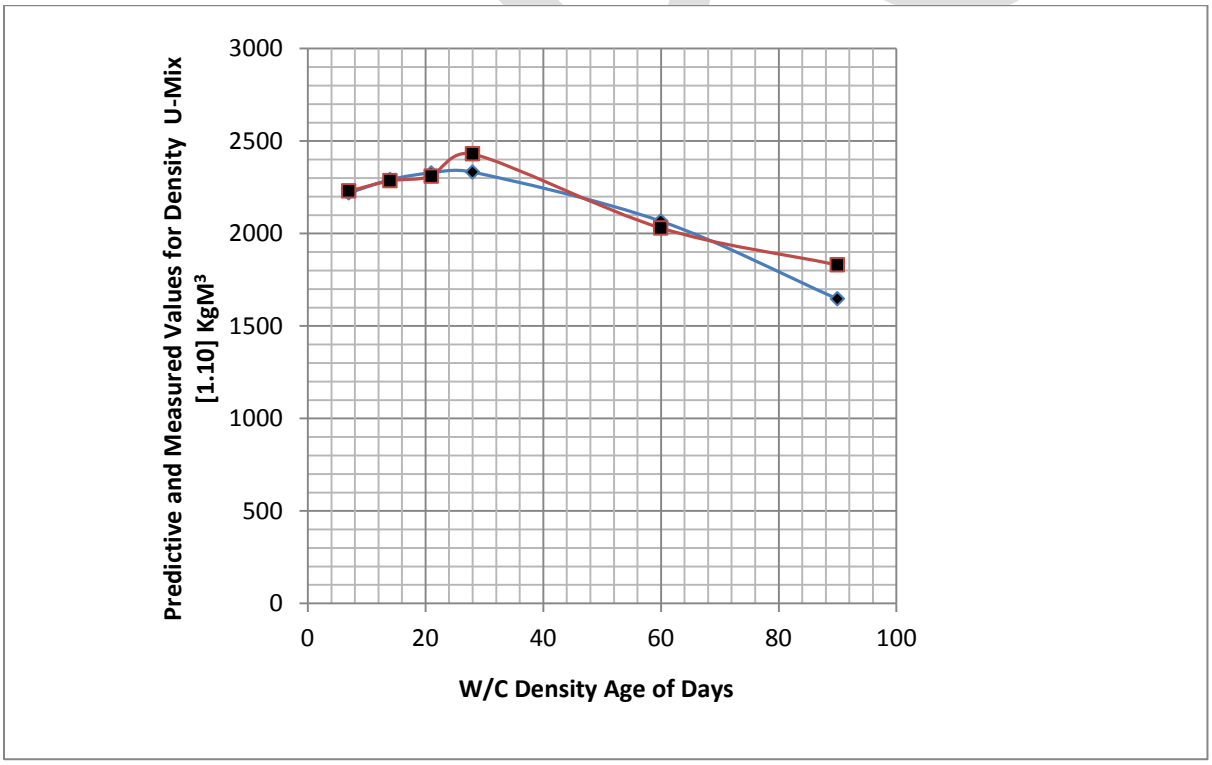

Figure: 15 Predictive and Measured Values for Density U- [1.10] of Concrete at Different Age of Days

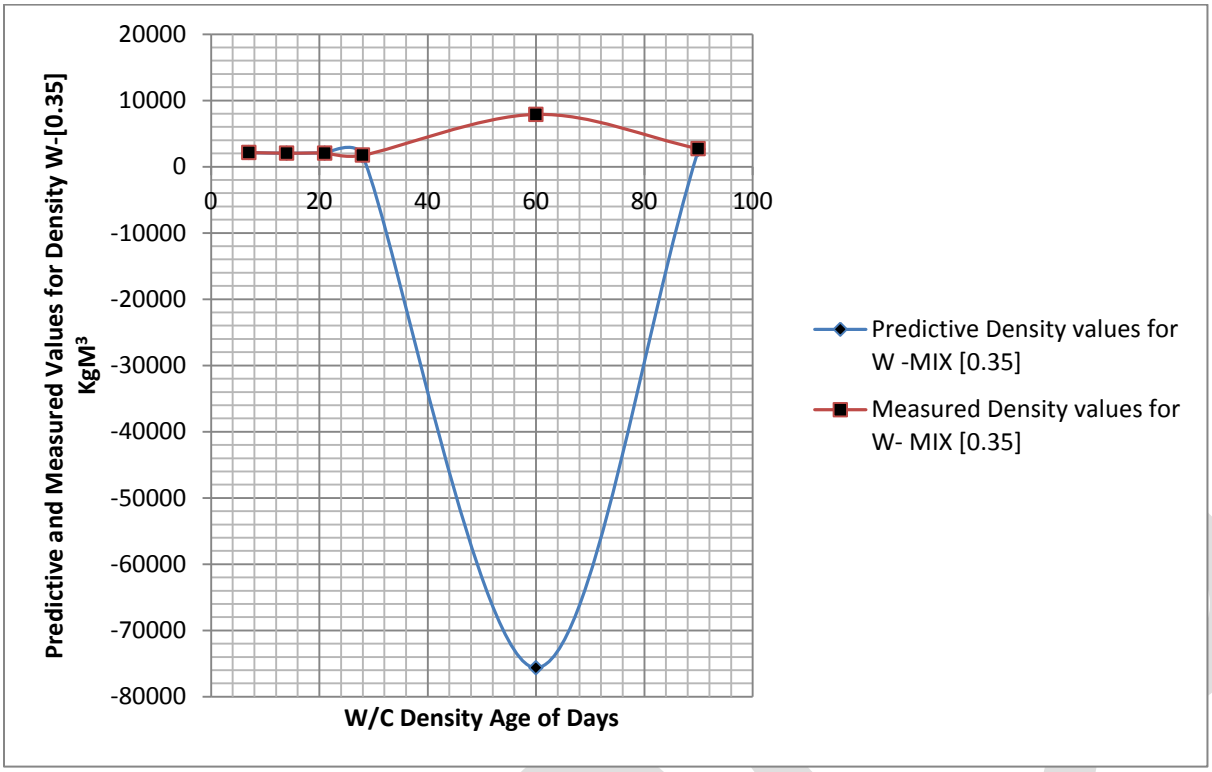

Figure: 16 Predictive and Measured Values for Density W- [0.35] of Concrete at Different Age of Days

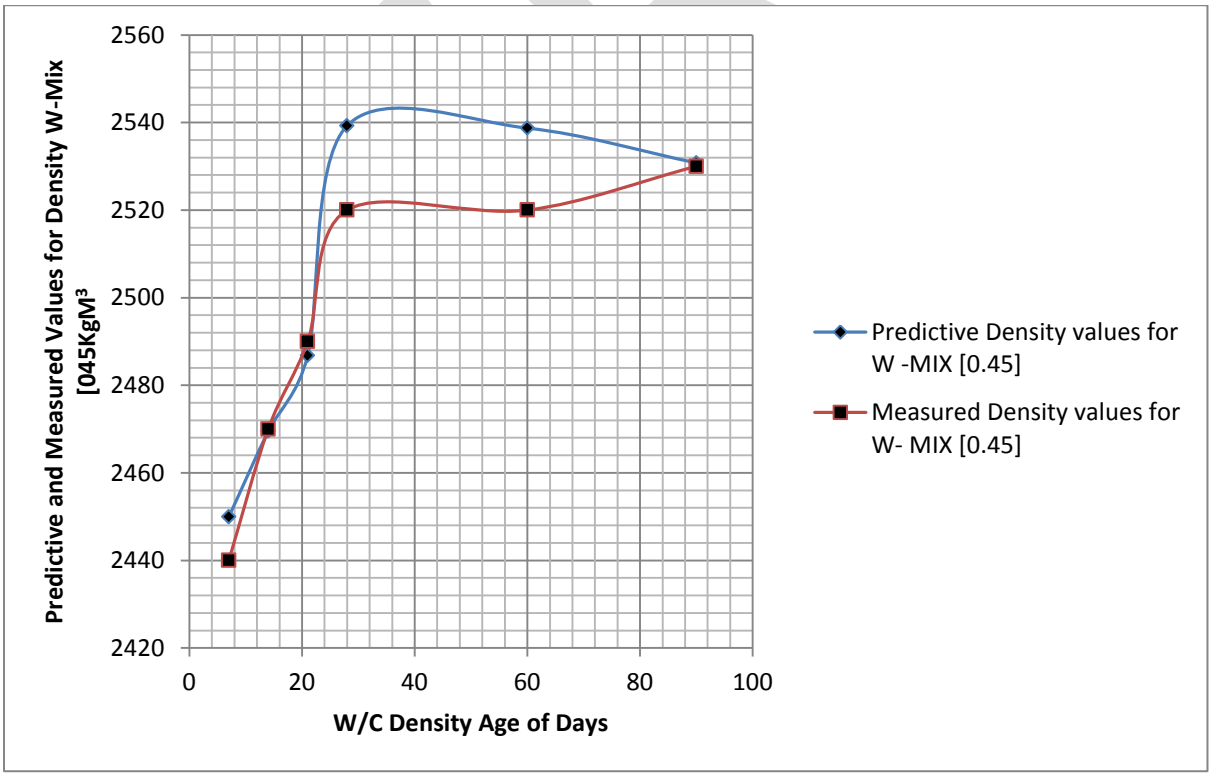

Figure: 17 Predictive and Measured Values for Density W- [0.45] of Concrete at Different Age of Days

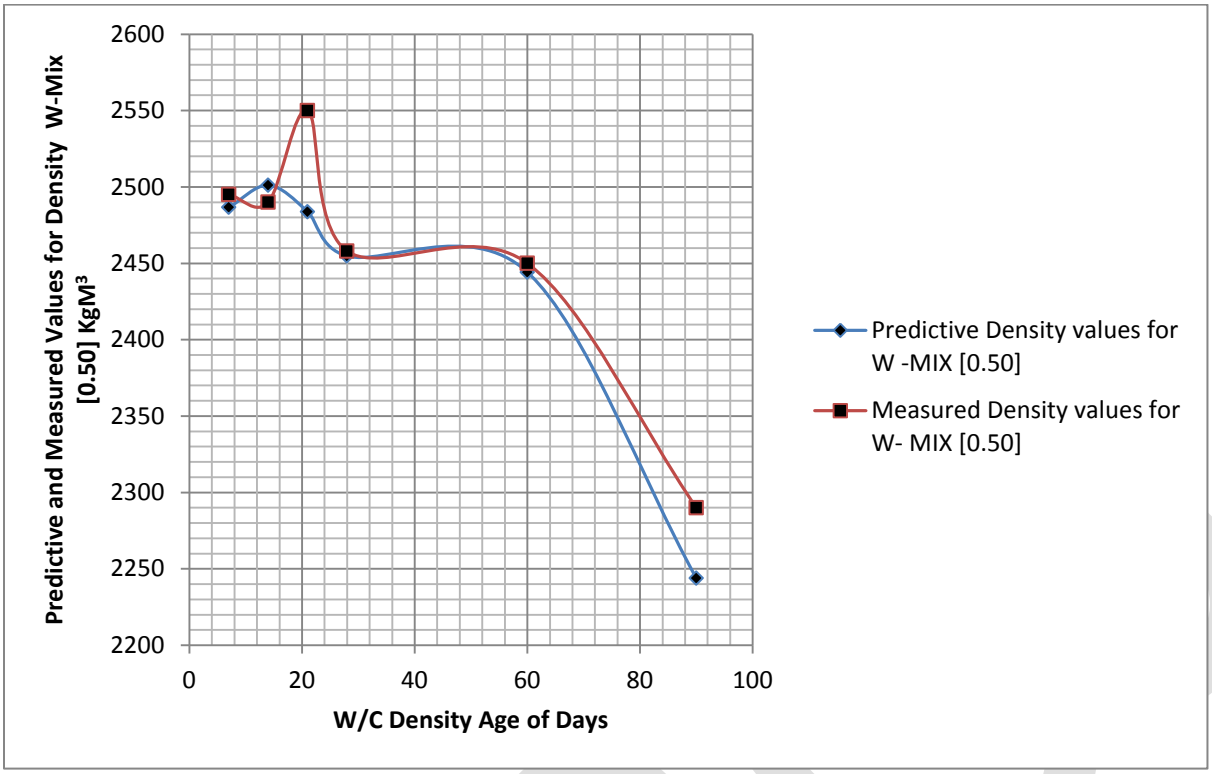

Figure: 18 Predictive and Measured Values for Density W- [0.50] of Concrete at Different Age of Days

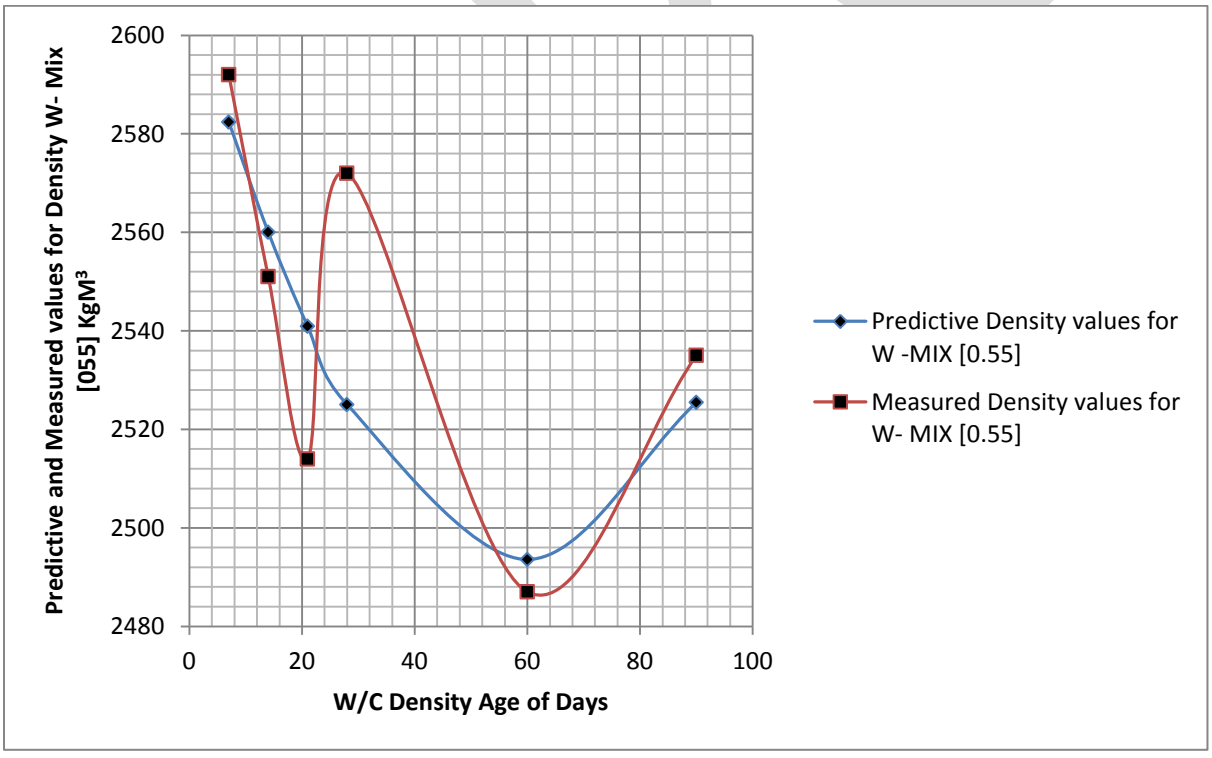

Figure: 19 Predictive and Measured Values for Density W- [0.55] of Concrete at Different Age of Days

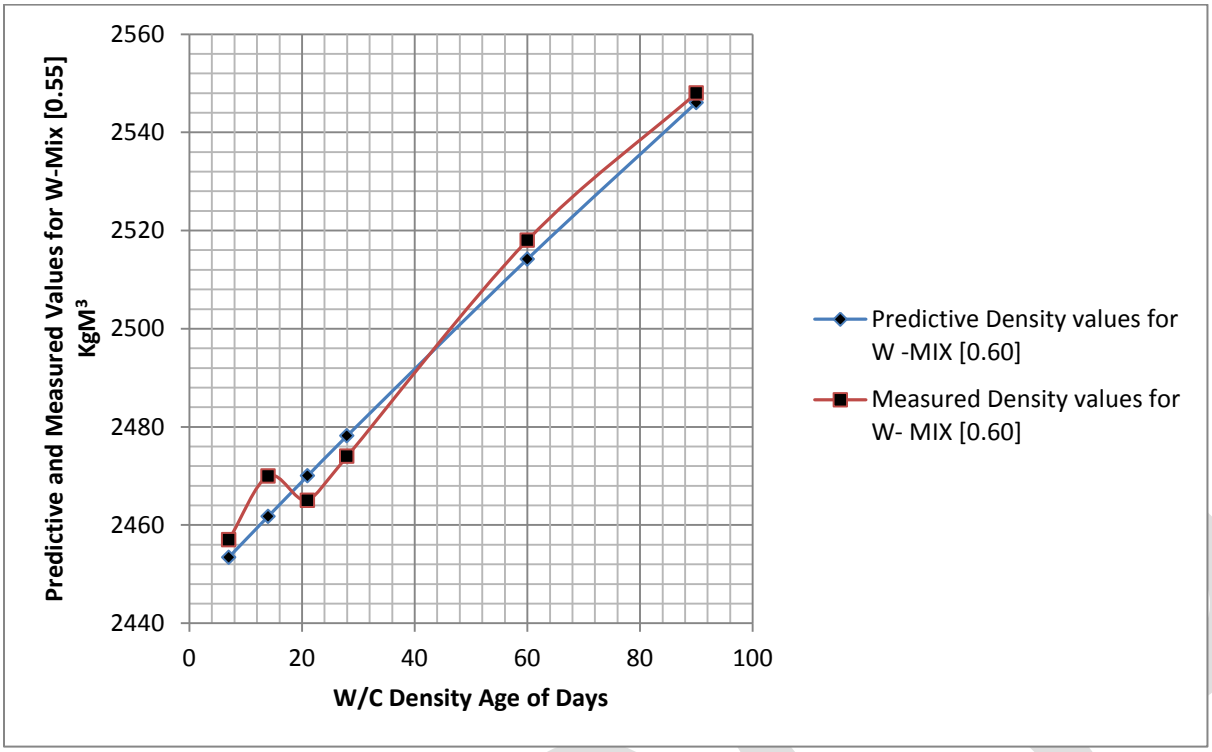

Figure: 20 Predictive and Measured Values for Density W- [0.60] of Concrete at Different Age of Days

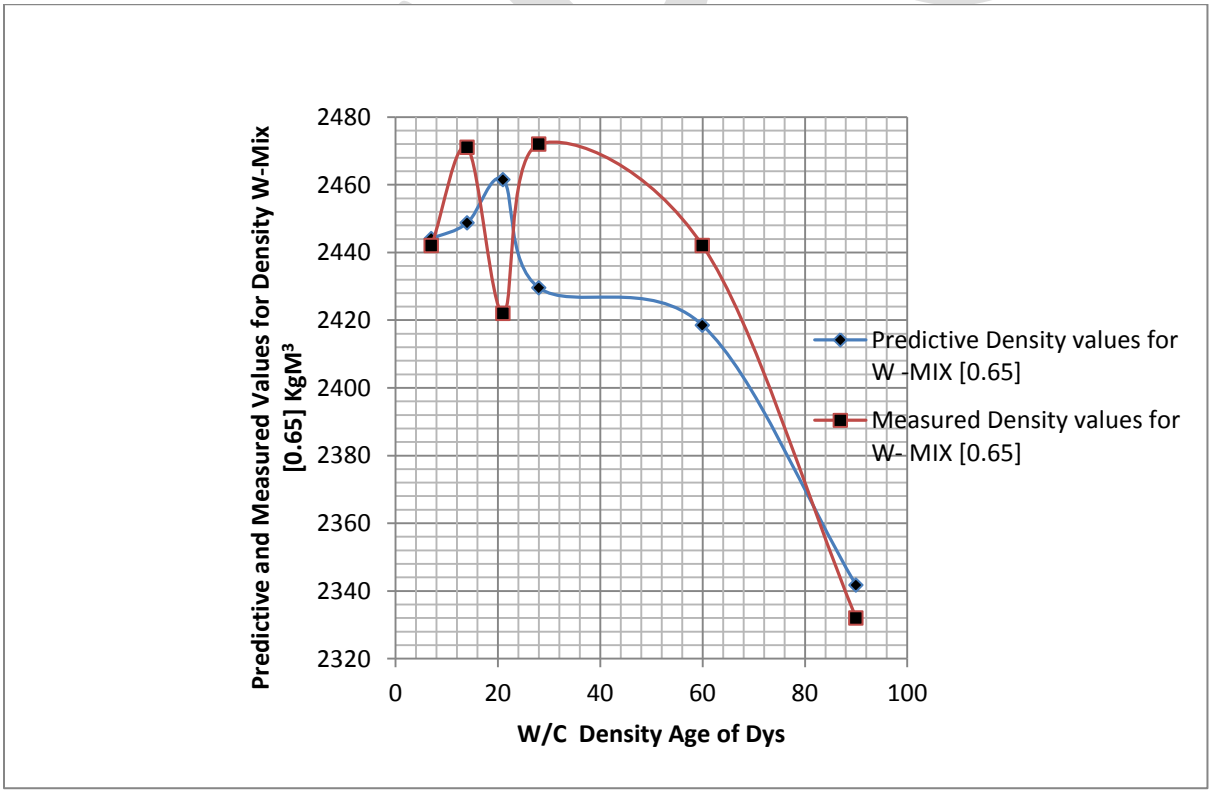

Figure: 21 Predictive and Measured Values for Density W- [0.65] of Concrete at Different Age of Days

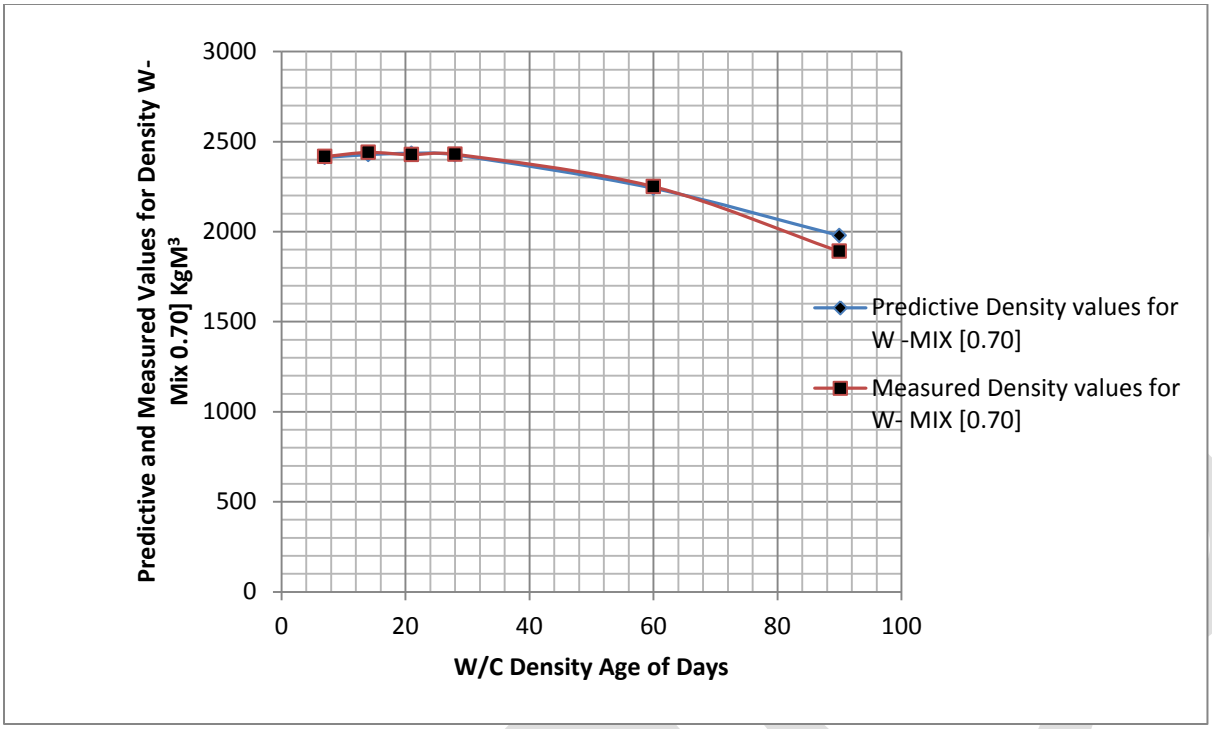

Figure: 22 Predictive and Measured Values for Density W- [0.70] of Concrete at Different Age of Days

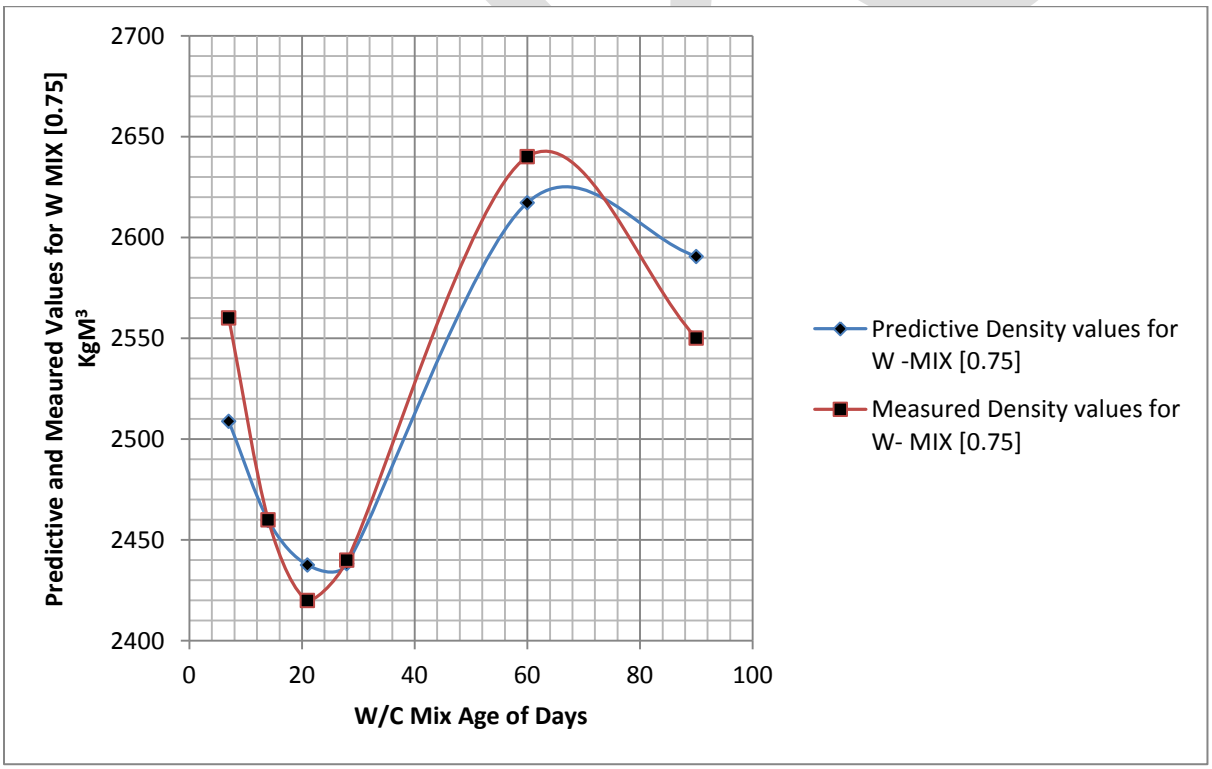

Figure: 23 Predictive and Measured Values for Density W- [0.75] of Concrete at Different Age of Days

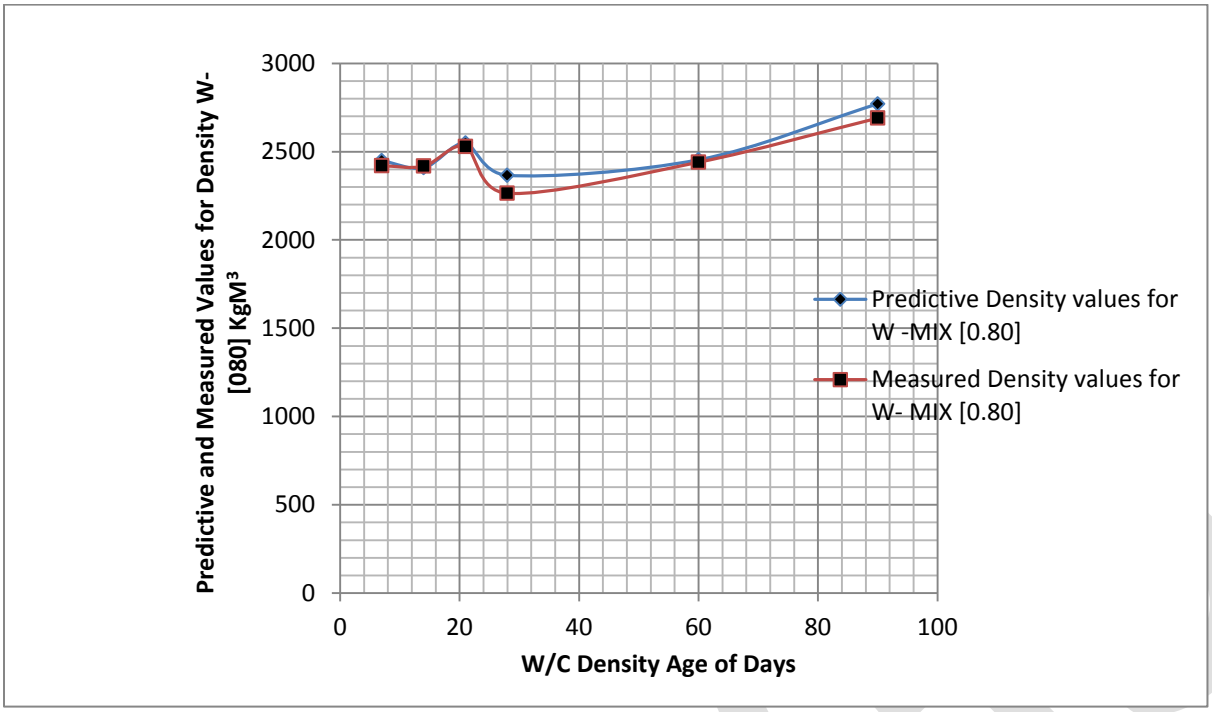

Figure: 24 Predictive and Measured Values for Density W- [0.80] of Concrete at Different Age of Days

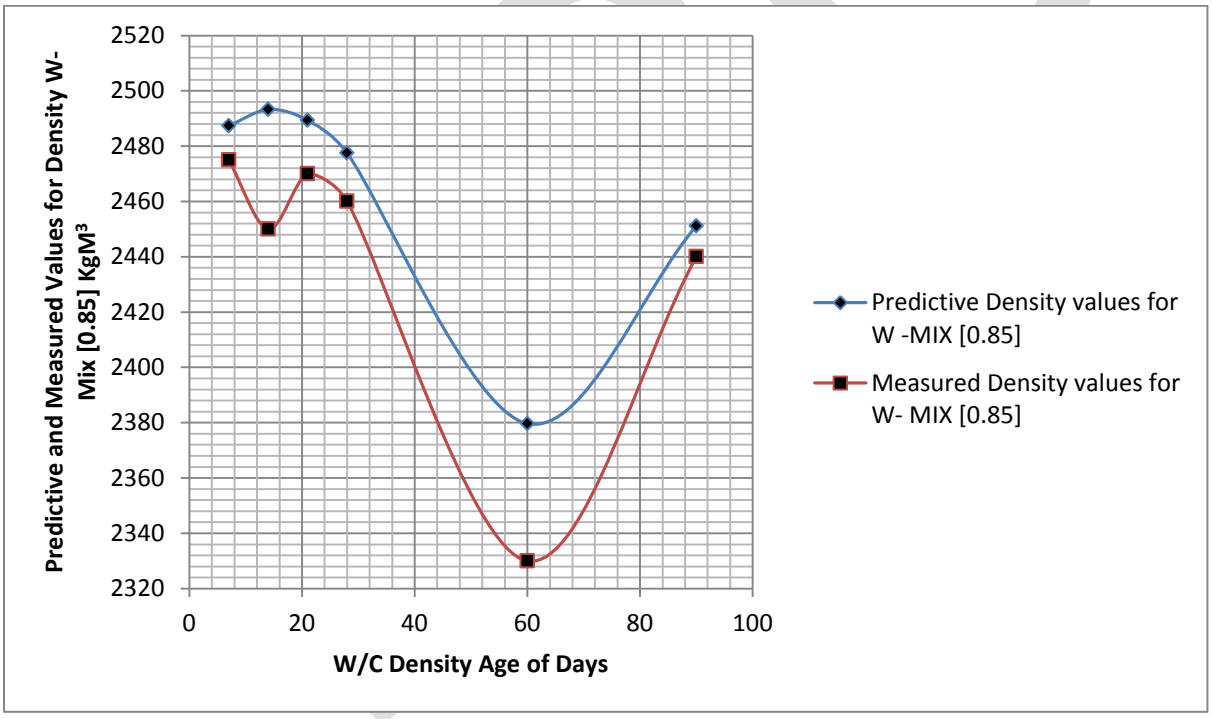

Figure: 25 Predictive and Measured Values for Density W- [0.85] of Concrete at Different Age of Days

The study expresses the variation rate of densities in different water cement ratios at various curing age, figure one express its density with rapid rate at seven curing days, sudden decrease were observed at sixty days thus gradual increase to the maximum density at ninety days. figure two express different conditions, vacillation were recorded between seven and twenty one curing days, while rapid increase were experiences to the maximum density recorded at ninety days, figure three express gradual increase to the optimum at twenty eight days and suddenly decrease down to the lowest at ninety days, similar condition were observed on the measure values but with slight fluctuation,. Figures four both predictive and measures values were observed developing best fits by expressing its maximum density within seven and fourteen days, but suddenly it developed slight decrease at

ninety days. figure five generated similar condition where the maximum density of both predictive and measured values express best fits trend line within seven and fourteen days, thus declining to where the lowest were recorded at ninety days. Figure six maintain established similarities on previous figures where optimum density was recorded within seven and fourteen days thus declining to the lowest at ninety curing days, figure seven developed different deposition of density, gradual increase were observed with fluctuation on the measured values to the optimum point at sixty days, sudden declined were experiences at ninety days. Figure eight express fluctuation from the measured, while the predicted developed gradual increase process to the maximum point at twenty eight days, in the same vein decline slightly at ninety days. Figure nine maintained similar condition both predictive and measured values with gradually increased to the maximum point at sixty days thus decrease rapidly at ninety days. Figure ten, the predictive and measured express gradual increase to the maximum point of ninety curing days. Figure eleven maintained gradual increase to the optimum values recorded at ninety curing days. While in figure twelve predictive and measured developed optimum density at fourteen days and suddenly decrease to the lowest at ninety days. Figure thirteen generated gradual increase where the maximum density was recorded at twenty eight days thus express slight decreases at ninety days. Figure fourteen developed exponential deposition of density declining down at ninety days, while the exponential continued on the trend of measured values. Figure fifteen developed similar trend, but with slight vacillation at twenty eight days thus decline at ninety days. Figure sixteen express linear increase of density and suddenly decline fluctuating with slight declined at ninety days, while it measured values express slight increase from the trend fits within seven and twenty eight days meeting at the point of ninety days. Figure seventeen predictive and measured values express rapid increase within seven and twenty eight days and suddenly maintained gradual increase at optimum point of ninety days. Figure eighteen developed fluctuation were the optimum values were recorded, between seven and twenty eight days and suddenly experienced rapid declined to the lowest at ninety days. Figure nineteen generated vacillation between the measured and predictive values were the lowest were recorded at twenty eight, thus rapid increases were observed to the optimum values at ninety days. Figure twenty predictive and measured expresses linear increase while the measured express slight vacillation between seven and fourteen thus develop linear increase to the optimum point at ninety days. Figure twenty one predictive and measured express oscillation were the optimum values recorded between seven and twenty eight days and finally express rapid declined to the lowest at ninety curing days, figure twenty two predictive and measured with best fits trend expresses maximum values at seven and gradually declined to the lowest at ninety days. Figure twenty three express gradual increase and suddenly deceases at twenty one, rapid increase were observe at sixty thus the maximum values were recorded with slight decline at ninety days. Figure twenty four, developed fluctuation expressing the lowest at sixty days, sudden increase were experienced at the maximum point of ninety days.

Conclusion

Concrete formations are determined by the type of materials and various mix designed, the density of concrete express the rate of compaction that will definitely developed variation in strength. These conditions establish some level of relationship in concrete formation, several densities of locally occurring 3/8 gravel express fluctuation due to variation of water cement ratio, the gravel were in two conditions washed and unwashed, most unwashed were observed to deposit some impurities that may reduce the compaction rate thus express variation of slight porosity at various mixed ratios, the locally sorted gravel predominantly generated impurities that developed variation on compactions thus fluctuation in density at different curing age. Such deposit variation of porosity affecting compaction on concrete density, these express the behaviour of concrete density fluctuating in locally occurring 3/8 gravel were thoroughly identified, the predictive model expressed the influences from porosity thus ingress of water on the strength variation in curing age of concrete from locally 3/8 occurring gravel, the measured values developed best fits predominantly express higher percentage of predictive values as a representation from the calibrated results.

REFERENCES:

[1] Adesanya, D. A. and Raheem, A. A. (2002). The Effect of Different Brands of Ordinary Portland Cement on the Compressive Strength of Concrete. Journal of Civil Engineering, Second Edition, November, 37-43.

[2] Aluko, O.S.(2005). Comparative Assessment of Concrete Curing Methods. Unpublished Post Graduate Diploma Thesis, Federal University of Technology, Akure, Nigeria.

[3] Arum, C. and Alhassan, Y.A. (2005). Combined Effect of Aggregate Shape, Texture and Size on Concrete Strength. Journal of Science, Engineering and Technology.13(2), 6876-6887.

[4] Arum, C. and Udoh, I.(2005). Effect of dust inclusion in aggregate on the compressive strength of concrete. Journal of Science, Engineering and Technology. 12(2), 6170-6184.

[5] British Standard Institution (1990) *Methods of Testing of Soils for Civil Engineering Purposes*, BS 1377, London, British Standard Institution

[6] Gowripalan, N., Cabrera, J.G.; A.R, Cusens and Wainwright, P.J. (1992) Effect of Curing on Durability, Durable Concrete, ACI Compilation 24. American Concrete Institute, Farmington Hills, Michigan, USA, 47-54.

[7] Mamlouk, M.S. and Zaniewski, J.P (2006). *Materials for Civil and Construction Engineers.* 2nd ed., New Jersey: Pearson Prentice Hall.

[8] Price, W. H. (1991) Factors influencing Concrete Strength. J. Am. Concrete Institute

[9] Neville, A. M. (1996). *Properties of Concrete*, 4th ed., USA, New York: John Wiley and Sons
[10] Akeem A R Aliu A S, Amaka J E 2013 Effect of Curing Methods on Density and Compressive Strength of Concrete International Journal of Applied Science and Technology Vol. 3 No. 4; April 2013

[11] Ode .T. 2004, Structural properties of concrete made with locally occurring 3/8 gravel, M.Tech Thesis pp 6

[12] Ephraim M.E. Ode .T. (2006) Specification for structural Application of concrete with 10mm (3/8) All – in Gravel Aggregate NEAM Vol 1 No 1

[13] Eluozo, S.N. Ode .T. (2015) Mathematical model to monitor stiff clay compression index in wet land area of Degema Volume 6, Issue 12, pp. 59-72, Article ID: IJARET_06_12_007

[14] Eluozo, S.N. Ode .T. (2015) Mathematical model to predict compression index of uniform loose sand in coastal area of Degema, Rivers State of Nigeria. International Journal of Advanced Research in Engineering and Technology Volume 6, Issue 12, pp. 86-103, Article ID: IJARET_06_12_009

[15] Eluozo. S. N and Ode T, Modeling and Simulation of Compression Strength for Firm Clay in Swampy Area of Ahoada East. *International Journal of Advanced Research in Engineering and Technology*, **6**(12), 2015, pp. 73-85.

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Design Of L-Slotted Dual Band Z-Shape Patch Antenna Useful For Wireless Applications

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Abstract- A Z-Shape dual band antenna is proposed in this paper. The Antenna consist of three L-Shape Slots being cut in the patch, and is being fed with coplanar waveguide, which ultimately radiates electromagnetic waves, and determines the radiation pattern of the antenna. The Z-shape patch has been provided Perfect E Boundary, which in turn results in better gain and return loss characteristics. The two resonant frequency of the antenna are 1.40Ghz and 1.68Ghz, which gives 0.18Ghz and 0.16Ghz bandwidth, and a gain of 18.3db at the solution frequency of 0.95Mhz. The frequency domain characteristics of the antenna has been studied, and performance of the antenna has been thoroughly investigated by simulating it with the help of High Frequency Structure Simulator(HFSS) software.

Keywords- Patch Antenna, Z-Shape Patch, Wireless Applications, Dual-Band Patch Antenna, L-Slot Antenna, Microstrip Antenna, HFSS

INTRODUCTION

Wireless Communication is more preferred these days compared to wired communication because of its flexibility, ease and durability. A patch antenna is a low profile antenna(called as rectangular microstrip patch antenna), which can be scaled on a flat surface, and usually consist of a patch of metal put on another large sheet of metal popularly known as the ground plane. Slots are being cut in patch antennas because slotted antennas provide greater control of radiation pattern, and has many advantages such as robustness, design simplicity and convenient adaptation. In slotted antennas, radiation arises by excitation of the slots, and protruding components are absent, which proves to be of greater advantageous than other antennas especially when these antennas are being mounted in the aircraft.

When E & H vectors are being replaced by H & -E vectors, the slots produce fields, that are much similar to the field of a sheet like dipole, and the input impedance of a slotted antenna can be as high as $10^3\Omega$, and the characteristic impedance of the cable can be in between 50 and 75Ω range. In this paper, a patch antenna having dual bands has been presented, which consists of a Z-Shape patch in which three L Shape slots are being incorporated in order to have better impedance matching and in turn better radiation characteristics. A rectangle shaped ground plane along with a co-planar waveguide transmission line is provided in order to provide necessary excitations to the antenna. The optimized values of length and width of the slots are taken, and these slots are used to enhance the upper frequency of the band, and improving the lower frequency along with impedance bandwidth. Good Bandwidth is achieved in dual resonant frequencies of 1.40Ghz and 1.68Ghz with S11<-10db. The simulation results are being obtained, and radiation pattern, return loss, VSWR, Gain and other properties are being studied. Design details of the proposed antenna along with results and detailed explanations are given and discussed in this paper.

ANTENNA DESIGN

In the proposed antenna, the ground plane and Z-Shape parasitic strip are on the same side of the substrate. The Z-shape Patch has been designed by cutting two rectangle shape slots having length of 35mm and width of 8mm The antenna has been fed with a coplanar waveguide transmission line having width of 3.8mm, and length of 41mm. Three L-Shaped slots are further being cut in the three sections of Z-Shape patch having width of 5mm each. The substrate used here is FR4 epoxy, and is having relative permittivity of 4.4, and di-electric loss tangent of 0.02, and mass density of 1900. The Antenna is provided with Perfect E excitation since it forces the H field tangential component to be on same side, and also models perfectly conducting surface of a structure. Current path induces from two resonant frequencies, which in turn creates dual resonant modes. The Gain achieved at the solution frequency of 0.95Mhz is 18.3 db, and S11 achieved at both the resonant frequency is -18.74db, -22.34db.

