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Real Time Traffic Light and Sign board Detection

Agnes Asmy P T(Student), Aiswarya C A(Student), Alice Augustine(Student), Anju S Kumar(Student), Aswathy N(Asst. Professor)

M G University,agnesasmypt@gmail.com

Abstract— Traffic light and sign board detection and recognition are the main features of upcoming driver assistance systems. However variations in illumination are considered as the main problem in transportation system. This method proposes traffic light and sign board detection in various illumination conditions irrespective of weather conditions. The proposed method is classified in two stages: the candidate extraction stage and the recognition stage. In extraction stage area of interest is extracted and the undesired backgrounds suppressed to highlight desired information [1]. Where as in recognition stage, based on shape, captured image is verified as traffic light or sign board. The proposed system is evaluated on video sequence, using a camera that runs at a speed of 20 frames per second. It captures images from suburban roads in varying illumination conditions and compared with the database. Depending upon the shapes recognized traffic light and traffic sign alert is provided to the driver.

Keywords— Traffic light recognition, traffic light detection, sign board recognition, sign board detection, real time processing, image processing, alertness.

I. INTRODUCTION

Intelligent Transport Systems (ITS) have great potential to save time, money, lives, and also to improve our driving conditions. Detecting the state of traffic light and their semantics at interactions is essential for autonomous driving in real time situations [3]. Traffic sign boards and light detection has an important role in transportation for reducing rising accident rate .There are many detection techniques developed recently for traffic light and sign board detection. A system which involves detection process of traffic sign and light in a single system does not exist [2]. Also illumination variation effect is a serious problem in real time environment. So keeping attention towards different traffic signs are difficult task for every drivers. Illumination variation in different climatic conditions adversely affects the clear vision of traffic signs by an individual driver. So we propose a system that can be used to detect traffic light and signs under different illumination conditions.

Traffic sign and light detection is an important part of driver assistant systems. These can be designated in different colors or shapes, in high contrast background. So in order to capture these images traffic light and signs are oriented upright and facing camera [1]. Hence there will be geometric and rotational distortions. In these cases accuracy is a key consideration. One miss classified or undetected sign and lights will produce adverse impacts on driver. The basic idea of proposed system is to provide alertness to the driver about the presence of traffic light and sign at a particular distance apart. The color of a traffic sign is easily distinguishable from the colors of the environment.

In section II, previous works are explained and the improvements we made are also stated. Then in section A the used methodologies are described, which includes image capturing, recognition and detection. In section B experimental results to illustrate performance of the system is provided. Finally acknowledgment and conclusion are mentioned.

II.RELATED WORK

Nowadays, studies on intelligent vehicles, which autonomously drive in urban environment, are becoming more popular. Detecting the traffic light in real driving environments is not an easy task. Although many researchers make efforts to provide the reliability required by the intelligent vehicles to safely pass through intersections, most of these methods, more or less, are defective in real driving environment. Traffic symbols have several distinguishing features that may be used for their detection and identification [1]. They are designed in specific colors and shapes, with the text or symbol in high contrast to the background. In early works, a vision based method is used to detect traffic lights. However this method requires that camera equipped at fixed place nearby traffic lights and these methods cannot meet the real time processing requirement [1]. Therefore these traffic light detection methods are not

applicable for intelligent vehicles. In the case of traffic sign detection majority of system make use of color information as a method for segmenting images. The performance of color based road sign detection is often reduced in scenes with strong illumination, poor lightning or adverse weather conditions [6]. The vast majority of the existing systems consist of hand label real images which are repetitive time consuming and error prone process. Information about traffic symbols, such as shape and color, can be used to place traffic symbols into specific groups; however there are several factors that can hinder effective detection and recognition of traffic signs [5]. These factors include variations in illumination occlusion of signs, motion blur, and weather –worn deterioration of signs. Road scene is also generally much cluttered and contains many strong geometric shapes that could easily be misclassified as road signs. Accuracy is a key consideration, because even one misclassified or detected sign could have an adverse impact on the driver.

Results from Literature survey

Existing Detection Method	Advantages	Disadvantages
Vision Based Method – Camera placed at fixed distance near traffic light	User friendly Geometric distortion is limited	Cannot meet real time requirements Cannot used in intelligent vehicles
Color based road sign detection	Used in hand labeled images	Time consuming Error prone process

Table 1 : Literature survey analysis [9]-[12]

A.PROPOSED SYSTEM

Proposed system detects and recognizes both the traffic light and traffic sign board. The proposed system consists of two stages: candidate extraction stage and the recognition stage. The detection stage identifies the region of interest and mostly performed by using color segmentation which is followed by shape recognition. Detected candidate are either identified or rejected during recognition stage using template matching. General traffic light detection method mainly focuses on locating the traffic lights in each frame and understanding their control semantics. It mainly aims to determine location of traffic light in each frame and later recognize them as different light types. The color of the emitting units will vary under dynamic light condition with video cameras.

