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Enhanced Feature Extraction Technique for Detection of Pharmaceutical Drugs

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Abstract— Image Processing has an important role in automation of visual inspection. In Pharmaceutical industry, drugs are to be produced on massive scale. Now-a-days, medicines have an important role in human life. Many diseases should have required proper medication. These drugs may be broken when manufactured. There may be side-effect of these defected drugs when consumed. So, the manufactured drugs should be properly inspected so that they do not cause any side-effect on human bodies. Hand-operated inspection of these drugs that are manufactured on massive scale takes a lot of time and hence a challenging task. So, this paper proposed an idea to inspect damaged tablets and missing capsules. A novel method is introduced i.e. detection of damaged pharmaceutical drugs with Centre of Mass (COM) edge detection method. This method involves finding edges of tablets by knowing their Centre. The missing capsules in the blister are audited by Color Detection Method.

Keywords— Pharmaceutical Drugs, Centre of Mass, Broken tablets, Missing Tablets, Missing Capsules, Histogram-Equalization, Color Detection.

1. INTRODUCTION

1.1 Image Processing: Image Processing has vital role in real life; it is used in almost every field. We use image processing, such as taking picture from camera, making videos. The picture taking from camera is called Image Acquisition, and camera is the source of the picture. Also, we can edit these pictures; extract some features or parameter of the pictures. We can apply filters on the picture according to our requirement. This is called Image Enhancement. We can also reduce the size of the image by reducing their pixels, this helps in storage of more picture, this process is called Image Compression. We can extract some part of the image by using Image Cropping. Thus, image processing has a vast number of fields with various techniques.

1.2 Edge Detection: One of the image processing Techniques is Edge Detection technique. This technique extracts the edge i.e. boundaries of the objects in the image. Edge detection can also extract only some features of image e.g. color extraction of object, object boundaries, Text extraction etc. A real life example of these techniques is retrieval of license plate of vehicle running on road from the camera fixed on the pole. Edge detection has a major role in the medical science e.g. heart analysis, Brain MRI, Lungs CT scan etc. Edge Detection further has a large number of techniques for detecting edges. These techniques are also called Edge Detection Operators or Edge Detectors.

1.3 Pharmaceuticals: A pharmaceutical drug also known as medicine is a drug used to diagnose, cure, treat, or prevent disease. Some diseases require proper medication. Some of these drugs are consumed by some people on regular basis. In Pharmaceutical industries, drugs i.e. Tablets and Capsules are produced in a large scale every day. These tablets may not be produced precisely i.e. there ought to be some drugs that are in damaged form when produced. These damaged drugs are not advisable to be consumed because it causes skin problems, infections etc. It could also happen that drug is missing in a blister [1][3]. So, Proper inspections of these pharmaceuticals are required. But manually it is not possible to inspect such a large scale production.

For the inspection of such a large scale production, automated tools are required. With the help of these tools, the inspection is done in short time period. It can co-relate the inspection with the production.

So, Edge Detection technique helps in inspection. Various techniques are developed for this inspection. In which edges of tablets and capsules in blister are detected and matched with the original blister which is learned in the software already. By matching this learned blister with the input blister, we can check that whether the input blister has all the tablets and capsules or not. If these two are matched, it means that all the tablets have correct shape and size and if not, it means there is some broken tablet, missing tablet or missing capsules. This is the most general way of matching images and easy way of detecting the broken or missing tablets and capsules.

2. RELATED WORK

Ramya. S, et.al, proposed some ideas to identify the damaged tablets after production. This involves a series of steps involving image enhancement, segmentation, thresholding, filtration, pixel calculation, subtraction, elimination of noise and region based statistic to identify the broken tablets. In the case of capsules, a feature extraction technique is proposed to find the defective blister. [1]

Aleksandar Jevtic, et.al, presents a novel edge detection method that computes image gradient using the concept of Center of Mass (COM) is presented. The algorithm executes with a constant number of operations per pixel independently from its scale by using integral image. Compared with the conventional convolution edge detector such as Sobel edge detector, the method performs faster when region size is larger than 9×9. This novel method can be used as framework for multi-scale edge detectors when the goal is to achieve fast performance. [2]

Munish Kumar Dhiman et.al, presents an approach for automatic inspection of broken pharmaceutical drugs. This approach is based on the use of edge detection method that canny edge detection and RC-algorithm to check for the defects in the tablets. It gives the percentage of matching different pharmaceutical drug blister. And give the match percentage of different pharmaceutical drugs blisters. [3]