"Fig. 1" denotes the general geometry of the proposed antenna, and "Fig. 2" denotes the Z-shape patch incorporated with three L-shape slots which are identical to each other in dimension. The simulation process was carried in HFSS software, and various characteristic plots of the antenna are being depicted below.

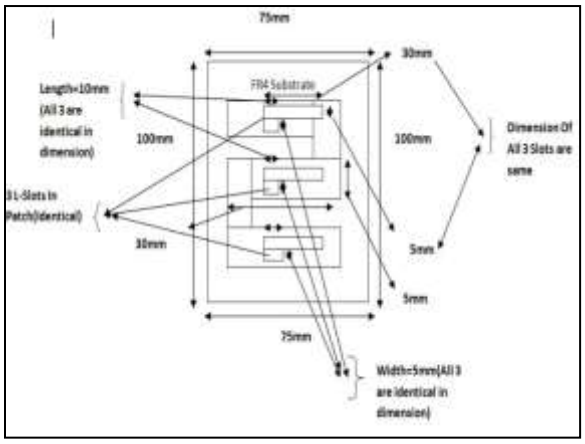

Fig. 1: Geometry Of The Patch And Substrate

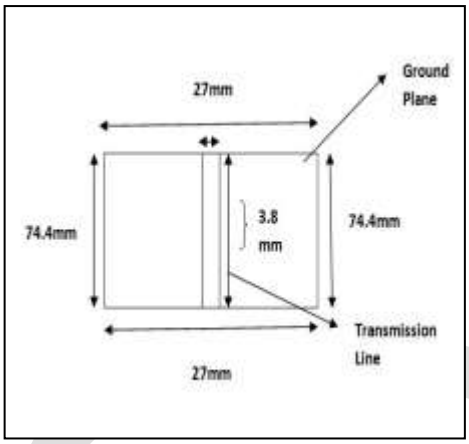

Fig. 2: Ground Plane Geometry

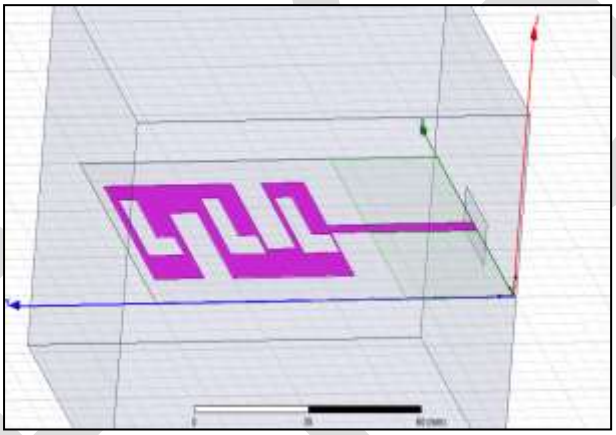

Fig. 3: Simulated Antenna(Proposed)

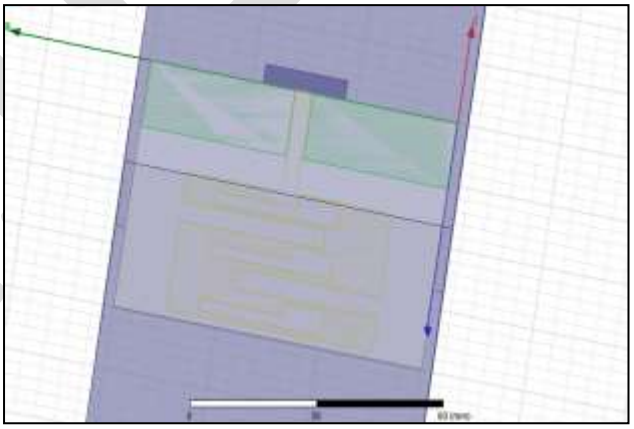

Fig. 4: Simulated Antenna(Top View)

Dimensions of the proposed antenna are clearly indicated in "Figure 1". The substrate that is being chosen is FR4 Epoxy having the following properties:

- **Relative Permittivity:** 4.4
- **Di-Electric Loss Tangent:** 0.02
- **Lande G Factor:** 2
- **Mass Density:** 1500

The ground plane dimension is (74.4 x 27mm), and the co-planar waveguide transmission line is incorporated by cutting the middle portion of the ground plane having dimensions equal to that of the transmission line. L-shape slots are being used here because presence of slots in any antenna confirms a roughly Omni-directional radiation pattern, and ensures linear polarization along with various design variables that can be helpful to tune performance of the antenna.

Operating Range Of The Antenna:

The Proposed antenna operates within the frequency band of wireless communications viz. F1= 1.40GHz, and F2=1.68GHz.

GOVERNING FORMULAS AND VARIABLES

- **Effective Di-electric Constant is given by:**

$$\varepsilon_{eff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2}\left[1 + 10\frac{H}{W}\right]^{-\frac{1}{2}}$$

- **Length Of The Patch is calculated by the formula:**

$$L = \frac{c}{2f\sqrt{\varepsilon_{eff}}} - 2\Delta L$$

- **Notations Used:**
  - ε_R= Relative Permittivity.
  - L= Length, f= Working frequency, c= Velocity of light
  - W= Patch Width($W=C/2f\sqrt{\varepsilon_R}$) [Non-Resonant]
  - Length Of The Patch Antenna is calculated as:

$$\Delta L = 0.412h\frac{(\varepsilon_{reff} + 0.3)\left(\frac{W}{h} + 0.264\right)}{(\varepsilon_{reff} - 0.258)\left(\frac{W}{h} + 0.8\right)}$$

- **Effective Length L_{eff} is given by:** [$Leff = c / 2 f 0 \ x \sqrt{\varepsilon_{Reff}}$]

OBSERVATION AND RESULTS

Return Loss And VSWR Graph:

- The return loss graph of the proposed antenna is shown in the "fig. 5" below. The two resonant frequencies are 1.40GHz and 1.68GHz yielding S11(F1)= -18.74db, and S11(F2)= -22.34db. The VSWR Graph is shown in "fig. 6", and it can be seen that highest VSWR(Voltage Standing Wave Ratio) is achieved at 1.10GHz, and value of VSWR at two resonant frequency of 1.40GHz and 1.68GHz is 2.01db and 1.32db respectively.

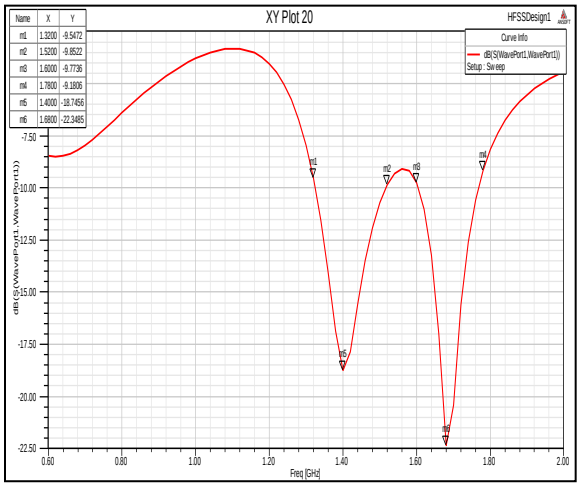

Fig. 5: Return Loss Of The Proposed Antenna

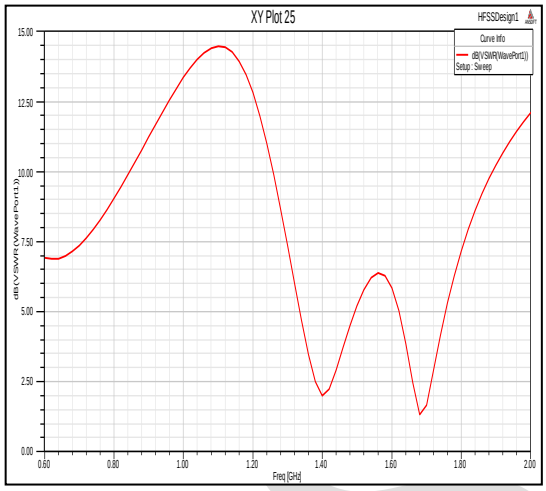

Fig. 6: VSWR Of The Proposed Antenna

- From the graph, it can be clearly seen that highest return loss is being found at 1.12GHz, and lowest return loss is being found at 1.68GHz. Bandwidth is being calculated from return loss graph are 0.18 GHz(at F1), and 0.15GHz(at F2).

3d Polar Plot:

- 3d Polar Plot graph is shown in "Fig 6". Data table has also been shown in "Fig. 7", which clearly depicts db[reTotal V] corresponding to various values of theta from -180 to +180.

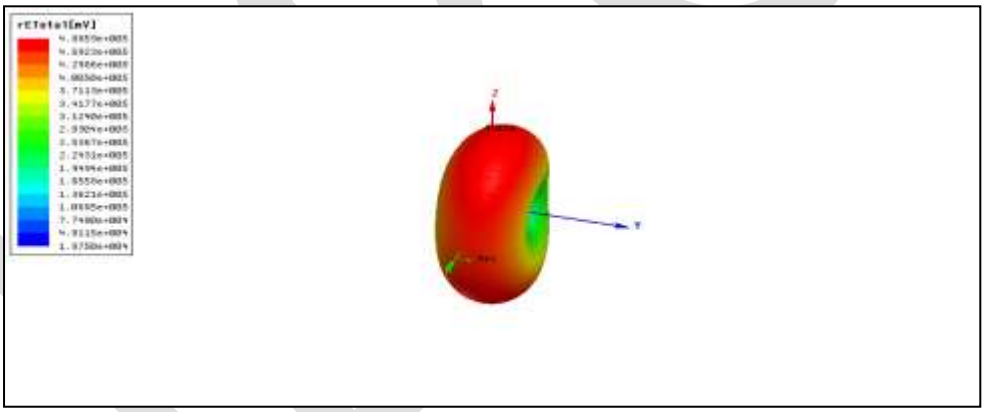

Fig. 6: 3d Polar Plot Of The Proposed Antenna

Data Table 2 — HFSSDesign1

	Theta [deg]	dB(rETotal) Setup : LastAdaptive Freq='0.95GHz' Phi='0deg'	dB(rETotal) Setup : LastAdaptive Freq='0.95GHz' Phi='5deg'	dB(rETotal) Setup : LastAdaptive Freq='0.95GHz' Phi='10deg'	dB(rETotal) Setup : LastAdaptive Freq='0.95GHz' Phi='15deg'	dB(rETotal) Setup : LastAdaptive Freq='0.95GHz' Phi='20deg'	dB(rETotal) Setup : LastAd... Freq='0.95GHz'...
1	-180.000000	53.331276	53.331276	53.331276	53.331276	53.331276	53.331276
2	-175.000000	53.177553	53.161932	53.146940	53.132718	53.119408	53.107158
3	-170.000000	52.993618	52.961375	52.929335	52.897834	52.867243	52.837969
4	-165.000000	52.781398	52.731724	52.680820	52.629252	52.577681	52.526856
5	-160.000000	52.543673	52.475982	52.404703	52.330641	52.254768	52.178214
6	-155.000000	52.284053	52.198004	52.105199	52.006658	51.903638	51.797635
7	-150.000000	52.006932	51.902448	51.787370	51.662875	51.530431	51.391825
8	-145.000000	51.717420	51.594701	51.457035	51.305673	51.142179	50.968487
9	-140.000000	51.421254	51.280775	51.120658	50.942117	50.746659	50.536175
10	-135.000000	51.124680	50.967192	50.785209	50.579793	50.352219	50.104104
11	-130.000000	50.834307	50.660823	50.457998	50.226625	49.967571	49.681929
12	-125.000000	50.556938	50.368718	50.146486	49.890667	49.601559	49.279495
13	-120.000000	50.299369	50.097898	49.858070	49.579868	49.262898	48.906543
14	-115.000000	50.068168	49.855133	49.599851	49.301827	48.959909	48.572411
15	-110.000000	49.869447	49.646706	49.378393	49.063542	48.700241	48.285712
16	-105.000000	49.708620	49.478172	49.199482	48.871157	48.490600	48.054023
17	-100.000000	49.590181	49.354137	49.067899	48.729737	48.336504	47.883596
18	-95.000000	49.517506	49.278056	48.987224	48.643063	48.242067	47.779099
19	-90.000000	49.492693	49.252077	48.959679	48.613476	48.209835	47.743430
20	-85.000000	49.516470	49.276941	48.986031	48.641785	48.240686	47.777585
21	-80.000000	49.588152	49.351948	49.065555	48.727225	48.333790	47.880619
22	-75.000000	49.705678	49.474991	49.196070	48.867497	48.486643	48.049686
23	-70.000000	49.865709	49.642653	49.374035	49.058857	48.695173	48.280160

Fig. 7: Data Table Of The Proposed Antenna

- **Note:** Values of db[rETotal] is shown for only few values starting from -180 degree to -70 degree.

Radiation Pattern:

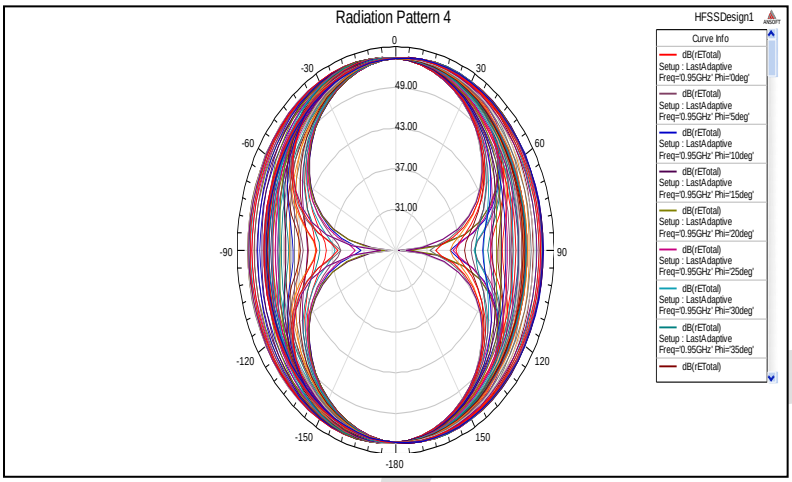

Fig. 8: Radiation Pattern Of The Proposed Antenna

- From the radiation pattern shown in "Fig 9", it is quite evident that there is sufficient cross polarization in the higher band, and because of this, the proposed antenna can receive large distance signals effectively.

CONCLUSION

A L-Slotted Z-shaped patch Antenna is presented in this paper. The Antenna operates in two resonant frequency bands viz. 1.4GHz and 1.68GHz, giving bandwidths of 0.18GHz and 0.15GHz. Gain, Radiation efficiency and other characteristics of the antenna are quite satisfactory, and the frequency domain study and numerical analysis of this antenna is being done in detail. The proposed antenna is having good impedance matching, and 96.61% radiation efficiency, which no doubt makes it suitable for establishing effective wireless communication.

REFERENCES:

[1] A Haidery, R.Tawde, T. Shaikh, "L-slot Rectangular Microstrip Patch Antenna for WiMAX and WLAN Applications", International Journal Of Emerging Technology And Advanced Engineering, Volume 3, Issue 10, October, 2013.
[2] Lin Dang, Zhen Ya Lei, Yong Jun Xie, Gao Li Ning, Jun Fan, "A Compact Microstrip Slot Triple-Band Antenna for WLAN/WiMAX Applications", Antennas and Wireless Propagation Letters, IEEE vol. 9, pp. 1178 - 1181, 2010.
[3] C. L. Mak, K. M. Luk and K. F. Lee, "Microstripline fed L-strip patch antenna", Microwaves, Antennas and Propagation, IEE Proceedings , vol. 146 , no. 4 , pp.282 -284.
[4] Bimal Garg, Rahul Dev Verma, Ankit Samadhiya, "Design of Rectangular Microstrip Patch Antenna Incorporated with Innovative Metamaterial Structure for Dual band operation and Amelioration in Patch Antenna Parameters with Negative μ and ε" International Journal Of Engineering And Technology, 1(3) (2012) 205-216.
[5] Joshua Madhukar Singh, Mayank Mishra, Prafull Sharma, "Design And Optimization Of Microstrip Patch Antenna" International Journal Of Emerging Trends & Technology, Volume 2, Issue 5, September-October 2013.
[6] Ranjan, P., Kishore, N. ; Singh, I. ; Tripathi, V.S., "Inverted Z and circular slot patch antenna for WLAN and WiMAX" Power, Control And Embedded Systems(ICPCES) Conference, 17-19th December, 2012.
[7] Muhammed Salim Garba, "Design Of Tri-Band Z-Shaped Patch Antenna For WLAN & WiMax Applications" International Journal Of Research In Electronics And Communication Technology, Volume 2, Issue 4, Oct-Dec 2015.
[8] Muhammed Aamir Afridi, "Microstrip Patch Antenna Designing-At 2.4GHz Frequency" Biological And Chemical Research, Volume 2015, 128-132, Science SignPost Publishing, March 25, 2015.

[9] A.B Mutiara, R. Refianti, Rachmansyah, "Design Of Microstrip Antenna For Wireless Communication At 2.4GHz" Journal Of Theoretical And Applied Information Technology, 30th November, 2011, Volume 33, No.2.

[10] Vikram Thakur, Sanjeev Kashyap, "A review paper on Techniques and Design For Microstrip Patch Antenna" International Journal Of Advanced Research In Electrical, Electronics And Instrumentation Engineering, Volume 4, Issue 2, February, 2015.

[11] Md. Samsuzzaman, Muhammaed Tariqul Islam, Mohammed Rashed Iqbal Farooq, "Dual Band Multi-Slot Patch Antenna For Wireless Applications" Journal Of Tele-Communications And Information Technology, February, 2013.

[12] Adnane Latif, "Design Of Miniature Patch Antenna Around The Frequency 3.5GHz For Wi-Max Technology" International Journal Of Computer Science Issues, Volume 9, Issue 1, No.2, January, 2012.

[13] M.T. Islam, "Multi-Slotted Microstrip Patch Antenna For Wireless Communication" Progress In Electromagnetic Research Letters, Volume 10, 11-18, 2009.

[14] M.K Soni, Shruti Vashist, P.K Singhal, "Genetic Approach In Patch Antenna Design" International Journal Of Emerging Science And Engineering, Volume-1, Issue 9, July, 2013.

[15] Hetal Pathak, "UWB Re-configurable Microstrip Antenna For Wireless Sensor Network Applications" International Conference On Communication Systems And Network Technologies, 2011.

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THE IMPACT OF CELEBRITY ENDORSEMENT THROUGH TELEVISION ADVERTISEMENTS ON INTRINSIC MOTIVATION OF PURCHASE INTENTION

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ABSTRACT - Celebrity endorsed advertisements are playing a vital role in changing the consumers' perception and also the consumption pattern of the society in general. Celebrity endorsement is extensive, nevertheless there is a limited study on the celebrity endorsement.

This conceptual paper makes an important contribution to fill the existing gap in the literature and identify the role played by celebrity endorsement in the creation of intrinsic motivation of consumers purchase intention created through television advertisements.

Therefore this study examines the relationship between the impact of celebrity endorsement through television advertisements in the creation of intrinsic motivation of consumers purchase intention in relation to "Lux" with special reference to Manmunai North Divisional Secretariat of Batticaloa District(MNDS).

While both the variables individually have high level attributes, the Pearson's correlation analysis explores a positively significant linear relationship between impact of celebrity endorsement through television advertisements on consumer's intrinsic motivation.

Key words: Celebrity endorsement; attractiveness; expertise; trustworthiness; familiarity; intrinsic motivation; perceived value; perceived risk and perceived quality.

01. INTRODUCTION

1.1. Introduction and Background of the Study

Advertising is the most common and effective tool in creating awareness and convincing customers about the brand name. There are various types of advertising and one of the most common current advertising forms is celebrity endorsement advertising. The practice of celebrities being used for rendering services other than performing their actual job as either an actor or an athlete, such as endorsements has proliferated over time. Marketers spend enormous amounts of money annually on celebrity endorsement contracts based on the belief that celebrities are effective spokespeople for their products or brands (Katyal, 2007). Despite the cost and the risks involved with this technique of advertising, it is been used quite extensively in the present era. The instrument of celebrity endorsement has nowadays become a pervasive element in advertising and communication management.

Due to the globalization, Sri Lanka attracts many overseas and international companies to enter into its market. In Sri Lanka, most of the consumer goods are endorsed by artists, Film stars, singers, cricketers or athletes. Companies, civil society organizations and government agencies spend billions of money annually placing one form of advertisement using celebrities in the media more specifically through the television advertisements in Sri Lanka. Celebrity endorsements can trigger the purchase of cosmetic products rather than other Fast Moving Consumer Goods (FMCG). In the cosmetic industry of Sri Lanka, Lux has achieved the number one position among the beauty soaps with more than 85% of households purchasing "Lux".(http://www.unilever.com.lk/our-brands/detail/Lux/324471/, retrieved 17-07-2014). From its inception in Sri Lanka Lux has been using world's leading celebrities as well as Sri Lankan celebrities.

1.2 Problem statement

In Sri Lanka, television advertisements are highly used for celebrity endorsements rather than other forms of the advertisements. More specifically, In Batticaloa district comparing with other divisional secretariats, MNDS is an urban area and most of the people are having televisions with cable connections or dish antenna connections and they spend more time with television. Therefore, this study has attempted to explore MNDS of Batticaloa district as a population of this survey. It seems clear that, celebrity endorsement will create high brand awareness but there is limited research on the impact of celebrity endorsement through television advertisements regarding the consumers' purchase intention specifically in the context of MNDS of the Batticaloa district of Sri Lanka. Hence, this study explores this as the problem attempt to investigate empirically with the general research question of "***What is the role played by the celebrity endorsed television advertisement in the creation of intrinsic motivation for "LUX" in MNDS of Batticaloa district?"***

1.3 Objective of the study

1. The level of Celebrity Endorsement for "Lux" through the Television Advertisements in MNDS of Batticaloa District.

2. The level of Intrinsic Motivation Created for "Lux" through Celebrity Endorsed Television Advertisements in MNDS of Batticaloa District.

3. The level of impact of celebrity endorsement through television advertisements on intrinsic motivation.

1.4 Significance of the study

The topic of celebrity endorsements and its elements is heavily documented in academic literature, but what makes this research interesting is that it enables us to understand the celebrity endorsement process from a Sri Lankan consumer's point of view. The research undertaken on celebrity endorsement and intrinsic motivation in this paper will be useful on both academic and professional platform, as it looks into the perception of Sri Lankan consumers and providing theory for scholarly and directives for managers and professionals.

2. LITERATURE REVIEW

2.1 Concept of celebrity

According to Gupta (2009) Celebrity was a person whose name could grab public attention, arouse public interest and generate profit from the public. Celebrities are well-known individuals (television stars, movie actors and actresses, famous athletes, pop stars, entertainers, etc) who owe their fame to their achievements.

2.2 Celebrity endorser

McCracken (1989, p.310) defined celebrity endorser as *"any individual who enjoys public recognition and who uses this recognition on behalf of a consumer good by appearing with it in an advertisement".* While Stafford *et al.*, (2003) gave a clear definition by defining celebrity endorser as, a famous person who uses public recognition to recommend or co-present with a product in an advertisement.

2.3 Celebrity endorsement

Celebrity endorsement is a form of advertising campaign that involves a well known person using their fame to help promote a product or service. When celebrities endorse products it gives that brand an automatic leg up on the competition.
There were certain forms of celebrity endorsements, which included print advertising in magazines, television advertising, products used in movies and television programs, mention of luxury brand in music, inviting celebrities to be co-creators in designing products and naming products after celebrities (Eshaghpour, 2010).

2.4 Sources of celebrity endorsement

Attractiveness, expertise, trustworthiness, and familiarity can contribute to celebrity endorsement and also use to measure celebrity endorsement.

2.5 Trustworthiness

Trustworthiness meant consumer's confidence in the source for providing information in an objective and honest manner (Ohanian, 1991). Marketers take the advantage of these set of values by employing celebrities those are most regarded as trustworthy, honest believable and dependable among their fans and people (Shimp 1997). When the communicator was perceived to be high trustworthy, an opinionated message was more effective than a non opinionated communication in producing attitude change.

2.6 Attractiveness

Source attractiveness refers to the endorser's physical appearance, personality, likeability, and similarity to the receiver, thus to the perceived social value of the source (Solomon 2002). Attractiveness does not mean simply physical attractiveness, but includes any number of virtuous characteristics that consumers might perceive in a celebrity endorser. Physical attractiveness suggests that a celebrity determines the effectiveness of persuasion as a result of that consumers wanting to be like the endorser and wanting to identify themselves with that endorser (Cohen and Golden, 1972).

2.7 Expertise

Expertise can be defined as the perceived ability of an endorser to make or provide valid assertions. With regard to expertise, it isn't important that the celebrity is really an expert in the field. It is important that consumers think and believe a celebrity has expertise (Ohanian, 1990). It includes the knowledge, experience and skills developed by the endorser while working in the same field.
The consumer will look to the celebrity for expertise, and if he feels that the celebrity is knowledge enough he will buy the endorsed product.

2.8 Familiarity

Familiarity is the audience's knowledge of the source through exposure (Sameen, 2013). Familiarity with the celebrity is a continuous variable which reflects the direct and indirect level of experience of the consumers with the product (Alba and Hutchinson, 1987, quoted by Robert *et al*., 1994). The target market must be aware of the person, and perceive him or her as empathetic, credible, sincere and trustworthy.

2.9 Purchase intention

Purchase intention refers as the behavior of a consumer to a future purchase decision for a particular good or service (Espejel *et al.,* 2008 as cited in Hodza, *et al.,* 2012). *Purchase intention can be measured through intrinsic motivation, extrinsic motivation and Consumer's attitude. This conceptual paper measures the impact of celebrity endorsement through the television advertisement on the intrinsic motivation of purchase intention.*

2.10 Intrinsic motivation

Intrinsic motivation is defined as Internal desires to perform a particular task, people do certain activities because it gives them pleasure, develops a particular skill, or it's morally the right thing to do. According to Teo *et al.,* (1999, p. 26). Intrinsic motivation refers to the reason why we perform certain activities for inherent satisfaction or pleasure. Deci *et al*., (1999) has suggested that when individual's intentions or behaviors are prompted by intrinsic motivations such as enjoyment, they will be more willing to persist in such intentions or behaviors in the future.

2.11 Sources of intrinsic motivation

Intrinsic factor is related to physical product characteristics where it includes perceived quality, risk and value.

2.12 Perceived quality

Perceived quality is a critical element for consumer decision making. According to Jin and Yong, (2005) consumers will compare the quality of alternatives with regard to price within a category. Consumers prefer intrinsic attributes over extrinsic attributes in the formation of perceived quality judgments, and use the latter only if they do not feel competent to evaluate a product on its intrinsic attributes (Grunert, 1986 and Steenkamp, 1989). the consumer`s expected quality evaluation will determine the consumer's intention to buy only in relation to the perceived costs associated with the product, where costs can be both monetary and other costs.

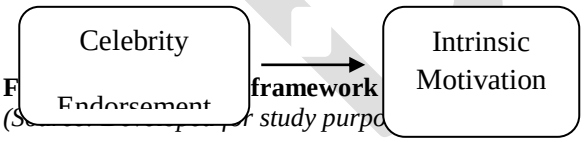
2.13 Perceived Risk

According to Zeithaml and Bitner (2003), perceived risk will typically influence early stage of consumer buying process. Besides that, Dowling and Staelin (1994) define risk as a consumer perception of uncertainty and adverse consequences of engaging in an activity.

2.14 Perceived Value

Price value is the utility derived from the product due to the reduction of its perceived short term and longer term costs. Dodds and Monroe (1985) proposed that the relationship model of price, quality and perceived value and mentioned that perceived value is an important factor in consumers' purchasing decision process, and consumers will buy a product with high perceived value. Dodds and Monroe (1985) and Zeithaml (1988) contended that consumers will evaluate what they give and what they get in their subjective perception when they are buying a product/service.

03. CONCEPTUAL FRAMEWORK AND HYPOTHESIS



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Hypothesis of this study are:

H1: Celebrity endorsement of Lux has positive relationship with intrinsic motivation of purchase intention created for Lux in MNDS of Batticaloa district.

H2: Trustworthy celebrities of Lux have a positive relationship with intrinsic motivation of purchase intention created for Lux in MNDS of Batticaloa district.

H3: Attractive celebrity endorsers of Lux have a positive relationship with intrinsic motivation of purchase intention created for Lux in MNDS of Batticaloa district.

H4: Expertise celebrity endorsers of Lux have a positive relationship with intrinsic motivation of purchase intention created for Lux in MNDS of Batticaloa district.

H5: familiar celebrities of Lux have a positive relationship with intrinsic motivation of purchase intention created for Lux in MNDS of Batticaloa district.

04. METHODOLOGY

4.1 Study Setting and Data Collection

This study was carried out in the MNDS of Batticaloa district. Primary data were collect through closed-ended structured questionnaires measured with five point Likert's scale. The targeted sample is 200 customers from general public who are using "Lux" in MNDS of Batticaloa district.

4.2 Methods of Data analysis

In the research process to analyze the collected data, statistical package for social science (SPSS16.0) has been used in this study.

4.3 Methods of Data Evaluation

Univariate analysis-

Univariate analysis is carried out for evaluating the attributes of dimensions and variables individually based on the response in the questionnaires. For this purpose, mean values and standard deviation of the dimensions and variables are taken into consideration.

Table 1: Decision Criteria for Univariate Analysis

Range for Decision Criteria	Decision Criteria	Decision Attribute
$Xi < (3-Z\ \sigma_x)$	$Xi < 3$	Low Level
$(3-Z\ \sigma x) \leq Xi \leq (3+Z\ \sigma_x)$	$Xi = 3$	Moderate Level
$Xi > (3+Z\ \sigma_x)$	$Xi > 3$	High Level

(Source: developed for study purpose)

Where;
Xi = mean value of a dimension/variable,
σ = standard deviation,
Z = value of the 95% confidence limit and
σ_X = standard error of the mean

Independent Variable and Dimensions

X1 = Mean Value of Trustworthiness
X2 = Mean Value of Attractiveness
X3 = Mean Value of Expertise
X4 = Mean Value of Familiarity
X5 = Mean Value of Celebrity
Endorsement

Dependent Variable and Dimensions

X6 = Mean Value of Intrinsic

Bivariate analysis- Bivariate analysis used to measure the magnitude and direction of the relationship between impact of celebrity endorsement and intrinsic motivation of purchase intension created for Lux in MNDS of Batticaloa district. The decision would be taken based on the amount of correlation coefficient (R) and its significance level

05. DATA PRESENTATION AND ANALYSIS

5.1 The Level of Celebrity Endorsement through Television Advertisements

Table 2: Overall Dimensions and Values of Independent Variable

HL: High level, ML: Moderate level, LL: Low level

Description	Dimensions				Independent Variable
	Trustworthiness (X1)	*Attractiveness (X2)*	*Expertise (X3)*	*Familiarity (X4)*	Celebrity Endorsement (X5)
Mean	3.8933	4.5238	4.0525	4.4083	4.2195
Standard Deviation (SD)	0.43540	0.49151	0.46321	0.46477	0.37911
Co-efficient of Variance	0.190	0.242	0.215	0.216	0.144
Maximum	5.00	5.00	5.00	5.00	5.00
Minimum	2.00	1.50	1.00	1.00	1.54
Number of data	200	200	200	200	200
Standard Error of Mean	0.03079	0.03475	0.03275	0.03286	0.02681
Z – Value at 95% confidence	1.960	1.960	1.960	1.960	1.960
Lower Limit of Mean (3-1.96σx)	2.940	2.932	2.936	2.936	2.947
Upper Limit of Mean (3+1.96σx)	3.060	3.068	3.064	3.064	3.053
Decision Attribute	HL	HL	HL	HL	HL

(Source: Survey data)

Trustworthiness

Trustworthiness has high level at its individual characteristic in influencing the celebrity endorsement for "Lux" through television advertisements in MNDS of Batticaloa district (Mean X1 = 3.8933, where X1> 3.060, see Table: 2). In addition, most of the respondents expressed the common opinion regarding the dimension of trustworthiness (SD = 0.43540).

Attractiveness

Attractiveness has high level at its individual characteristic in influencing the celebrity endorsement for "Lux" through television advertisements in MNDS of Batticaloa district (Mean X2 = 4.5238, where X2>3.068, see Table: 2). In addition, most of the respondents expressed the common opinion regarding the dimension of attractiveness (SD = 0.49151).

Expertise

Expertise has high level at its individual characteristic in influencing the celebrity endorsement for "Lux" through television advertisements in MNDS of Batticaloa district (Mean X3 = 4.0525, where X3>3.064, see Table: 2). In addition, most of the respondents expressed the common opinion regarding the dimension of expertise (SD =0.46321).

Familiarity

Familiarity has high level at its individual characteristic in influencing the celebrity endorsement for "Lux" through television advertisements in MNDS of Batticaloa district (Mean X4 = 4.4083, where X4>3.064, see Table: 2). In addition, most of the respondents expressed the common opinion regarding the dimension of familiarity (SD = 0.46477).

Celebrity Endorsement

Celebrity Endorsement also has high level at its individual quality of independent variable (Mean X5 = 4.2195, where X_5>3.053, see Table: 2). In addition, most of the respondents expressed the common opinion regarding the variable of celebrity endorsement (SD = 0. 37911).

This independent variable includes four dimensions which are trustworthiness, attractiveness, expertise, and familiarity. These dimensions show high level of influence in influencing the celebrity endorsement for "Lux" through television advertisements in

MNDS of Batticaloa district. They have the mean value 3.8933, 4.5238, 4.0525 and 4.4083 respectively (see Table 2). In addition, most of the respondents have expressed the common opinion toward the dimensions of celebrity endorsement for "Lux" through television advertisements in MNDS of Batticaloa district (Standard Deviation is 0.43540, 0.49151, 0.46321 and 0.46477).

5.2 Level of Intrinsic Motivation Created through Celebrity Endorsed Television Advertisements

Table 3: Values of Dependent Variable

Description	Dependent variable
	Intrinsic Motivation (X6)
Mean	4.4367
Standard Deviation (SD)	0.40707
Co-efficient of Variance	0.166
Maximum	5.00
Minimum	1.00
Number of data	200
Standard Error of Mean	0.02878
Z – Value at 95% confidence	1.96
Lower Limit of Mean (3-1.96σx)	2.944
Upper Limit of Mean (3+1.96σx)	3.056
Decision Attribute	**HL**

HL: High level, ML: Moderate level, LL: Low level
(Source: Survey data)

Table 4: Overall Dimensions of Dependent Variable

(Source: Survey data)

Intrinsic motivation

Intrinsic motivation also has high level at its individual quality of dependent variable which falls within the range of $X_6 > 3.056$, (mean

Indicator	Mean	Std Deviation
Perceived quality	4.37	0.553
Perceived risk	4.45	0.565
Perceived value	4.48	0.601
Intrinsic	4.4367	0.40707

value is 4.4367). In addition, most of the respondents expressed the common opinion regarding the variable of celebrity endorsement (SD = 0.40707).

This dependent variable includes three dimensions which are perceived quality, perceived risk and perceived value. These dimensions show high level of influence in influencing the intrinsic motivation created for "Lux" through celebrity endorsed advertisements in MNDS of Batticaloa district. Perceived value has high level of contribution to intrinsic than other two indicators (mean value is 4.48, see table 4). Perceived risk influence higher rather than perceived quality (mean values are respectively 4.45 and 4.37).In addition, most of the respondents have expressed the common opinion toward the dimensions of intrinsic motivation for "Lux" through television advertisements in MNDS of Batticaloa district (Standard Deviation is 0.553, 0.565, and 0.601).

5.3 The Level of Impact of Celebrity Endorsement through Television Advertisements on Intrinsic Motivation.

Table 5: Correlation between the Overall Dimensions of Independent Variable and Depended Variable.

		Intrinsic
Trustworthiness	Pearson Correlation	.302**
	Sig. (2-tailed)	.000
Attractiveness	Pearson Correlation	.459**
	Sig. (2-tailed)	.000
Expertise	Pearson Correlation	.515**
	Sig. (2-tailed)	.000
Familiarity	Pearson Correlation	.629**
	Sig. (2-tailed)	.000
Celebrity endorsement	Pearson Correlation	.585**
	Sig. (2-tailed)	.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
(Source: Survey data)

The significance is at 0.01 level (2-tailed), and coefficient of correlation (r) is greater than 0.3 it is found as a moderate positive influence (0.585**, see Table: 5)of celebrity endorsement through celebrity endorsed television advertisements on the intrinsic motivation created for Lux in MNDS of Batticaloa district.

According to the correlation matrix, it is obvious that all of the correlations between dimensions are significant at the 1% level. The correlation matrix explained a positive relationship between trustworthiness and intrinsic motivation (r = 0.302**), between Attractiveness and intrinsic motivation (r = 0. 459**), between Expertise and intrinsic motivation (r = 0.515**) and between familiarity and intrinsic motivation (r = 0.629**) (see Table: 5).

0.6 DISCUSSION OF FINDINGS

Objective 1: The level of Celebrity Endorsement for "Lux" through the Television Advertisements in MNDS of Batticaloa District.

The celebrity endorsement for "LUX" created through celebrity endorsed television advertisement in MNDS of Batticaloa district indicates high level, which falls within the range of X_5>3.053, (mean value is 4.2195). (see table 2).

Attractiveness has contributed very much (mean value is 4.5238) to celebrity endorsement for "Lux" through television advertisements rather than other dimensions. Furthermore, familiarity has contributed much to celebrity endorsement for "Lux" through television advertisements rather than trustworthiness and expertise. However, trustworthiness has contributed lower to celebrity endorsement for "Lux" through television advertisements than expertise in MNDS of Batticaloa district.

6.2.1 Trustworthiness

According to the indication of Friedman *et al.*, (1979), Advertisers can create the highest effect regarding the products by taking trustworthiness into account. According to Miller and Baseheart (1969) it was found out that if the perceived trustworthiness of the source is high; attitude change is more likely to occur. In this study trustworthiness indicates high level of contribution to the celebrity endorsement through television advertisement for "Lux" in MNDS of Batticaloa district, which falls within the range of X_1> 3.060 (mean value is 3.8933) (see table 2). Therefore this study confirms the indication of Friedman *et al.*, (1979) and Baseheart (1969), that the trustworthiness has higher contribution to the celebrity endorsement.

Correlation analysis explained a positive relationship between trustworthiness in celebrity endorsed television advertisements for "Lux" and intrinsic motivation created for "Lux" in MNDS of Batticaloa district(r = 0.302**, See Table: 5). The relationship between trustworthiness in celebrity endorsed television advertisement and intrinsic motivation created for "Lux" in MNDS of Batticaloa district is positive and significant at 1% level. Thereby, accept the hypothesis H2: Trustworthy celebrities of Lux have a positive relationship with intrinsic motivation created for Lux in MNDS of Batticaloa district.

6.2.2 Attractiveness

According to the indication of Cohen and Golden (1972), physical attractiveness suggests that a celebrity determines the effectiveness of persuasion as a result of that consumers wanting to be like the endorser and wanting to identify themselves with that endorser. In this study attractiveness indicates high level of contribution to the celebrity endorsement through television advertisement for "Lux" in

MNDS of Batticaloa district, which falls within the range of X_2> 3.068, (mean value is 4.5238) (see table 2). Therefore this study confirms the indication of Cohen and Golden (1972), that the attractiveness has high level of contribution to the celebrity endorsement.

Correlation analysis explained a positive relationship between attractiveness in celebrity endorsed television advertisements for "Lux" and purchase intention created for "Lux" in MNDS of Batticaloa district (r = 0.459**, See Table: 5). The relationship between attractiveness and intrinsic motivation created for "Lux" is positive and significant at 1% level. Thereby, accept the hypothesis *H3: Attractive celebrity endorsers of Lux have a positive relationship with consumer's purchase intention created for Lux in MNDS of Batticaloa district.*

6.2.3 Expertise

According to the indication of Ohanian (1990) when consumers exposed to a source perceived as high expert, they would exhibit a higher level of agreement with the source's recommendation than did those exposed to a source with lower level of expertise. In this study expertise indicates high level of contribution to the celebrity endorsement for "Lux" through television advertisements in MNDS of Batticaloa district, which falls within the range of X_3> 3.064, (mean value is 4.0525) (see table 2). Therefore this study confirms the indication of Ohanian (1990), that the expertise has high level of contribution to the celebrity endorsement. .

Correlation analysis explained a positive relationship between expertise in celebrity endorsed television advertisements for "Lux" and intrinsic motivation created for "Lux" in MNDS of Batticaloa district (r = 0.515**, See Table: 5). The relationship between expertise in celebrity endorsement and intrinsic motivation created for "Lux" is positive and significant at 1% level. Thereby, accept the hypothesis *H4: Expertise celebrity endorsers of Lux have positive relationship with intrinsic motivation created for Lux in MNDS of Batticaloa district.*

6.2.4 Familiarity

According to the indication of Alba and Hutchinson, (1987), familiarity with the brand is a continuous variable which reflects the direct and indirect level of experience of the consumers with the product. In this study familiarity indicates high level of contribution to the celebrity endorsement for "Lux" through television advertisements in MNDS of Batticaloa district, which falls within the range of X_4> 3.064, (mean value is 4.4083 (see table 2). Therefore this study confirms the indication of Alba and Hutchinson (1987), that the familiarity has high level of contribution to the celebrity endorsement.

Correlation analysis explained a positive relationship between familiarity in celebrity endorsed television advertisements for "Lux" and purchase intention created for "Lux" in MNDS of Batticaloa district (r = 0.629**, See Table: 5). The relationship between familiarity in celebrity endorsement and intrinsic motivation created for "Lux" is positive and significant at 1% level. Thereby, accept the hypothesis *H5: familiar celebrities of Lux have a positive relationship with intrinsic motivation created for Lux in MNDS of Batticaloa district.*

6.3 Objective 2: The level of Intrinsic Motivation Created for "Lux" through Celebrity Endorsed Television Advertisements in MNDS of Batticaloa District.

The intrinsic motivation created for "Lux" through celebrity endorsed television advertisements indicates high level in MNDS of Batticaloa district, which has fall within the range of X_6> 3.056, (mean value is 4.4367) (see table 5). Intrinsic measured though three indicators such as perceived quality, perceived risk, and perceived value

Perceived value has high level of contribution to intrinsic than other two indicators (mean value is 4.48, see table 2). Perceived risk influence higher rather than perceived quality (mean values are respectively 4.45 and 4.37).

Objective 3: The level of impact of celebrity endorsement through television advertisements on intrinsic motivation.

In this study the Pearson correlation analysis exposed the relationship between the celebrity endorsement and *intrinsic motivation* created for "Lux" through the television advertisement in MNDS of Batticaloa district. The correlation of coefficient (r) was 0.585**, which was significant at 0.0 level. Since the r > 0.3, p-value is less than 0.01, the correlation was significant and the two variables were linear related. It is reflect the celebrity endorsement positively influencing the intrinsic motivation created for "Lux" through television advertisement in MNDS of Batticaloa district. Thereby, accept the hypothesis *H1: Celebrity endorsed television advertisement has a positive relationship on* intrinsic motivation *for Lux in MNDS of Batticaloa district.*

Therefore this study confirms the indication of Laroche *et al*., (1996), that the celebrity endorsement has a positive relationship with purchase intention.