Ritesh Chavda et.al, proposed some ideas to identify the damaged tablets after production. A morphological operation is applied to detect the defects. Image segmentation is applied and the input image is filtered to eliminate the noises thereby making the input image that is fit for further processing. The image is deducted by inscribing rectangles with morphological operation. Then the image is deducted from the original gray image that identifies the broken tablets. Pseudo colouring is applied and the pixel of the broken tablet is computed. The input image undergoes pre-processing. Objects are retrieved based on the region based properties. Detected Corners are compared with the stored image. If the detected feature points match in the stored image and the test image capsule is accepted otherwise rejected. [4]

Hardeep Kaur et.al, presents a method for detection of defective capsules using different image processing techniques. The production of two part gelatin capsules requires a quality inspection system that not only keeps up with the high production throughput, but also performs accurately and reliably. The Proposed approach covers all the aspects of defects related to shape, size and surface defects of the pharmaceutical capsules. The algorithm can be implemented in various digital image processing environments and can be part of complex automated manufacturing and testing system. [5]

AMIT CHHABRA et.al, proposed a sequential hybrid approach to overcome all the limitations of existing edge detection algorithms. The operations accomplished by image edge detection algorithm can be computationally expensive and takes lots of execution time for processing the data. Hybrid color based image edge detection technique is improved by using the data parallelism approach. The comparison among parallel and sequential edge detection will be drawn based upon different parallel metrics. [6]

3. PROPOSED WORK:

There are a lot of methods for the detection of broken or missing pharmaceutical drugs. Most of the detection is based on the template matching i.e. matching of template image with the input image. Here, we propose a new technique that detects the pharmaceutical drugs using Center of Mass and Color Segmentation. In Centre of Mass, we find the centers of each tablet in strip, if centers are detected then tablet is present in the blister, if not then tablet is broken or absent. Similarly, in the Color Segmentation Method, we applied Color Detection on the blister of Capsules. There are two images of blisters, one image is of Missing Capsule and another image is of the blister with all Capsules present in it. By matching pixels of these two images we concluded that there is a missing capsule or not. That is, if the pixel values are same then there is no missing capsule in blister. If these values differ then capsules are missing. The number of present capsules is displayed in the results. This is shown in the architecture of the proposed system.

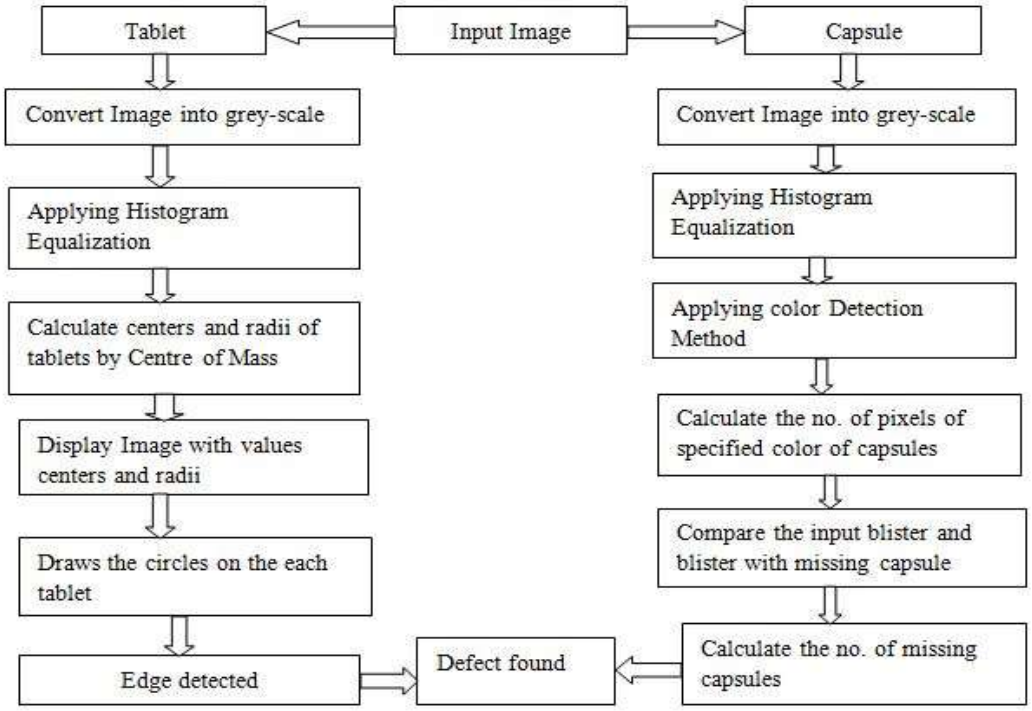

Fig. 1 Architecture of proposed System

The architecture shows the working of both methods. The left-side of the architecture shows centre of mass and right-side dhows the color detection method. The algorithms for these methods are as follows:

Algorithm for finding broken or missing tablets:

Step 1: Input the tablet strip.
Step 2: Convert image into Gray-Scale.
Step 3: Applying Histogram-equalization to enhance the contrast.
Step 4: By applying centre of mass method, calculate the centers and radii of each tablet in the strip.
Step 5: Display image and value of centers and radii of each tablet.
Step 6: Draw the circle on each tablet of strip.
Step 7: Edge Detected if tablet is present in the strip, if tablet is broken or missing edge is not detected.

Algorithm for identifying missing capsules in a blister:

Step 1: Input the capsule blister.
Step 2: Convert image into Grey- Scale image.
Step 3: Applying Histogram-equalization to enhance the contrast.
Step 4: Applying Color Detection method.
Step 5: Calculate the number of pixels of the color we want to find in the image. For example, we take green color capsules with different color of blister.
Step 6: Compare the pixel values of input blister and blister with missing capsule. If value differs then there is a missing capsule
Step 7: Calculate the no. of missing capsules by using pixel values.

4. RESULTS AND DISCUSSION:

The proposed Method is implemented with different strips of Tablets and different Capsule Blisters. The Centre of mass Method calculates the centers and radii of each tablets and. It draws circle on the image where tablet is present i.e. on each tablet i.e. detects edges of Tablets and does not draws circle at the image where the tablet is absent.

The method applied for Capsule is color detection method. In this method, two images are inputted. Capsule Blister and Missing capsule Blister. The color pixels (color of capsule) are calculated for both the images and then both values are compared. If both value matches then all capsules are present and if values differ then there are some missing capsules. Then calculate the number of missing capsules.

1. **Input Image and Detected Edges:** Fig 2 shows tablet strip with all tablets present. This input image is a RGB colored image that is converted into gray-Scale Image then this image is enhanced by applying Histogram-Equalization. On this enhanced image edges are detected. It draws circles on the image where tablets present as shown in Fig 3. Similar process is undertaken for all iput images.

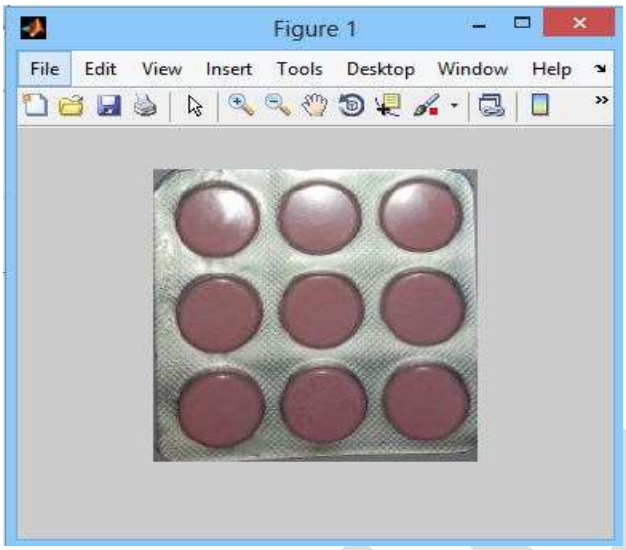

Fig. 2 Input Image of Tablet Strip

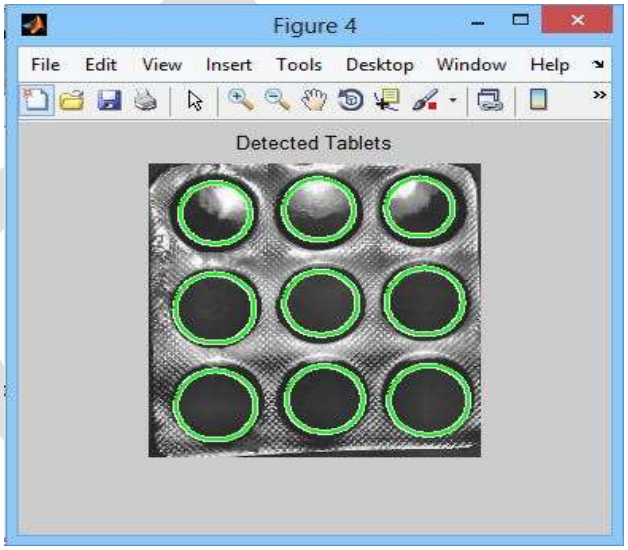

Fig. 3 Resultant image of the input image

2. **Input Image with One Missing Tablet and Detected Edges:**
Fig. 4 shows the image of tablet strip in which one tablet is missing and Fig. 5 is the resultant image of fig. 4. It draws the circles on the image where all tablets present except the absent tablet position.