0.7 CONCLUSIONS AND RECOMMENDATIONS

Based on the study data it can be concluded that an endorser with a high celebrity status more positively influences the consumer's attitude towards the advertisement and intrinsic motivation towards the brand "Lux" in MNDS Batticaloa district. So companies must select right celebrity endorsers for "Lux" in order to grab the attentions and arouse the interest of the target customers in MNDS of Batticaloa district.

According to the analysis, mainly attractiveness and familiarity contributed highly for the celebrity endorsement than other dimensions, therefore marketers can specifically focus on the celebrities who possess these qualities are more persuasive and are more capable of positively influencing both attitude towards the advertisement and Intrinsic motivation "Lux" in MNDS of Batticaloa district.

Attractiveness has the high contribution to the celebrity endorsement for "Lux" than other three dimensions. Therefore in the "Lux" advertisements, marketers should select celebrities who are attractive to the target audience. Consumers may use appearance as a differentiating variable between advertisements which they like and remember and those which they do not like.

Seeing a familiar face on the television screen gives consumers that extra incentive to go out and buy that particular product. Famous personalities should be favored by marketers as endorsers, marketers must exercise good judgment in choosing celebrity endorsers who are very popular in current period and having acceptance among the target audience for reasons previously cited.

Intrinsic measured by perceived quality, perceived risk and perceived value. Perceived value has contributed high to intrinsic than other two dimensions. Perceived risk has contributed to intrinsic rather than perceived quality. Therefore marketers can specifically focus on the perceived value and perceived risk to increase intrinsic values in the way of telling in the celebrity endorsed advertisements that the "Lux" is high in value, its good in quality, good in smell, make your skin glowing and "Lux" isn't harmful to the skin so its reducing risk in the consumption .

The correlation of coefficient is reflecting the celebrity endorsement has moderate positive influence in the intrinsic motivation. Regression analysis indicates that 1 unit of celebrity endorsement for "Lux" is impact 0.585 times into intrinsic motivation regarding of "Lux" in MNDS of Batticaloa district.

"The celebrity endorsement through Television advertisements has a strong positive role in the creation of intrinsic motivation regarding of Lux in MNDS of Batticaloa district". Since celebrity endorsement through television advertisements enhances the intrinsic motivation of the customers, every marketer should try to use celebrity endorsers in their television advertisements in order to increase the intrinsic motivation to increase the purchase intention for the "Lux" in MNDS of Batticaloa district.

REFERENCES:

1. Alba, Joseph W. and J. Wesley Hutchinson (1987), "Dimensions of Consumer Expertise," Journal of Consumer Research, 13 (4), 411-454.
2. Cohen, J.B., Golden, E., (1972). Informational social influence and product evaluation. Journal of Applied Psychology, Vol. 56, 54-59.
3. Deci, Koestner, and Ryan (1999) Effects of Reward on Intrinsic motivation – Negative, Neutral and Positive.
4. Dodds, K. B Monroe, &Grewal, D. (1991).Effects of price, brand, and store information on buyers'productevaluations.Journal of Marketing Research, 28, 307- 319.
5. Dowling, G., Staelin, R. ìA Model of Perceived Risk and Intended Risk-Handling Activity, Journal of Consumer Research, 21, June 1994, pp. 119-134.
6. Eshaghpour, 2010, promotion of fashion designs and celebrity endorsement.
7. Espejel, J., Fandos, C., &Flavián, C. (2008).Customer satisfaction a key factor of consumer loyalty and buying intention of a PDO food product.British Food Journal, 110(9), 865-881.
8. Friedman, H. H. and Friedman, L. (1979).Endorser Effectiveness by Product Type. Journal of Advertising Research, 19(5): 67-71.

9. Grunert, K.G., Bredahl, L. and Brunso, K. (1986).Consumer perception of meat quality and implications for product development in the meat sector- a review.Meat Science. Vol.66 pp. 259-272

10. Gupta (2009), The Impact of Celebrity Spokespersons´ perceived Image on Consumers´ Intention to Purchase.

11. Hodza, A., Papadopoulou, K., &Pavlidou, V. (2012). Electronic Word-of-Mouth through Social Networking Sites – How Does It Affect Consumers?. Bachelor's Thesis. Linnaeus University.
12. http://www.unilever.com.lk/our-brands/detail/Lux/324471/, retrieved 17-07-2014

13. Jin, B. and G.S. Yong, 2005.Integrating effect of consumer perception factors in predicting private brand purchase in a Korean discount store context. J. Consumer Market., 22: 62-71.

14. Katyal, S. (2007). Impact of Celebrity Endorsement on a Brand, Chillibreeze writer, available at www.chillibreeze.com/articles/ accessed on 15th Jan , 2010.
15. Laroche, M., Kim, C. and Zhou, L. (1996) 'Brand familiarity and confidence as determinants of purchase intention: an empirical test in a multiple brand context, Journal of Business Research, 37(2), 115-120.

16. McCracken, G. (1989) "Who is the Celebrity Endorser? Cultural Foundations of the Endorsement Process", The Journal of Consumer Research, 16(3), pp. 310- 321.

17. Miller and Baseheart (1969- Miller, Gerald P and John Basehart (1969), "Source Trustworthiness, Opinionated Statements, and Response to Persuasive Communication," Speech Monogropfu, 36 (1), (March), 1-7.

18. Ohanian, R. (1990) "Construction and Validation of a Scale to Measure Celebrity Endorsers' Perceived Expertise, Trustworthiness, and Attractiveness", Journal of Advertising, 19, pp. 39-52.

19. Ohanian, R. (1991), "The impact of celebrity spokespersons' perceived image on consumers' intention to purchase", Journal of Advertising Research, Vol. 31 No. 1,pp. 46-54.

20. Robert J, Kent CTA (1994). Competitive interference effects in consumer memory for advertising: The role of brand familiarity, J. marketing, 58, 97-105.

21. SameenJawaid, 2013, Impact of Celebrity Endorsement on Teenager's Impulsive Buying Behavior, interdisciplinary journal of contemporary research in business, Vol4, no 10.

22. Shimp, T. E., (1997). Advertising, promotion and supplemental aspects of integrated marketing communication. Consumer Behavior: A European Perspective, 3th ed.,New Jersey: Prentice Hall

23. Solomon, M.R., Stephen, D., Susan, D., and Bennett, R.R., (2002). Consumer behavior: buying, having, and being. Australia. p. 342

24. Stafford, M. R., N. Spears, E., and C.-k.Hsu. 2003. Celebrity images in magazine advertisements: application of the visual rhetoric model. Journal of Current Issues & Research in Advertising 25 (2): 13-20.

25. Teo, T.S.H., Lim, V.K.G. and Lai, R.Y.C. (1999) "Intrinsic and extrinsic motivation in internet usage", International Journal of Management Science, vol. 27, no. 1, pp.25–37.

26. Zeithaml, V. (1988). "Consumer perceptions of price, quality and value: A means-end model and synthesis of evidence." Journal of Marketing, 52(3),pp 2-22

27. Zeithaml, V.A. (1988). "Consumer perceptions of price, quality and value: a means-end model and synthesis of evidence."Journal of Marketing.Vol.52(3).pp. 48-62

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Simulation of Convolution Encoder and Viterbi decoder Using Verilog HDL

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Abstract— Convolution encoder and Viterbi decoder of rate 2/3 is simulated using Model Sim. Test benches for encoder and decoder are coded and simulated. Two bits are provided to the encoder as input and three bits are obtained as output of encoder. These encoded three bits are provided as input to the Viterbi decoder. Viterbi decoder consists of different modules such as Euclidean distance calculation module, Subset decode module, Compute metric module, Compare Select Module, Path module, Path memory module, Path in Module, Metric Module, Output decision module and reduce module. All these modules are internally connected by Verilog HDL codes and simulated using Model Sim. The output of the Viterbi decoder will be two bit output. When Input to the Convolution encoder is compared to the output of Viterbi decoder, results shows that they are the same. Convolution Encoder with Viterbi decoder finds applicable in digital broadcasting, Satellite applications, Digital Mobile Applications, Deep Space, Code Division Multiple Access and voice-band data communications.

Keywords— Convolution encoder, Viterbi decoder, Viterbi Algorithm, Verilog HDL, Soft decision decoding, Trace back method, Model Sim

INTRODUCTION

Convolution codes were invented in 1955 by P.Elias. Convolution codes are generally error correcting codes that are used to improve the performance of many digital systems such as digital radio, mobile phones and the Bluetooth implementations. Viterbi decoder together with its improved versions is one of the best applications of convolutional codes. Convolutional coding has been used in communication systems including deep space communications and wireless communications. It offers an alternative to block codes for transmission over a noisy channel. An advantage of convolutional coding is that it can be applied to a continuous data stream as well as to blocks of data. Convolution codes are also used in real time error correction to improve the performance of digital radio, mobile phones, satellite links etc. The simplicity and performance of convolution codes for Gaussian channel is very close to the accurate. They are one of the most widely used channel codes in the practical communication systems.

There are three alternative methods that are often used to describe the convolutional code. These are the tree diagram, state diagram and trellis diagram. There exist four basic convolutional codes decoding techniques: sequential, threshold, maximal-likelihood and the Viterbi algorithm. The sequential algorithm can provide very strong correcting capabilities while it needs relatively large memory, which strongly depends on communication channel error density. The threshold algorithm is extensively good for channels with mid to good signal to noise ratios (SNR). The Viterbi algorithm is an optimum decoding technique. It is optimum as it results in the minimum probability of error. It is also the relatively straight algorithm to implement in hardware and is the best decoding technique. Viterbi algorithm is a maximum likelihood algorithm and performs decoding, through searching the minimum cost path in a weighted oriented graph, called trellis. The basic building blocks of Viterbi decoder are branch metric unit (BMU), path metric unit (PMU), add compare and select unit (ACSU) and survivor memory management unit (SMU).

CONVOLUTION ENCODER

Convolution encoding is widely used for satellite and other noisy communications channels. There are two important components of a channel using Convolution encoding: the Convolution encoder (at the transmitter) and the Viterbi decoder (at the receiver). An encoder includes extra information in the transmitted signal to reduce the probability of errors in the received signal that may be corrupted by noise. Every two bits of data stream are encoded into three bits for transmission. The ratio of input to output information in an encoder is the rate of the encoder; this is a rate 2/3 encoder. The following equations relate the three encoder output bits (Yn2 , Yn1 , and Yn0) to the two encoder input bits (Xn1 and Xn0) at a time nT:

$$Yn2 = Xn1 \quad (1.1)$$
$$Yn1 = Xn0 \text{ xor } Df2 \quad (1.2)$$
$$Yn0 = Df1 \quad (1.3)$$

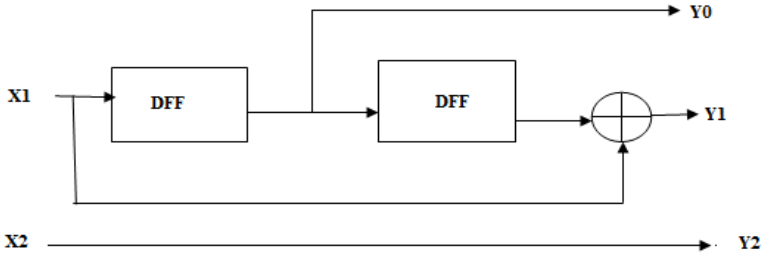

Figure1. Convolution encoder of rate 2/3

VITERBI DECODER

The Viterbi decoder consists of three main units branch matrices unit, add control select unit and survivor management unit. The branch metric unit (BMU) is responsible for the computation of matrices, second block add compare select unit (ACSU) selects the survivor paths for each trellis state, third block survivor management unit (SMU) performs the selection of output which is based on the most optimum path metric. Figure shown below shows the general structure of Viterbi decoder

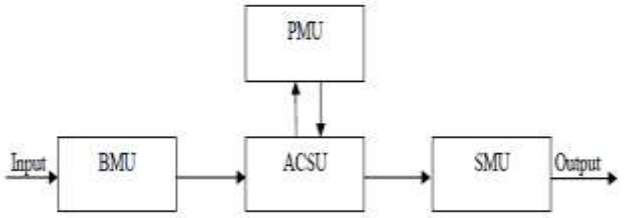

Figure2. Block diagram of Viterbi decoder

INTERNAL MODULES OF VITERBI DECODER

The Viterbi decoder consists of various internal modules for Branch metric calculation, Path metric calculation, modules to perform addition of branch metric and path metric, comparison module to select the smallest path and other modules. The first module is Euclidean distance calculation module. The other modules are subset decode module, Compute metric module, Compare Select module, Path in and Path memory modules, Reduce metric and Output decision module.

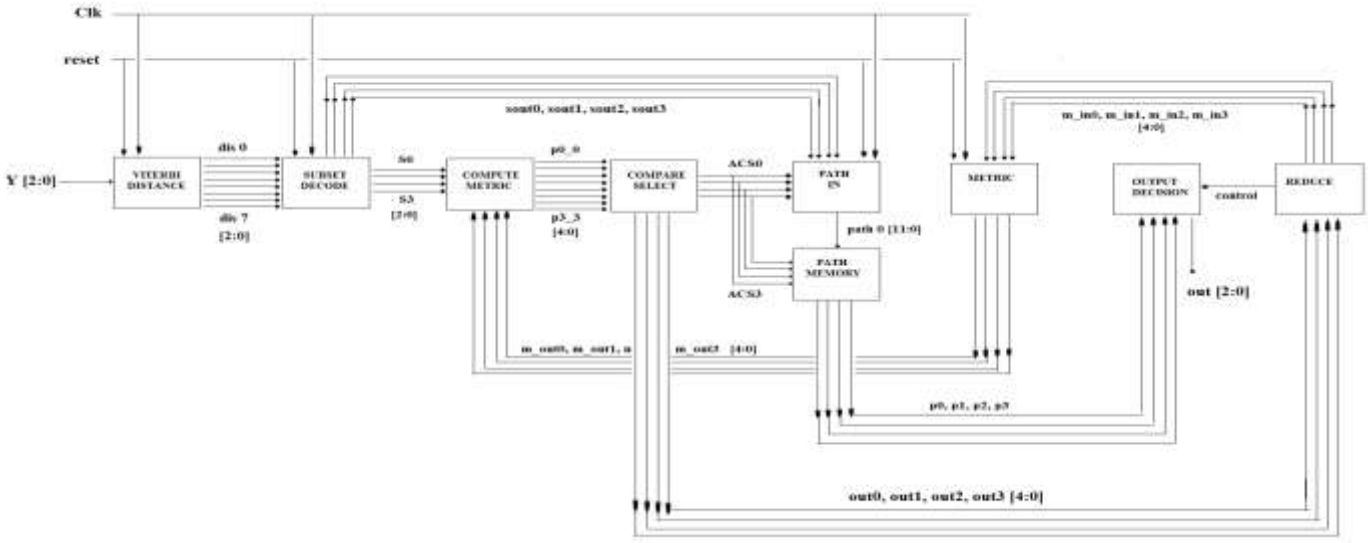

Figure3. Internal modules of Viterbi decoder

Viterbi distance

The received signal (with noise) is converted into a series of distance measures from the known eight possible transmitted signals: The digitally encoded 3-bit signal, Y, from the encoder is converted directly to the distance measures. d[N] is the distance from signal = N to signal = 0 d[N] = (2*sin(N*PI/8))**2 in 3-bit binary (on the scale 2=100)

Table 1.1 Calculation of Euclidean distance

Signal	Algebraic distance from signal 0	X =Distance from signal 0	Euclidean distance $E = X^2$	B = binary quantized value of E	D = decimal value of B	Quantization error Q = D - 1.75 E
0	2 sin (0 π / 8)	0.00	0.00	000	0	0
1	2 sin (1 π / 8)	0.77	0.59	001	1	-0.0325
2	2 sin (2 π / 8)	1.41	2.00	100	4	0.5
3	2 sin (3 π / 8)	1.85	3.41	110	6	0.0325
4	2 sin (4 π / 8)	2.00	4.00	111	7	0
5	2 sin (5 π / 8)	1.85	3.41	110	6	0.0325
6	2 sin (6 π / 8)	1.41	2.00	100	4	0.5
7	2 sin (7 π / 8)	0.77	0.59	001	1	-0.0325

Module Subset decode

This module chooses the signal corresponding to the smallest of each set {||r-s0||**2,||r-s4||**2}, {||r-s1||**2, ||rs5||** 2}, {||r-s2||**2,||r-s6||**2}, {||r-s3||**2,||r-s7||**2}. Therefore there are eight input signals and four output signals for the distance measures. The signals sout0, sout3 are used to control the path memory. The statement dff #(3) instantiates a vector array of 3 D flip-flops.

Module Compute metric

This module computes the sum of path memory and the distance for each path entering a state of the trellis. For the four states, there are two paths entering it; therefore eight sums are computed in this module. The path metrics and output sums are 5 bits wide. The output sum is bounded and should never be greater than 5 bits for a valid input signal. The overflow from the sum is the error output and indicates an invalid input signal.

Module Compare select

This module compares the summations from the Compute metric module and selects the metric and path with the lowest value. The output of this module is saved as the new path metric for each state. The ACS output signals are used to control the path memory of the decoder.

Module path

This is the basic unit for the path memory of the Viterbi decoder. It consists of four 3-bit D flip-flops in parallel. There is a 2:1 mux at each D flip-flop input. The statement dff #(12) instantiates a vector array of 12 flip-flops.

Module Path memory

This module consists of an array of memory elements (D flip-flops) that store and shift the path memory as new signals are added to the four paths (or four most likely sequences of signals). These module instantiates 11 instances of the path module.

Module Path in

This module determines the input signal to the path for each of the four paths. Control signals from the subset decoder and compare select modules are used to store the correct signal. The statement dff #(12) instantiates a vector array of 12 flip-flops.

Module metric

The registers created in this module (using D flip-flops) store the four path metrics. Each register is 5 bits wide. The statement dff #(5) instantiates a vector array of 5 flip-flops.

Module Output decision

This module decides the output signal based on the path that corresponds to the smallest metric. The control signal comes from the reduce module.

Module reduce

This module reduces the metrics after the addition and compares operations. This algorithm selects the smallest metric and subtracts it from all the other metrics

SIMULATION RESULTS OF CONVOLUTION ENCODER

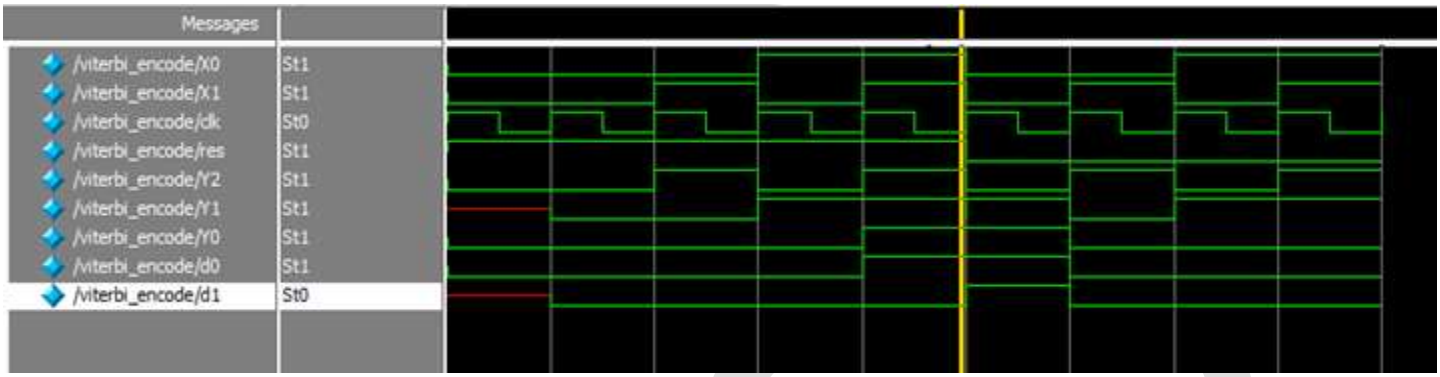

Figure4. Simulation of convolutional encoder

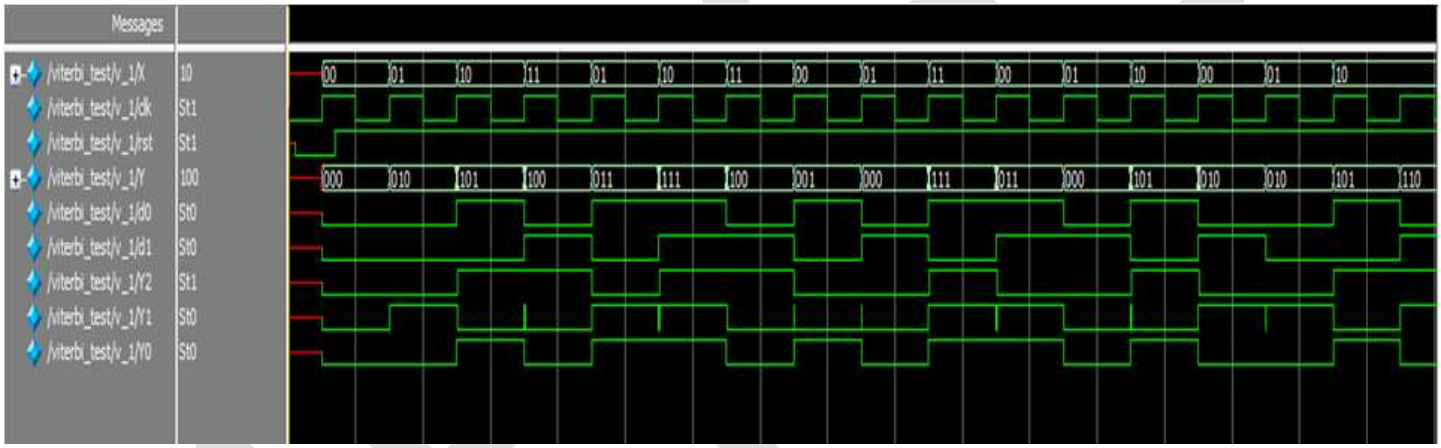

Figure5. Test bench of convolutional encoder

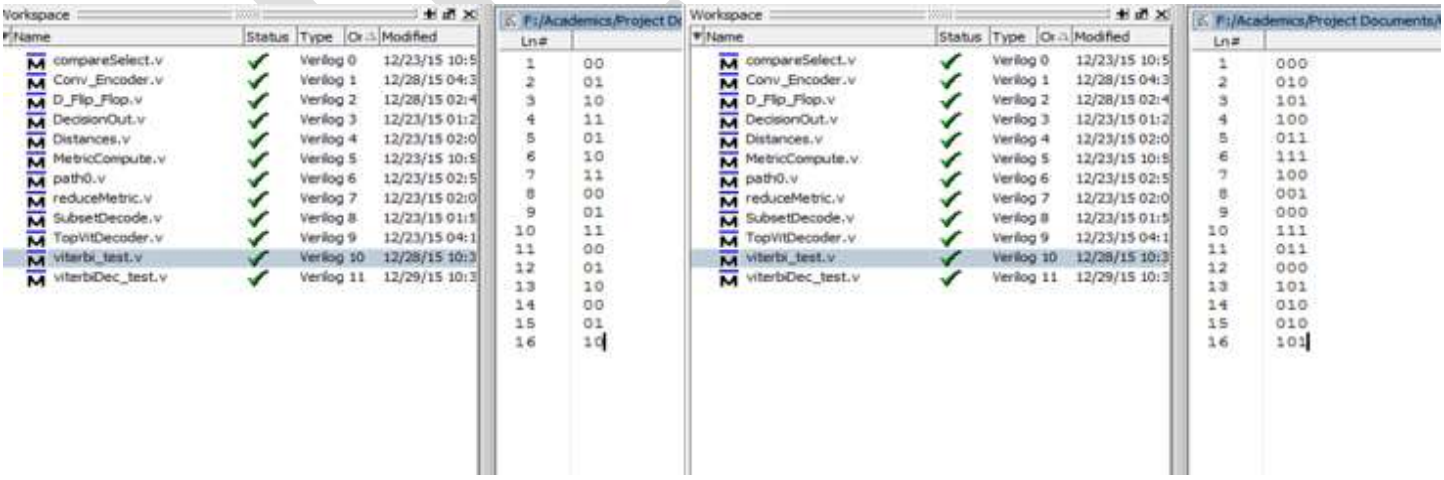

Figure6. Input and Output of Convolution encoder of rate 2/3

Two bit inputs are provided to Convolution encoder. The inputs are taken as text document. Thus the convolution encoder of rate 2/3 is simulated successfully and three bit outputs are obtained which confirms that the simulation is successful. Test bench results prove the same. Two bit input and three bit output are visible on the test bench.

SIMULATION RESULTS OF VITERBI DECODER

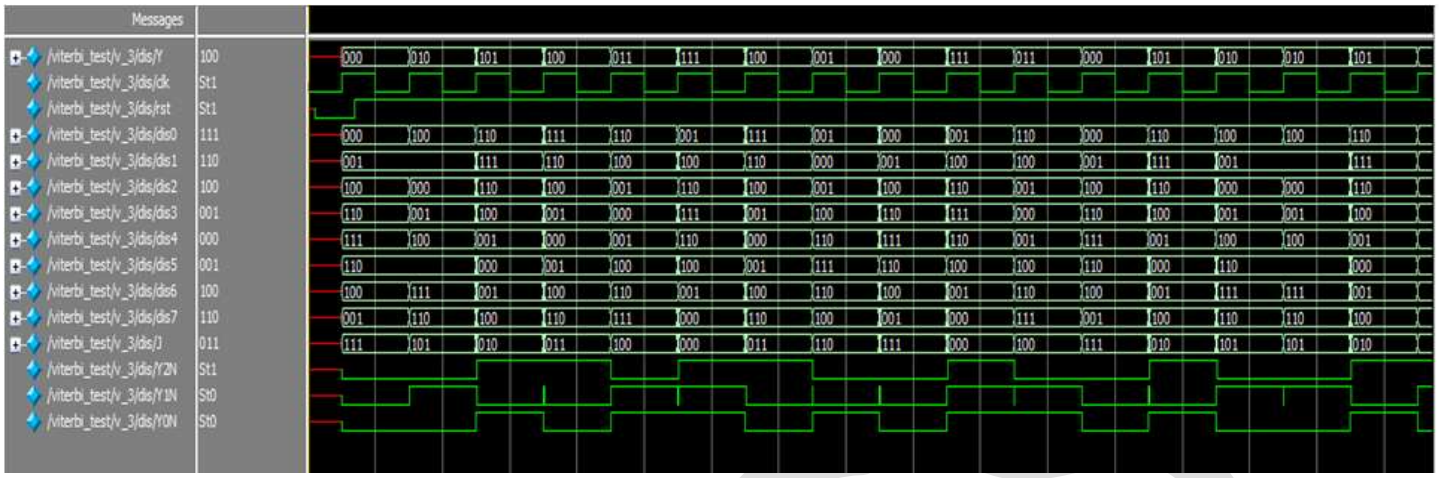

Figure7. Calculation of Euclidean distance

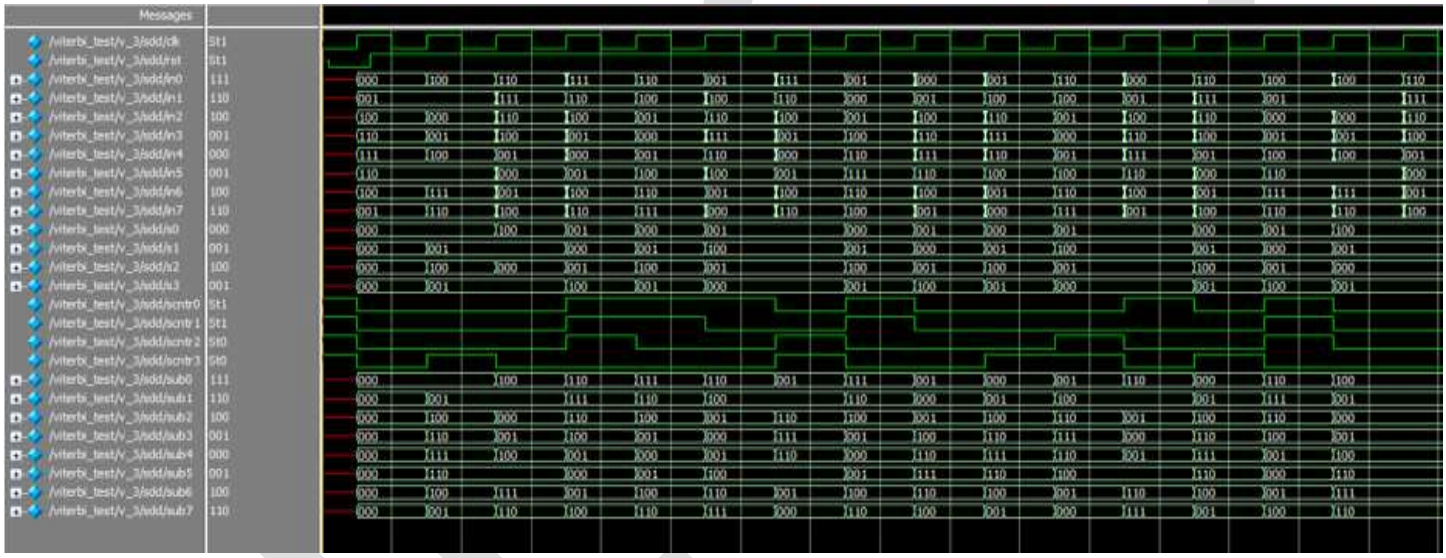

Figure8. Subset Decode Module

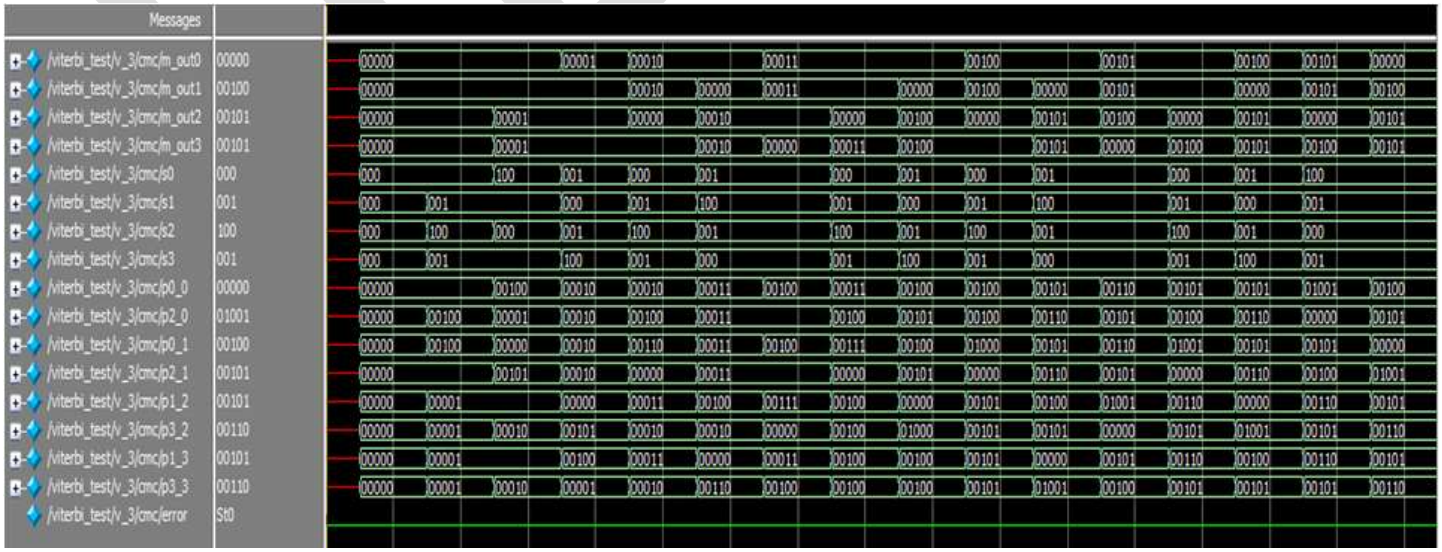

Figure9. Compute Metrics Module

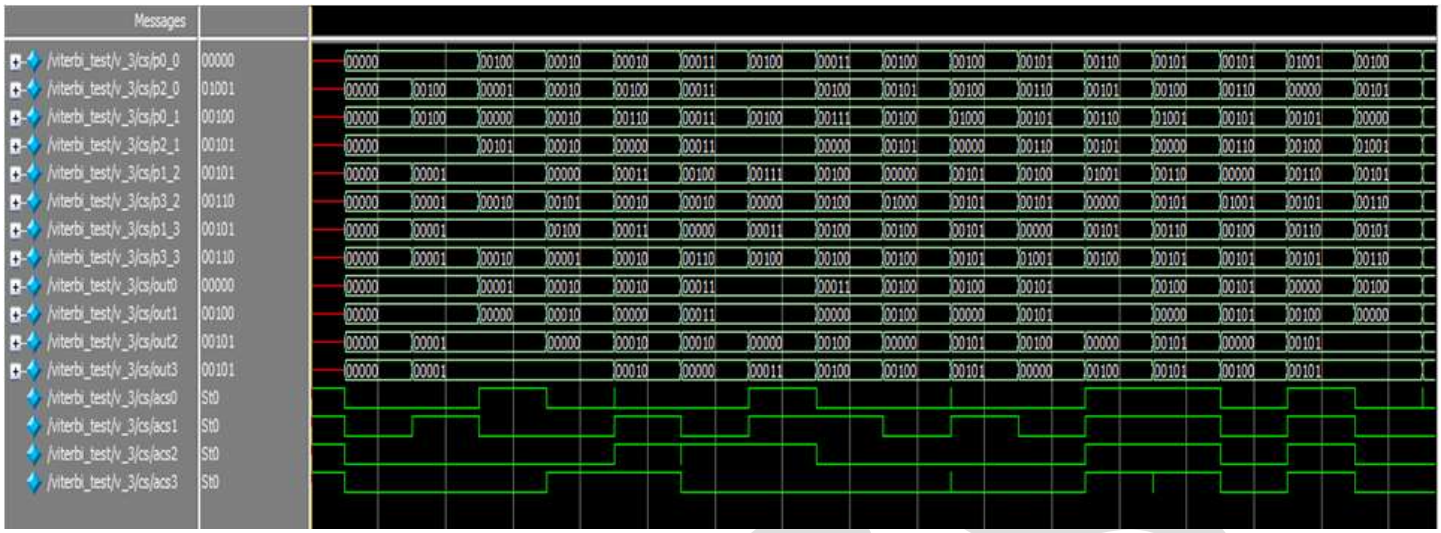

Figure10. Compare Select Module

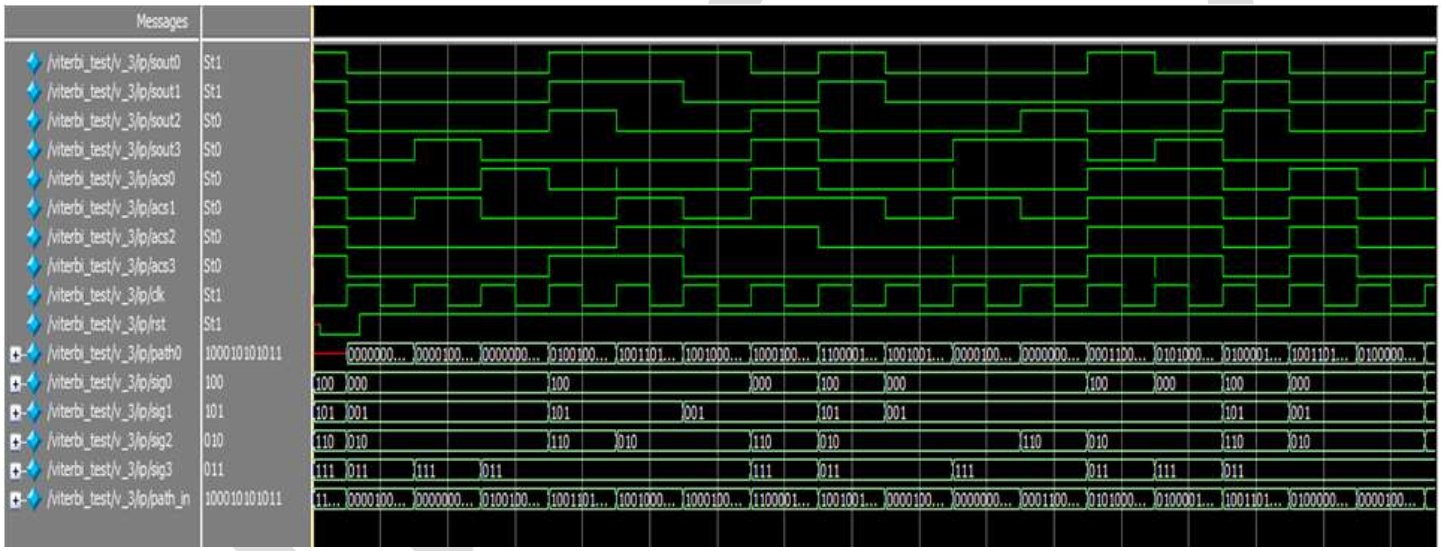

Figure11. Path in Module

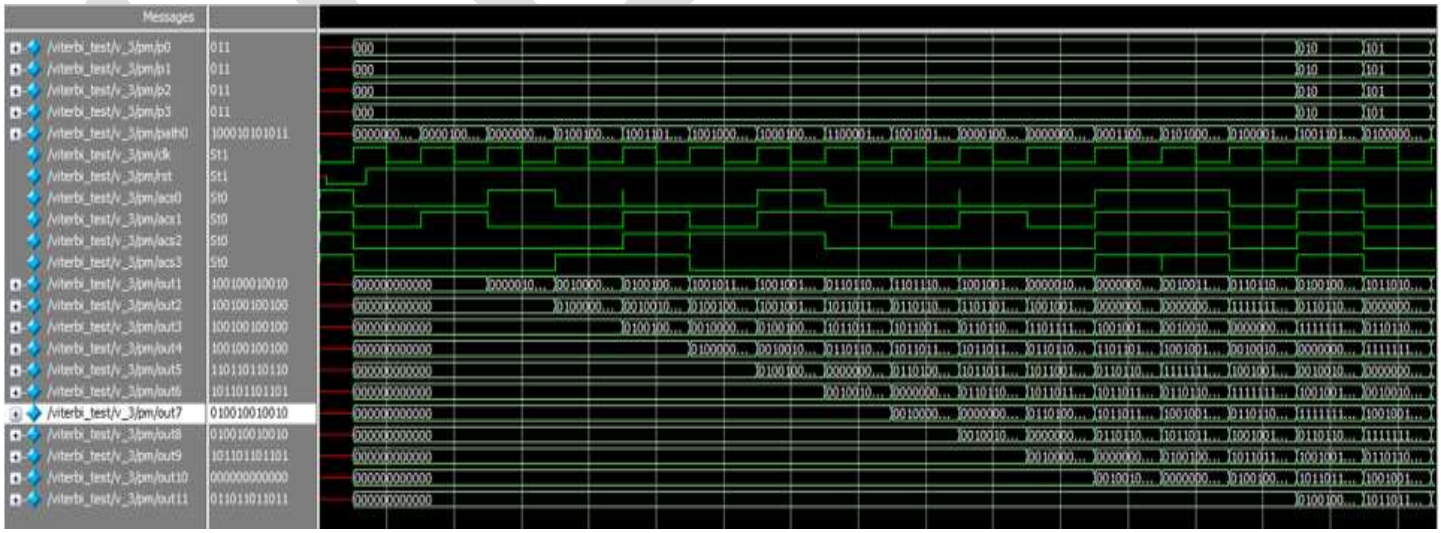

Figure12. Path Memory Module

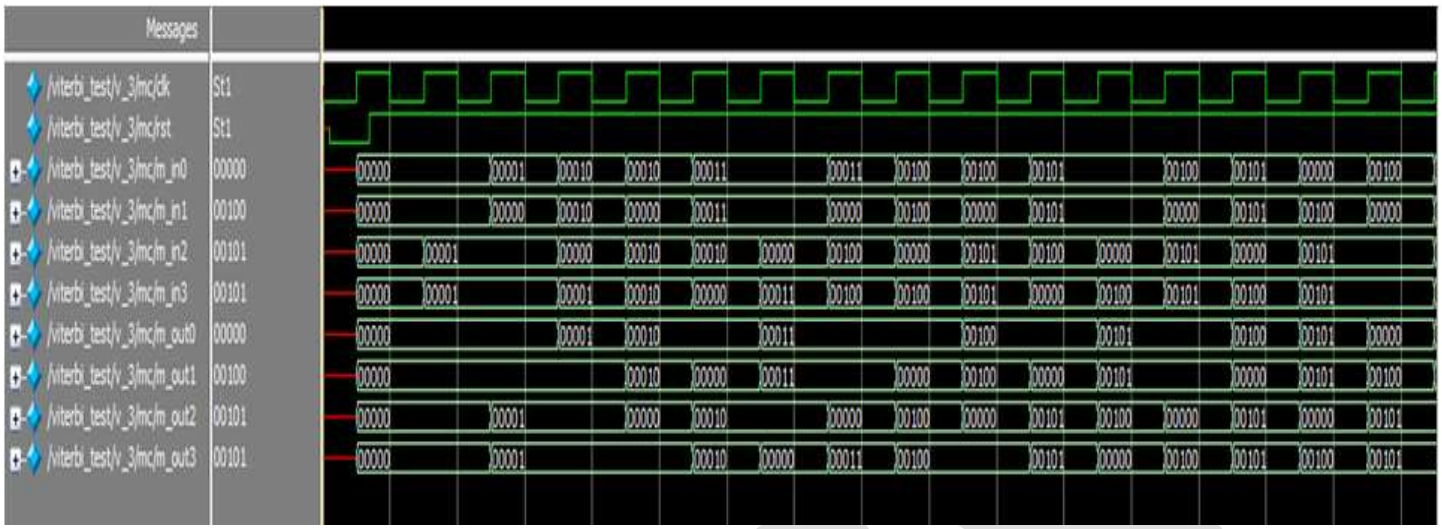

Figure13. Metric Module

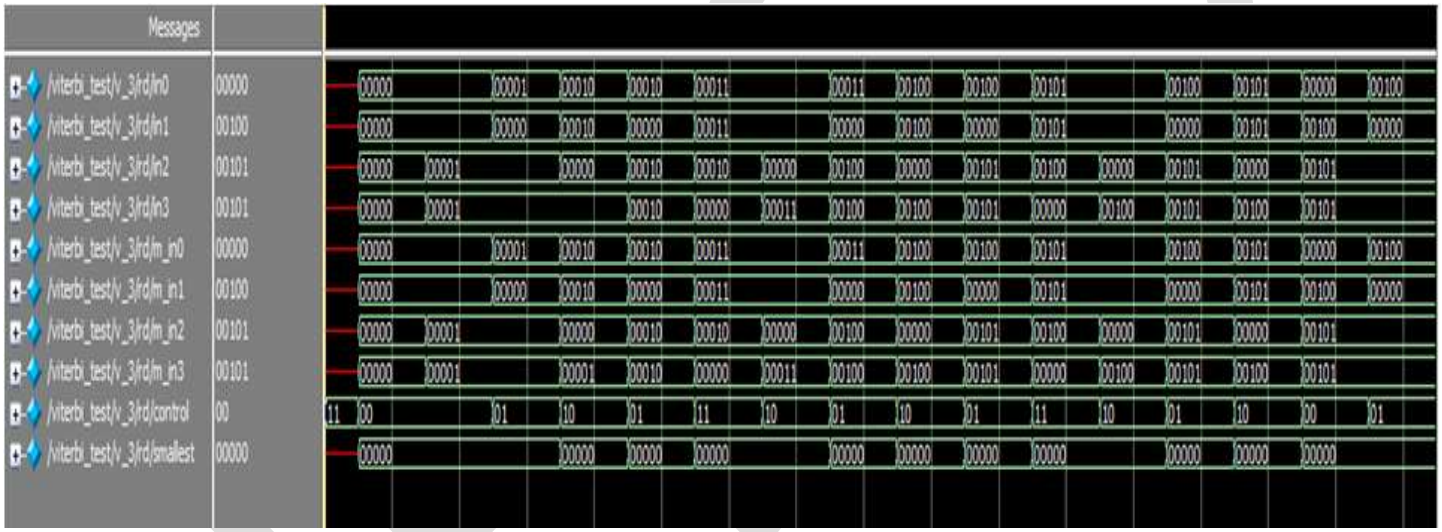

Figure14. Reduce Module

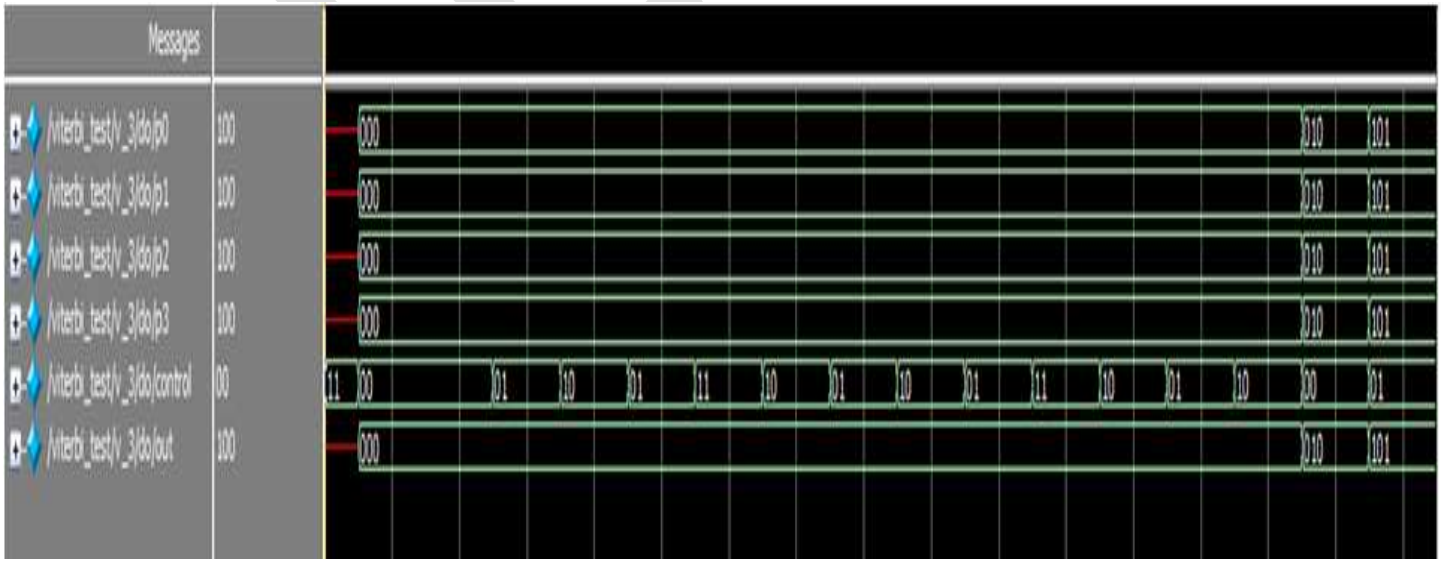

Figure15. Output Decision Module

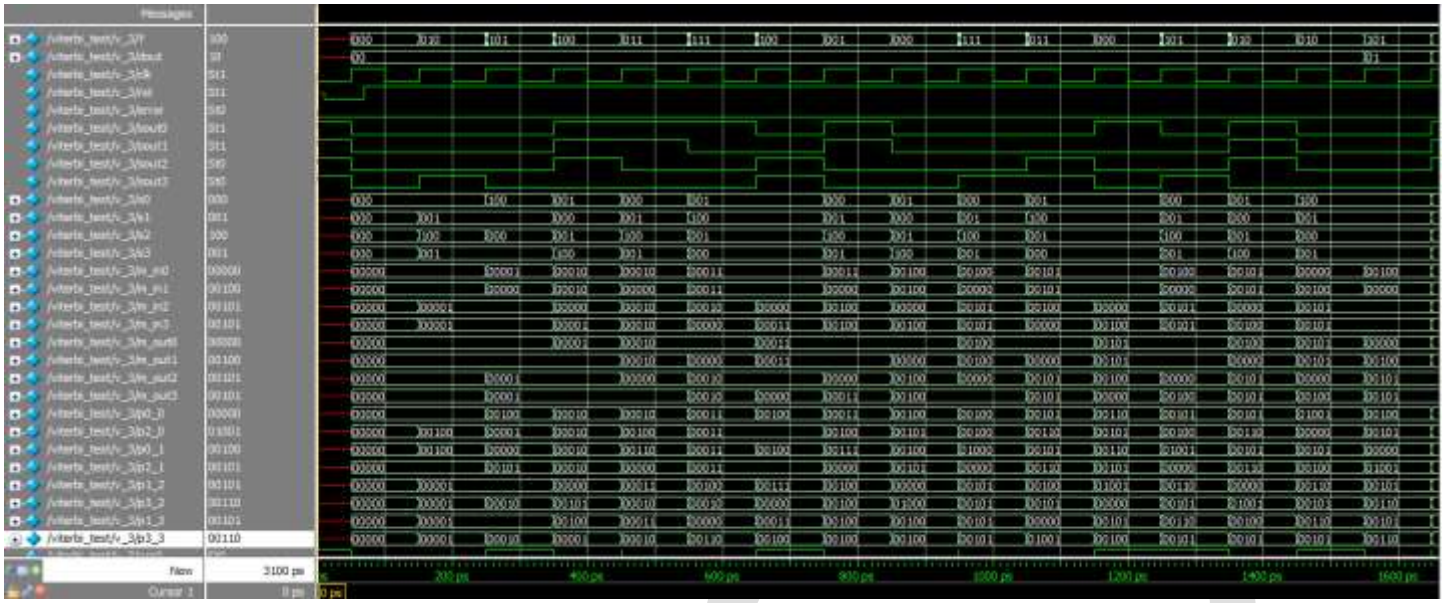

Figure16. Test bench of Viterbi decoder

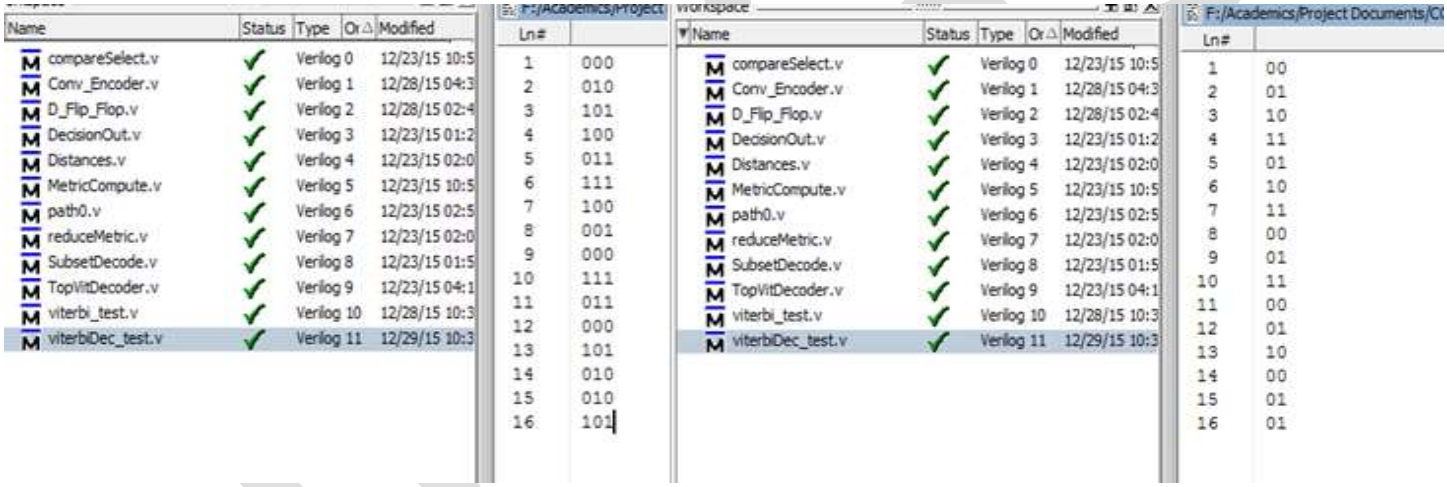

Figure17. Input and Output of Viterbi decoder

CONCLUSION

A Viterbi algorithm based on the strongly connected trellis decoding of binary convolutional codes has been presented. The use of error-correcting codes has proven to be an effective way to overcome data corruption in digital communication channels. The Viterbi decoder is modelled using Verilog, and Simulated by Xilinx ISE .We can implement a higher performance Viterbi decoder with such an algorithm. So in the future, with this algorithm with larger code rates we can get better results.

REFERENCES:

[1] Mandwale A. J and Mulani A O" Different Approaches For Implementation of Viterbi decoder on reconfigurable platform"International Conference on Pervasive Computing (ICPC) 2015

[2] P R Pachlegaonkar, S S Patki "Implementation of Reconfigurable Convolutional Encoder and optimum Adaptive Viterbi Decoder with Multi booting and Error Detection on FPGA", International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 3 Issue 10, October- 2014

[3] Mahe Jabeen, Salma Khan," Design of Convolution Encoder and Reconfigurable Viterbi Decoder" International Journal of Engineering and Science ISSN: 2278-4721, Vol. 1, Issue 3 (Sept 2012), PP 15-21

[4] Yan Sun, Zhizhong Ding "FPGA Design and Implementation of a Convolutional Encoder and a Viterbi Decoder Based on 802.11a for OFDM", Wireless Engineering and Technology, 2012, 3, 125-131.

[5] Karim, M.U., Khan, M.U.K. and Khawaja, Y.M. "An area reduced, speed optimized implementation of Viterbi decoder", International Conference on Computer Networks and Information Technology (ICCNIT), pp. 93-98, 2011
[6] Guan, M. and Yang, M. "Comparison and design of decoder in B3G Mobile communication system", Communications and Network, pp. 20-24, 2009
[7] Arun and V. Rajamani,"DESIGN AND VLSI IMPLEMENTATION OF A LOW PROBABILITY OF ERROR VITERBI DECODER"IEEE, First International Conference on Emerging Trends in Engineering and Technology,2008
[8] Russell Tessier, Sriram Swaminathan, Ramaswamy, Dennis Goeckel and Wayne Burleson. "A Reconfigurable, power-efficient adaptive Viterbi decoder", IEEE Transactions on Very Large Scale Integration (VLSI) systems, Vol. 13, No. 4, pp. 484-488, 2005
[9] Engling yeo, Augsburger, S.A., Rhett Davis, W. and Borivoje Nikolic . " A 500-Mb/s soft-output Viterbi decoder", IEEE Journal of solid-state circuits ,Vol. 38, No. 7, pp. 1234-1241,2003
[10] M. Kivioja, J. Isoaho and L.Vanska, "Design and implementation of Viterbi decoder with FPGAs," Journal of VLSI Signal Processing Systems for Signal, Image, and Video Technology, Kluwer Academic Publishers, vol. 21, no. 1, pp. 5-14, May 1999.
[11] C. Berrou, P. Adde, E. Angui and S. Faudeil "A Low Complexity Soft-Output Viterbi Decoder Architecture," *IEEE Int. Conf.Communications*, vol. 2, pp. 737–740, May. 1993
[12] Viterbi.A.J, "Convolution codes and their performance in communication systems," *IEEE Transaction on Communications*, vol.com-19, pp. 751 to 771, October 1971
[13] Samirkumar Ranpara, "On a Viterbi decoder design for low power dissipation," towards his master"s thesis submitted to virginia polytechnic institute and state university.
[14] B. Sklar, "Digital Communications, Fundamentals and Applications", Second Edition, New Delhi, Pearson Education, 2004
[15] Chip fleming, "A tutorial on Convolutional coding with viterbi decoding".
[16] Samir Palnitkar, "Verilog HDL: A Guide to Digital Design And Synthesis, Second Edition", Prentice Hall PTR
[17] Text book by Simon Haykin and Michael Moher : Modern Wireless Communications; Pearson Prentice Hall, 2005
[18] Text book on Applied Coding and Information Theory for Engineers by Richard B. Wells, Prentice Hall, Information and system science series

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Blue Eyes Technology

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Abstract— 21st century is an era of speed and smartness, but due to this several problems has been evolved one of them is that emotional quotient getting overshadowed. In this paper, **BLUE EYES TECHNOLOGY** aims allow people to interact with computers in a more natural manner. In this technology **BLUE** stands for bluetooth, which enables reliable wireless communication and **EYES** related to the movement of the eye that enables us to see lot of interesting and important information. It objective at creating computational machines that have perceptual and sensory ability.In this technology actions and emotions can be identified using camcorder. The technologies used for this are Manual and Gaze Input Cascaded, Artificial Intelligent Speech Recognition, Simple User Interest Tracker , the eye movement sensor. Its main applications are Automobile industry, Video games, Medical diagnosis,Lie-detector tests. It is an emerging technology and in future it is expected to reduce the gap between electronic and physical world.

Keywords— Blue eyes, Emotions, Images, Magic Pointing ,Image processing, Emotional Mouse ,Sense.

INTRODUCTION

Assume yourself in a world where humans communicate with computers. You are sitting in front of your personal computer that can hear, speech, or even scream aloud. It has the power to gather information about you and communicate with you through special techniques like eye movement sensor, facial identification, speech identification, etc. It can even understand your emotions at the touch of the mouse. It verify your identity, feels your presents, and starts interacting with you .You asks the computer to dial, your friend at his office. It realizes the urgency of the situation through the mouse, dials your friend at his office, and establishes a connection.

The **BLUE EYES** technology aims at creating computational machines that have affective and sensory perform like those of human beings . It uses non-obtrusive sensing method, employing most modern video camcorder to identify the users actions through the use of imparted sensory abilities. The machine can understand what a user wants, where he is looking at, and even realize his physical or emotional state.

TECHNIQUES OF BLUE EYES TECHHNOLOGY

Emotional Mouse :- It obtains physiological data and emotional state such as pulse, pressure, skin temperature, heart rate, etc through the touch of user on mouse where different sensors (such as pressure sensor, heart rate sensor, GSR sensor, temperature sensor) are deployed inside it. Then it determines the personality of the user.

Manual And Gage Input Cascading (Magic Pointing) :- A webcam is used to quickly determine the glints and pupils of the user under variable and real lightning conditions and wrap the cursor to every new object user looks at. Then user get control of the target by hand near the target or ignores it and search for next one.

Artifical Intelligent Speech Identification :- The user talk to the computer through microphone and that talk get filtered and saved in Random Access Memory. The input words are scanned and matched against the internally stored words. Pattern matching is designed to look for the best fit because of variations in loudness, pitch, frequency difference, time gap, etc .The identification causes some action to be taken.

Simple User Interest Tracker (SUITOR):- Blue eye enabled suitor become active when the user build an eye contact and regularly detect users area of interest and starts searching it. **E.g.:** If you are reading title, pops up the story in the browser window.

EMOTION SENSORY WORLD

Human emotion is a visible proof of effective state, personality, emotional state and cognitive activity. There has been a lot of work done on blue eyes technology. This paper presents number of techniques proposed to identify emotional state of a person. According

to Ekman, the neuro-part of the theory mention the partly innate and biological program, called a facial affect program, which specifies the relationships between various movements of the facial muscles and particular emotions (happiness, sadness, anger, surprise). According to Ekman findings during:

Happiness :- the eyes are relaxed ;

Anger :-The forehead are pulled down and inward; no sclera is shown in the eyes;

Sadness :- The brows are drawn together with the inner corners raised and the outer corners lowered ; the eyes are glazed;

Surprise :-The eyebrows are raised and curved.

In this paper a new technique Emotion Sensory World of blue eyes technology have been deals with the detection of emotions of human through the texture of eye because eyes are window to the soul that they can tell much about person internal state just by gazing into them, a camera will capture the image of a person and focuses on the eye area by using texture filtering algorithm which is then compared with the list of images place in data base .The correct image that identifies the emotion of a person is shown on the window, after detecting the emotion a song is played in order to normalize the mood of person.

METHODOLOGY

The methodology of Blue Eyes Technology is as follows:

Step 1: Get Snapshot

A video stream will start and when a person set focus on face and press "Enter" then it will take a snapshot. Immediately returns one single image frame, from the video input object . The frame of data returned is independent of the video input object Frames Per Trigger property and has no impact on the value of the Frames Available or Frames Acquired property. The object must be a one-by-one video input object. Frame is returned as an H-by-W-by-B matrix where H- Image height, as specified in the ROI Position property W- Image width, as specified in the ROI Position property B- Number of bands associated with obj, as specified in the Number of Bands.

Step 2: Extract Eye Portion

1. Detection of Face Parts:

(a) Input parameters:
Detector: The detection object built by build Detector.
Thick (optional): Thickness of bounding box.

(b) Output parameters:
It creates bounding box for face, eye, left eye, right eye, mouth and nose, image with found face and these faces are stored as cell array buildDetector build face parts detector object with threshold values for parts.

2. Shape Recognition and Edge Detection:

(a) After getting the eye part we match it with the existing images by classifying it according to structure of eye and it texture we call it Shapes Classiffier.
(b) Separates the eye part only from the box boundaries of face.
(c) Convert image from rgb to gray.
(d) Threshold the image Convert the image to colorless, in order to prepare for boundary tracing using bw boundaries.
(e) Invert the Binary Image.
(f) Find the boundaries Concentrate only on the outside boundaries. Option 'noholes' will accelerate the processing by preventing bw boundaries from searching for inner contours.
(g) Determine Shapes properties.
(h) Classify Shapes according to properties Wrinkles, flat, swelled, etc.

Step 3: Comparison with stored Images in data base

The shape classifier will then match the captured image with the data entries in our database which in then converted to gray scale; the idea is to create a function which will return the distinctness in range [0, 1] between two postures.This means, we want to compare only a posture and on this basis the emotion of person for given two images (a grey region). For example, if we pass 4 to my function, the result will be 0 (because postures or emotions are not same and the result will be 1 if same).
There are 25 images in database used for training. To create a database: open"create_ db.m", and load the image. It will detect eyes and store left eye and Right Eye in Database and save this entry in "Database.dat".
database {x,y}
x=entry /serial no,
y=1 Left Eye
y=2 Right Eye
y=3 name of Mood
For multiple entries to store in database we can change with coding:
%load ('database.dat','-mat');
%entries=size (database, 1);
and change: database{1,1}=a;
with database{entries+1,1}=a;
then it will add a new entry each time and save all entries in database.
database {1,2}=b;
with database{entries+1,2}=b;
database {1,3}='a';
with database{entries+1,3}='a';
It has been computed the correlation coefficient by flattening the matrix into a vector; the obtained results were around 0.987, indicating a close match. If essential we could have measured scaling and regular change to better align the images but it was not needed here.

Step 4: Play song according to matched mood

The generated script take a list of sound files and create a database of these sounds according to the emotion detection defined in database for each song, and then subsequently take one or more audio files according to matched emotion of previously created image database and plays it, List of sound files is analyzed and written to a single database file. Various sound file formats are supported, including wav, mp3 and aac.our database files are encoded with.wav extension. The sound file in database can then be saved as a wav file using the WAVWRITE function and later can be loaded using the WAVREAD function. The played sound returns the sample rate (Fs) in Hertz and the number of bits per sample (n bits) used to encode the data in the file.

APPLICATION AREAS OF BLUE EYES TECHNOLOGY

1. Users emotions can beneficial in marketing intelligence for banks and retailers.
2. Blue Eyes is related to measure the pulse of the human while operating the system. It is useful in Medical diagnosis.
3. Blue Eyes can be used in education programs, enable computers to observe students emotional state (frustration, excitement, and so on) and adjust information delivery accordingly.
4. It can be used as an adjunct in liedetector tests and in security systems that attempt to identify people by their faces.
5. A car equipped with an affective computing system could indentify when a driver is feeling sleepy and advise her to pull over, or it might sense when a stressed-out motorist is about to explode and warn him to slow down and cool off.

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CONCLUSION

The paper present two results of emotional sensory world. First, observation reveals the fact that different eye colors and their results in change in emotions. It changes without giving any information on shape and actual detected emotion. It is used to favorably recognize four different emotions of eyes. This developed methodology can be widespread to other activities. Second result were achieved for converging in good emotions using a mixture of features, shapes, colors based on eye points. After this favorable capturing of eye spots, it will help to tell about the state of a person and also helps to cheer up by playing songs or other sources. The motive of this research proves to be a source of economic growth over all.

FUTURE WORK

This study work can be extended to home appliances where it can perform various tasks within home premises through blue eye technology. Further as a world is digitizing and we are moving towards robotic world, several human activities can be shrunk with emotion sensory world tool. The tool or system is fitted in robot with eye emotions which detects what is the demand and the action can be taken by robot accordingly.

REFERENCES:

[1] S.Madhumitha, Slide Share, Blue Eyes Technology, March 2013,<www.slideshare.net/Colloquium/blue-eyes-technology>.

[2] Texture Based Expression Modeling for a Virtual Talking Head, Daniel Hoglind ,Master of Science Thesis Stockholm Sweden 2006, <www.cse.kth.se>.

[3] Psychologist World, Eye Reading Language (Body Language), July2013, <www.psychologistworld.com/bodylanguage/eyes.php>.

[4] Suvam Chatterjee, Haoshi, ”A Novel Neuro Fuzzy Approach to Human Emotion Determination”, Digital Image Computing Techniques And Application ,2010 International Conference.

[5] Renu Nagpal, Pooja Nagpal,Sumeet Kaur, ”Hybrid Technique for Human Face Emotion Detection”, International Journal of Advanced Computer Science And Applications Vol.1 No6,December 2010.

[6] Amir Aly, Adriana Tapus,”Towards an Online Fuzzy Modeling For Human Internal States Detection”,2012 12th Internal Conference on Control,Automation Robotics And Vision Guangzhou, China ,5-7th December 2012(ICARCV2012).

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A Study of Noise Pollution in Greater Noida City – U.P., India

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Abstract— Sound in the environment is caused by the quivering of particles present in the air that reaches the human ears and stimulates a feeling of hearing. When sound becomes loud, or disagreeable, or unwanted, or annoying, it becomes noise. This production of noise causes some undesirable effects on the human being as well as on animals, therefore this noise is also termed as environmental pollutant such as air pollution, water pollution etc. Noise can cause annoyance, diseases, sleeplessness, communication interference, hearing loss etc. due to which it should be controlled in the surroundings. The Air Act 1981 also includes noise as one of the air pollutant. In this paper, the noise pollution level and its impacts on the environment of Greater Noida a small city of Uttar Pradesh, India is discussed. In this area the major sources of noise pollution are vehicle horns, commercial areas and industrial areas. The sound pressure level is measured at morning, noon and evening during the peak hours. It is found that in the most areas of the city the prevailing noise level is more than the ambient noise level. In Greater Noida the average prevailing noise level through the vehicle is 83dB which is far more than the desired level of noise. The city is developing rapidly due to which the number of vehicle are increasing day by day and hence traffic noise is also increasing that has to be analyzed and controlled for the sake of human health. At the end of the paper some fruitful suggestion for noise abatement and control has been discussed.

Keywords— Noise; Pollution; Environment; Traffic; Vehicle; industrial; commercial; residential; Noise level; Limits; dB.

INTRODUCTION

The simple expression of term noise is an unnecessary sound and important form of energy, which is emitted by a vibrating body and on reaching the ear causes sensation of hearing through nervous system [8]. Noise pollution has been recognized as new threat to the human being after the air and water pollution. It is mainly due to the increasing urbanization and population due to which the vehicle is increasing day by day. . It is an underrated environmental problem because of the fact that we can't see, smell, or taste it [6]. Not only vehicles but due to urbanization and increasing population the increase in infrastructure and industries is also taking place which is also a healthy reason for noise pollution. Now days the main task for the urban planners and environmental engineers is to administer the mounting noise level [1]. The city dwellers may undergo a serious stress on auditory and non-auditory and nervous system due to continuous high level of noise [2]. The poor condition of engine in cars, motorcycles or the poor condition of exhausts in the houses, industries etc. may lead to a cause of great annoyance to the population [3]. Physical and psychological, irritation, human performance and actions, hypertension, heart problems, tiredness, headache and sore throat are some of the severe health problem due to the noise pollution which has been seen in numerous studies of road traffic noise pollution [4]. Noise pollution is not a continuing or persisting phenomenon and hence it is transient in nature which differ this pollutant from other pollutants (air, water etc.) [5]. Unlike the other pollutant like gases and particulate matter, which continue to linger on, once they enter in the environment , the noise pollution stops and the environment becomes free from this pollutant [5]. The noise may induce annoyance, diseases, hearing loss, sleeplessness, communication interference and may cause some ill effects on the wild life as well. The noise may cause disease such as anxiety, tenseness, nervousness, headache, fatigue, nausea, insomnia, high blood pressure, high pulse rate, greater perspiration, gastric secretions, etc. [5]. The hypothesis is that long-time exposure to noise could result in lasting cardiovascular changes such as atherosclerosis, and increase cardiovascular risk as well as hypertension [7]. The noise level has not exceeded to such an extent, as to cause drastic adverse effects on human being due to which the noise has so far not been regarded as a killer pollutant. Noise pollution is not prominent except in industrial areas and big cities, and hence has generally remained ignored from being treated as an environmental pollutant. The consequential increase in noise producing automobiles and with increasing industrialization and commercialization of our society noise is becoming a slow poison. At present, noise pollution is considered as one of the key problems of urban communities that has numerous hazardous effects on the urban environment and may result in a great deal of costs on the society [9], [10].

SOURCES OF NOISE POLLUTION

In our society the noise is mainly produced by traffic (air, road and sea shore and inland water traffic) and industries. The increasing number of vehicles, musical instruments, small scale industries, and urbanization and human activities are the main sources of noise pollution [11]. Increasing density of traffic related with the traffic composition, the road slope, width, and surface structure distance to crossroad increases the traffic noise [12]. Traffic can be considered as the major source of noise pollution in large cities [13], [14], [15]. In big cities like Delhi a lot of noise is produced by traffic and which is causes a lot of nuisance to the society. The amount and type of noise produced by traffic is largely dependent upon the type of traffic. The noise level produced by different types of traffic is given in Table 1.

Table 1: Noise level from different sources of traffic.

S.No.	Sources of Noise	Noise Level in dB
1.	Air Traffic a) Jet aircraft at take off stage at about 300m b) Propeller type of aircraft at take of stage at about 300m	 100-110 90-100
2.	Rail traffic (at about 30m)	90-110
3.	Heavy road traffic (highway)	80-90
4.	Medium road traffic (main streets)	70-80
5.	Light road traffic (side streets)	60-70

Source: Sewage disposal and air pollution engineering, Environmental engineering volume 2 – Santosh Kumar Garg.

In Greater Noida the main sources of noise pollution is heavy moving traffic. Greater Noida is an emerging city of Uttar Pradesh as well as it is nearly connected to the highways due to which movement of heavy vehicle takes place now and then which creates lots of noise and air pollution. Use of horns by the drivers of the vehicle un-purposely is also a main cause of increasing noise level. Presently, Greater Noida is a developing city and hence plenty of constriction work is taking place which is also enhancing the level of noise. In many of industrial areas of the city level of noise is under control due to the proper planning of industries to resist the pollution created by noise.

ACCEPTABLE LIMITS OF NOISE ACCORDING TO GOVERNMENT OF INDIA AND INDIAN STANDARD CODES

The union Environment ministry has prescribed noise standards for different types of vehicle, as given in Table 2.

Table2: GoI noise standards for different types of vehicles.

S.No.	Type of Vehicles	Noise level in dB
1.	Two wheelers	80
2.	Cars	82
3.	Passenger or commercial vehicle a) Up to 4 MT (Metric tons) b) Between 4 MT to 12 MT c) More than 12 MT	 85 89 91

Source: Sewage disposal and air pollution engineering, Environmental engineering volume 2 – Santosh Kumar Garg.

The desirable outdoor noise levels in different types of residential areas, as well as the acceptable indoor noise levels for various types of buildings, as recommended by Indian standard code IS : 4954-1968 are given in Table 3 and Table 4 respectively.

Table 3: **Acceptable outdoor noise level in residential areas.**

S.No.	Location	Noise level in dB
1.	Rural areas	25-35
2.	Suburban areas	30-40
3.	Urban residential areas	35-45
4.	Residential and business urban areas	40-50
5.	City areas	45-55
6.	Industrial areas	50-60

Source: Sewage disposal and air pollution engineering, Environmental engineering volume 2 – Santosh Kumar Garg.

Table 4: Acceptable indoor noise level in various types of buildings in residential areas.

S.No.	location	Noise level in dB
1.	Radio and T.V. studios	25-35
2.	Music rooms	30-35
3.	Hospitals, class rooms, auditoria	35-40
4.	Apartments, hotels, homes, conference rooms, small offices	35-40
5.	Court rooms, private offices, libraries	40-45
6.	Large public offices, banks, stores, etc.	45-50
7.	Restaurants	50-55

Source: Sewage disposal and air pollution engineering, Environmental engineering volume 2 – Santosh Kumar Garg.

To control the noise levels, the Government of India has created the Noise Pollution Rules 2000, under the Environment Protection Act 1986. In these rules GoI has specified the limits of noise levels in Industrial, Residential, Commercial area and Silence zone which has been given Table 5.

Table 5: Limits if noise in different type of areas according to GoI.

S.No.	Category of area/zone	Limits in dB (A) Leq at day time	Limits in dB (A) Leq at night time
1.	Industrial area	75	70
2.	Commercial area	65	55
3.	Residential area	55	45
4.	Silence zone	50	40

Source: Sewage disposal and air pollution engineering, Environmental engineering volume 2 – Santosh Kumar Garg.

MATERIALS AND METHOD

In the present study the Noise level of different areas of Greater Noida city have been analyzed to identify whether the level is under the standard limits or not. The areas which are covered in the study are Kasna market, Kasna chowk near Bus stand, Pari chowk, Tugalpur, Alpha commercial and residential area, Jagat farm, Petrol pump near P3 golchakkar, Gautam Buddha University

commercial and residential area, Site 5 industrial area and Surajpur industrial area where the noise level has been checked. The noise level in this area has been checked thrice in a day – morning from 8 to 9 am, afternoon from 2 to 3 pm and at evening from 8 to 9 pm on 1st February 2016. The instrument used to measure the noise level is Sound Level Meter. It measures sound pressure level and equivalent noise level (Leq) of a particular area up to ___ km. To measure the loudness of sound, electronic filtering circuits are built into the sound measuring meters which filter out certain frequencies [5]. There are 3 types of filter circuit's i.e. A, B and C, but A type of network is generally used in sound level meters. The A network largely filters out very low and very high frequencies below about 200 Hz and above about 10,000 Hz. Hence the measured sound in dB (decibel) is written as dB (A) [5]. Filter A measures low frequencies which are quite severely filtered, moderate frequencies are measured by filter B and hardly at all by filter C. Therefore the sound measured on network A is much lower than that on C network [5].

OBSEVATIONS

The following observation is made using sound level meter in different areas of the city in three shifts- morning, afternoon and evening. The noise level given below of different areas is the average of at least 10 readings of noise level in the area. The sound level meter used consist of electronic filter circuit A, hence the unit of noise level is turned out to be dB (A).

Table 6: Sound pressure level in Greater Noida city at morning (8 to 9).

S.No.	location	Time	Noise level dB (A)
1.	Kasna Market	8:00-8:05 am	72.5
2.	Kasna Chowk	8:06-8:10 am	81.25
3.	Pari Chowk	8:11-8:15 am	91
4.	Tugalpur commercial area	8:16-8:20 am	66.25
5.	Sector alpha commercial area	8:21-8:25 am	54.3
6.	Sector alpha residential area	8:26-8:30 am	62.7
7.	Jagat farm	8:31-8:35 am	74.82
8.	Petrol pump near P3 golchakkar	8:36-8:40 am	70.2
9.	Gautam Buddha University commercial area	8:41-8:45 am	58.9
10.	Gautam Buddha University residential area	8:46-8:50 am	45.9
11.	Site 5 industrial area near kasna	8:51-8:55 am	77.35
12.	Surajpur industrial area	8:56-9:00 am	85.6

Table 7: Sound pressure level in Greater Noida city at afternoon (2 to 3).

S.No.	location	Time	Noise level dB (A)
1.	Kasna Market	2:00-2:05 pm	74.5
2.	Kasna Chowk	2:06-2:10 pm	85
3.	Pari Chowk	2:11-2:15 pm	93
4.	Tugalpur commercial area	2:16-2:20 pm	86
5.	Sector alpha commercial area	2:21-2:25 pm	67.3
6.	Sector alpha residential area	2:26-2:30 pm	72
7.	Jagat farm	2:31-2:35 pm	86.6
8.	Petrol pump near P3 golchakkar	2:36-2:40 pm	79.2
9.	Gautam Buddha University commercial area	2:41-2:45 pm	61.5
10.	Gautam Buddha University residential area	2:46-2:50 pm	58.4
11.	Site 5 industrial area near kasna	2:51-2:55 pm	77.8
12.	Surajpur industrial area	2:56-3:00 pm	82.9

Table 8: Sound pressure level in Greater Noida city at evening (8 to 9).

S.No.	location	Time	Noise level dB (A)
1.	Kasna Market	8:00-8:05 pm	93.75
2.	Kasna Chowk	8:06-8:10 pm	88.5
3.	Pari Chowk	8:11-8:15 pm	92.82
4.	Tugalpur commercial area	8:16-8:20 pm	86
5.	Sector alpha commercial area	8:21-8:25 pm	77.25
6.	Sector alpha residential area	8:26-8:30 pm	70.25
7.	Jagat farm	8:31-8:35 pm	82.15
8.	Petrol pump near P3 golchakkar	8:36-8:40 pm	74.5
9.	Gautam Buddha University commercial area	8:41-8:45 pm	72.5
10.	Gautam Buddha University residential area	8:46-8:50 pm	60.3
11.	Site 5 industrial area near kasna	8:51-8:55 pm	68.2
12.	Surajpur industrial area	8:56-9:00 pm	71.7

RESULT

Table 9: Noise level in Greater Noida at day and night time.

S.No.	Category of area/zone	Noise level in dB (A) at day time	Noise level in dB (A) at night time
1.	Industrial area	81	70
2.	Commercial area	70.2	82.4
3.	Residential area	68	77.6
4.	Traffic /roadway zone	87.7	96.80

From the above table it can be analyzed that the noise level in industrial areas of Greater Noida is acceptable with respect to the Table 5 which gives the limits of noise level at day and night time according to the Environmental Protection Act, 1986. But the commercial and the residential areas of the city are having higher noise level than acceptable, especially at night time. The noise level in Greater Noida due to vehicles is very high than the limits which are acceptable, which can be compare from Table 1.

CONCLUSION

The study concludes that the noise level in commercial and the residential areas of Greater Noida is higher than the acceptable limits. Greater Noida is a developing city of Uttar Pradesh which is attracting more and more population towards it and due this increasing population the number of vehicles in the city is growing rapidly which are creating high level of noise pollution. The increase noise nuisance in the city should be reduced and abated, if their adverse effects on human health are to be controlled. Some noises can be controlled by legal laws and there are other which has to be damped by use of good technology and town planning. The firms in the industrial area of Greater Noida are abating and reducing the noise by raising obstructions and barriers in between the noise sources and the residence due to which the noise level in industrial areas of Greater Noida is under limit.

REFERENCES:

[1] Li B., Taoa.S, Dawsona. R.W., Caoa. J. and Lamb. K.A. GIS based road traffic noise prediction model, Applied Acoustics, 2002; 63:679–691.
[2] Alam, J.B., Jobair.J. Rahman.M.M, Dikshit. A.K. and Khan S.K. Study on traffic noise level of sylhet by multiple regression analysis associated with health hazards‖, Iran. J.Environ. Health. Sci.Eng., 2006; 3(2):71-78
[3] Baaj, M. H., El-Fadel.M., Shazbak.S.M. and Saliby.E. odeling noise at elevated highways in urban areas: a practical application, Journal of Urban Planning and Development, 2001;127 (4):169-180.
[4] Fyhri, A. and Klæboe.R. Road traffic`c noise, sensitivity, annoyance and self-reported health—"A structural equation model exercise" Environment International, 2009; 35: 91–97.
[5] Sewage disposal and air pollution engineering, Environmental engineering volume 2 – Santosh Kumar Garg.
[6] Keerthana, Gobinath.R, Neelima Singhv, Chitravel.3, Saranya.S, Kannan.T, "An Analysis of noise pollution in Tirupur city", Scholars Journal of Engineering and Technology (SJET), Sch. J. Eng. Tech., 2013; 1(3):154-168.
[7] Babisch W: Traffic Noise and Cardiovascular Disease: Epidemiological Review and Synthesis. 2000, 2(8):9- 32
[8] Singh Vartika, "Environmental Noise Pollution Monitoring and Impacts On Human Health in Dehradun City, Uttarakhand, India", Civil and Environmental Research , Vol 1, No.1, 2011.
[9] Martin, M.A., Tarrero, M.A., Gonzaler,A., & Machimbarrena, M. (2006), "Exposure Effect Relationships, between Road Traffic Noise Annoyance and Noise Cost Valuations in Valladolid, Spain", Journal of Applied Acoustics 67 (10), 945-958.
[10] Chien, M.K. & Shih, L.H. (2007), "An Empirical Study of the Implementation of Green Supply Chain Management Practices in the Electrical and Electronic Industry and their Relation to Organizational Performances". International Journal of Environment, Science and Technology 4 (2), 383-394.

[11] Gangwar, K.K., Joshi, B.D., and Swami, A. (2006). "Noise Pollution Status at Four Selected Intersections in Commercial areas of Bareilly Metropolitan City, U.P". Himalayan Journal of Environment and Zoology 20 (10), 75-77.

[12] Williams.I.D. & McCrae., I.S. (1995), "Road Traffic Nuisance in Residential and Commercial Areas", Science of the Total Environment 169 (1), 75- 82.

[13] Jamrah, A., Al-Omari, A., & Sharabi, R. (2006), "Evaluation of Traffic Noise Pollution in Amman, Jordan", Environmental Monitoring Assessment 120 (1-3), 499-525.

[14] Murthy. K., Kamruzzaman Majumder, A., Nath Khanal, S., & Prasad, S.D. (2007)."Assessment of Traffic Noise Pollution in Banepa, A semi Urban Town of Nepal", Kathmandu University Journal of Science, Engineering and Technology 3 (2), 12-20.

[15] Omidvari, M.I., & Nouri, J.(2009), "Effects of Noise Pollution on Traffic Policemen", International Journal of Environmental Research , 3 (4), 645-652.

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Survey on Feature Extraction of Images for Appropriate Caption Generation

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Abstract- In many industrial, medical and scientific image processing applications, various feature and pattern recognition techniques are used to match specific features in an image with a known template. Despite the capabilities of these techniques, some applications require simultaneous analysis of multiple, complex, and irregular features within an image as in semiconductor wafer inspection. In wafer inspection discovered defects are often complex and irregular and demand more human-like inspection techniques to recognize irregularities. By incorporating neural network techniques such image processing systems with much number of images can be trained until the system eventually learns to recognize irregularities. The aim of this project is to develop aframework of a machine-learning system that can produce caption to accurately describe images. Such a system finds application in semiconductor industry, biomedical field where microscopy for identifying different cell types and analysis of tumour growth etc. Also such systems help visually impaired people in understanding pictures. They can be used for providing alternate text for images in parts of the world where mobile connections are slow and making it easier for everyone to search on Google for images are also possible.

Keywords: Artificial Intelligence, Neural Networks, Computer Vision, Learning, Bag of words, Caption, Convolution;

I. INTRODUCTION

Automatically describing the content of an image is a fundamental problem in artificial intelligence that connects computer vision and natural language processing. In machine learning and cognitive science, artificial neural networks (ANNs) are a family of statistical learning algorithms inspired by biological neural networks (the central nervous systems of animals, in particular the brain) and are used to estimate or approximate functions that can depend on a large number of inputs and are generally unknown. Artificial neural networks are generally presented as systems of interconnected "neurons" which send messages to each other. The connections have numeric weights that can be tuned based on experience, making neural nets adaptive to inputs and capable of learning. For example, a neural network for handwriting recognition is defined by a set of input neurons which may be activated by the pixels of an input image. After being weighted and transformed by a function (determined by the network's designer), the activations of these neurons are then passed on to other neurons. This process is repeated until finally, an output neuron is activated. This determines which character was read. Like other machine learning methods - systems that learn from data - neural networks have been used to solve a wide variety of tasks that are hard to solve using ordinary rule-based programming, including computer vision and speech recognition.

II. LITERATURE REVIEW

Automatically generating captions of an image is a task very close to the heart of scene understanding. This requires, identifying and detecting objects, people, scenes etc., reasoning about spatial relationships and properties of objects, combining several sources of information into a coherent sentence. Hence it is a complex task to define an image or a scene; which is an important problem in the field of computer vision. Even though it is a challenging one, a lot of research is going on which explores the capability of computer vision in the field of image processing and it helps to narrow the gap between the computer and the human beings on scene understanding. The purpose of this survey is to analyze various techniques used for an image caption generation using the neural network concepts.

Jim Mutch et al (2006) proposed a biologically inspired model of visual object recognition to the multiclass object categorization problem. First applied gabor filters on every positions and scale of the image. The template matching and max pool operations are utilized to built the feature complexity and position or scale invariance. Utilizes S-layer called the simple layer which uses convolution with local filters to compute higher order features. C-layer stands for the complex layer which increases invariance by pooling units of same type in previous layers over limited ranges [20].

Eric Nowak et al (2006) described about various sampling methods for BoF for image classification. Representing images as a collection of independent local patches has been a great aid for object recognition or image classification; but it raises the question of which patch to choose. There lies the importance of sampling. Dense sampling processes every pixel at every scale, thus captures the most information, but it is also memory and computation intensive as it spends time on processing relatively featureless regions [19].

Juan C Caicedo et al (2009) proposed a model for the evaluation of different representations obtained from the bag of features approach to classify histopathology images. The process involved feature detection and description, construction of a visual vocabulary and image representation building through visual word occurrence analysis. The obtained image descriptors are processed using appropriate kernel functions for Support Vector Machines classifiers. Medical imaging applications are challenging because they require effective and efficient content representations to manage large image collections. The first stage for medical image analysis is modeling image contents by defining an appropriate representation, which is a fundamental problem for all image analysis tasks such as image classification, automatic image annotation, object recognition and image retrieval, which require discriminative representations according to the application domain. In this work two feature detection strategies with their corresponding feature descriptor have been evaluated. The first strategy is dense random sampling and the other one is the raw pixel descriptor which is more computationally efficient [18].