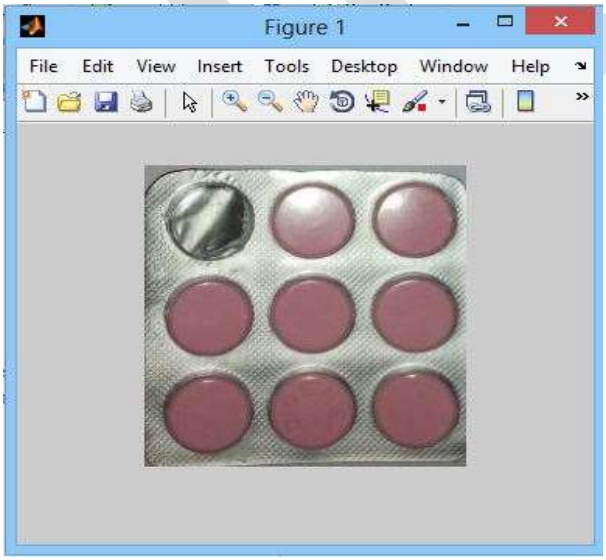

Fig. 4 Input image of One Missing Tablet

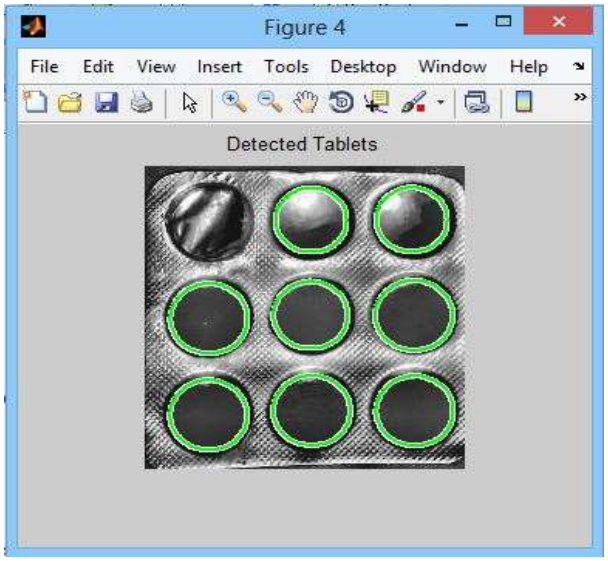

Fig. 5 Resultant Image of input image

3. **Input Image with Two Missing Tablet**

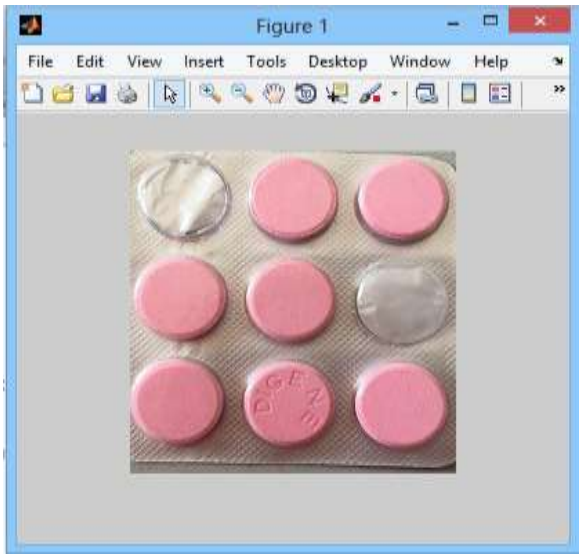

Fig. 6 Input Image of Two Missing Tablets

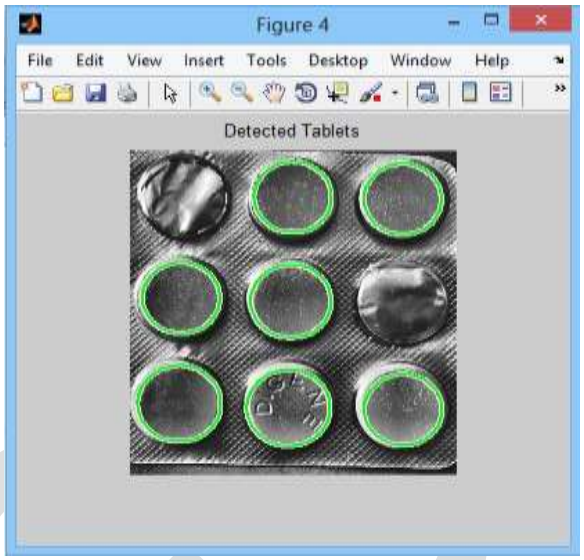

Fig. 7 Resultant Image of Two Missing Tablets

4. Input image of Broken Tablet and Detected edge:

Similarly, the broken tablet is detected with the centre of mass method. As missing tablets are not detected by this method, broken tablets are also not detected. That is broken tablets are not marked by circles. Fig. 8 shows the input image and Fig. 9 shows the resultant image.

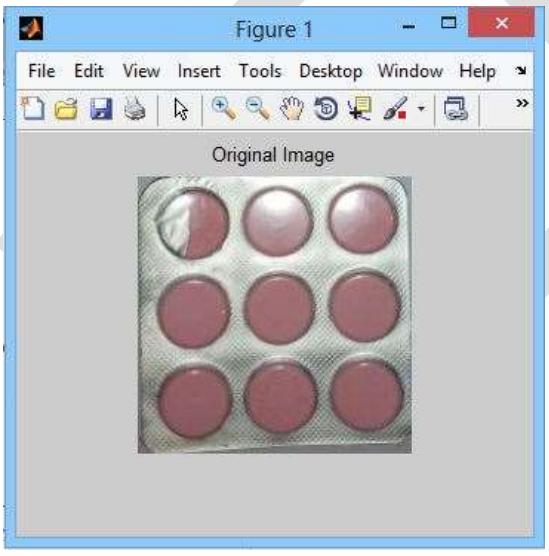

Fig. 8 Input image of Broken Tablet strip

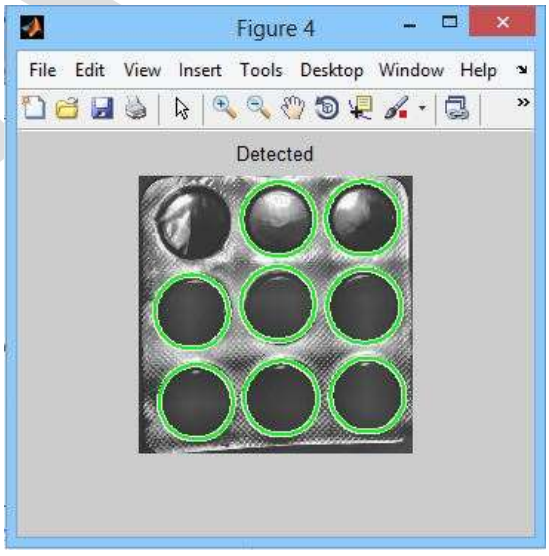

Fig. 9 Resultant image of the Broken Tablet Strip

5. Input Images of Capsule Blister and Missing Capsule blister:

For the detection of missing Capsules we applied Color Detection Method. Here, we take the capsules of green color. So, the method extracts green color pixels. We can extract any color pixels by using suitable combination for that color. The input images are Fig 10 and Fig. 11 and result that is total number of capsules present are shown in the Fig. 12.