Ahmet Aker et al (2010) describes about the automatic captioning of geo-tagged images. The approach was based on the summarization of multiple web documents that holds information related to an image's location. It is based on dependency patterns modeled towards sentences which contains features typically provided for different types of images such as church, bridges etc. Such a model is said to have high scores than any other methods proposed earlier. Such dependency patterns also lead to more readable summaries than those generated without dependency patterns. This method is applied only to images of static features of the built or natural landscape, i.e. objects with persistent geo-coordinates, such as building sand mountains, and not to images of objects which move about in such landscapes, e.g. people, cars, clouds, etc. The summarizer is an extractive, query-based multi-document. It is given two inputs: a toponym associated with an image and a set of documents to be summarized which have been retrieved from the web using the toponym (topographical feature) as a query. The summarizer creates image descriptions in a three step process. First, it applies shallow text analysis, including sentence detection, tokenization, lemmatization and POS-tagging to the giveninput documents. Then it extracts features from the document sentences. Finally, it combines the features using a linear weighting scheme to compute the final score for each sentence and to create the final summary [17].

Xiaoli Yuan et al (2011) proposed a novel image retrieval system based on bag-of-features (BoF) model by integrating scale invariant feature transform (SIFT) and local binary pattern(LBP) which leads to a patch-based integration and an image-based integration. Based on thier experimental studies, this image-based integrationgave the best performance compared to other existing models utilizing a codebook size of N = 200 and K-means weight of w=0.6 [16].

Stephen O'hara et al (2011) studied about the growing importance of Bag of Features (BoF) approaches to many computer vision tasks, including image classification, video search, robot localization, and texture recognition. The main reason is its simplicity and described it as a method based on order-less collections of quantized local image descriptors and they discard spatial information and are therefore conceptually and computationally simpler than many alternative methods.There are two common perspectives for explaining the BoF image representation. Thefirst is by analogy to the Bag ofWords representation. With Bag of Words, one represents a document as a normalized histogram of word counts. Commonly, one counts all the words from a dictionary that appear in the document. This dictionary may exclude certain non-informative words such as articles like "the", and it may have a single term to represent a set of synonyms. The term vector that represents the document is a sparse vector where each element is a term in the dictionary and the value of that element is the number of times the term appears in the document divided by the total number of dictionary words in the document. The term vector is the Bag of Words document representation called a bagbecause all ordering of the words in the document have been lost [15].

Yezhou Yang et al (2011) proposed a sentence generation strategy that describes images by predicting the most likely nouns, verbs, scenes and prepositions that make up the core sentence structure. The inputs are initial noisy estimates of the objects and scenes detected in the image using state of the art trained detectors.It used a language model trained from the English Gigaword corpus to obtain their estimates; together with probabilities of co-located nouns, scenes and prepositions.Then used these estimates as parameters on a HMM that models the sentence generation process, with hidden nodes as sentence components and image detections as the emissions.The most natural thing would be to describe it using words: using speech or text. This description of an image is the output of an extremely complex process that involves: 1) perception in the Visual space, 2) grounding to World Knowledge in the Language Space and 3) speech/text production, and introduced a computational framework that attempts to integrate these components together. Here the hypothesis is based on the assumption that natural images accurately reflect common everyday scenarios which are captured in language.For example, knowing that boats usually occur over water will enable us to constrain the possible scenes a boat can occur and exclude highly unlikely ones – street, highway etc.It also enables us to predict likely actions (verbs) given the current object detections in the image: detecting a dog with a person will likely induce walk rather than swim, jump, fly.Key to this approach is the use of a large generic corpus such as the English Gigaword as the semantic grounding to predict and correct the initial and often noisy visual detections of an image to produce a reasonable sentence that succinctly describes the imageThe input is a test image where objects and scenes are detected using trained detection algorithms [14].

Siming Li et al (2011) presented an approach to automatically compose image descriptions given computer vision based inputs and using web-scale n-grams. Experimental results indicate that it is viable to generate simple textual descriptions that are pertinent to the specific content of an image, while permitting creativity in the description – making for more human-like annotations than previous approaches.These work contrasts to most previous approaches in four key aspects; First composed fresh sentences from scratch, instead of retrievingor summarizing existing text fragments associated with an image.Second, generated textual descriptions that are truthful to the specific content of the imagework in automatic caption generation creates news-worthy textor encyclopedic textthat is contextually relevant to the image, but not closely pertinent to the specific content of the image. Third one aimed to build a general image description method as compared to work that requires domain specific hand-written grammar rules. The proposed approach consists of two steps: (n-gram) phrase selection and (n-gram) phrase fusion.The first step – phrase selection – collects candidate phrases that may be potentially useful for generating the description of a given image. This step naturally accommodates uncertainty in image recognition inputs aswell as synonymous words and word re-ordering to improve fluency. The second step – phrase fusion finds the optimal compatible set of phrases using dynamic programming to compose a new phrase that describes the image [13].

Misha Denil et al (2011) proposed an attention model for simultaneous object tracking and recognition that is driven by gaze data. Motivated by theories of perception, the model consists of two interacting pathways: identity and control, intended to mirror what and where pathways in neuroscience models. The identity pathway models object appearance and perform classification using deep Restricted Boltzmann Machines. At each point in time the observations consist of foveated images, with decaying resolution toward the periphery of the gaze. The control pathway models the location, orientation, scale and speed of the attended object. The posterior distribution of these states is estimated with particle filtering.This approach gives good performance in the presence of partial information and allows us to expand the action space from a small, discrete set of fixation points to a continuous domain [12].

Chih-Fong Tsai et al (2012) described about Content based image retrieval (CBIR) which require users to query images by their low-level visual content and this not only makes queries, but also can lead to unsatisfied retrieval results. Thus an image annotation was proposed. The aim of image annotation is to automatically assign keywords to images, so image retrieval users are able to query images by keywords. Image annotation can be regarded as the image classification problem either image is represented by some low- level features and high-level concepts. The bag-of-words is one of the most widely used feature representation method.

Image annotations is an automatic classification of images by labeling images intoone of a number of predefined classes or categories, whereclasses have assigned keywords or labels which can describethe conceptual content of images in that class [11].

Bharathi S et al (2014) proposed a BoF framework for remote sensing image classification. The most representative features are selected using Gabor convolution, Scale-invariant Feature Transform (SIFT) key points and Random Sample Consensus (RANSAC) method**.** The feature vector forms the classifier under K-means and Support Vector Machines (SVM) for semantic annotation. In the testing stage key points are extracted from every image, fed into the visual dictionary to map them with one feature vector and it was finally fed into the multi-class SVM training classifier model to recognize the category of an image. The time complexity of the classification is not very complex; it took 3mins for given dataset. And they came to a conclusion that BoF is one of the best methods for content based image classification. To extract Gabor features, a set of Gabor filters tuned to several different frequencies and orientations are utilized.SIFT keypoints are used for feature extraction. It has rich information and is suitable for fast and accurate features in huge data set and will produce a large number of feature vectors even though there are a few objects [10].

Razvan Pascanu et al (2014)in this paper describes the different ways to extend a recurrent neural network (RNN) to a deep RNN.The three important points of an RNN includes (1) input-to-hidden function, (2) hidden-to hidden transition and (3) hidden-to-output function.Two novel architectures of a deep RNN which are orthogonal to an earlier attempt of stacking multiple recurrent layers to build a deep RNN are proposed.The proposed deep RNNs are empirically evaluated on the tasks of polyphonic music prediction and language modeling. The experimental result supports that the proposed deep RNNs benefit from the depth and outperform the conventional, shallow RNNs. Four types of RNN are described in this paper and based on them two deep RNN architectures are defined [9].

Andrej Karpathy et al (2014) presented a model that generates natural language descriptions of images and their regions.This model is based on a novel combination of Convolutional Neural Networks over image regions, bidirectional Recurrent Neural Networks over sentences, and a structured objective that aligns the two modalities through a multimodal embedding.Then used a Multimodal Recurrent Neural Network (MRNN) architecture that uses the inferred alignments to learn to generate novel descriptions of image regions. Used the Flickr8K, Flickr30K and MSCOCO datasets for the experiment.The Multimodal RNN model is subject to multiple limitations. First, the model can only generate a description of one input array of pixels at a fixed resolution. A more sensible approach might be to use multiple saccades around the image to identify all entities, their mutual interactions and wider context before generating a description [8].

Junhua Mao et al (2014) proposed a multimodal Recurrent Neural Network (m-RNN) model for generating novel image captions. It directly models the probability distribution of generating a word given previous words and an image. Image captions are generated according to this distribution. The model consists of two sub-networks: a deep recurrent neural network for sentences and a deep convolutional network for images. These two sub-networks interact with each other in a multimodal layer to form the whole m-RNN model [7].

Jeff Donahue et al (2014)developed a novel recurrent convolutional architecture suitable for large-scale visual learning which is end-to-end trainable, and demonstrate the value of these models on benchmark video recognition tasks, image description and retrieval problems, and video narration challenges.In contrast to existing models which assume a fixed spatio-temporal receptive field or simple temporal averaging for sequential processing, recurrent convolutional models are “doubly deep” in that they can be compositional in spatial and temporal “layers”. Such models may have advantages when target concepts are complex and/or training data are limited.Long-term RNN models are appealing in that they directly can map variable-length inputs (e.g., video frames) to

variable length outputs (e.g., natural language text) and can model complex temporal dynamics; yet they can be optimized with back propagation [6].

Kyunghyun Cho et al (2014) propose a novel neural network model called RNN Encoder– Decoder that consists of two recurrent neural networks (RNN). One RNN encodes a sequence of symbols into a fixed length vector representation, and the other decodes the representation into another sequence of symbols. The encoder and decoder of the proposed model are jointly trained tomaximize the conditional probability of a target sequence given a source sequence. The performance of a statistical machine translation system is empirically found to improve by using the conditional probabilities of phrase pairs computed by the RNN Encoder–Decoder as an additional feature in the existing log-linear model. Qualitatively the proposed model learns a semantically and syntactically meaningful representation of linguistic phrases maximize the conditional probability of a target sequence given a source sequence [5].

Dzmitry Bahdanau et al (2015) The models proposed recently for neural machine translation often belong to a family of encoder–decoders and encode a source sentence into a fixed-length vector from which a decoder generates a translation. In this paper, it is concluded that the use of a fixed-length vector is a bottleneck in improving the performance of this basic encoder–decoder architecture, and propose to extend this by allowing a model to automatically (soft) search for parts of a source sentence that are relevant to predicting a target word, without having to form these parts as a hard segment explicitly. With this new approach, a translation performance comparable to the existing state-of-the-art phrase-based system on the task of English-to-French translation has been achieved. Furthermore, qualitative analysis reveals that the (soft) alignments found by the model agree well with this intuition [4].

Jimmy Lei Ba et al (2015) proposed an attention-based model for recognizing multiple objects in images.The proposed model is a deep recurrent neural network trained with reinforcement learning to attend to the most relevant regions of the input image.The model learns to both localize and recognize multiple objects despite being given only class labels during training.Finally evaluated the model on the task of transcribing multi-digit house numbers from publicly available Google Street View imagery and showed that it is more accurate than the state-of-the-art convolutional networks and uses fewer parameters and less computation.Processing an image x with an attention based model is a sequential process with N steps.At each step n, the model receives a location l(n) along with a glimpse observation x(n) taken at location l(n).The model uses the observation to update its internal state and outputs the location l(n+1) to process at the next time-step. Usually the number of pixels in the glimpse x(n) is much smaller than the number of pixels in the original image x, making the computational cost of processing a single glimpse independent of the size of the image [3].

Oriol Vinyals et al (2015) In this paper, a generative model based on a deep recurrent architecture that combines recent advances in computer vision and machine translation and that can be used to generate natural sentences describing an image is presented. The model is trained to maximize the likelihood of the target description sentence given the training image. Experiments on several datasets show the accuracy of the model and the fluency of the language it learns solely from image descriptions. This model is often quite accurate, when verified both qualitatively and quantitatively. For instance, while the current state-of-the-art BLEU-1 scores on the Pascal dataset is 25, this approach yields 59, to be compared to human performance around 69. Also showed BLEU-1 score improvements on Flickr30k, from 56 to 66, and on SBU, from 19 to 28. Lastly, on the newly released COCO dataset, it achieved a BLEU-4 of 27.7, which is the current state-of-the-art [2].

Kelvin Xu et al (2015) described an approach to caption generation that attempt to incorporate a form of attention with two variants: a hard attention mechanism and a soft attention mechanism. The hard stochastic attention mechanism is trainable by maximizing an approximate variation lower bound while the soft deterministic attention mechanism is trainable by standard back-

propagation methods. The main attention of the framework is the visualization of 'Where' and 'What' the attention is focused on. Here a CNN act asan encoder and it extracts a set of features called convolution features of the input image.In order to obtain a correspondence between the feature vectors and portions of the 2-D image, features are extracted from a lower convolutional layer. This allows the decoder to selectively focus on certain parts of an image by selecting a subset of all the feature vectors.Then used a long short-term memory (LSTM) networkthat produces a caption by generating one word at every time step conditioned on a context vector, the previous hidden state and the previously generated words. Two alternative mechanisms are used for learning as stochastic attention and deterministic attention. Stochastic hard attention represents location variables as where the model decides to focus attention when generating a particular word.Learning stochastic attention requires sampling the attention location while taking the direct expectation of the context vector can formulate deterministic soft attention model.Finally, quantitatively validated the usefulness of attention in caption generation with state of the art performance on three benchmark datasets: Flickr8k, Flickr30k and the MS COCO dataset [1].

III. CONCLUSION

The major part lies in the decision of choosing the better method for feature extraction. There are different types of features as well. There are various methods of feature extraction in image processing. Upon survey it was found that most of the former methods are concentrating on a single feature alone, which would not aid for my purpose. Hence after working on various available methods the SURF features were found to be better as it is independent of the scale and orientation of an image. The Bag-of-Words utilizes the SURF feature extraction method.

REFERENCES:

[1] Kelvin Xu, Jimmy Lei Ba, Ryan Kiros, Kyunghyun Cho, Aaron Courville, Ruslan Salakhutdinov, Richard S. Zemel, YoshuaBengio, "Show, Attend and Tell: Neural Image CaptionGeneration with Visual Attention", February 2015.

[2] OriolVinyals, Alexander Toshev, Samy Bengio, Dumitru Erhan, "Show and Tell: A Neural Image Caption Generator", Google, 2015.

[3] Jimmy Lei Ba, Volodymyr Minho, Koray Kavukcuoglu, "Multiple object recognition with visual attention", Google, April 2015.

[4] Dzmitry Bahdanau, Kyung Hyun Cho, Yoshua Bengio, "Neural machine translation by jointly learning to align and translate", April 2015.

[5] Kyunghyun Cho, Bart van, Caglar Gulcehre, Dzmitry Bahdanau, Fethi Bougares, Holger Schwenk, Yoshua Bengio, "Learning Phrase Representations using RNN Encoder–Decoderfor Statistical Machine Translation", September 2014.

[6] Jeffrey Donahue, Lisa Hendricks, Sergio Guadarrama, Marcus Rohrbach, Subhashini Venugopalan, Kate Saenko, Trevor Darrell, "Long-term Recurrent Convolutional Networks for Visual Recognition and Description", University of California at Berkeley, Technical Report No. UCB/EECS-2014-180, November 2014.

[7] Junhua Mao, Wei Xu, Yi Yang, Jiang Wang, Zhiheng Huang, Alan L. Yuille, "Deep Captioning with Multimodal Recurrent Neural Networks (m-RNN)", Published as a conference paper at ICLR 2015,July 2014.

[8]Andrej Karpathy, Li Fei-Fei, "Deep Visual-Semantic Alignments for Generating Image Descriptions", Stanford University, 2014.

[9] Razvan Pascanu, Caglar Gulcehre, Kyunghyun Cho, Yoshua Bengio, "How to Construct Deep Recurrent Neural Networks", April 2014.

[10] Bharathi S, Karthik Kumar S, P Deepa Shenoy, Venugopal K R, L M Patnaik, "Bag of Features Based Remote Sensing Image Classification Using RANSAC And SVM", Proceedings of the International Multi Conference of Engineers and Computer Scientists Vol I, IMECS, March 2014.

[11] Chih-Fong Tsai, F. Camastra, "Bag-of-Words Representation in Image Annotation: A Review", International Scholarly Research Network ISRN Artificial Intelligence Volume 2012.

[12] Misha Denil, Loris Bazzani, Hugo Larochelle, Nando de Freitas, "Learning where to Attend with Deep Architectures for Image Tracking", September 2011.

[13] Siming Li, Girish Kulkarni, Tamara L Berg, Alexander C Berg, and Yejin Choi, "Composing Simple Image Descriptions using Web-scale N-grams", Stony Brook University, 2011.

[14] Yezhou Yang , ChingLikTeo, Hal Daume, Yiannis Aloimonos, "Corpus-Guided Sentence Generation of Natural Images", Proceedings of the 2011 Conference on Empirical Methods in Natural Language Processing, pages 444–454,Scotland, UK, July, 2011.

[15] Stephen O'hara AND Bruce A. Draper , "Introduction to the bag of features paradigm for image classification and retrieval", January 2011.

[16] "A SIFT-LBP image retrieval model based on Bag-Of-Features", 18th IEEE International Conference on Image Processing, 2011.

[17] Ahmet Aker, Robert Gaizauskas,"Generating image descriptions using dependency relational patterns", Proceedings of the 48th Annual Meeting of the Association for Computational Linguistics, pages 1250–1258, Uppsala, Sweden, July 2010.

[18] Juan C. Caicedo, Angel Cru, Fabio A. Gonzalez, "Histopathology Image Classification using Bag of Features and Kernel Functions", Bioingenium Research Group, National University of Colombia, 2009.

[19] Eric Nowak, FredericJurie, Bill Triggs, "Sampling Strategies for Bag-of-Features Image Classification", Springer-Verlag Berlin Heidelberg, ECCV Part IV, LNCS 3954, pp. 490–503, 2006.

[20] Jim Mutch, David G. Lowe, "Multiclass Object Recognition with Sparse, Localized Features", Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'06), 2006.

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ANALYSIS OF PROPERTIES OF ARTIFICIAL BIOLOGICAL COMPOSITE MATERIALS

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Abstract- Market demands environmental friendly fibrous materials which enables composite materials to be manufactured. Composites have already proven their worth as weight saving materials; the current challenge is to make them cost effective. Natural fiber composites can easily be recycled than glass fiber or carbon fiber composites. The natural fibers are currently extracted from plants like sisal, jute, and palm etc….wood-thermoplastic composites products are growing rapidly. Major markets are decking materials, pallets, automobiles and building materials. Animals can also provide a source of fibers. The animal products like hair, bird's feathers, quills etc. can be used as fiber materials. It is anticipated that by incorporating quill particulates into polypropylene/epoxy resin matrix, the composite materials can be produced which can give good mechanical with low weight. Also the quill being the waste product of the poultry industry, the final cost of the composite product will be too low compared to other biological composite material. Meanwhile the problem of poultry solid waste handling can be solved.

Key Words: Biological composite, Hand Layup Technic, Fibers, slabs, testing, animal waste.

Introduction

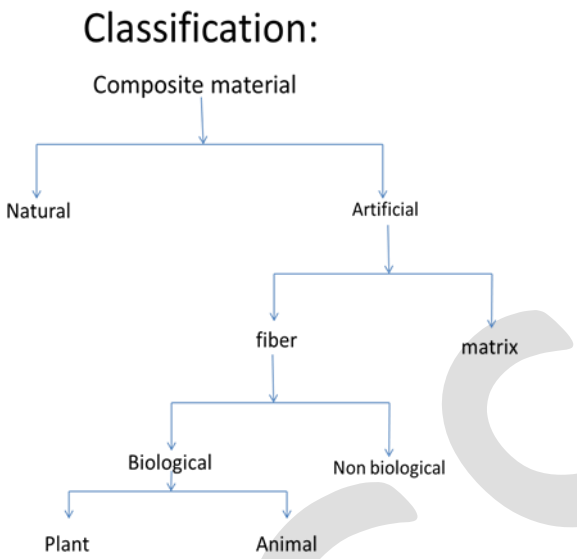
It is truism that technological development depends on advances in the field of material. One does not have to be an expert to realize that the most advanced turbine/aircraftdesign is of no use if adequate material to bear the service loads and condition are not available

Since the early 1960 there has been an increasing demand for material that stiffer and stronger yet lighter in fields as diverse as aerospace, energy and civil construction. The demands made on materials for better overall performance are so greater and diverse that number one material can satisfy them. This leads to resurgence of the ancient concept of combining different materials in an integral –composite material to satisfy the user requirement

Yes composite material is an ancient concept or we can say it is a natural concept. In the nature we can get a no. of natural and artificial composite materials. For example coconut palm leaf,wood,bone, carbon black in rubber, Portland cement and glass fibers in resins etc.

In all above ex. We saw two phases in each that is a continues matrix phase and reinforced fibrous phase. This is because the reinforcement of flexible fibers in to the matrix gives high strength materials with lighter weight. In present day we are manufacturing composite materials by using glass fibers, carbon fiber, natural fibers and metallic fibers in resins, ceramics and other matrix materials.

The vegetable kingdom is the largest source of the natural fibers. Cellulosic fibers in the form of cotton, flax, jute, hemp, sisel and ramies have been used as fiber in manufacturing of composite material. Also the natural fibers from animal source such as wool,hair and silk can be used as fibers therefore the classification of the fibers can be given as follows



Another member to the animal based natural fiber is quill. The fiber obtained from the feather of the ground hen which consist rich amount of Keratin protein can be used as the fiber material for manufacturing composites.Chicken feathers are approximately 91% protein (keratin), 1% lipids, and 8% water.

Objective and Scope Of The Paper

1. To show the ground hen feather can be used as the fiber for reinforcement phase in composite materials.
2. To fabricate composite material by varying the proportion of the matrix phase and reinforcement phase i.e. mainly:
   - 1:7 -> fiber: resin by weight
   - 1:9 -> fiber: resin by weight
3. To test fabricated material under UTM machine to check its tensile strength.
4. Comparing the tensile strength and density with the different bio composite materials.

MARKET SURVEY

Today chicken is widely used as food everywhere. It produces the lot of organic waste. The lacs of tones waste is producing every day, handling of this waste is becoming very difficult because major part of this waste is feather and its take more than twenty years to bio degrade. Also it is not reused anywhere. So we decided to reuse this material as a fiber to prepare composite material.

Below table shows the quantity of waste produced from poultry farms and chicken centers near our college.

Table no.1:

No. of poultry farms	Avg. capacity/batch	No. of batches/year	Total hens/year	place
7	5000	5	175000	Nidasoshi

No. of chicken centers	Avg. requirement/day	Waste produced/ hen	Feather wt./hen	place

5	20	300 gm	70 gm	sankeshwar

After survey we came to know that from sankeshwar(Karnataka) only the feather waste produced is about 2550 kg/year. So we have lot of material world wide that can be reused effectively.

Literature Survey

We studied the different types of resins, fibers and their properties to select the desired materials which will give the desired mechanical properties.

Types of Fibers

1. GLASS FIBER

E-glass (electrical)-lower alkali content and stronger than A glass(alkali). Good tensile and compressive strength and stiffness, good electrical properties and relatively low cost, but impact resistance relatively poor.

2. Carbon Fiber

Carbon fiber is produced by the controlled oxidation, carbonization and graphitization of carbon-rich organic precursor which are already in the fiber form. The most common precursor is polyacrylonitrile(PAN),because it gives the best carbon fiber properties ,but fibers can also be made from pitch or cellulose. Variation of the graphitization process produces either high strength fibers (@~2600˚C) or high modulus fibers (@~3000˚C) with other types in between. Once formed, the carbon fiber has a surface treatment applied to improve matrix bonding and chemical sizing which serves to protect it during handling.

3. ARMED FIBER

This is the generic name for fibers produced from aromatic polyamide fibers. The company Do-pont produces these fibers under the trade name Kevlar fibers.Kevlar fibers are compound based on benzene rings. The basic structure of Kevlar consist of Para substituted aromatic unit which gives the rigidity to the structure.

Categories of natural fibers

Natural fiber materials are derived from several sources within nature andthe agricultural community. These materials are basically "cellular" in formand structure with a degree of inherent strength and stiffness built in"naturally" due to the geometric internal structure. One of the basic cellularmaterials is cellulose. As a natural polymer itself, it possesses vety highstrength and stiffness per unit weight--exaccly the type of performancethat drives today's advanced composites technologies. Cellulose forms long,fiber-like cell structures that are found in wood cores and stems, leafmaterials, and seed materials. These are the three dominant sources fornatural fiber materials.

Table 1 shows the three basic categories of natural fiber sources aIid theircharacteristics. Each of these sources has a spot for their use within thecomposites industry. Natural fiber resources also provide materials morecommonly used in sandwich construction (core) designs with more wellknown materials such as balsa wood, reed, and bamboo forms. For thisarticle, we will not cover the sandwich structures but will concentrate moreonshonfibei and con"tinuous fiber forms.

Bast Fiber: The "bast" fiber family generally consistsofflax, hemp, jute,kenaf, and ramie ("China Grass"). These fibers are derived from wood coreand stem materials. The wood core is basically surrounded by the stem andthe stem consists of a number of fiber bundles. Cellulose is the primarychemical basis for the fJament structure that makes up the fiber bundles.The cellulose is the essential filament and is bonded or held together by anatural "resin" from either the lignin or pectin family. (Note: The intent isnot to get too heavy on "chemistry stuff" here, so we will tread lightly andjust cover things in general.)During the processing to obtain the natural basttypefibers, the pectin is removed during the systemthat leaves only the filaments and lignin. The fibersare processed into suitable reinforcement forms thatinclude short fibers (5-30 mm), continuous fibers ortextile-type fiber forms. In order to fabricate a traditionalcomposite, the resin system chosen to bond thefibers within the structure is used to impregnate thefiber structure using a number of available processing methods. However, the lignin actually is a weak linkin the critical interface bond region between

thenatural fiber and the incoming structural resin matrix.The lignin material between the cells of the fibers,being the weakest link, is not desirable and everyattempt is made to remove it or treat the fibers chemicallyto enhance the resin bond later.
Flax has a fairly high level oflignin.

Leaf Fiber: Leaf fibers include sisal, abaca (from the banana plant), andpalm materials. These fibers tend to be much coarser than the bast-typefibers overall. We have probably heard of sisal more than any of the othersin the group. Sisal is the most important and has a relatively high stiffnesscompared to the others.

SeedFibers: The last group, seed fibers, covers cotton, coir (coconuthusk materials), and kapok materials. Cotton is easily recognized for itswidespread international use in textiles and other fibrous products withinthe clothing and rope industries. Coir obviously is a much more durable,thick and course fiber material as we probably know just from picking upa coconut husk. Many of these materials are used for upholstery and"stuffing" furniture products.

Natural fiber properties provide variety

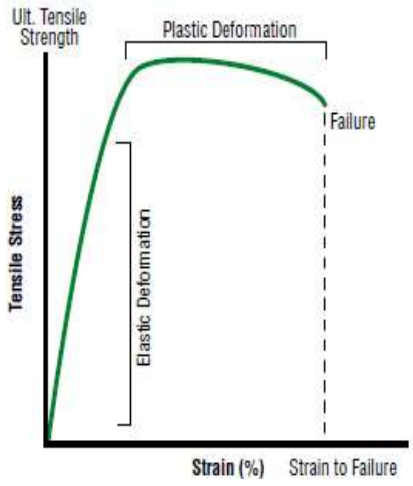
We have already noted that there are basically three fiber categories as shown
in Table 1. The densities of all of the natural fibers lie roughly in the 1.25·1.51 g/cm3 range. With E-glass fiber sitting at 2.57 g/cm3, this means that(he natural fibers are 50-60 percent of the E-glass density. This is one ofthe major drivers for natural fiber composites on a weight basis alone.Aramid fibers, traditionally among the lightest weight materials for truestructural composites, is somewhere in the middle of the natural fibers atroughly 1.42 g/cm3.

- Resin

Matrix resins bind feather fibers together, protecting them from impact and the environment. Quill fiber properties such as strength dominates in continuously reinforced composites. When quill fiber is used in discontinuous reinforcement, resin properties dominate and are enhanced by the quill fiber.

- Mechanical properties of the Resin system

The figure below shows the stress/strain curve for an 'ideal' resin system. The curve for resin shows high ultimate strength, high stiffness (indicated by the initial gradient) and a high strain to failure.



Adhesive properties of the resin system

High adhesion between resin and reinforcement fibers is necessary for any resin system. This will ensure that the loads are transferred efficiently and will prevent cracking or fiber/resin debonding when stressed.

Toughness properties of resin system

Toughness is a measure of a material's resistance to crack propagation, but in a composite this can be hard to measure accurately. However, the stress/stain curve of the resin system on its own provides some indication of the material toughness. Generally the more deformation the resin will accept before failure the tougher and more crack resistant the material will be.

Conversely, a resin system with a low strain to failure will tend to create a brittle composite, which cracks easily. It is important to match this property to the elongation of the fiber reinforcement.

Environmental properties of the resin system: Good resistance to the environment, water and other aggressive substances, together with an ability to withstand constant stress cycling, are properties essential to any resin

system. These properties are particularly environmental properties of the resin system important for use in a marine environment.

Types of resins

Polymer matrix resin fall into two categories:

1) Thermoset.
2) Thermoplastic.

Thermoset

With their track record of performance, Thermoset have become the matrix of choice in continuously reinforced glass fiber composites and plastic parts made with glass filler. Especially popular are unsaturated polyester resin, which are relatively in expensive, easy to handle, and have good mechanical, electrical and chemical resistance.

Polyester

These are named for their ingredients, such as orthopolyster(utilizing orthopathalic acid), isopolysters(resins containing isopathalic acid for superior chemical and thermal resistance),and terephthalic resins (formulated with terephthalic acid for improved toughness).

Vinyl esters

Cost more than polysters but are used in many of the some applications.their performance surpasses polysters in chemically corrosive environments (such as filament would glass/vinyl ester chemical tanks)and structural laminates requiring high moisture resistance(such as boat manufacturing).

Epoxy resins

The large family of epoxy resins represents some of the highest performance resins of those available at this time. Epoxies generally out-perform most other resin types in terms of mechanical properties and resistance to environment degradation, which leads to their almost exclusive use in aircraft component. As laminating resins their increased adhesive properties and resistance to water degradation make these resins ideal for use in applications such as boating building. Here epoxies are widely used as a primary construction material for high performance boat or as a secondary applications to sheath a hull or replace water degraded polyester resins and gel coats.

The term ‘epoxy’ refers to a chemical group consisting of an oxygen atom bonded to two carbon atoms that are already bonded in some way.the simplest epoxy is a three member ring structures known by the term ‘alpha-epoxy’ or ‘1,2epoxy’.the idealized chemical structure is shown in the figure below and is the most easily identified characteristic of any more complex epoxy module.

IDEALISED CHEMICAL STRUCTURE OF SIMPLE EPOXY(ETHYLENE OXIDE)

Epoxy differ from polyster resins in that they are cured by a ‘hardener’rather than a catalyst.thehardner,often an amine,is used to cure the epoxy by an ‘additional reaction’ where both materials take place in the chemical reaction.the chemistry of this reaction means that there are usually two epoxy sites binding to each amine site.this forms a complex three-dimensional molecular structure.

Since the amine molecules ‘co-react’ with the epoxy molecules in a fixed ratio, it is essential that the correct mix ratio is obtained between resin and hardner to ensure that a complete reaction takes place. If amine and epoxy are not mixed in the correct ratios,unreacted resin or hardener will remain within the matrix which will affect the final properties after cure. To assist with the accure mixing of the resin and hardner,manufacturers usually formulate the components to give a simple mix ratio which is easily achieved by measuring out by weight or volume.

Thermoplastic:

While Thermoset are more widely used, thermoplastic resins are in a significantly wider range of matrix choices. Higher in cost, they are also high-performance, withstanding temperature up to 400 degrees F & beyond. Besides elevated temperature performance, thermoplastic.

The most common commodity thermoplastic is polyethylene, polystyrene, polypropylene & thermoplastic polyesters (PET,PBT). Melt flow & density options, enhanced impact resistance & relative’s case processing characterize them.

Thermoplastics reinforced with non-continuous fiberglass are used to manufacture a wide range of consumer, commercial & light industrial products. Because of its high processing temperatures, thermoplastics are not effective in hand lay-up & spray-up fabrication projects, unless high performance mechanical properties are demanded.

Advantages of Thermo –plastics:

- Soften on heating & application of pressure.
- Can accommodate high strains before failure.
- Indefinite shell life.
- Can e reprocessed.
- Short curing cycles

Resin comparison:

The polyesters, Vinylesters and epoxies discussed here probably account for some 90% of all thermosetting resin systems used in structural composites. In summary the main advantages of each of these types are:

Polyesters

Advantages:

- Easy to use.
- Lowest cost of resins available

Disadvantages:

- Possess moderate mechanical properties
- High styrene emissions in open moulds
- High cure shrinkage limited range of working times.

Vinyl esters

Advantages:

- Very high chemical/environmental resistance.
- Higher mechanical properties than polyesters.

Disadvantages:

- Post cure generally required for high properties.
- High styrene content.
- High cure shrinkage.

Epoxies:

Advantages:

- High mechanical and thermal properties.
- High water resistance.
- Long working times available
- Low cure shrinkage.

Hardener:

A wide variety of curing agent for epoxy resin is available depending on process & properties required. The commonly used curing agents include amines, polyamides,Phenolics resinanhydrides, isocyanatespolymercaptanes. The choice of resin and hardener depends upon the application, the process selected and properties desired. The stoichiometry of the resin-hardener system also effects the properties of the cured material.

- The following table gives the comparison between various properties of the different natural fibers
  - Young's modulus and densities of various natural fibers :-

Table no.2:

Fiber	*Young's modulus*	*Density*
• jute -	8 to 20 GN/m2	1.3 gm/cm3
• Banana –	9 to 16 GN/mm2	1.35 gm/cm3
• Siesel -	34 to 82 GN/m2	1.45gm/cm3

- Coir - 4 to 6 GN/m2 1.15 gm/cm3
- Cotton – 27 GN/m2 1.52 gm/cm3
- QUILL – 3 to 50 GN/m2 0.89 gm/cm3

Aspect ratio:
It is the ratio of length to the diameter of the material.
For safe working aspect ratio should be greater than 15.

That is $\frac{l}{d} \geq 15$

Below Table shows the Dimension and Measuring of the randomly selected Quills:

Table no.3:

Model no	Point no	Diameter in mm	Average diameter	Length in cm
1	A	2.66	1.74	15.4
	B	1.83		
	C	0.73		
2	A	2.17	1.31	14
	B	1.16		
	C	0.59		
3	A	1.66	1.31	11.4
	B	1.68		
	C	0.59		
4	A	2.56	1.65	14
	B	1.67		
	C	0.72		
5	A	2.66	1.656	12.9
	B	1.65		
	C	0.66		
6	A	2.07	1.4	13.5
	B	1.5		
	C	0.63		
7	A	2.4	1.51	12.5
	B	1.63		
	C	0.5		
8	A	2.42	1.53	14
	B	1.53		
	C	0.64		
9	A	2.44	1.456	15
	B	1.47		
	C	0.46		
10	A	2.44	1.41	14.1
	B	1.33		
	C	0.46		
11	A	2.67	1.86	12.5
	B	1.86		
	C	1.12		
12	A	2.78	1.66	15.4
	B	1.75		
	C	0.46		
13	A	2.28	1.32	14.3
	B	1.25		
	C	0.43		

14	A	2.78	1.487	15.4
	B	1.67		
	C	0.42		
15	A	2.05	1.22	12.3
	B	1.14		
	C	0.48		
16	A	2.71	1.656	13.4
	B	1.68		
	C	0.58		
17	A	2.89	1.686	16.1
	B	1.67		
	C	0.50		
18	A	2.67	1.516	16.2
	B	1.52		
	C	0.36		

For example the Aspect ratio for 1st model in the above table is given as:

l/d=154/1.74

=88.5 > 15

The tensile test conducted on the quill material gives the following results

Specimen-1

The average dia = 1.6405 mm Length = 138.9 mm

The maximum load carried:-35 N

Extension at maximum load: - 0.375 mm

Tensile stress = load/area

= 35/2.1137

= 16.558 N/mm2

Young's modulus = 16.558/0.375

= 44.154 N/mm2

Specimen- 2

The average dia = 1.594 mm Length = 145.6 mm

The maximum load carried:-37 N

Extension at maximum load: - 0.896 mm

Tensile stress = load/area

= 37/1.995

= 18.541 N/mm2

Young's modulus = 18.541/0.896

= 20.693 N/mm2

From the above calculation we can see that the young's modulus of the quill is very similar to the young's modulus of the materials listed in the table no.2. Therefore we can use the quill as the fiber material in composite material.

Phenolics are the example of polymer matrix. It is superior in high temperature applications for many years. It is available with low viscosity version that is easier to process and including those with low volumes.

Phenolics are particularly useful in composite parts that must meet smoke emission, combustion of toxicity requirements. They can be found in panels of flooring of aircrafts, rotor blades of helicopters, automobile bodies, marine applications, bicycles frames etc.

Phenolics offer low density, good thermal insulation, outstanding durability, and easy of formability to complex contours

With their reduced cost, light weight of other advantages, glass reinforced Phenolics have replaced metal in automotive components.

PRELIMINARY PROCEDURE TO PREPARE THE FIBER

1. Collecting material
2. Cleaning the material
3. Soaking
4. Separation of barbs from quill
5. Trials for alignments

1. Collecting material: The row material was collected in the forms of wings form chicken centers sankeshwar.(Karnataka)

2. Cleaning the material:- By keeping the material in hot water feather get loosen from bone and separate by wearing hand glows. Then by using detergent powder the blood, bacteria's and flesh particle from remove feather.

3. Soaking:-Clean feathers were soaked under sun light for whole one day.

5. **Separating barbs form quill:-**By using sharp tools like blades and seizers barbs were separated from the quill fibers and collected separately.

5. by crushing the quill:- Due to the problem to get the composite material in various or complex shapes it require crush the quill fiber by using plastic crushing machines used in plastic industries or by using domestic mixer, and mix it with barbs to get mixture suitable to make mat's

PREPARATION OF SLABS:-Fiber reinforce polymer matrix composite are produced from basic building blocks namely fibers,rein,fillers &gel coats etc. followingprocesses are available for the production of the desired product

- **Open moulding process**

A. Hand lay-up process

B. Spray up process

- **Bag moulding process**
  - C. Pressure bay moulding
  - E. Vacuum bay moulding
  - F. Auto clave
- **Compression moulding**
- **Matched die moulding or resin transfer moulding**
- **Filament winding**
- **Injection moulding**
- **Thermo forming**
- **Blow moulding**

HAND LAY-UP PROCESS

Description: Hand lay-up is the oldest and simplest method used for producing reinforced plastic laminates. Capital investment for hand lay-up process is relatively low. There is virtually no limit to the size of the part that can be made. The fiber reinforcement which is normally in the form of a woven cloth or chopped strand mat or crushed material is laid first. The plastic resin mixed with hardener is then applied by using brush. Rollers are used to thoroughly wet the resin matrix material to enable good compaction and to remove entrapped air. To increase the thickness of the composite material being produced; more layers of the fiber and resin are added. Applications of this method include boat hulls, tanks, housing, chairs etc.

Hand lay-up process is particularly suitable under the following conditions:

- Only one side needs smooth finish.
- Slight variation in thickness is permissible.
- When product size is large and complex in shape
- Labor charges are not prohibitively high.
- Only a few moldings are required.
  Different stages of hand lay-up process are as under:
  - Raw material preparation.
  - Laying up.
  - Curing.

- **Raw material preparation:**

1.Preparation of reinforcementsChopped strands mat and crushed material of quill fibers are the reinforcement materials used. The preparation of these materials is explained all ready. for the strand mats the quill fibers are trimmed to suit the size of the product.

2.Preparation of the resin matrix:The resin stored at low temperatures with stabilizers added to it. this is done to prevent the gelling. The resins are in liquid phase. The resin is mixed with the hardener in the prescribed ratio. After adding the hardener to the resin only the gelling process starts.

3. Laying-up: When the initial materials are ready, then the resin mix is coated on the aluminum foil of thickness about 0.5 mm uniformly. A soft brush is used to apply the resin. After that the quill fiber layer is placed uniformly on the resin applied area. If it is a crushed fiber then a roller is to uniformly distribute the fiber material on resin. After this once again the resin mix I applied on the fiber surface. The process is repeated until the desired thickness is obtained.

To get fine surface finish on the upper side of the material an aluminum foil is placed and rolled uniformly.

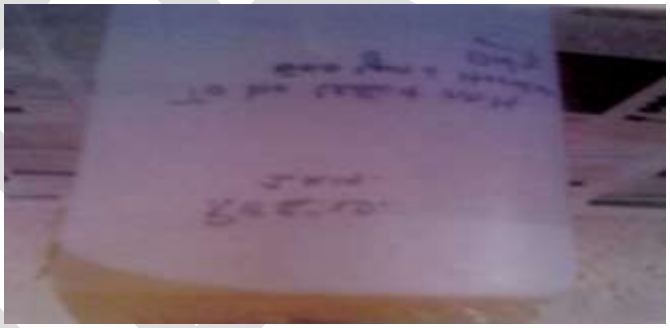
4.Curing: Curing is very important stage in the hand lay-up process. The final strength of the material depends on the curing time. As the curing time increases the strength of the material is also increases. The curing has to be carried out under the pressure so that a compact material with less porosity can be obtained. And it can be done under room temperature also. But it depends on the properties of resin.

Advantage of hand lay-up process:

1. Process is extremely simple.
2. Simple principle to teach
3. The process does not require sophisticated machinery and tools.
4. Simple accessories like mugs, brushes are adequate.
5. Highly suitable for part of large and complex shapes.
6. Contours and surface finish can be imparted according to the need of the customer.

Disadvantages of hand lay-up process:

1. Techniques arelabour intensive.
2. Process is not amenable when smooth finish is required on both sides.
3. Thickness cannot be controlled.
4. It is difficult to obtain uniform fiber to resin ratio at all places.
5. Mass production is not possible.



MATERIALS SELECTED

From the above literature survey we have selected the fallowing materials for fabrication of required composite material.

✓ **RESIN**

SPECIFICATIONS:

TYPE	boat polyester resin (Phenolics)	Epoxy resin
Density(gm/cc)	1.2	1.14
Tensile strength (MPa)	50 to 55	63-70
Youngs modulus(GPa)	15 to 35	26-43
Coefficient of thermal expansion(/℃)	4.5 to 11*10^-5	4.8 to 13*10^-5

✓ **SPECIFICATIONS OF HARDNER:**

Type- k-46 (atulceba),Density -850 kg/m3
Cost –Rs100 /kg ,Mixture ratio-1:10
CASE-1 BY WEIGHT
1:9-FIBER: RESIN

Weight of the fiber – 16 gm.
Weight of the resin – 144 gm.
Total weight – 160 gm.
Volume of the composite material -163100 mm3.
Density of the composite material – 0.98 gm/cm3
CASE-2BY WEIGHT
1:7-FIBER: RESIN

Weight of the fiber – 38 gm.

Weight of the resin – 266 gm.

Total weight – 304 gm.

Volume of the composite material – 220220 mm3.

Density of the composite material – 1.38 gm/cm3.

CASE-3 BY WEIGHT
1:8

Weight of the fiber – 33 gm.
Weight of the resin – 264 gm.
Total weight – 297 gm.
Volume of the composite material – 268625 mm3.
Density of the composite material – 1.105gm/cm3.

COMPARISON WITH OTHER MATERIALS

properties	E-glass	Flax	Jute	Hemp	Cotton	Ramie	Coir	Sisal	**quill**
Density,g/cm3	2.57	1.40	1.46	1.48	1.51	1.50	1.25	1.33	**1.18**
Tensile strength,Pa	3450	800-1500	400-800	550-900	400	500	230	600-700	**7**
Specific modulus	28	25-45	7-20	45	8	30	5	30	**3-10**
Elongation,%	4.8	1.2-1.6	1.8	1.6	3-10	2	15-25	2-3	**1.167**

In the above table the various properties of the natural fiber composite are compared with quill fiber composite. The properties like density elongation and specific modulus are comparatively good or similar. But the tensile strength is less than other the use of resin effects the tensile strength of material. Also the curing period play very important roll to determine strength of material, so to get higher tensile strength the high quality resin can be used with enlarged curing period.

APPLICATIONS

- Aerospace industry
- Electronics and marine industry
- Automotive industry
- Pallets and Building material
- Helmet making material

CONCLUSION:

The animal products like hair, bird's feathers, quills etc. can be used as fiber materials. It is anticipated that by incorporating quill particulates into polypropylene/epoxy resin matrix, the composite materials can be produced which can give good mechanical with low weight. Also the quill being the waste product of the poultry industry, the final cost of the composite product will be too low compared to other biological composite material. Meanwhile the problem of poultry solid waste handling can be solved.

REFERENCES:

1. Text book of composite material byK.K.Chawla
2. Journal of Armatec environmental ltd New Zealand
3. Journal of Experimental Biology
4. Physical and mechanical properties of chicken feather materialsBy Jeffrey W. Kock
5.Composites from ground chicken quill and polypropylen By Shah Huda[a] and Yiqi Yan

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A Survey on Different Algorithms for Automatic Speaker Recognition Systems

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Abstract- In this paper, a literature survey on Different algorithms used for Automatic Speaker Recognition Systems has been done. Speaker recognition is the process of automatically recognizing who is speaking on the basis of individual information included in speech waves. This technique makes it possible to use the speaker's voice to verify their identity and control access to services such as voice dialing, banking by telephone, telephone shopping, database access services, information services, voice mail, security control for confidential information areas, and remote access to computers. Speech is a complicated signal produced as a result of several transformations occurring at several different levels: semantic, linguistic, articulatory, and acoustic. Differences in these transformations are reflected in the differences in the acoustic properties of the speech signal. An overview of different algorithms for Feature Extraction and Feature Matching techniques for Speaker recognition systems is presented in this paper.

Keywords- Feature Extraction, Feature matching, Mel Frequency Cepstrum Coefficients (MFCC), Linear Prediction Cepstrum Coefficients (LPCC), Gaussian Mixture Model (GMM), Euclidean Distance, Vector Quantization (VQ), Dynamic Time Warping (DTW), Neural Networks.

INTRODUCTION

The speech signal contains many levels of information. Primarily a message is conveyed via the spoken words. At other levels, speech conveys the information about the language being spoken, the emotion, gender, and the identity of the speaker. The automatic recognition of speaker and speech recognition are very closely related. While speech recognition sets its goals at recognizing the spoken words in speech, the aim of automatic speaker recognition is to identity the speaker by extraction, characterization and recognition of the information contained in the speech signal. The applications of speaker recognition technology are quite varied and continually growing. This technique makes it possible to use the speaker's voice for verification of their identity and thereafter enable the control access to services such as voice dialling and voice mail, tele-banking, telephone shopping, database access related services, information services, security control for confidential information areas, forensic applications, and remote access to computers. Speaker recognition technology is expected to create a host of new services that will make our daily lives more convenient.

Speaker recognition is a commonly used biometric today in most of the commercialization that has taken place for control of access to information services or user accounts on computers. Speaker recognition offers the ability to replace or augment the personal identification numbers and passwords with something that cannot be stolen or lost. There are two main factors, that make speaker recognition a compelling biometric; (1) Speech is natural signal to produce that is not considered threatening by the users to provide, and (2) the telephone system provides a familiar network of sensors for obtaining and delivering the speech signal.

Speaker Recognition

Speaker recognition is a biometric system which performs the computing task of validating a user's claimed identity using the characteristic features extracted from their speech samples. Speaker identification is one of the two integral parts of a speaker recognition system with speaker verification being the other one. On a brief note, speaker verification performs a binary decision which consists of determining whether the person speaking is the same person he/she claims to be or to put it in other words verifying their identity. Speaker identification on the other hand does the job of matching (comparing) the voice of the speaker (known or unknown) with a database of reference templates in an attempt to identify the speaker.

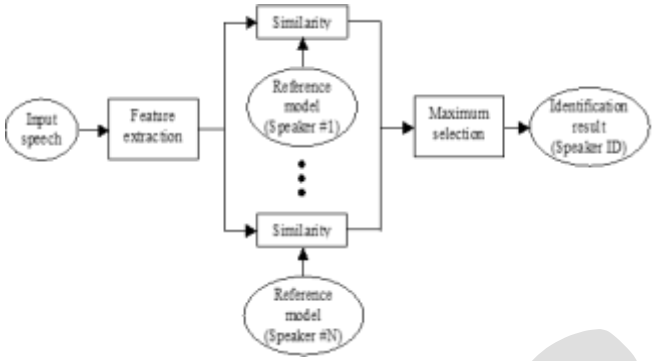

Figure1. Speaker Identification System

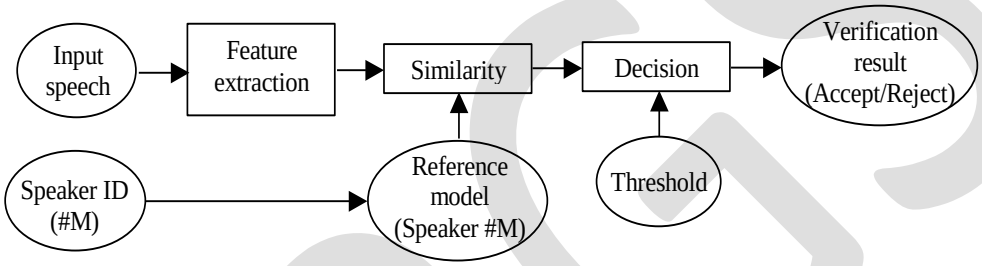

Figure2. Speaker Verification System

LITERATURE STUDY

During the past four decades, a large number of speech processing techniques have been proposed and implemented, and a number of significant advances have been witted in this field during the last one to two decades, which are spurred by the high speed developing algorithms, computational architectures and hardware. Speech recognition refers to the ability of a machine or program to recognize or identify spoken words and carry out voice. The spoken words are digitized into sequence of numbers, and matched against coded dictionaries so as to identify the words. Speech recognition systems are normally classified as to following aspects:

- Whether system requires users to train it so as to recognize users' speech patterns;
- Whether system is able to recognize continuous speech or discrete words;
- Whether system is able to recognize small vocabulary or large one.

A number of speech recognition systems are already available on the market now. The best can recognize thousands of words. Some are speaker-dependent, others are discrete speech systems. With the development of this field speech recognition systems are entering the mainstream, and are being used as an alternative to keyboards.

However nowadays more and more attention has been paid on speaker recognition field. Speaker recognition, which involves two applications: speaker identification and speaker verification, is the process of automatically recognizing who is speaking on the basis of individual information included in speech waves. This technique makes it possible to use the speaker's voice to verify their identity and control access to services such as voice dialing, banking by telephone, telephone shopping, database access services, information services, voice mail, security control for confidential information areas, and remote access to computers.

Related Work

A considerable number of speaker-recognition activities are being carried out in industries, national laboratories and universities. Several enterprises and universities have carried out intense research activities in this domain and have come up with

various generations of speaker-recognition systems. Those institutions include AT&T and its derivatives (Bolt, Beranek, and Newman); the Dalle Molle Institute for Perceptual Artificial Intelligence (Switzerland); MIT Lincoln Labs; National Tsing Hua University (Taiwan); Nippon Telegraph and Telephone (Japan); Rutgers University and Texas Instruments (TI). Sandia National Laboratories, National Institute of Standards and Technology, the National Security Agency etc. have conducted evaluations of speaker-recognition systems. It is to be noted that it is difficult to make reasonable comparison between the text-dependent approaches and the usually more difficult text-independent approaches. Text-independent approaches including Gish's segmental Gaussian model, Reynolds's Gaussian Mixture Model, need to deal with unique problems (e.g. sounds and articulations present in the test material but not in training).

It's difficult also to compare the binary choice verification task and the usually more difficult multiple-choice identification task. General trends depict accuracy improvements over time with larger tests i.e. enabled by larger data bases, thus enhancing confidence in performance measurements. These speaker recognition systems need to be used in combination with other authenticators (for e.g. smart cards) is case of high-security applications. The performance of current speaker-recognition systems, however, makes them ideal for a number of practical applications. There exist several commercial ASV systems, including those from Lernout & Hauspie, T-NETIX, Veritel, Voice Control Systems and many others. Perhaps the largest scale deployment of any biometric system to date is Sprint's Voice FONCARD. Speaker-verification applications include access control, telephone credit cards and a lot others. Automatic speaker-recognition systems could help a great deal in reducing crime over fraudulent transactions substantially. However it is imperative to understand the errors made by these ASV systems keeping note of the fact that these systems have gained widespread use across the world. They experience two kinds of errors:- Type I error (False Acceptance of an invalid user (FA)) and Type II error (False Rejection of a valid user(FR)). It uses a pair of subjects: an impostor and a target, to make a false acceptance error. These errors are the ultimate cause of concern in high-security speaker-verification applications.

Yoseph Linde et al (1980) developed an efficient and intuitive algorithm for the design of good block or vector quantizers with 'quite general distortion measures for use on either known probabilistic source descriptions or on a long training sequence of data. An approach of Lloyd algorithm is the basis for this paper which is not a variational technique, and involves no differentiation. Therefore it works well even when the distribution has discrete components, as is the case when a sample distribution obtained from a training sequence is used. The algorithm produces a quantizer meeting necessary but not sufficient conditions for optimality as with the common variational techniques. Both approaches assure atleast local optimality. Algorithms for both known distribution and unknown distribution are described [1].

In 1981, E. H. Wrench Jr. described the design and implementation of a real time speaker recognition system performing text independent, closed set speaker recognition with up to 30 talkers in real time. The reference speech used to characterize these 30 talkers can be extracted from 10 seconds of speech from each talker, and the actual recognition performed with less than one minute of speech from the unknown talker. Two algorithms developed by Markel and Pfeifer were investigated in this paper and the best method is implemented in a laboratory demonstration system [2].Izuan Hafez Ninggal et al (2006) presented a literature survey and discussion on the fundamentals of speaker features in speaker recognition, popular techniques used for feature extraction and their performance evaluation [4].

In 2009, Ali Zulfiqar et al presented a method in which feature vectors from speech are extracted by using Mel-Frequency Cepstral Coefficients and Vector Quantization (VQ) technique is implemented through Linde-Buzo-Gray algorithm. Two purposeful speech databases with added noise, recorded at sampling frequencies 8000 Hz and 11025 Hz, are used to check the accuracy of the developed speaker identification system in non-ideal conditions. An analysis is also provided by performing different experiments on the databases that number of vectors in VQ codebook and sampling frequency influence the identification accuracy significantly. Results show that MFCC based Speaker Identification system with VQ modeling technique has very good identification accuracy and therefore, it is robust against noise [5].

Li Shaomei et al (2009) proposed a new speaker recognition algorithm using acoustic feature distribution around common codebook to model speaker's characteristics. The common codebook is generated via the training data from all reference speakers, which is used to classify speech feature space, and the model of each reference speaker is described by the statistics of speaker's acoustic feature distribution around the common codebook. The method proposed in this paper can save both calculation time and space while having better performance over the current algorithm [6].

In 2010, Lindasalwa Muda et al. discussed two voice recognition algorithms which helps in improving the recognition performance of a speaker recognition system in this paper. The technique was able to authenticate the particular speaker based on the individual information that was included in the voice signal. The results show that these techniques could be used effectively for voice recognition purposes [7]. Vibha Tiwari (2010) discussed several feature extraction techniques and found out that Mel Frequency Cepstrum Coefficients is a well suited technique to describe the signal characteristics. The extracted speech features (MFCC's) of a speaker for designing a text dependent speaker recognition system are quantized to a number of centroids using vector quantization algorithm [8].

Zhiyi Qu et al (2010) presented a method applying MFCC and Vector Quantization algorithm for Pornographic Audio Detection. Firstly, MFCC of selected pornographic audios are extracted and then encoded into codebooks using VQ algorithm; Secondly, all of the codebooks obtained will be averaged to get an average codebook; Finally, the type of any newly input audio belonging to, either pornographic or non-pornographic, will be determined by measuring the Euclidean distance between the average codebook and its own codebook. Experiment results show that the algorithm can detect pornographic audios effectively [9].

Yuan Yujin et al (2010) developed a Linear Prediction Cepstrum Coefficient (LPCC) and Mel Frequency Cepstrum Coefficient (MFCC) are used as the features for text independent speaker recognition in this system. And the experiments compare the recognition rate of LPCC, MFCC or the combination of LPCC and MFCC through using Vector Quantization (VQ) and Dynamic Time Warping (DTW) to recognize the speaker's identity. Experimental results proved that the combination of LPCC and MFCC has a higher recognition rate [10].

In 2010, M.Hassan Shirali-Shahreza et al. described a comparison of the pre-processing techniques of MFCC features using the effect of these two processes on the accuracy of a Vector Quantization (VQ) speaker identification system. One of these pre-processing is creating delta and delta-delta coefficients and append them to MFCC to create feature vector and the other pre-processing is coefficients mean normalization. The results reported that removing the first coefficient can improve the accuracy and using the delta coefficients does not improve the accuracy and even decrease the accuracy [11]. Tiwalade O. Majekodunmi et al (2011) reviewed four biometric identification technologies (fingerprint, speaker recognition, face recognition and iris recognition) in which it discussed the mode of operation of each of the technologies and highlighted their advantages and disadvantages [12].

Danko Komlen et al (2011) described a system based on LBG vector quantization and the *k*-NN classifier. The features that were used for extraction are MFCC coefficients and energy of the sound signal. The developed system was evaluated on two sets of speakers. The results obtained showed an accuracy of more than 95%. The system was also evaluated for the case of interference in the voice signal transmission, and accuracy in this case ranges from 70% up to 85% [13]. Supriya Tripathi et al (2012) proposed the comparison of MFCC and Vector Quantization for Speaker Recognition. Feature vectors are extracted using Mel Frequency Cepstrum Coefficients (MFCC) and Vector Quantization is implemented through Linde Buzo Gray algorithm. These coefficients are used to identify an unknown speaker from a given set of speakers [14].

Jorge Martinez et al (2012) proposed a new method for automatic speaker recognition method in which MFCCs are used to extract features from the voice signal and Vector Quantization to identify the speaker. The approximation to the human voice behaviour is good when using MFCC because the MFCC uses the Mel scale [15]. M. G. Sumithra et al (2012) discussed various feature extraction techniques for text independent speaker identification such as Mel-frequency cepstral coefficients(MFCC), Modified Mel-frequency cepstral coefficients(MMFCC), Bark frequency cepstral coefficients(BFCC), Revised Perceptual liner prediction (RPLP) and linear predictive coefficient cepstrum (LPCC) are implemented and the comparison is done based on performance and computation time. Vector quantization (VQ) codebook has been used for modeling speaker identity. MFCC obtained a very less false rejection rate for the optimum distance minimum value. Also it yields higher identification accuracy [16].

In 2012, Amruta A. Malode et al described the system is able to recognize the speaker by translating the speech waveform into a set of feature vectors using Mel Frequency Cepstral Coefficients (MFCC) technique. Vector Quantization (VQ) is used to make the same number of MFCC coefficients. This paper proposed the idea that the Speaker Recognition system performance can be improved by VQ and HMM. It can improve the accuracy of the system upto 99.99% by more training of data and denoising methods [17]. Fatma zohra Chelali et al (2012) developed a speaker-dependent Arabic phonemes recognition system using MFCC analysis and the VQLBG algorithm. The system is examined with and without vector quantization to analyze the effect of compression in an acoustic parameterization phase. Experimental results show that vector quantization using a codebook of size 16 achieves good results compared to the system without quantization for a majority of the phonemes studied [18]. In 2012, Dr. H. B. Kekre et al. implemented a method using a combination of Mel Frequency Cepstral Coefficients (MFCC) & Kekre's Median Codebook Generation Algorithm (KMCG) for automatic speaker recognition system. The system is implemented as a text-dependent system in which MFCC algorithm is used for feature extraction and codebook generation and feature matching is done using KMCG algorithm. It provides simplicity in implementation and achieves high level of accuracy [19].

N. N. Lokhande et al. (2012) introduced robust features of MFCC for speech recognition in noisy environments. In noisy environments, the performance of MFCC features is degraded. These features further normalized to get new set of features known as Cepstral Mean Normalized (CMN) features. The recognition rate in presence of additive noise is improved using normalized features. Performance of these noise robust features evaluated on own created English digit database using Vector Quantization technique [20].

Genevieve I. Sapijaszko et al (2012) presented a survey that compares and contrasts recent window frames algorithms such as Real Cepstral Coefficients (RCC), Mel Cepstral Coefficients (MFCC), Linear Predictive Cepstral Coefficients (LPCC), and Perceptual Linear Predictive Cepstral Coefficients (PLPCC). These feature extraction methods will be used in conjunction with a Vector Quantization (VQ) method and a Euclidean distance classifier to find the best recognition rate among the feature extraction features. When comparing recognition time, MFCC was faster than all other methods. Overall MFCC in a noise free environment was the best method in terms of recognition rate and recognition rate time [21]. In 2013, A. S. Bhalerao et al proposed an algorithm for implementing automatic speaker recognition system on TMS320C6713 DSP kit using MFCC for feature extraction of the incoming speech signal and Vector Quantization for classification and Euclidean distance between MFCC and trained vectors for speaker identification [22]. Mahmoud I. Abdalla et al (2013) introduced a new method for feature extraction is presented for speech recognition using a combination of discrete wavelet transform (DWT) and mel Frequency Cepstral Coefficients (MFCCs)**.** The objective of this method is to enhance the performance of the proposed method by introducing more features from the signal. The performance of the Wavelet-based Mel Frequency Cepstral Coefficients method is compared to mel Frequency Cepstral Coefficients based method for features extraction [23]. Nisha.V. S. et al (2013) presented a survey on feature extraction and feature matching or modelling techniques that are currently used for Speaker Recognition Systems [24].

In 2013, Shivam Jain et al developed a Text Dependent Automatic Speaker recognition system and it is simulated using MATLAB. The system is trained to store voice of the same person under various physiological conditions such as coughing, shouting, during chewing, mouth covered etc for a better computational efficiency. A dictionary is created to store the signature features of each

user's voice. A neural networks is then trained using back propagation and accordingly weights are obtained to recognize voice in the testing phase. The efficiency of the proposed system is then compared to the system implemented using vector quantization [25].

Shahzadi Farah et al (2013) implemented a speaker recognition system (SRS) using Mel-Frequency Cepstrum Coefficients (MFCC), Linear Prediction Coding (LPC) as feature extraction techniques and Vector Quantization (VQ) as speaker classification technique and investigated the effect of noise and pitch alteration on accuracy of the system. Speaker Recognition System with MFCC and VQ showed better accuracy as compared to Speaker Recognition System with LPC and VQ. The accuracy of speaker recognition decreases with increase of noise and the effect of pitch alteration resulted in lower classification accuracy [26]. Rishiraj Mukherjee et al (2013) introduce a novel method to recognize/identify speakers including a new set of features, the shifted MFCC which allowed inclusion of accent information in the recognition algorithm. The algorithm was evaluated using TIDIGIT dataset and the results showed on the average 10% improvement over the performance of previous works [27].

In 2013, Liu Ting-ting et al proposed a paper which mainly included the study of the text-independent speaker recognition. MATLAB software is used to realize the design of the system. Preprocessing of the speech signal is performed as the initial step. Then the features are extracted which involved differential MFCCs. Pattern match judgment is based on vector quantization (VQ) model. The optimum codebook is generated by LBG algorithm. The identification of the speaker is achieved by calculating the distortion between the reference models and the testing model. The decreased feature parameters is obtained through Fisher criterion, which helps reduce the space complexity. The efficiency of the algorithm is improved on the basis of high recognition rate, which is more than 80% [28].

Amit Kumar Singh et al (2014) presented a performance evaluation of MFCC technique when applied to K means clustering using two experiments. The speech features were directly matched in the first experiment and in the second case, a VQ codebook was created by clustering the training features of the speakers. The recognition rate is determined vitally by the choice of number of clusters. The failure rate of speaker recognition in first case was found to be 10% while in the second case was found to be 14%. A better idea regarding the choice of ideal number of clusters for a better recognition is provided in this paper [29]. In 2014, Zhujianchen et al. introduced a method in which the simulation results show that the hybrid LPCC or MFCC feature extraction has a significant improvement in efficiency based on the speaker recognition among the feature extraction, LPCC and MFCC coefficients for complementary advantage, its integration [30].

Riadh Ajgou et al (2014) derived a scheme to improve the performance of Remote Speaker Recognition System in noisy environment in which feature extraction framework is based on the well-known MFCC and autoregressive model (AR) features since MFCC is a very useful feature for speech processing in clean conditions but it deteriorates in the presence of noise. The use of AR-MFCC approach has provided significant improvements in identification rate accuracy when compared with MFCC in noisy environment. However, in terms of runtime, AR-MFCC requires more time to execute than MFCC [31]. Mandeep Singh Walia (2014) proposed a new method that uses modified Mel Frequency Cepstrum Coefficients (MFCC) using discrete fractional fourier transform for feature extraction and Vector Quantization for feature matching or modeling. Speakers identified with comparison between training and testing speech samples [32].

In 2014, Milind U. Nemade implemented a real time speech recognition system. MFCC is used for designing a text dependent speaker identification system. The DSP processor TMS320C6713 with Code Composer Studio (CCS) has been used for real time speech recognition in this paper. After feature extraction from recorded speech, each Euclidian Distance (ED) from all training vectors is calculated using Gaussian Mixture Model (GMM) as it gives better recognition for the speaker features. The command/voice having minimum ED is applied as similarity criteria [33].

Shanthi Therese S. et al (2015) presented a speaker based Language Independent Isolated Speech Recognition System. The most popular feature extraction technique Mel Frequency Cepstral Coefficients (MFCC) is used for training the system. Representative specific features are identified using K-Means algorithm. Euclidian distance function is used for calculating the Distortion measure. Pitch contour characteristics are used to identify the language specific features. Decision rules are formed to recognize language and speech of the given input [34].

CONCLUSION

Speaker recognition techniques alongside with facial image recognition, fingerprints and retina scan recognition represent some of the major biometric tools for identification of a person. Each of these techniques carries its advantages and drawbacks. The question to what degree each of these techniques provides unique person identification remains largely unanswered. If these methods can provide unique identification then, it is still not clear what kind of parametric representations contain information which is essential for the identification process, and for how long and under what conditions, this representation remains valid? As long as these questions are unanswered, there is a scope for research and improvements.

In this survey paper, a study on different feature extraction and feature matching tecniques for speaker recognition systems have been presented. The LPC features were very popular in the early speaker-identification and speaker verification systems. However, comparison of two LPC feature vectors requires the use of computationally expensive similarity measures such as the Itakura-Saito distance and hence LPC features are unsuitable for use in real-time systems. MFCCs are based on the known variation of the human ear's critical bandwidths with frequency, filters spaced linearly at low frequencies and logarithmically at high frequencies have been used to capture the phonetically important characteristics of speech. Pattern matching is often based on Hidden Markov Models (HMMs), a statistical model which takes into account the underlying variations and temporal changes of the accoustic pattern and other models include Vector Quantization and Dynamic Time Warping is used, this algorithm measures the similarity in between two sequences that vary in speed or time, even if this variation is non-linear such as when the speaking speed changes during the sequence.

REFERENCES:

[1] Yoseph Linde, Andres Buzo and Robert M. Gray, "An Algorithm for Vector Quantizer Design", IEEE Transactions on Communications, vol. com-28, no. 1,pp.84-95, January 1980.

[2] E. H. Wrench, Jr., "A Realtime Implementation of a Text Independent Speaker Recognition System", IEEE International Conference on Acoustics, Speech, and Signal Processing, vol.6,pp.193-196, April 1981

[3] Jialong He, Li Liu, and Gunther Palm, "A New Codebook Training Algorithm for VQ-based Speaker Recognition", IEEE International Conference on Acoustics, Speech, and Signal Processing, vol.2, pp.1091-1094, April 1997.

[4] Izuan Hafez Ninggal & Abdul Manan Ahmad, "The Fundamental of Feature Extraction in Speaker Recognition : A Review", Proceedings of the Postgraduate Annual Research Seminar, pp.435-439, 2006.

[5] Ali Zulfiqar, Aslam Muhammad and Martinez Enriquez A. M., "A Speaker Identification System using MFCC Features with VQ Technique", Third International Symposium on Intelligent Information Technology Application,vol.3, pp.115-118, November 2009.

[6] Li Shaomei, Guo Yunfei, Wei Hongquan "Speaker Recognition via Statistics of Acoustic Feature Distribution", International Conference on Multimedia Information Networking and Security, vol.2, pp.190-192, 2009.

[7] Lindasalwa Muda, Mumtaj Begam and I. Elamvazuthi, "Voice Recognition Algorithms using Mel Frequency Cepstral Coefficient (MFCC) and Dynamic Time Warping (DTW) Techniques", Journal of Computing, vol.2, issue.3, pp.138-143, March 2010.

[8] Vibha Tiwari, "MFCC and its applications in speaker recognition", International Journal on Emerging Technologies, vol.1, issue.,pp.19-22, February 2010.

[9] Zhiyi Qu, Jing Yu, and Qiang Niu, "Pornographic Audios Detection Using MFCC Features and Vector Quantization", IEEE International Conference on Computational and Information Sciences, pp.924-927, December 2010.

[10] Yuan Yujin, Zhao Peihua and Zhou Qun, "Research of Speaker Recognition Based on Combination of LPCC and MFCC", IEEE International Conference on Intelligent Computing and Intelligent Systems, vol.3, pp.765-767, October 2010.

[11] M.Hassan Shirali Shahreza and Sajad Shirali Shahreza, "Effect of MFCC Normalization on Vector Quantization Based Speaker Identification", IEEE International Symposium on Signal Processing and Information Technology(ISSPIT), pp.250-253, December 2010.

[12]Tiwalade O. Majekodunmi and Francis E. Idachaba, "A Review of the Fingerprint, Speaker Recognition, Face Recognition and Iris Recognition Based Biometric Identification Technologies", Proceedings of the World Congress on Engineering, vol.2, pp.1681-1687, July 2011.
[13] Danko Komlen, Tomislav Lombarovic, Mario Ogrizek Tomas, Denis Petek and Andrej Petkovic, "Text Independent Speaker Recognition Using LBG Vector Quantization", Proceedings of the 34th International Convention MIPRO, pp.1652-1657, May 2011.
[14] Supriya Tripathi and Smriti Bhatnagar, "Speaker Recognition", Third International Conference on Computer and Communication Technology, pp.283-287, November 2012.

[15] Jorge Martinez, Hector Perez, Enrique Escamilla and Masahisa Mabo Suzuki, "Speaker recognition using Mel Frequency Cepstral Coefficients (MFCC) and Vector Quantization (VQ) Techniques", IEEE International Conference on Electrical Communications and Computers, pp.248-251, February 2012.
[16] M. G. Sumithra and A. K. Devika, "A Study on Feature Extraction Techniques for Text Independent Speaker Identification", IEEE International Conference on Computer Communication and Informatics (ICCCI), pp.1-5, January 2012.

[17] Amruta A. Malode and Shashikant L. Sahare, "An Improved Speaker Recognition by Using VQ & HMM", IEEE Third International Conference on Sustainable Energy and Intelligent System (SEISCON), pp.377-383, December 2012.

[18] Fatma zohra Chelali and Amar Djeradi, "MFCC and vector quantization for Arabic fricatives Speech/Speaker recognition", IEEE International Conference on Multimedia Computing and Systems, pp.284-289, May 2012.

[19] Dr. H B Kekre, Dr. V A Bharadi, A R Sawant, Onkar Kadam, Pushkar Lanke and Rohit Lodhiya, "Speaker Recognition using Vector Quantization by MFCC and KMCG Clustering Algorithm", IEEE International Conference on Communication, Information & Computing Technology (ICCICT), pp.1-5, October 2012.

[20] N. N. Lokhande, N. S. Nehe and P. S. Vikhe, "MFCC Based Robust Features for English Word Recognition", Annual IEEE India Conference (INDICON), pp.798-801, December 2012.

[21] Genevieve I. Sapijaszko and Wasfy B. Mikhael, "An Overview of Recent Window Based Feature Extraction Algorithms for Speaker Recognition", IEEE 55th International Midwest Symposium on Circuits and Systems (MWSCAS), pp.880-883, August 2012.

[22] A. S. Bhalerao and V. B. Malode, "Implementation of Automatic Speaker Recognition on TMS320C6713 Using MFCC", IEEE International Conference on Computer Communication and Informatics (ICCCI), pp.1-4, January 2013.

[23] Mahmoud I. Abdalla, Haitham M. Abobakr and Tamer S. Gaafar, "DWT and MFCCs based Feature Extraction Methods for Isolated Word Recognition", International Journal of Computer Applications, vol.69, no.20, pp.21-26, May 2013.
[24] Nisha.V. S. and M. Jayasheela, "Survey on Feature Extraction and Matching Techniques for Speaker Recognition Systems", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE),vol.2, issue 3, pp.357-362, March 2013.

[25] Shivam Jain, Preeti Jha and Suresh R., "Design and Implementation of an Automatic Speaker Recognition System using neural and fuzzy logic in Matlab", IEEE International Conference on Signal Processing and Communication (ICSC), pp.319-324, December 2013.

[26] Shahzadi Farah and Azra Shamim, "Speaker Recognition System Using Mel-Frequency Cepstrum Coefficients, Linear Prediction Coding and Vector Quantization", IEEE 3rd International Conference on Computer, Control and Communication (IC4), pp.1-5, September 2013.

[27] Rishiraj Mukherjee, Tanmoy Islam, and Ravi Sankar, "Text Dependent Speaker Recognition Using Shifted MFCC", Proceedings of IEEE Southeastcon, pp.1-4, March 2013.

[28] Liu Ting-ting and Guan Sheng-xiao, "On Text-independent Speaker Recognition via Improved Vector Quantization Method", Proceedings of the 32nd Chinese Control Conference, pp.3912-3916, July 2013.

[29] Amit Kumar Singh, Rohit Singh, Ashutosh Dwivedi, "Mel Frequency Cepstral Coefficients Based Text Independent Automatic Speaker Recognition Using Matlab", International Conference on Reliability, Optimization and Information Technology (ICROIT), pp.524-527, February 2014.

[30] Zhu Jianchen and Liu Zengli, "Analysis of Hybrid Feature Research Based on Extraction LPCC and MFCC", Tenth International Conference on Computational Intelligence and Security, pp.732-735, Nov.15-16,2014.

[31] Riadh Ajgou, SalimSbaa, Said Ghendir, Ali Chamsa and A. Taleb-Ahmed, "Robust Remote Speaker Recognition System Based on AR-MFCC features and Efficient Speech activity

detection Algorithm", 11th International Symposium on Wireless Communications Systems (ISWCS), pp.722-727, August 2014.

[32] Mandeep Singh Walia," Discrete Fractional Fourier Transform and Vector Quantization Based Speaker Identification System", Fourth International Conference on Advanced Computing & Communication Technologies, pp.459-463, February 2014.

[33] Milind U Nemade and Satish K shah, "Real Time Speech Recognition Using DSK TMS320C6713",International Journal of Advanced Research in Computer Science and Software Engineering(IJARCSSE); vol.4,no.1,pp.461-469, January 2014.

[34] Shanthi Therese S., Chelpa Lingam, "Speaker based Language Independent Isolated Speech Recognition System", International Conference on Communication, Information & Computing Technology (ICCICT), pp. 1-7,January 2015.

[35] J. P. Campbell, "Speaker recognition: A tutorial," Proc. IEEE, vol. 85, no. 9, pp. 1437–1462, Sep. 1997.

[36] Sadaoki Furui, "An overview of Speaker Recognition Technology", ECSA workshop on Automatic Speaker Recognition, Identification and Verification, pp.1-9, 1994.

[37] Aleksandra Babich, "Biometric Authentication. Types of biometric identifiers", Bachelor's Thesis Degree Programme in Business Information Technology 2012.

[38] Sujatha K., Nageswara Rao P.V., Rao A.A., Prasad K.R. and Deepthi M.S.B., "Biometric Identity Verification Using Automatic Speaker Recognition", IEEE International Conference on Electrical, Electronics Signals, Communication and Optimization (EESCO), pp.1-5, January 2015.

[39]http://www.usfst.com/article/Demystifying-Voice-Biometrics-The-Future-of-Security-is-Available-Today/cited 21.04.2012.

[40] http://www.technewsworld.com/story/59728.html cited 13.04.2012.

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Graphical Password Scheme: CAPTCHA

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Abstract- Today's, Many security primitives are used for secure user authentication which are mostly based on hard mathematical problems. Using hard AI problems for security is emerging as a new paradigm, but has been underexplored. Captcha as graphical passwords (CaRP) is one of the new security primitive based on hard AI problems which is a novel family of graphical password systems built on Captcha technology. As its name implies that CaRP is the combination of both CAPTCHA and Graphical password scheme. CaRP addresses a number of security problems altogether, it offers reasonable security and usability with some practical applications for improving online security.

Keywords— *CaRP, gimpy, CAPTCHA, Pix ,bongo, graphical password, automated boats.*

I. Introduction

CAPTCHA(pronounced as cap-ch-uh) which stands for ―Completely Automated Public Turing test to tell Computers and Humans Apart". CaRP addresses a number of security problems altogether, such as online guessing attacks, relay attacks, shoulder-surfing attacks etc. CaRP password can be found by guessing it in search set from dictionary. A Fundamental task in security is to create cryptographic primitives based on hard mathematical problems that are computationally intractable. This can be achieved by using graphical passwords along with CAPTCHA. The term Captcha was coined in 2000 by Luis Von Ahn, ManuelBlum, Nicholas J. Hopper It is the word verification test to ensure that the response is only generated by humans and not by a computer .It is mainly used to prevent automated software's (bots) from performing actions on behalf of actual humans. Generally text passwords have been widely used for user authentication, however it is seen that text passwords are insecure for variety of reasons.

As compared to textual passwords ,graphical password schemes are believed to be more secure and more resilient to dictionary attacks. Text Passwords can be found within a fixed number of trials.Captcha is now a standard Internet security technique to protect online email and other services from being abused by bots. The main goal of Captcha is to put forth a test which is simple and straight forward for any human to answer but for a computer it is almost impossible to solve. Usually this test is conducted at the end of a sign up form while signing up for Gmail or Yahoo account. For example free web based e-mail services allow people to create an account free of charge.

II. Materials and methods

A. A Way to Avoid Guessing Attacks

In a guessing attack, number of trials are attempted to enter an password ,a password guess tested in an unsuccessful trial is determined wrong and excluded from subsequent trials. The number of undetermined password guesses decreases with more trials, leading to a better chance of finding the password. Mathematically, let G be the set of password guesses before any trial, p be the password to find, T denote the probability that p is tested in trial T. Let I_n be the set of password guesses tested in trials up to (including) T_n. The password guess to be tested in n-th trial T_n is from set $G \backslash I_{n-1}$, i.e., the relative complement of I_{n-1} in G. If $p \in G$, then we have

$$p\,(T = p \mid T_1 \neq p, \ldots, T_{n-1} \neq p) > p(T = p), \qquad (1)$$

and

$$\left.\begin{array}{l} I_n \rightarrow G \\ p(T = pT_1 \neq p, \ldots, T_{n-1} \neq p) \rightarrow 1 \end{array}\right\} \text{ with } n \rightarrow |G|, \qquad (2)$$

where $|G|$ denotes the cardinality of G. From Eq. (2), the password is always found within $|G|$ trials if it is in G; otherwise G is exhausted after $|G|$ trials. Each trial determines if the tested password guess is the actual password or not, and the trial's result is deterministic.

B. Main Modules

- ***Graphical Password*** :

In this module, Users are having authentication and security to access the detail which is presented in the Image system. User must have to register first to access or search the details, user should have the account in that.

- ***Captica in Authentication****:*

It is efficient to use both Captcha and password in a user authentication protocol, which we call *Captcha-based Password Authentication (CbPA) protocol*, to counter online dictionary attacks after inputting a valid pair of user ID and password, The CbPA-protocol in requires solving a Captcha challenge unless a valid browser cookie is received. For an invalid pair of user ID and password the user being denied access. For this reason user has to cross the challenge of Captcha on or before accessing or searching of some data.

- ***Thwart Guessing Attacks :***

In a guessing attack, a password guess tested in an unsuccessful trial is determined wrong and excluded from subsequent trials. The number of undetermined password guesses decreases with more trials, leading to a better chance of finding the password. To counter guessing attacks, traditional approaches in designing graphical passwords aim at increasing the effective password space to make passwords harder to guess and thus require more trials. No matter how secure a graphical password scheme is, the password can always be found by a brute force attack. In this paper, we distinguish two types of guessing attacks: *automatic guessing attacks* apply an automatic trial and error process but *S* can be manually constructed whereas *human guessing attacks* apply a manual trial and error process.

- ***Security Of Underlying Captcha*****:**

CaRP is Computational intractable in recognizing objects in CaRP images. It is Fundamental to CaRP. It is also necessary to provide security for Captcha, existing analyses on Captcha security were mostly case by case or used an approximate process. No theoretic security model has been established yet. Generally Object segmentation is used for this purpose but it is also considered as a computationally expensive, combinatorially-hard problem, which modern text Captcha schemes rely on.

III. OVERVIEW OF THE TECHNIQUE

There are different types of Captcha depending on the form in which they are presented to the user. The main point to be considered is the pattern in Captcha, it can be Textual Captcha and Graphical Captcha.

- ***Text Based Captcha***

These types of Captcha are simple to implement. This Captcha presents some queries to the user whose answers are only given by users and not by computers or any machines. Examples of such questions are:

1. What are twenty minus three?
2. What is the third letter in UNIVERSITY?
3. Which of Yellow, Thursday and Richard is a color?
4. If yesterday was a Sunday, what is today?

Such type of questions can be answered only by humans, which ensures that no computer program or any boat access them. Other text CAPTCHAs involves text distortions and the user is asked to identify the text hidden. The various implementations are:

a. *Gimpy and Ez-Gimpy*

Gimpy presents a set of words which belongs to dictionary, and displaying them in a distorted and overlapped manner. Gimpy then asks the users to enter a subset of the words in the image. Only human user is capable of identifying the words correctly, whereas a computer program cannot.

Ez-Gimpy is same as Gimpy Captcha,Whereas Ez – Gimpy randomly picks a single word from a dictionary and applies distortion to the text. The user is then asked to identify the text correctly. These two types are adopted by Yahoo in their signup page.

b. *Baffle Text*

This technique overcomes the drawback of Gimpy CAPTCHA because, Gimpy uses dictionary words and hence, clever bots could be designed to check the dictionary for the matching word by brute-force. This is a variation of the Gimpy. This doesn‘t contain

dictionary words, but it picks up random alphabets to create a nonsense but pronounceable text. Distortions are then added to this text and the user is challenged to guess the right word.

- ***Graphical Captcha***

These Captchas includes some sort of pictures or objects with some properties or characteristics that the user have to guess.

a. PIX

PIX is a program that has a large database of labelled images. All of these images are pictures of concrete objects (a horse, a table, a house, a flower). The program picks an object at random, finds six images of that object from its database, presents them to the user and then asks the question "what are these pictures of?" Current computer programs should not be able to answer this question, so PIX should be a CAPTCHA.

b. BONGO

BONGO asks the user to solve a visual pattern recognition problem. It displays two series of blocks, the left and the right. The blocks in the left series differ from those in the right, and the user must find the characteristic that sets them apart.

- **Audio CAPTCHAs**

The Audio Captcha is based on sound. The program picks a word or a sequence of numbers at random, renders the word or the numbers into a sound clip and distorts the sound clip; it then presents the distorted sound clip to the user and asks users to enter its contents. This CAPTCHA is based on the difference in ability between humans and computers in recognizing spoken language. The idea is that a human is able to efficiently disregard the distortion and interpret the characters being read out while software would struggle with the distortion being applied, and need to be effective at speech to text translation in order to be successful.

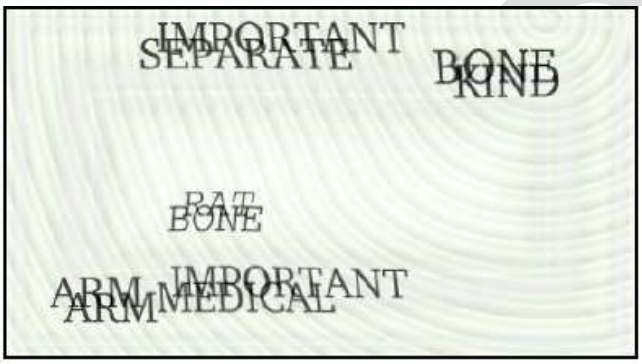

Fig.1 Gimpy Captcha

Fig.2 ez-gimpy captcha

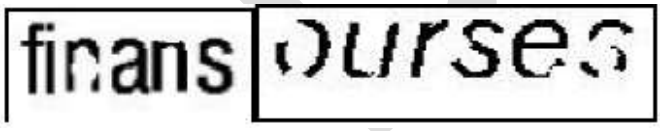

Fig. 3 baffle text captcha.

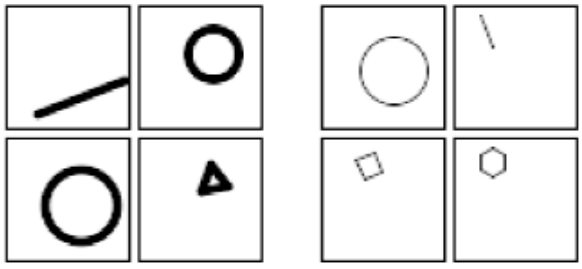

Fig.4 Bongo Captcha

IV. APPLICATIONS

- ***SECURE WEBSITE REGISTRATION.***

Many companies like Yahoo!, Microsoft, etc. offer free email services. Most of these services are not secured as they are suffered from attacks called as bots which leads to sign up for thousands of email accounts every minute. It is not sure that account is created by human; Captchas provides the solution to this problem to ensure that only humans can create their accounts and obtain free accounts.

- ***Protecting Email Addresses From Scrapers.***

Captchas provides the facility in which you can hide your email address from web scrapers. The idea is to require users to solve a CAPTCHA before showing your email address. It is an effective mechanism to protect your email address and its abuse.

- ***Online Polls.***

Now a day, many reality programs are taking their decisions depending on the audience choice. For this reason their votes are collected online. As is the case with most online polls, IP addresses of voters were recorded in order to prevent single users from voting more than once. However, some of people found a way to stuff the ballots using programs that voted for one thousands of times. One of them score started growing rapidly. The next day, another person wrote their own program and the poll became a contest between voting one person and another one. Can the result of any online poll be trusted? Not unless the poll ensures that only humans can vote.

- ***Dictionary Attacks.***

In general password system like text based passwords Dictionary attacks are made to guess the password. CAPTCHAs are used to prevent dictionary attacks in password systems. The idea is simple: prevent a computer from being able to iterate through the entire space of passwords by requiring it to solve a CAPTCHA after a certain number of unsuccessful logins. This is better than the classic approach of locking an account after a sequence of unsuccessful logins, since doing so allows an attacker to lock accounts at will.