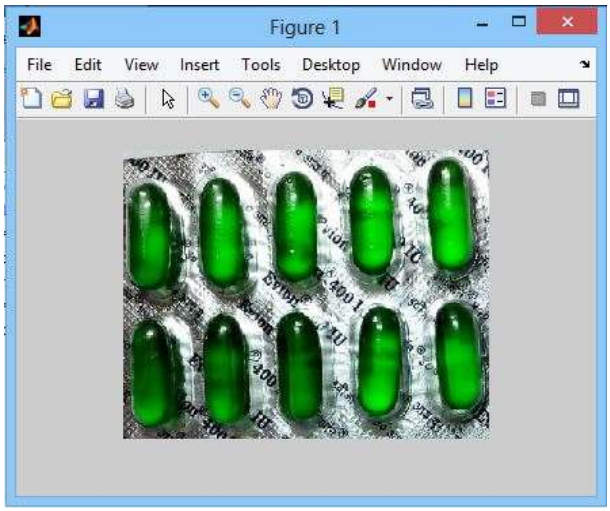

Fig. 10 Input Image of Capsule Blister

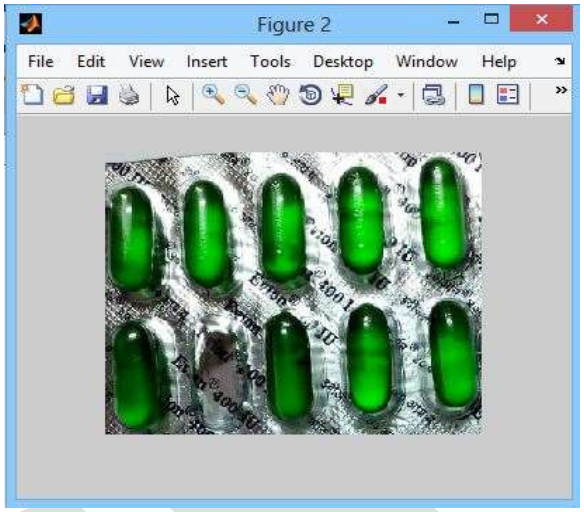

Fig. 11 Input Image of Missing Capsule Blister

The result of both input images is:

Fig. 12 Finding the number of capsules

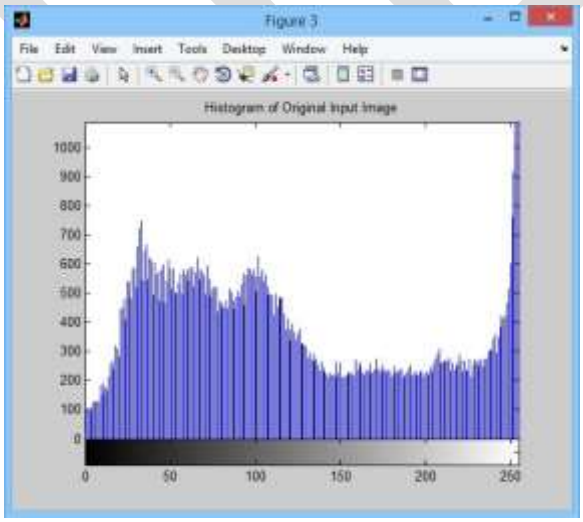

Fig. 13 Histogram of green color pixels in Original Capsule Blister

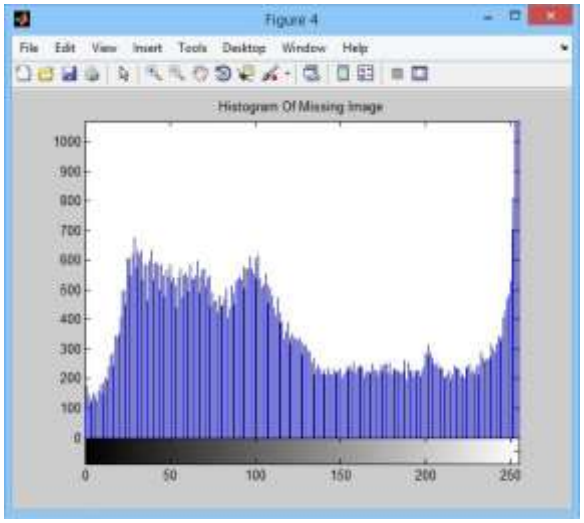

Fig. 14 Histogram of green color pixels in Missing Capsule Image

Fig. 13 shows the Histogram of green color pixels of the strip with all capsules present and Fig. 14 shows the Histogram of green color pixels of the strip with one capsule missing. We can see the difference in the color pixels in both the images. On the basis of this difference number of capsules present is detected.

The method followed for detection of capsules is:
The method applied for Capsule is color detection method. In this method, two images are inputted. Capsule Blister and Missing capsule Blister. The color pixels (color of capsule) are calculated for both the images and then both values are compared. If both value matches then all capsules are present and if values differ then there are some missing capsules. Then calculate the number of missing capsules.

5. CONCLUSION:

Pharmaceutical drugs are the need of Human life. These are used to cure disease. Some diseases need proper care and medication. So, the inspection of these drugs should be done. There are a lot of automated tools for this inspection. The proposed method Center of mass easily detects broken and missing tablets. The color detection method can detect any color of capsules in the blister only by changing the value of color. Thus we can say that both the methods are easy to implement and showing their results precisely. Both the methods are implemented using different tablet strips and capsule blister. In all cases, they give good results.

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