- ***Preventing Search Engine from Bots***

Indexed webpages can found easily, however It is sometimes desirable to keep webpages unindexed to prevent others from finding them easily. Search engines bots can be prevented from reading web pages by an html tag. It may work sometimes but not sure that bots won't read a web page. Search engine bots, usually belong to large companies, respect web pages that don't want to allow them in. In this case CAPTCHAs are needed to guarantee that bots won't enter a web site.

- ***Worms and Spam.***

CAPTCHAs also offer a plausible solution against email worms and spam. It means that they will accept the emails only if the email is sent bu human and not by any automated software. This idea is now used by many companies.

V. Conclusion

- It offers reasonable security and usability and appears to fit well with some practical applications for improving online security.
- This threat is widespread and considered as a top cyber security risk. Defense against online dictionary attacks is a more subtle problem thanit might appear.
- This paradigm has achieved just a limited success as compared with the cryptographic primitives based on hard math problems and their wide applications.
- Using hard AI (Artificial Intelligence) problems for security, initially proposed in [17], is an exciting new paradigm. Under this paradigm, the most notable primitive invented is Captcha, which distinguishes human users from computers by presenting a challenge.
- CaRP also offers protection against relay attacks, an increasing threat to bypass Captchas protection. Captcha can be circumvented through relay attacks whereby Captcha challenges are relayed to human solvers, whose answers are fed back to the targeted application. Our future work concentrates on improving the login time and memorability.

REFERENCES:

[1]Bin B. Zhu, Jeff Yan, GuanboBao, Maowei Yang, and NingXu_, ―Captcha as graphical Passwords—A New Security Primitive Based on Hard AI Problems‖IEEE RANSACTION SON INFORMATION ORENSICS AND SECURITY, VOL. 9, NO. 6, JUNE 2014.

[2] Luis von Ahn, Manuel Blum and John Langford.Telling Humans and Computers Apart (Automatically) or How Lazy Cryptographers do AI. To appear in Communications of the ACM.

[3] R. Dhamija and A. Perrig, Deja Vu: A User Study Using Images for Authentication. In the 9th USENIX Security Symposium, 2000.

[4] J. Yan and A. S. El Ahmad. Usability of CAPTCHAs or usability issues in CAPTCHA design. In SOUPS _08, pages 44–52, New York, NY, USA, 2008..ACM.

[5] Greg Mori and Jitendra Malik.Breaking a Visual CAPTCHA. Unpublished Manuscript, 2002.

[6] K. Barnard, P. Duygulu, D. Forsyth, N. de Freitas, D. Blei, and M. Jordan. Match-ing words and pictures. Special Issue on Text and Images, Journal of Machine Learning Research, 3:1107{1135, 2002.

[7] Pdictionary. The internet picture dictionary. http://www.pdictionary.com, 2004.

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Experimental Investigations of Nappe Profile and Pool Depth for Broad Crested Weirs

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ABSTRACT- There are relatively few investigations for computing the required stilling basin length for broad weirs structures. This length is mainly divided into two parts, the first one is the length at which the falling nappe strikes the basin floor "Drop Length", and the second part is the hydraulic jump length. This research work deals mainly with the determination of the drop length and some characteristics of free-nappe in case of broad crested weirs. Theoretical and experimental studies were carried out for smooth horizontal rectangular channel having subcritical approaching flow condition. The experiments for different models were carried out using different values of discharge per unit width (q) in Lit./sec./m to determine the brink depth (h_e) in cm, the average pool depth beneath the nappe (h_p) in cm, the upstream water depth over the upstream channel bed (h_o) in cm, the horizontal length of lower nappe profile (L_L) in cm, the horizontal length of upper profile (L_u) in cm, and the upper nappe angle with the stilling basin floor (φ) in degrees. Experimental results of the present investigation were represented in the form of tables and graphs. Comparative study between other research works and both the suggested design formulae and experimental results of this investigation was performed.

Key words: Broad crested weirs, Nappe profile, Drop length, Subcritical flow.

1. INTRODUCTION

The water velocity downstream the drop is relatively high and the excessive amount of kinetic energy carried in the flow may be of danger to the outlet structure or its surroundings. A drop structure-stilling basin is used to change the exit supercritical flow downstream the drop to a subcritical state by both the jump and circulation in pool beneath the nappe Abdul (Abdul Khader et. al., 1970).

The drop structure may be low or high, Little and Murphey (1982) defined the low drop as the drop, in which the relative drop height (P/h_c) (P = drop height, h_c = critical depth) is equal to or less than one, conversely a high drop is the one with a relative drop height greater than one.

The problem of the free overfall has attracted considerable interest for almost 70 years, and a large number of theoretical and experimental studies has been carried out by many investigators. outstanding contributors to the present field are Rouse, Diskin, Smith, Rajaratnam and Muralidhar, Schwartz, Bauer and Graf, Neogy, Kraijenhoff and Dommerholt, Naghdi and Rubin , Little and Murphey, Tung and Mays , Keller and fong, Terzidis and partheniou, Gupta et al., Ferro, and Dey. (Chamani and Beirami, 2002)

Donnelly and Blaisdaell (1965) presented a significant work on vertical drop spillway stilling basin. Hager (1983) used an analytical approach to solve the Bernoulli equation, extended to take account of curvature effects, and applied it to a rectangular free overfall. Bohrer et al. (1998) predicted the velocity decay of free falling jet while the energy loss at free overfall was discussed by Rajaratnam and Chamani (1995).

Numerical solutions include the works of Chow and Han, Khan et al., and Davis et al.

Ali and Sykes (1972) applied free vortex theory to free overfall in rectangular, triangular, and parabolic channels while Marchi (1993) used a relaxation method to integrate the potential flow equations and obtained solutions for the nappe profile and upstream profile in rectangular free overfall.

Recently, Watson et al. (1998), and Rajaratnam (1998) presented the aeration performance of free falling jet.

Abdul Khader et. al., (1970). Stated that Birkhoff in 1961 presented a brief survey of the approximate methods available for solving the free surface problems in which boundary layer separation is not likely to play an important role, the employed methods are: 1- Relaxation technique; 2- Complex function theory and conformal mapping technique; 3- Conformal mapping and singularity distribution; 4- Matching technique (inner and outer expansion); and 5- Electrolytic model.

Hydraulics of Falling Jet: The brink section divides the flow into the upstream zone, bounded by the channel with straight bottom, and the unbounded downstream jet zone. Two types of jets have been evaluated, a fully air entrained developed jet and non-aerated undeveloped one. The free overfall studies have been restricted to jets with atmospheric pressure conditions on both the upper and lower boundaries (Dey and Kumar, 2002)

Drop Length: Donnelly and Blaisdaell (1965) deduced a theoretical equation to compute the vertical drop stilling basin length. They presented a design chart to determine the drop length. (Ferro, 1992)

The following types of nappe are classified according to the extent of vacuum and ventilation, Fig. (1):

Free nappe: the atmospheric pressure exists beneath the nappe. The discharge through this type of nappe is the same as given by the theoretical analysis.

Depressed nappe: the nappe is partially ventilated, the negative pressure below the nappe tried to drag the lower portion of the nappe. The discharge of the nappe depends upon the amount of ventilation and the negative pressure. Generally, the discharge of this type of nappe is 6% to 7% more than that of a free nappe.

Clinging nappe: in this type of nappe where no air is left below the water and the nappe clings to the wall of the drop. The discharge over such drop is 25% to 30% more than that of a free nappe.

Drowned nappe: this type of nappe occurs under high heads when there is practically no ventilation. The entire space between the lower face of the nappe and the drop is filled with eddying mass of water. The discharge is 10 to 20 percent more than that in a free nappe.

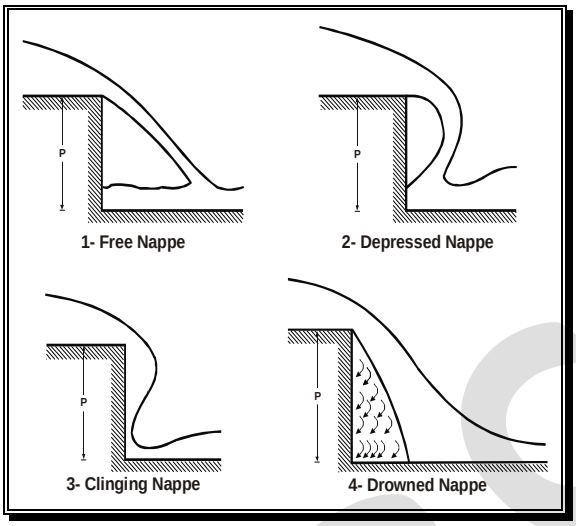


Fig. (1): Types of nappe (after, Arora, 1973).

2. THEORITICAL APPROACH

The flow over broad crested weirs is analyzed by the one-dimensional momentum equation and Newton's laws of motion in smooth prismatic horizontal channel. The horizontal distance from the crest of weir to the point at which the nappe strikes the stilling basin floor is termed as the drop length, (L_d). For computing the drop length, the momentum equation is applied between the upstream section and the brink section, the following assumptions are considered:

- The case of ventilated jet into the downstream zone is considered.

- The pressure distribution at the upstream section is hydrostatic.

- The pressure at the brink section is zero.

- The horizontal component of the velocity at the beginning of jet is the effective amount, while the vertical component is neglected.

- The coefficient of non-uniform velocity distribution, the energy coefficient ($\alpha = 1.0$) and the momentum coefficient ($\beta = 1.0$).

- The crest width, $\delta \geq 4h_1$, (h_1 = water depth over the weir crest).

According to these assumptions, for one-dimensional flow, the theoretical relationships for the average drop length, (L_d) will be deduced.

On the basis of previous assumptions, the conservation of momentum in x-direction between section I-I and section II-II, Fig. (2), can be applied as:

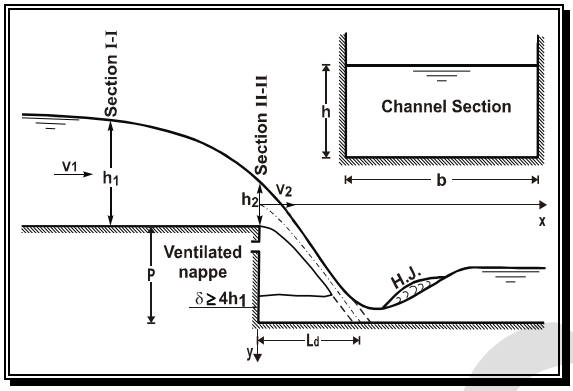


Fig. (2): Broad crested weir.

$$F_1 - 0.0 = \rho Q(V_2 - V_1) \quad (1)$$

$$F_1 = \frac{1}{2}\gamma\, b h_1^2 \quad (2)$$

Substituting Eqn. (2) into Eqn. (1) noting that (Q = q*b) and ($\rho = \gamma/g$), Eqn. (1) becomes:

$$\frac{1}{2}\gamma\, b h_1^2 = \frac{\gamma}{g} q\, b(V_2 - V_1) \quad (3)$$

Eliminating (γ) and (b) from Eqn. (3), the following equation is obtained:

$$\frac{q}{g}(V_2 - V_1) = \frac{h_1^2}{2} \quad (4)$$

from the continuity equation in rectangular channel where: ($V_1 = q/h_1$), then Eqn. (4) will be:

$$V_2 = \frac{2q^2 + g h_1^3}{2 q h_1} \quad (5)$$

using Newton's laws of motion for a particle at the point of intersection of axes, Fig. (2), the following equations hold:

$$X = V_2\, t \quad (6)$$

$$Y = \frac{1}{2} g\, t^2 \qquad (7)$$

Substituting Eqn. (7) into Eqn. (.6) for (t) value gives:

$$X = V_2 \sqrt{\frac{2Y}{g}} \qquad (8)$$

$$Y = P + \frac{h_2}{2} = P + \frac{q}{2V_2} \qquad (9)$$

Substituting Eqn. (5) into Eqn. (9) yields:

$$Y = P + \frac{q^2 h_1}{2q^2 + g h_1^3} \qquad (10)$$

Substituting Eqns. (5) and (10) into Eqn. (8) using the boundary condition ($X = L_d$) yields:

$$\mathrm{L_d} = \frac{2q^2 + g h_1^3}{2q h_1} \sqrt{\frac{2}{g}\left(P + \frac{q^2 h_1}{2q^2 + g h_1^3} \right)} \qquad (11)$$

If section I-I is considered critical then:

$$\mathrm{h_1} = h_c = \sqrt[3]{\frac{q^2}{g}} \qquad (12)$$

$$\mathrm{V_2} = 1.5\sqrt{\mathrm{g h_c}} \qquad (13)$$

Substituting Eqns. (12) and (13) into Eqn. (3.11) and simplifying:

$$\boxed{L_d = 2.12\sqrt{h_c\left(P + 0.33 h_c\right)}} \qquad (14)$$

Multiply Eqn. (14) by a drop length correction coefficient (C_L) to compensate the effects of previous assumptions yields:

$$L_d = 2.12 C_L \sqrt{h_c\left(P + 0.33 h_c\right)} \qquad (15)$$

Equation (15) is the final relationship, which represents the average drop length in case of flow over broad crested weir.

It is assumed that the dependent variable drop length, (L_d), Fig. (2) is a function of the following independent variables: the drop height (P), the upstream water depth over the weir crest (h_1), the velocity at section I-I (V_1), the acceleration of gravity (g), the mass density (ρ), the surface tension (σ), and the dynamic viscosity (μ).

The general function relationship between the above variables can be written as:

$$f\left(L_d, P, h_1, V_1, g, \rho, \sigma, \mu\right) = 0.0 \qquad (16)$$

The number of variables is eight, these variables contain three dimensions, length, (L), Mass, (M), and, time, (T). The selected repeated

variables are (h_1, V_1, and ρ). The number of π-terms equal to five and are made up as:

$$\pi_1 = h_1^{x_1}\, V_1^{y_1}\, \rho^{Z_1}\, L_d^{-1} \qquad (17)$$

$$\pi_2 = h_1^{x_2}\, V_1^{y_2}\, \rho^{Z_2}\, P^{-1} \qquad (18)$$

$$\pi_3 = h_1^{x_3}\, V_1^{y_3}\, \rho^{Z_3}\, g^{-1} \qquad (19)$$

$$\pi_4 = h_1^{x_4}\, V_1^{y_4}\, \rho^{Z_4}\, \sigma^{-1} \qquad (20)$$

$$\pi_5 = h_1^{x_5}\, V_1^{y_5}\, \rho^{Z_5}\, \mu^{-1} \qquad (21)$$

The variables pertinent to the analysis are put for convenience in non-dimensional form by the following function:

$$f\left(\pi_1, \pi_2, \pi_3, \pi_4, \pi_5\right) = 0.0 \qquad (22)$$

$$f_1\left(\frac{1}{\pi_1}, \frac{1}{\pi_2}, \sqrt{\pi_3}, \pi_4, \pi_5\right) = 0.0 \qquad (23)$$

$$f_1\left(\frac{L_d}{h_1}, \frac{P}{h_1}, \frac{V_1}{\sqrt{gh_1}}, \frac{\rho h_1 V_1^2}{\sigma}, \frac{\rho h_1 V_1}{\mu}\right) = 0.0 \qquad (24)$$

the surface tension (Weber number, $W = \rho h_1 V_1^2/\sigma$) has a negligible effect due to the dimensions of the flume.

Reynolds number ($R_e = \rho h_1 V_1/\mu$) in all runs is bigger than (2000), turbulent flow then the effect of viscosity could be neglected. If the upstream water depth over the crest is considered critical depth then the value of ($Fr_o = V_1/\sqrt{gh_1}$) is equal to unity then Eqn. (24) may be written as:

$$\frac{L_d}{h_c} = f_2\left(\frac{P}{h_c}\right) \qquad (25)$$

Equation (25) represents the drop length is dimensionless form (L_d/h_c) as a function of relative drop height (P/h_c).

3. EXPERIMENTAL WORK

The present experiments were conducted in a rectangular flume with a mild slope of 0.40 m wide, 0.40 m deep, and 12.0 m long, with 2.0 m long Perspex sides, **Fig. (3),** in irrigation and hydraulics laboratory of the faculty of engineering, El-Mansoura University.

Fig. (3): The Apparatus view.

The experimental work in this study was performed on two groups of models with different shapes. These models were made of wood at the faculty workshop and painted several times to be watertight.

***The first group*:** *Consists of four models with different heights for the broad crested weir.*

***The second group*:** *Consists of three models with different slopes for the downstream side of broad crested weir.*

Aeration was provided to the downstream face of the model by means of an orifice of diameter 19 mm approximately, connected with a hose and located near the top of the model face. The definition sketches for these groups of models are shown in Figs. (4) to (5).

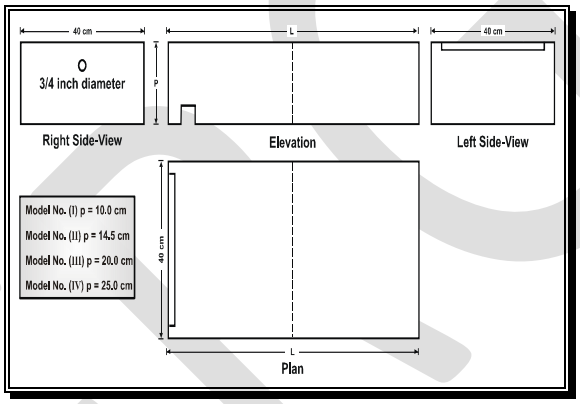


Fig. (4): Definition sketch for the first group of broad crested weir.

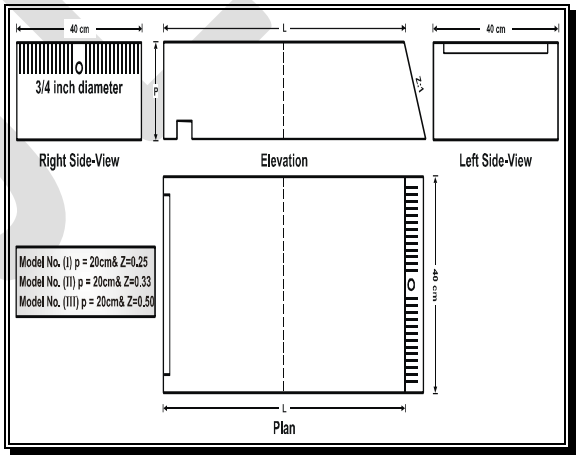


Fig. (5): Definition sketch for the second group of broad crested weir with an inclined downstream face.

Data of the first group

Model No.		Model Height	Model Width b (cm)	Model Length L (cm)
First Group	1	10.0	40	100
	2	14.5	40	100
	3	20.0	40	100
	4	25.0	40	100

Data of the second group

Model No.		Model Height P (cm)	Model Width b (cm)	Model Length L (cm)	Inclination Z : 1
Third Group	1	20.0	40	95.00	0.25 : 1
	2	20.0	40	93.33	0.33 : 1
	3	20.0	40	90.00	0.50 : 1

Experimental Preparation

The experiments were performed using different models with different values of discharge to determine the following items, Fig. (6):

- The horizontal length of lower nappe profile, L_L.
- The horizontal length of upper nappe profile, L_u.
- The average drop length, L_d.
- The brink depth, h_e.
- The upstream water surface profile.
- The upper nappe angle, φ.
- The average pool depth beneath the nappe, h_p.

Eight runs were carried out for every model with a discharge ranged from (3 to 20) Lit./sec. During these runs, the flow was subcritical and the nappe was ventilated.

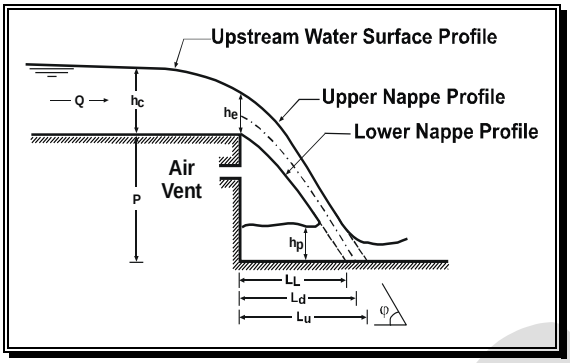


Fig. (6): Definition sketch for models.

Experimental Procedure

1- A steady flow of water over the weir is established.
2- Care is taken to ensure that the nappe is ventilated.
3- The discharge is measured using the flow meter and the stopwatch.
4- The upper nappe profile, the lower nappe profile, and the pool profile beneath the nappe are drawn on the millimeter translucent paper.
5- The upstream water surface profile along the centerline of the model is determined by using the movable point gauge at 5.0 cm intervals, starting from the crest of the weir and proceeding upstream.
6- Fluctuation of the water surface is observed during the experimental work. To obtain a proper depth, the reading of the point gauge is adjusted so that the point is submerged and exposed for equal intervals of time at the water surface.
7- After completion of the experiment, another model is placed in the flume and the experiment is repeated.

4. RESULTS AND ANALYSIS

Nappe profiles

The upper nappe profile, the lower nappe profile, and pool profile beneath the nappe were obtained from the experimental work for all groups.

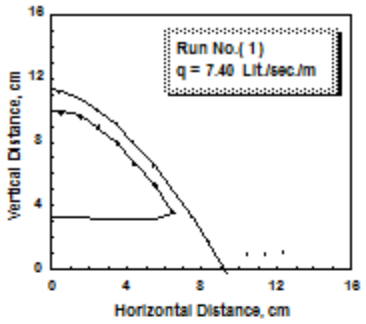
All of these nappe profiles are illustrated in this section in order to calculate the horizontal length for upper and lower nappe profiles and the average drop length (L_d). eight runs for every model were carried out using different discharges.

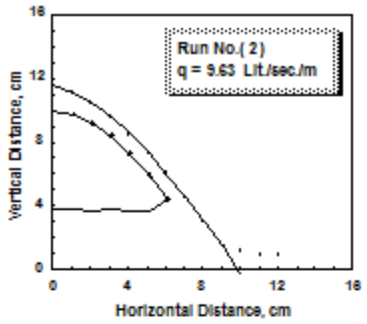
During the experimental work, it was noticed that the oscillations in the pool profile beneath the nappe were decreased in the first group with vertical downstream face, while these oscillations were increased in second group with inclined downstream face. This is mainly due to the area of ventilation under the nappe profile.

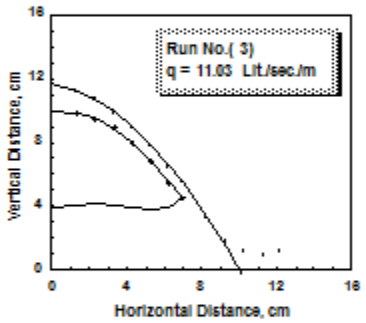
Figs. (7) to (10) present the nappe profiles in case of first group.

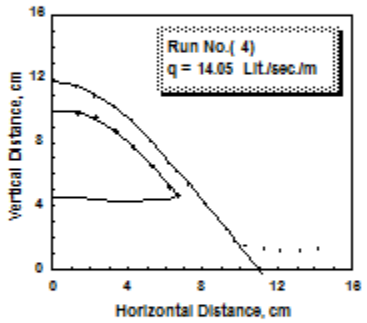
Figs. (11) shows the nappe profiles in case of broad crested weir with the maximum inclined downstream face (second group) in case of model No. (III), P = 20.0 cm, Z = 0.50 only.

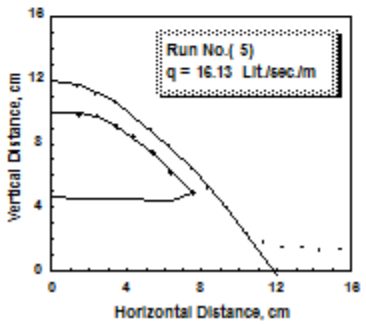
The best fitting for the experimental data shown in these figures is the third order polynomial equations for the upper and lower nappe profiles.

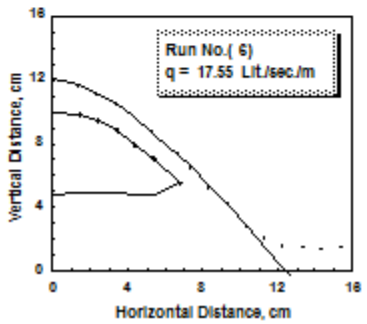


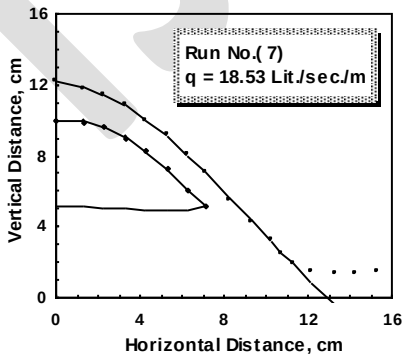












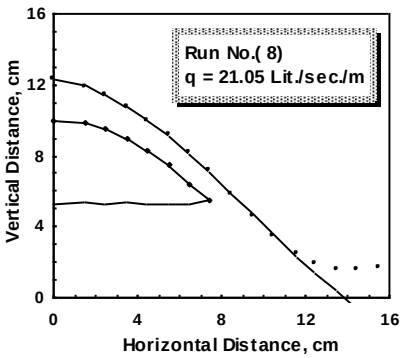


Fig. (7): Nappe profiles for the first group of broad crested weir (Model No. (I), P = 10.0 cm).

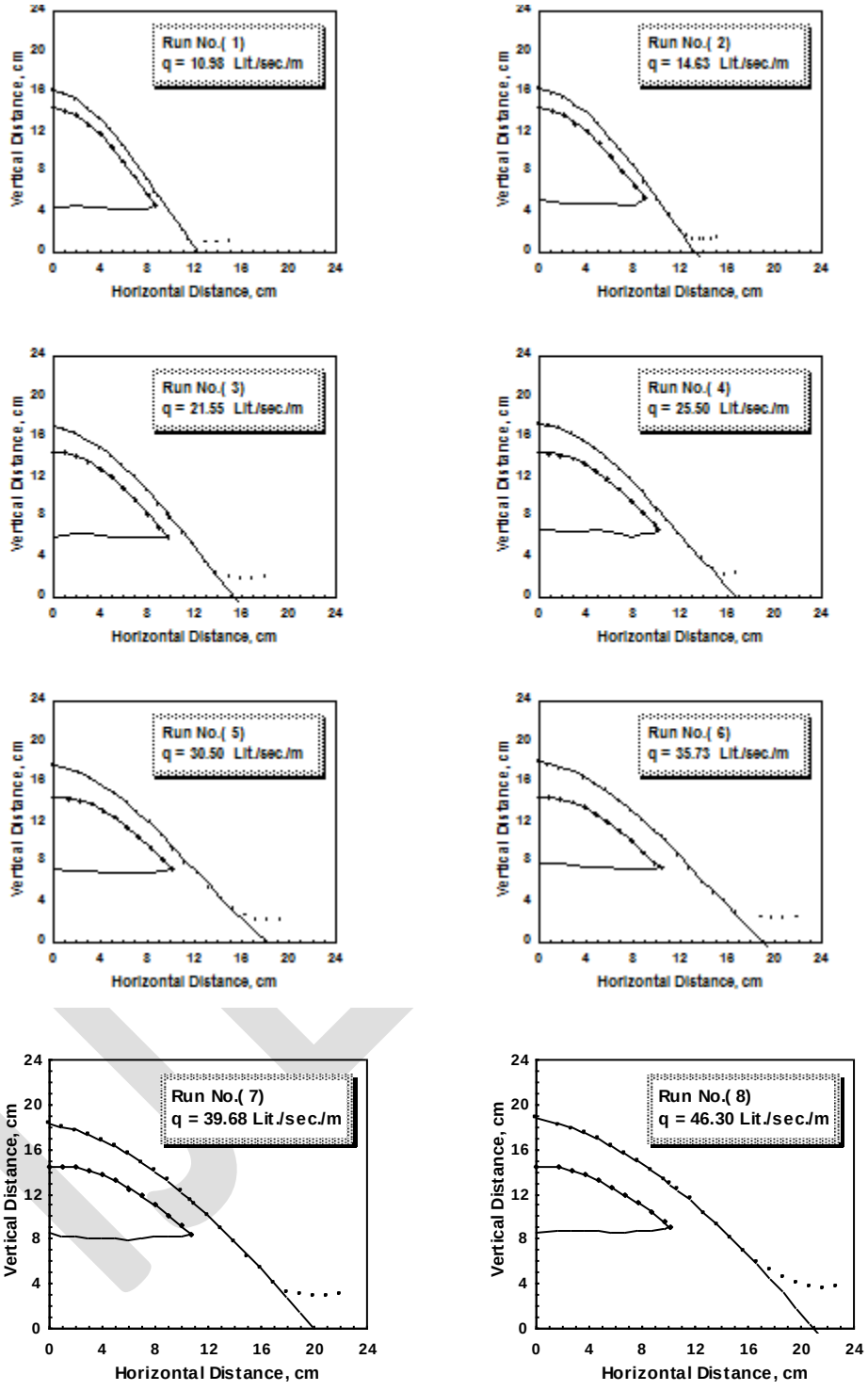


Fig. (8): Nappe profiles for the first group of broad crested weir (Model No. (II), P = 14.5 cm).

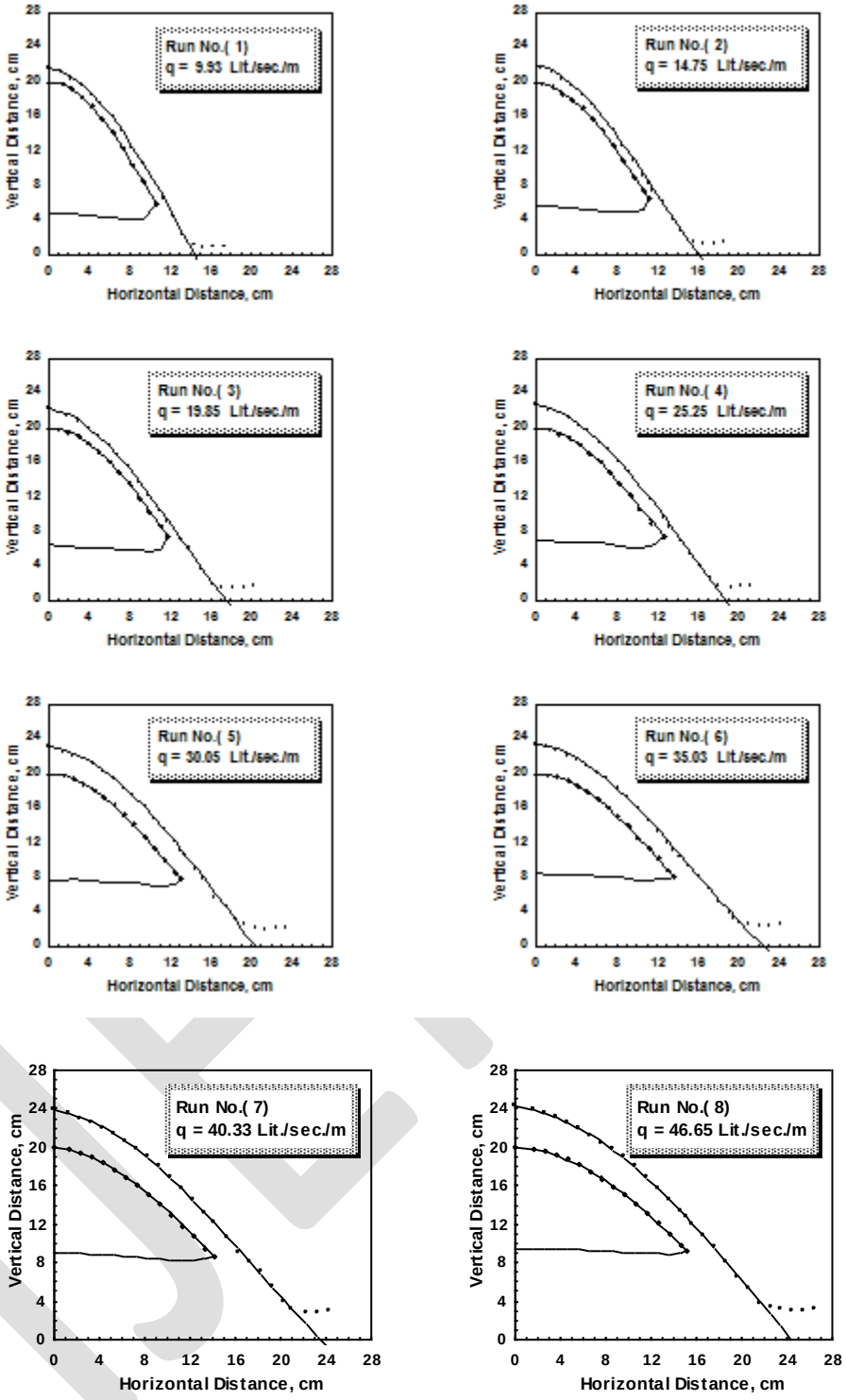


Fig. (9): Nappe profiles for the first group of broad crested weir

(Model No. (III), P = 20.0 cm)

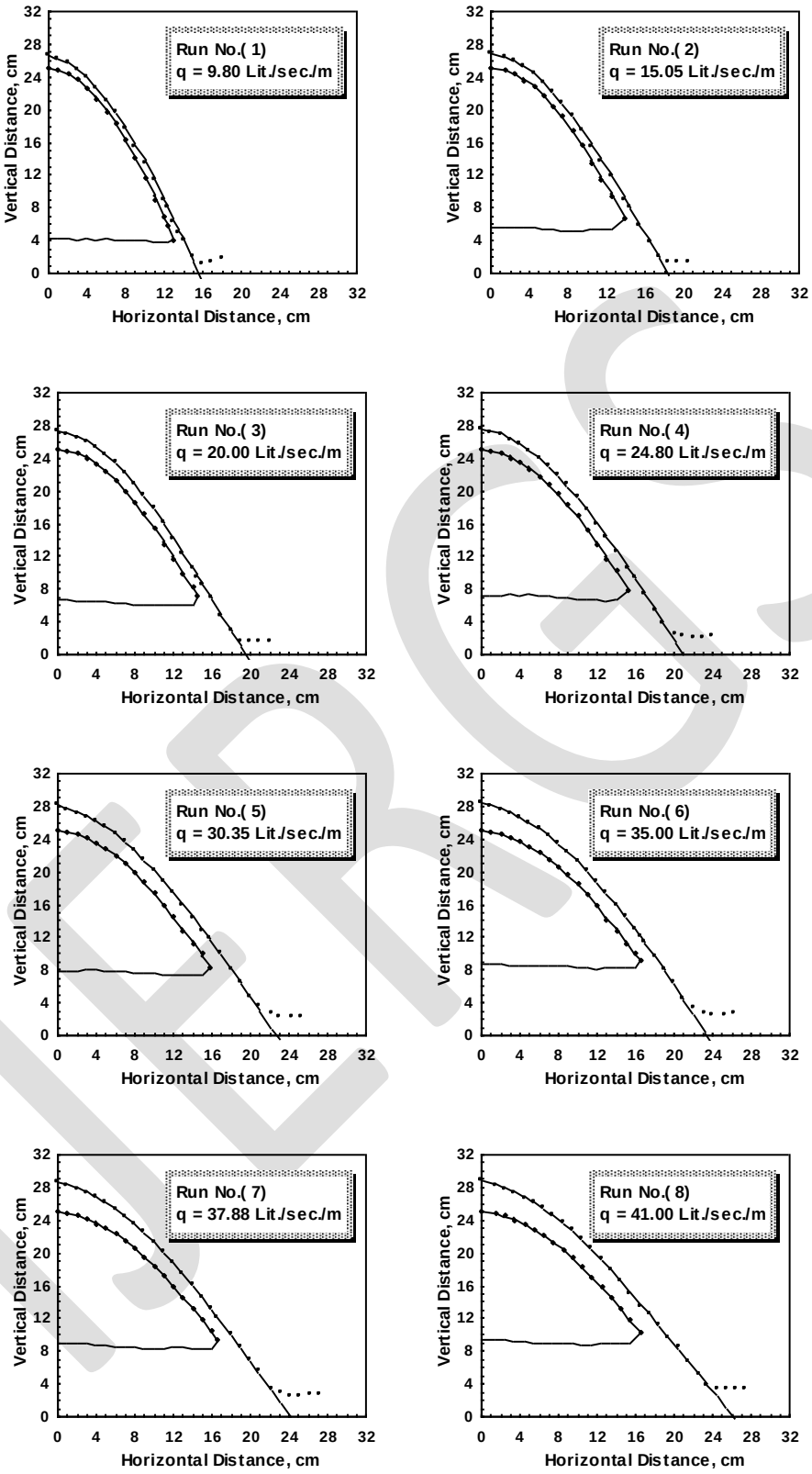


Fig. (10): Nappe profiles for the first group of broad crested weir (Model No. (IV), P = 25.0 cm).

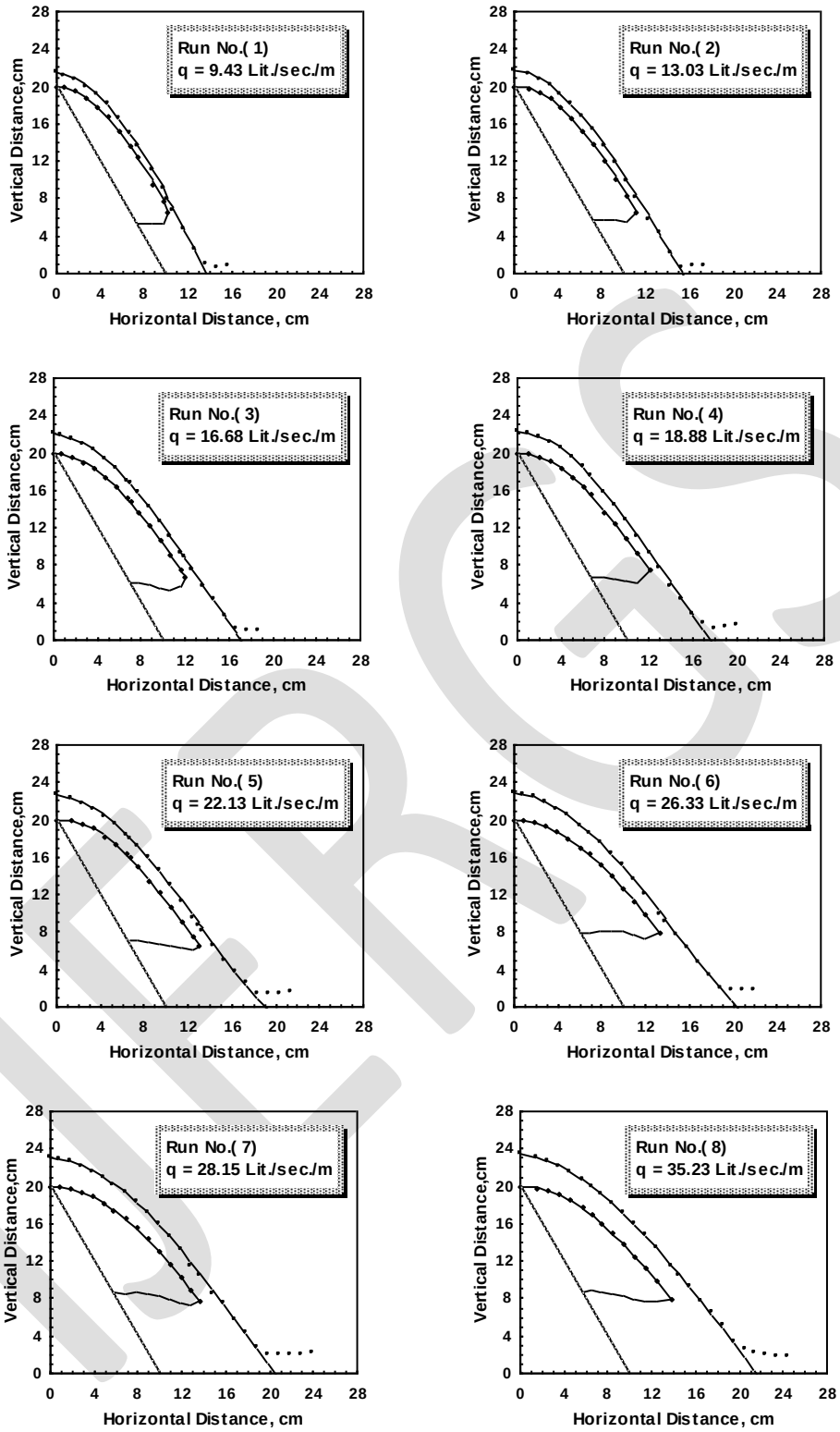


Fig. (11): Nappe profiles for the second group of broad crested weir with an inclined downstream face (Model No. (III), P = 20.0 cm, Z = 0.50).

Drop length

In Eqns. (15), the coefficient (C_L) is presented to cover the total effects of the theoretical assumptions. Fig. (12), shows the experimental drop length versus the calculated one for the first group of broad crested weir. In this figure, the linear correlation passes through the origin is used and from this correlation, the coefficient (C_L) is obtained, it is equal to 0.95 for broad crested weirs. According to these values of (C_L), could be written as follows:

$$L_d = 2.014\sqrt{h_c\left(P + 0.33h_c\right)} \qquad (6.1)$$

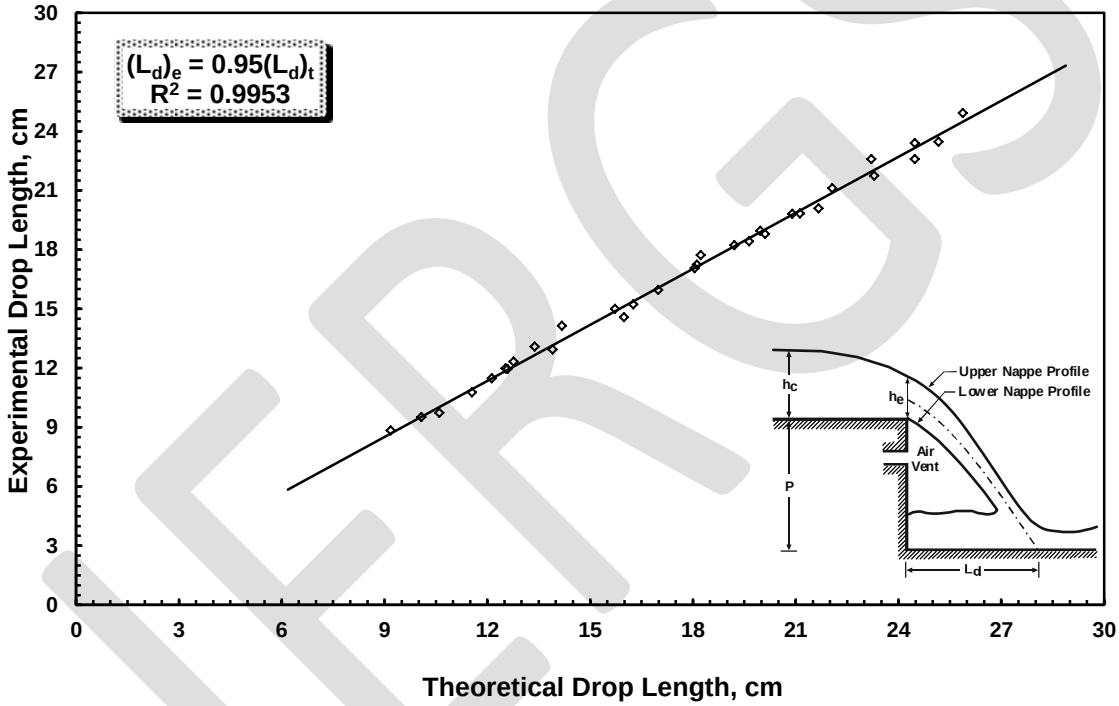


Fig. (12): Experimental drop length $(L_d)_e$ versus theoretical drop length $(L_d)_t$ for broad crested weir (First Group).

5. CONCLUSIONS

This study concerns with the determination of average drop length and some characteristics of nappe and brink section for broad crested weirs. For a horizontal smooth rectangular channel, the experimental investigations were carried out under specific conditions such as a free nappe, which occurred when the atmospheric pressure exists beneath the drop; different discharges; different model dimensions and shapes; subcritical approaching flow; and no tail-water effect.

Two groups of models were made; the first group having height of 10, 14.5, 20 and 25 cm; the second group for broad crested weir with an inclined downstream face with slopes of 1:2, 1:3, and 1:4 and all of these slopes having 20 cm height

Based on theoretical approach, under specific assumptions, an equation, which compute the average drop length for the broad crested weir was developed.

The experimental drop length in all cases of this study was less than that given by the theoretical equations by an average difference ranged from 5% to 7%. This difference is mainly due to the assumptions used for the derivation of the theoretical equation. A coefficient, C_L (drop length correction coefficient) was determined from the comparison between the theoretical and experimental results and its value was found equal to 0.95.

REFERENCES:

[1] Abdul Khader, M.H., and Rao, H.S., (1970) "Discussion of "pattern of potential flow in a free overfall", by Theodor Strelkoff and Mohammed S. Moayeri, Journal of the Hydraulics Division, ASCE, Vol. 96, No.11, pp. 2397-2398.

[2] Ali, K.H.M., and Sykes, A., (1972) "Free-Vortex Theory Applied to Free Overfalls", Journal of the Hydraulics Division, ASCE, Vol. 98, No.5, pp. 973-979.

[3] Arora, K.R., (1973) "Fluid Mechanics, Hydraulics, and Hydraulic Machines", Standard Publishers Distribution, Nai Sarak, Delhi.

[4] Bohrer, J.G., Abt, S.R., and Wittler, R.J., (1998) "Predicting Plunge Pool Velocity Decay of Free Falling Rectangular Jet", Journal of Hydraulic Engineering, ASCE, Vol. 124, No. 10, pp. 1043-1048.

[5] Chamani, M.R., and Beirami, M.K., (2002) "Flow Characteristics at Drops", Journal of Hydraulic Engineering, ASCE, Vol. 128, No.8, pp. 788-791.

[6] Dey, S., and Kumar, B.R., (2002) "Hydraulics of Free Overfall in Δ-Shaped Channels", Sadhana, Vol. 27, Part3, pp. 353-363.

[7] Donnelly, C.A., and Blaisdaell, F.W., (1965) "Straight Drop Spillway Stilling Basin", Journal of the Hydraulics Division, ASCE, Vol. 91, No.3, pp. 101-131.

[8] Ferro, V., (1992) "Flow Measurement with Rectangular Free Overfall", Journal of Irrigation and Drainage Engineering, ASCE, Vol. 118, No.6, pp. 956-964.

[9] Hager, W.H., (1983) "Hydraulics of Plane Free Overfall", Journal of Hydraulic Engineering, ASCE, Vol. 109, No.12, pp.1683-1697.

[10] Little, W.C., and Murphey, J.B., (1982) "Model Study of Low Drop Grade Control Structures", Journal of the Hydraulics Division, ASCE, Vol. 108, No. 10, pp. 1132-1146.

[11] Marchi, E., (1993) "On the Free Overfall", Journal of Hydraulic Research, IAHR, Vol. 31, No.6, pp.777-790.

[12] Rajaratnam, N., and Chamani, M.R. (1995) "Energy Loss at Drops", Journal of Hydraulic Research IAHR, Vol. 33, No.3, pp. 373-384.

[13] Watson, C.C., Walters, R.W., and Hogan, S.A., (1998) "Aeration Performance of Low Drop Weirs", Journal of Hydraulic Engineering, ASCE, Vol. 124, No.1, pp. 65-71.

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Coconut Husk Mini-Chipper Machine

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Abstract- The study focuses on the design and fabrication of a coconut husk mini-chipper machine which can contribute and improve the lives of farmers and the competitiveness of micro-scale coconut industries particularly in rural areas.

The machine is connected into a cold roll shaft and utilizes a 6hp diesel engine generator. This is used to produce chips out of coconut husk and utilized as a potting medium for gardeners and orchids enthusiasts.

This has been developed to further improve the utilization of the coconut husks into a productive used which are commonly ignored by most of the farmers in the rural areas. By adapting this machine, farmers can earn more from coconut husks and become competitive in coconut husk industries.

The average coconut husks processed by the mini-chipper machine is 282 pcs in an hour while the volume of coconut husk chips produced has an average of 155 kilogram in an hour. The diesel used for an hour is 0.72 liters

Normally, the 282 pcs of coconut husks should have an approximate weight of 169 kg but from the data above it produced 155 kg which is almost 92% chips and 8% waste or dust. This proves that the machine is efficient. (Note: average weight of *coconut husk in Lucban, Quezon is about 0.6 kg).*

The machine obtained an overall acceptability mean rating of 4.9 and interpreted as Very Highly Acceptable. It means that Mini-Chipper is technically and operationally acceptable. This machine is considered very useful and significant to the end users specifically to the farmers who can earn more profit from processed coconut husks.

Keywords: coconut husks, mini chipper, machine, potting

Introduction

Most of the farmers in the rural areas were not aware the importance of the coconut husks. They usually leave the coconut husks as a waste after harvesting the coconut and send it into the market wherein they do not realized that their wastes are something that can contribute and improve their lives and the competitiveness of micro-scale coconut industries particularly in rural areas.

In consideration of the above observation, the researcher proposed a machine that can be very useful to turn the wastes into money. He initiated the designed and development of the coconut husk mini-chipper machine which can process the coconut husk into a very useful chips that can be sold to the market and used it as a potting medium for orchids and other ornamental plants.

This study was focused on the fabrication, testing and evaluation of an coconut husk mini-chipper machine. The efficiency of a coconut husk mini-chipper machine was limited to processing the coconut husks into chips. The study also includes determination of the capacity of the machines in processing coconut husk within a period of time and its energy requirements for the operation.

The drying, baling, softening, bleaching, dyeing, analysis of fibers and chemical compositions of the coconut husks were not included in this study

Research Objectives

This project was focused on the development of a coconut husk mini-chipper machine.

Specifically, it aimed to achieve the following objectives:

1. To design a machine for chipping the coconut husks.
2. To fabricate the coconut husk mini-chipper machine
3. To test the output performance and efficiency of the coconut husk mini-chipper machine in terms of coconut husk chips produced

4. To evaluate the acceptability of the coconut husk mini-chipper machine based on the following criteria:
   a. Functionality
   b. Adaptability
   c. Cost Effectiveness
   d. Originality

Related Literature and Studies

According to Bob and Wellenstein (2012), in order to grow a good root system on a Paph you need to balance a number of things. Roots need adequate aeration, firm anchoring (wobbly plants' roots will have their sensitive growing tips damaged/destroyed), adequate supply of moisture without remaining too wet too long (which eliminates adequate aeration), adequate and properly balanced mineral nutrition without excess, reasonable temperatures, and a suitable pH in their surroundings. Because paphs do depend on root hairs for water and mineral uptake, it is important to grow new roots frequently as the effectiveness of root hair uptake does diminish with age.

They mentioned two medium components that defy logic and have the capacity to hold large amounts of air and water simultaneously.

The first is New Zealand sphagnum moss used alone. NZ sphagnum will simultaneously hold more water and more air than almost any other potting medium commonly available if kept loosely packed. They experienced that it was a very good medium for temporary root recovery culture of the acid substrate Paphiopedilums, but they have not found it to be particularly good for long term culture.

The second was coconut husk chips. While holding approximately the same level of air immediately after watering and as it dried out over a 5-day period in 2.5-inch rose pots; it also held substantially more water. After six months under greenhouse conditions, fine fir bark had broken down and dramatically lost its air holding capacity and stayed quite soggy, while the small coconut husk performed essentially as it did when new.

According to them, one of the most encouraging signs that the plants like the coconut husk chips is that when they unpot them, all of the new roots are attaching themselves firmly to the cut fiber end of the husk chunks, as if they are seeking out their personal water and nutrient reservoirs(*ladyslipper.com/coco3.htm).*

Terry (2012) of eHow Contributor mentioned that Orchids are bright, elegant plants and are available in a wide range of species and cultivars. All orchids do best with soft, indirect lighting and good air movement, and need loose, organic potting media. Plant or re-pot orchids in airy foundations, like coconut husks, to guarantee quick drainage and good air circulation around the roots (http://www.ehow.com/how_8623523_use-coconut-husk-chips-orchids.html).

The Metals Industry Research and Development Center (MIRDC) mentioned that the decorticator is a machine that separates coco fibers (coir) from coconut husk through crushing action of multiple replaceable blades with holder. The holder is strategically welded on the main shaft (rotating drum) . The design configuration of blades cause the rapid separation of fibers and dust as the husks are crushed against a set of fixed counter blades arranged horizontally and parallel to the axes of the decorticating blades. Fibers and dust are discharged in separate outlets (http://www.mirdc.dost.gov.ph/index.php/available-technologies-mainmenu-68/144-decorticating.html).

On the article of Madel R.S. posted in Manila Bulletin (2008), stated that DOST developed versatile machines for coconut products. These new machines can process coconut-husk based products, including one which can produce geotextiles for erosion and landslide control, have been developed by the Metals Industry Research and Development Center (MIRDC).

Among the machines developed by MIRDC is the "Coco Fiber Twinning Machine," which makes coconut fiber twines for use in producing geotextile nets for erosion control as well as for road and river embankment. It can process 20 kilos of coconut fiber twines per day or five kilos "more than its conventional counterpart."

Rangania, Ramakumar, and Said (2010) studied the development and performance evaluation of a nutmeg decorticator which addressed to solve issue on the traditional process of decortication which is done manually using a hammer or mechanically a cracking hand tool. The study introduced faster processing of nutmeg, a mechanical decorticator has been developed which consisted of a cylinder and a concave. The cylinder was made up of M.S. angle flats of size 4.8 × 1.9 cm and a rubber of 0.5 cm thickness was fixed on to these flats to establish impact to the nuts. While, the concave was fabricated using 6 mm size M.S. rods.The length of concave was 25 cm with slotted opening size of 7.7 × 1.0 cm. The developed decorticator had the decortication efficiency, total recovery, breakage and capacity of 98.11, 63.92, 3.08 and 56.59 per cent kg/h, respectively, at the cylinder speed of 450 rpm.

Shansen, Yan, and Zhaoyu (2015) conducted study entitled the design of coconuts automatic decorticator based on the PLC. They said coco industry plays an important role in Hainan economy. However, with coconuts production increased year by year, the issue like how to pretreat the coconuts and improve the added value of coconuts will come out. The current situation that most areas of

Hainan are still hand- shelled coconuts, so they designed a new type of coco decorticator equipment based on PLC, they elaborated overall structural features and working principle of machine, key components and its parameters were analyzed. The machine is adaptable to process a variety of coconuts, peel with high efficiency and the breakage rate is low, the machine plays a great role in promoting mechanization level of coconut processing industry.

*Palomar et al. (2008) conducted study on the d*esign, fabrication and evaluation of a prototype coconut husk decorticating machine. They made decorticating machine driven by a 10-hp, 3-phase electric motor and evaluated based on its performance to defiberize coconut husks. Its main features include, among others, 1/4- cu m capacity cylindrical case which encloses the 16 blades rotary assembly to decorticate the husks, and two hoppers which serve as separate passages for coir fibers and dusts exiting from the cylinder. The estimated cost of fabrication was P64,168.00. Results of test showed that the machine has an optimum output of three tons of husks per day. Recovery of coir fibers was 40 percent while the dusts constituted the remaining 60 percent. Based on the grading standard, the coir fibers produced fall under CH-3 or mixed fibers. The estimated production cost of coir fibers was P0.90 per kilogram.

Venkataramanan, Abhinav, and Rahul (2014) presented paper on developing an automated coconut de-husking and coconut crown removal machine. The main purpose of this machine is to eliminate the skilled operator involved in de-husking the coconut and to completely automate the dehusking and crown removing process. In some small scale industries, the process is either manual or semiautomatic. A completely automated machine with manual loading and unloading of coconuts will yield productivity higher than the existing process. In view of this they focused on an automated machine for dehusking and crown removing. The machine aims at de-husking and removing the crown of the de-husked coconut of various sizes across the world. In order to get to know about the different sizes of the coconut, various places across India has been visited where exuberant yielding of coconuts are made. Also, dimensional data of coconuts have been collected in some of the other most eminent countries where prominent coconut cultivations are done.

Hellstrom (2010) observed that the chipping process was found to be a versatile tool. He noticed from his study, there exist different types of fracture processes, each giving different chip thicknesses. He concluded that the friction between the wood and the chipping tool is probably one crucial factor for the chip formation process. Another outcome from his experiment is that just prior to the formation of a chip, there is a concentration of strains in an arrow zone in a thin region starting from the edge of the tool and directed parallel to the grain.

Bolaji, Adejuyigbe, and Ayodeji (2008) studied the performance evaluation of a locally developed cassava chipping machine. A cassava chipping machine was designed and constructed, and its performance evaluated. The results showed that motor speed has significant effects on chipping capacity, chipping efficiency, and chips geometry. The higher the motor speed, the higher the chipping capacity and the lower the chipping efficiency of the machine. The machine has a maximum capacity of 245 kgh1 at 500 rpm, and maximum chipping efficiency of 92.6% at a speed of 300 rpm. The overall best performance of the machine is obtained at a speed of 400 rpm with chipping efficiency of 86.5% and chipping capacity of 240 kgh1.

Ugoamadi and Ekwere (2014) studied the development and performance evaluation of a manually operated cassava chipping machine. The chipping machine was designed and fabricated, and its performance was evaluated. The machine has the following parts: the hopper, groove chipping disc, chipping unit, pulleys, shafts, frame, bearings, and handle. The chipper Performance evaluation was done using the following machine speed: 63 rpm, 66 rpm, 69 rpm, 72 rpm, 75 rpm, 78 rpm, 81 rpm, 84 rpm, 87 rpm, and 90 rpm. The chipper's highest efficiency was 91.20% at 78rpm and capacity of 29.50 Kg/h at 90rpm. An overall mean efficiency of 89.404% (0.825) and mean capacity of 26.59 (1.66) Kg/h were achieved. The optimum machine speed was in the range of 72 rpm to 78 rpm. From the results, it was observed that as the machine speed and capacity increase, both the chipping time and chipping efficiencies decrease. Hence high quality chips are produced using groove chipping disc at relatively low speed. The machine is simple to operate and maintain without special training and is suitable for small and medium scale farming.

Conceptual Model

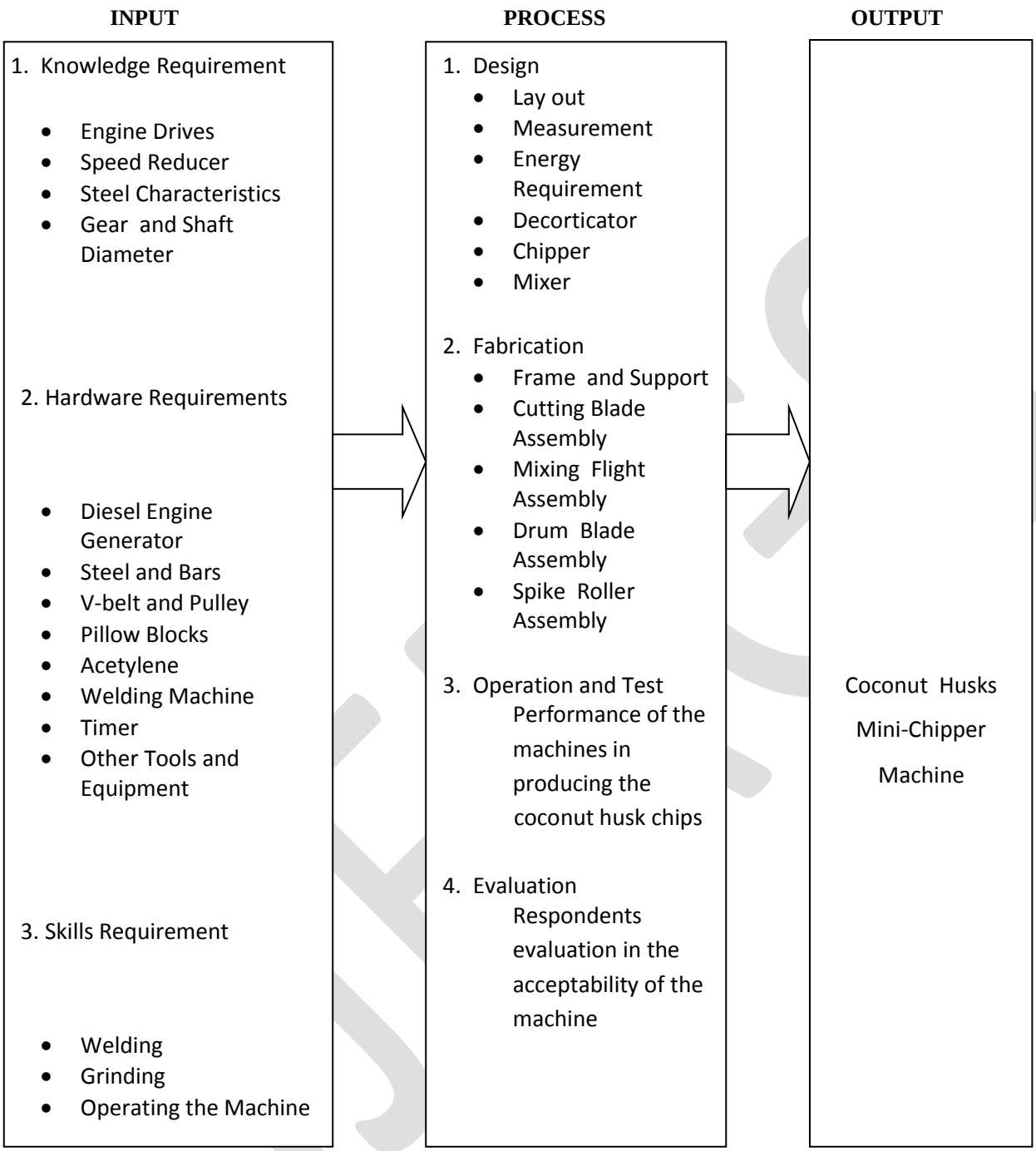

Figure 1. Conceptual Model of the Study

The figure above serves as a guide in carrying the machine design and fabrication. Input indicated the required knowledge relative to the desired project. Individuals who are skilled in planning, welding, grinding and operating the machine are also needed in conceptualizing the design Appropriate tools, equipment and financial requirements in purchasing supplies and materials must be used to fabricate the machine. Based from the design concepts of the machine, several testing must be considered to validate its performance. Moreover, the validation based from the evaluation criteria must also be considered to determine the level of acceptability of the machine.

After all of these considerations, the output project would be the new developed coconut husk mini- chipper machine which can improve the lives of farmers and competitiveness of micro-scale coconut industry in rural areas.

Methodology

This chapter presents the project design, project development, operation and testing procedure, instruments and techniques used, and evaluation criteria.

Project / Research Design

The developmental research and experimental type of research were employed in this study.

The predictive capabilities of the machines were determined through experimental method where series of test were undertaken. While the acceptability of the machines in terms of functionality, adaptability, cost effectiveness and originality was evaluated through descriptive researc

Project Development

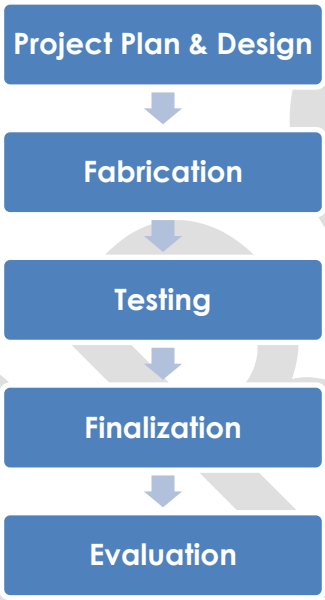

Figure 2. **Stages of Development of the Machine**

The figure above shows the development of the project. It started with the project plan with corresponding design of an integrated coconut husk processing machine. After planning and conceptualizing the design, machines were fabricated. A test was conducted to find out whether the machines are performing well based on the design. The series of testing of the fabricated machines have been done to determine its performance. Adjustment and some corrections were taken before finalizing and fixing the machines. After all the corrections, the machines were finalized. The newly developed and fabricated machines were subjected to evaluation in order to determine the acceptability of the machines.

Design Concept

The technical design of the machine was conceptualized through analyzing the functions of the chipper machine. The principle of operation of the machine has been considered. Determining the sizes and parts of the machine gave high consideration in finalizing the design in order to fix the machine for effective and efficient operation. The researcher used the concept of the chipper machine purposely to help improve the lives of the farmer and competitiveness of micro-scale coconut industries in the area.

Design of the Integrated Coconut Husk Mini-Chipper Machine
Mini-Chipper Machine

Indicated below is the actual design including the features and measurement of the coconut husk mini-chipper machine.

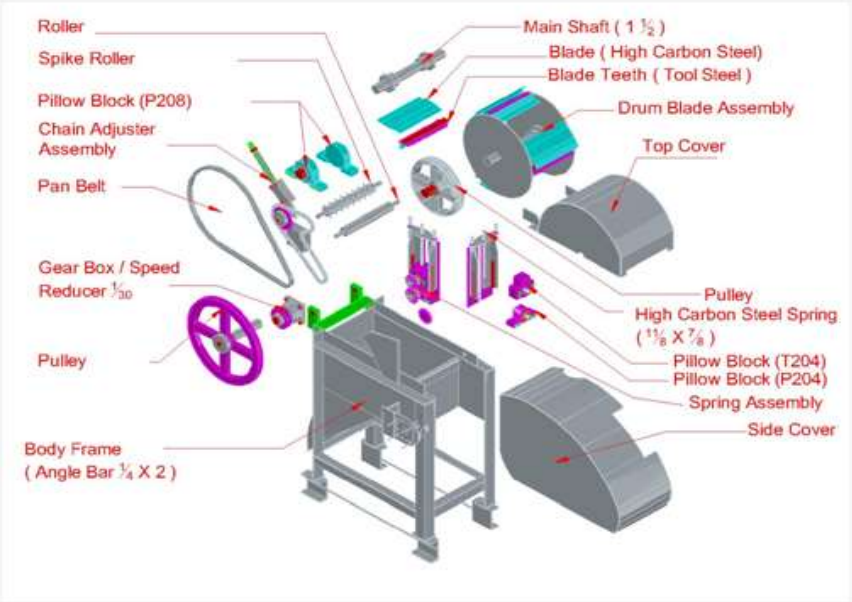

Figure 3. **Exploded Parts of Mini-Chipper Machine**

The figure above shows the exploded parts of the mini-chipper machine. It shows the drum blade and spike roller which play the vital role in the operation of the mini-chipper.

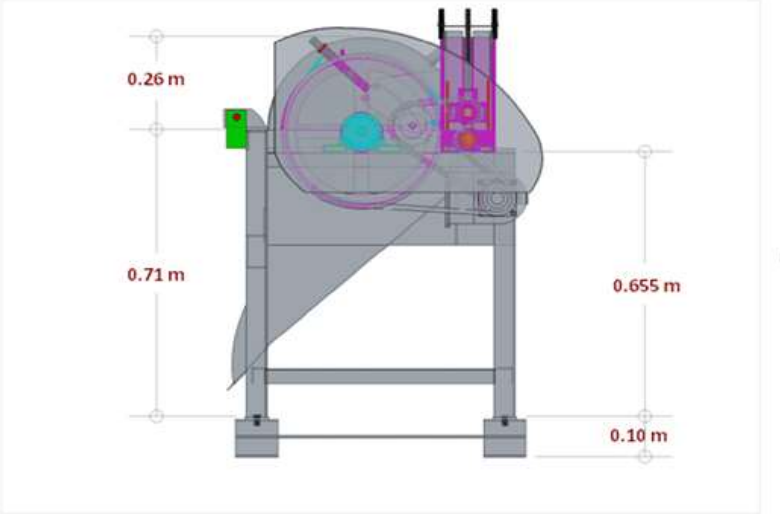

Figure 4. Right Side View of the Mini-Chipper Machine

The figure above shows the spring assembly attached to the upper body of the machine. Spring assembly is automatically adjusting while holding the coconut husk to be cut by the beating blade.

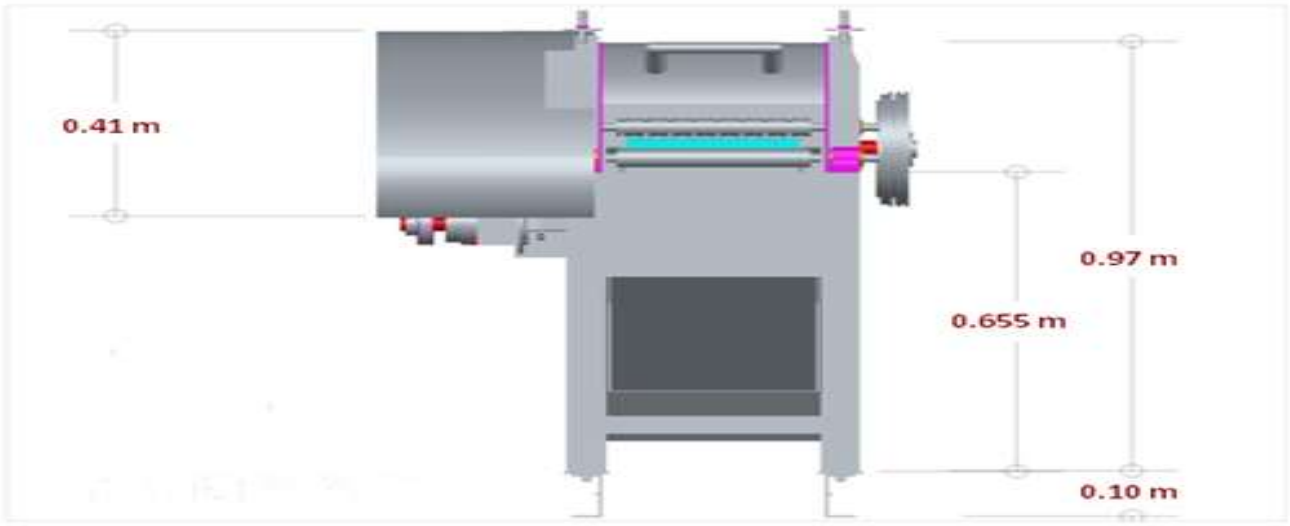

Figure 5. **Left Side View of the Mini-Chipper Machine**

The figure above shows the left side view of the mini-chipper. It shows the cover and the output panel where the coconut husk chipped
came out. The spike roller is used to hold and feed the husk to be cut by the beating blade.

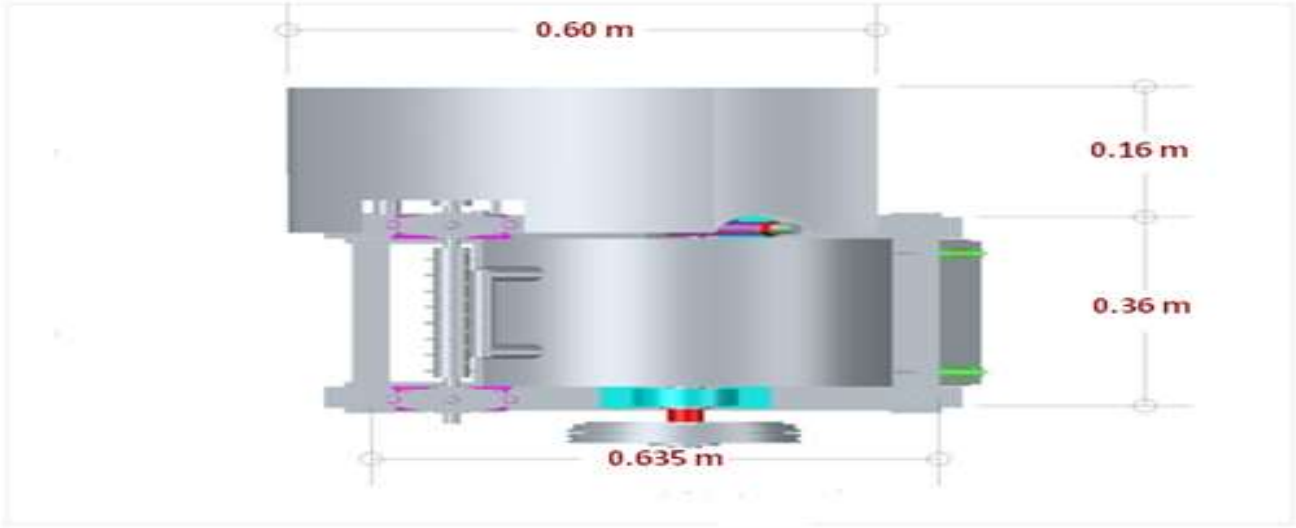

Figure 6. Top View of the Mini-Chipper Machine

The figure above shows the cover, spike roller and the pulley. The pulley is attached to the drum blade assembly where the v-belt is connected. It is used to rotate the blade and the spike roller.

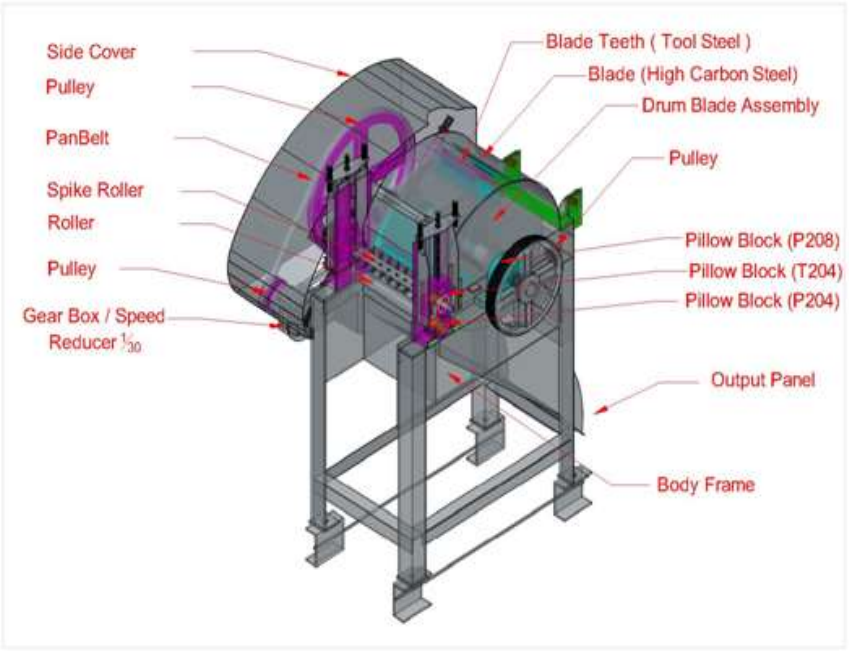

Figure 7. Isometric View of Mini-Chipper Machine

The figure above shows the isometric view of mini-chipper machine. It shows the front, side and top view of the machine. Complete parts of the mini-chipper are being illustrated.

Operation and Testing Procedure

The Coconut Husk Mini- Chipper machine was operated using the 6Hp diesel engine generator. Presented hereunder is the operation procedure of the machine.

a. Inspect all the connection and parts of the machine if these are in proper position.
b. Prepare the coconut husk.
c. Turn on the diesel engine generator.
d. Put with care the coconut husk into the feeder passing though the roller spike of the machine.
e. See to it that the spike roller and drum assembly run smoothly, no unnecessary sounds must be heard.
f. If the unnecessary sounds are heard, there is trouble so check it and make necessary correction. If sounds are heard clearly, proceed to the next step.
g. Continue cutting by putting the coconut husk into the feeder of the machine.
h. After cutting, turn off the machine and clean it.

Instruments and Techniques Used

The instrument and technique used in this study were the actual interview, survey questionnaires, and evaluation questionnaire regarding the use of machine in processing coconut husk.

Data were gathered by means of actual interview from the ten (10) selected farmers of Bgy. Palola, Lucban, Quezon, ten (10) faculty of Industrial Technology and ten (10) experts from the Industry.

Evaluations were conducted which dealt on the two (2) criteria:

1. First, on the performance of the processing machines in terms of coconut husk chips produced
2. Second, acceptability of the mini-chipper machine based on the following criteria:
   - 2.1 Functionality
   - 2.2 Adaptability
   - 2.3 Cost Effectiveness
   - 2.4 Originality

Results and Discussion

A. **Discussion on Performance Test of Mini-Chipper Machine**

The machine was tested several times. It was observed that during the 1st test of the operation of the machine using the 2Hp AC Induction Motor, it was effective on the 1st five minutes but came after, the operation did not work properly because of the insufficient energy supply that caused intermittent power resulted to poor processing of the coconut husks. As a result, the motor from AC source 5 Hp Induction Motor was changed to 6Hp Diesel Engine Generator. Through this change and adjustment, the operation went back to normal which resulted to the following observations:

Table 1. **Performance Test of Mini-Chipper Machine**

Description	**Trial 1**	**Trial 2**	**Trial 3**	**Average**
Number of Coconut Husk Processed for One (1) Hour (pieces)	280.00	285.00	283.00	282.70
Volume of Coconut Chips Produced for One (1) hour (Kilogram)	154.00	157.00	156.00	155.67
Diesel Used for One (1) Hour (Liter)	0.74	0.73	0.70	0.72

Table above shows that the average coconut husk processed into chips is 282.70 while the volume of coconut chips produced has an average of 155.67 kilogram. The diesel used for an hour is 0.72 liters. It proves that the machine is efficient because the chipped husk produced is 92.00 % while the waste is about 8.00 %.Note: average weight of *coconut husk in Lucban,Quezon is about 0.6 kg.*

B. **Acceptability of the mini-chipper machine based on the following criteria**

Project Evaluation

The project was evaluated in order to determine the acceptability level of the mini-chipper machine. This was evaluated by thirty (30) selected individuals who were farmers, technical teachers and technology experts who have technical and appropriate knowledge about the project.

Table 2. **Functionality of the Machine**

Functionality	**Numerical Equivlent**
1. Parts of the machine are purposeful	4.87
2. The machine functions effectively	4.93
3. The machine has a control knob to control the revolution of the crank shaft.	5.00

4. The machine can decorticate, mix, and chip according to desired volume.	4.80
5. The machine can be selected into each desired uses as for decorticator, mixer and chipper	5.00

The table above shows descriptive average value 4.92 which is interpreted as the machine is functional based from the responses of the respondents to the given evaluation questionnaires. The parts of the machine are said to be purposeful, effective, and able to pass the required output for the machine. The selector knob for the speed of the generator functions properly as selected by the user.

Table 3. **Adaptability of the Machine**

Adaptability	**Numerical Equivalent**
1. The machine can be operated in any weather condition	4.83
2. The machine can process coconut husk whether wet or dry	4.87
3. The machine can process the husk into a desired volume	4.93
4. The machine can be placed in the farm or backyard	5.00
5. The machine can be operated by single, two or three persons	4.80

Table above shows the adaptability rating of the machine which is 4.88. This is interpreted as the machine is adaptable in any situation and condition. Most of the respondents agreed that the machine can be operated by one person or more. They also believed that the machine can be placed in a backyard or farm.

Table 4. **Cost Effectiveness**

Cost Effectiveness	**Numerical Equivalent**
1. The fabricated machine is less expensive compare to buying in the market.	5.00
2. The parts and components of the	4.87

machine are available and easy to be bought in different stores.	
3. The price of the parts and components of the machine are cheaper	4.87
4. Parts and components of the machine can be changed or replaced easily.	4.93
5. The materials used in the machine are long lasting.	4.90

Table above shows the machine has a mean rating of 4.91. It means that the machine is cost effective. They considered integration of machines which can be operated by single diesel engine generator rather than buying three separate motors for three machines. Most of the respondents believed that the supplies and materials used were available in the market.

Table 5. **Originality of the Machine**

Originality	**Numerical Equivalent**
1. The machine can be integrated into one but multi–purpose used	4.93
2. The machine can be operated through a single 6hp diesel engine generator	4.90
3. The machine can be used simultaneously	4.93
4. The machine can process coconut husk into a different output products within one location	4.87
5. The design of the integrated machine is new and different from others	4.90

The table above shows an average descriptive value of 4.90. It means that the design of integrated machine issomething new and different from the others. Its characteristic of being operational in a simultaneous used using single 6hp diesel engine generator makes different. This is said to be interesting among the farmers and individuals who are working in a micro-scale coconut processing industries because of its originality and uniqueness.

Table 6. **Overall Acceptability of the Machine**

Overall Acceptability	Numerical Equivalent
1. Functionality	4.92
2. Adaptability	4.88
3. Cost Effectiveness	4.91
4. Originality	4.91

The table above shows the overall acceptability mean rating of the machine which is 4.90. It means that the, Mini-Chipper machine is technically and operationally acceptable. This machine is considered very useful and significant to the respondents specifically to the experts such as technical professors and the farmers. This can be used to earn more profit from coconut husk, and manage properly the coconut husk wastes.

Summary of Findings, Conclusions and Recommendations

1. This research study developed a design of a mini-chipper, and pre-compost mixer machine which is an innovative technology used to chip the husk. The machine is connected through a cold-roll shaft attached with pulley and connected to the 6-Hp diesel engine generator.
2. The machine is fabricated using common and locally available parts and materials based on the design requirements. The mini-chipper is composed of drum blade assembly, spike roller, frame and support assemblies.
3. Test results on the performance of the machine revealed that the Mini-mixer machine is efficient. The mini-chipper can cut and chip 92 % of the coconut husk while the 8% is the residue or waste.
4. The acceptability of the processing machines in terms of its (a) functionality, has a mean of 98.40 % which i s very highly acceptable, (b) adaptability, has a mean of 97.72 % which is very highly acceptable, (c) cost effectiveness, has a result of 98.28 % which is very highly acceptable and (d)originality has a mean of 98.12% which is very highly acceptable. The data above show that the machine was rated very highly acceptable with the mean average of 98.13%.

Conclusions

Based on the results of the study, the following conclusion were drawn:

1. The design of the mini-mixer machine is best suited in the farm or backyard near with abundant source of coconut husks.
2. The fabricated machine is easily be made because of its materials are available in the local market. The machine can help improve the lives of the farmers and suitable for the micro-scale coconut processing industries particularly in rural areas.
3. The result of the test for the machine demonstrated the efficiency of the mini-chipper. It functioned very well as to cut or chip the coconut husk.
4. The acceptability of the coconut husk mini-chipper processing machine attests to the functionality, adaptability, cost effectiveness and originality. This proves that the machine is not just a prototype but rather a very useful machine that helps farmers to earn more in coconut industry.

Recommendations

To further improve the mini-chipper machine, the following were recommended:

1. To conduct further study on a bigger capacity of the mini-chipper machine to be installed in urban and rural areas.
2. To provide much bigger feeder for the mini-chipper for a much larger inputs of the husks.
3. To mount protective screen on the feeder of the machine
4. To include protective guard on the rotating spike roller of mini-chipper.
5. To install safety cover for the rotating shaft and belts of the machine in order to maintain safety of the workers.

REFERENCES:

[1] Akaranta, O. (1996) "Wood finishes from modified coconut coir dust extract", *Pigmail and Resin Technology*, vol 25 lss:pp. 11-15.

[2] Bagci, S., Cayci, G., & C. Kutuk, C. (2011). Growth of Primula Plant in Coir Dust and Peat-Based growing Media. Journal of Plant Nutrition.34, pages 909-919. Retrieved February 13, 2011 from http://www.tandfonline.com/doi/abs

[3] Balam, A., Adgidzi, D., & Mua'zu, A. (2013). Development and Testing of an Animal Feed Mixing Machine. *International Journal of Basic and Applied Science, vol 1, pp. 491-503.*Black, P. H., and E.O. Adams. (2006). Machine Design. New York: Macmillan

[4] Faires, V. M. (2002). Design of Machine Elements. New York: Mackmillan Co.

[5] Gosse link, R.J.A ., J.C. Van der Putten, J.C. Van der Kolk, J.E.G. Van Dam, and B. de Klerk-Eugels. (2000). Vegetable fibre based geotextiles with adjusted durability. IECA annual conference, Palm Springs, USA.

[6] Hahn, W.J. (1997). Arcane: The Palms. Retrieved April 4, 2011 from http://tolweb.org/Arecanae/21337.

[7] Hellstrom, L. (2010). On the wood chipping process-A study on basic mechanism in order to optimize chip properties for pulping. Sweden: Kopieringen Mittuniversitetet.

[8] Hughes, A. U., & Bil, D. (2013). Electric Motors and drives, Fundamental types and Application. 4th Edition. Oxford, United Kingdom: Elsievier Limited.

[9] Hughes, A. U. (2006). Electric Motors and drives, Fundamental types and Application. Oxford, United Kingdom: Elsievier Limited.Hyder, Naveen; Sims, James J.; Wegulo, Stephen N. (2008). Vitro Suppresion of Soilborne Plant Pathogens by Coir. Department of Plant Pathology, University of Nebroska, NE68583. 2008-11-19 URL: http://www.agrococo.com/Pathogen-Suppression.pdf. Accessed: 2009 – 08 - 17.

[10] Mathur, P. N.; Muralidharan, K.; Porthasathy, V.A.; Batugal, P.; Bonnot, F. (2008). Data Analysis Manual for Coconut Researchers ISBN 978-92-9043-736-9.

[11] Meerow, W. (2012). Coir Dust, A Viable Alternative to Peat Moss. *Manila Bulletin*. p.14.

[12] Miller, R. and Miller, M.R. (2008). Industrial Electricity and Motor Control,New York Mc Graw Hill. ONYEGU, O.S.,

[13] Ranganna, B.B., Ramakumar, V.M., &Said,P.P. (2011). Development and Performance of Nutmeg Decorticator. *The Mysore Journal of Agricultural Sciences*, 4, 764-768.

[14] Salaverria, L.B. (2012), Coconut husk touted as next big PH export. *Philippine Daily Inquirer. Retrieved December 27, 2014 from* http://business.inquirer.net/65553/coconut-husks-touted-as-next-big-
.

[15] Sarian, Z. (2010, August 18). New Coconut fields high. The Manila Bulletin. p.11.

[16] Shansen, F., Yan, Z., & Zhaoyu, M. (2015). The Design of Coconuts Automatic Decorticator Based on the PLC. Journal of Agriculturel Mechanization Research, p.02

[17] Spotts,M.F, and Shoup, T.E. (2000). Design of Machine Elements, 7th Edition.
Upper Saddle River, New Jersey: Prentice Hall.

[18] Somyos Kijikar. "Handbook: Coconut Husk as a potting medium". ASEAN Canada Forest Tree Seed Center Project 1991, Muak-Lek, Saraburi; Thailand. ISBN 974-3612-77-1.

[10] Tejano, E.A. (1984, November 12). State of the Art of Coconut Coir Dust and Husk Utilization. *Philippine Journal of Coconut Studies*. Retrieve December 27, 2014, from www.pcrdf.org/artimages%5Carticle14.doc.

[20] Van Dam. J.E.G. (1999). Environmentally safe bleaching and dyeing technologies of coir fibers and yarns for diversified markets. Col News, 28, 2 - 11 –

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