III. BLOCK DIAGRAM DESCRIPTION

Throughout this section paper explains the steps that are carried out for the detection and recognition process of the proposed system.

i. Image Acquisition:

The first step is collection of images of traffic signs, data. The collection and storing of images are referred to as image acquisition. The real time traffic lights and road sign board images are used as data. Data's that are freely available from an online are not used. These images are collected at an average speed of 20 frames per second from high speed vehicles under different illumination conditions. Captured image in RGB form is converted to grey scale image. Grey scale images measures light intensity. Since each color image has several intensity levels detection process will be complex. Hence the input images are converted to grey scale format.

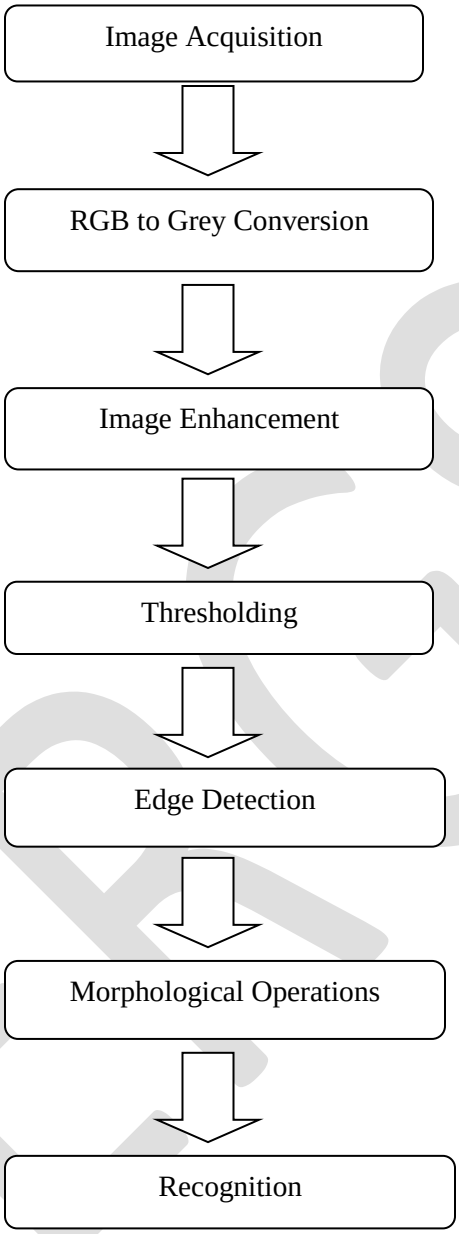

Fig I: Block diagram of proposed system

ii. RGB to Gray Conversion:

Grey scale images contain brightness information. Each pixel value corresponds to amount of light. Each pixel is represented by a byte or word. An 8 bit image have a brightness variation from 0 to 255 and 0 represents black and 1 represents white. This conversion makes calculations performed in every image simpler, it reduce complexity in performing mathematical operations in the image.

iii. Image Enhancement:

In order to extract every detail in the given image it needed to be enhanced. It improves the quality of information in every image which provided better quality to the image and can be used for many applications. Enhancement process is manly carried by

either suppressing the noise or by increasing the image contrast. Enhancement algorithms are used to sharpen or smoothen image features for analyzing. Median filter is employed in the proposed system. Each output pixel contains median value in MxN neighborhood around the corresponding pixel in the input image. It pads the image with zeros on the edges, so the median value of points is within [MN]/2.

iv. Thresholding

The enhanced image is then converted to binary image by theresholding. The process is completed by grouping pixels with same intensities. The threshold value of output image is chosen as 0.1 by trial and error method. The input image with luminance greater than the level of 0.1 is treated as 1 and below 0.1 is treated as 0. That is now the image has been converted to binary image, pixels with combination 0 and 1.This converted image is then made set for morphological operations to extract the required area of interest. Here shape based detection is carried out to find whether the received image by the camera is traffic light or traffic sign board.

v. Edge Detection

Required shape features are extracted by morphological operations. The proposed system detects whether the captured image is traffic light or sign by considering the shape. The captured image is checked for circular shape of required area and if system recognizes the circular region of interest of specified size, the image is recognized as traffic light else image is detected as traffic sign board. So in order to detect required shapes a flat shaped structuring element with specified radius R is created. For application purposes R is chose as 5. Image dilation operations are also used for gray scale, binary or packed binary image returning the dilated image. Function is used to extract structural element, object or array of structuring elements are returned. In order to extract element details image should be flat as possible. So to attain that, required area is removed from binary image. All connected components that are fewer than 300 pixels produce another image, by area opening.

vi. Morphological Operation and Recognition

Morphological operations capture the essence of the features such as shape in an image. These operations remove unwanted pixels and highlight the required operations of the image .Every image has a background information as well as region of interest. These morphological operations are used to extract the required region

B.EXPERIMENTAL RESULTS

Here we conducted limited number of experiments to understand the performance of our traffic light and sign board detection system. The test was conducted on images that are captured under different illumination conditions by camera mount on vehicle.

SIMULATION RESULTS

Following shows the results of Matlab programming for the recognition and detection of traffic lights and sign board.

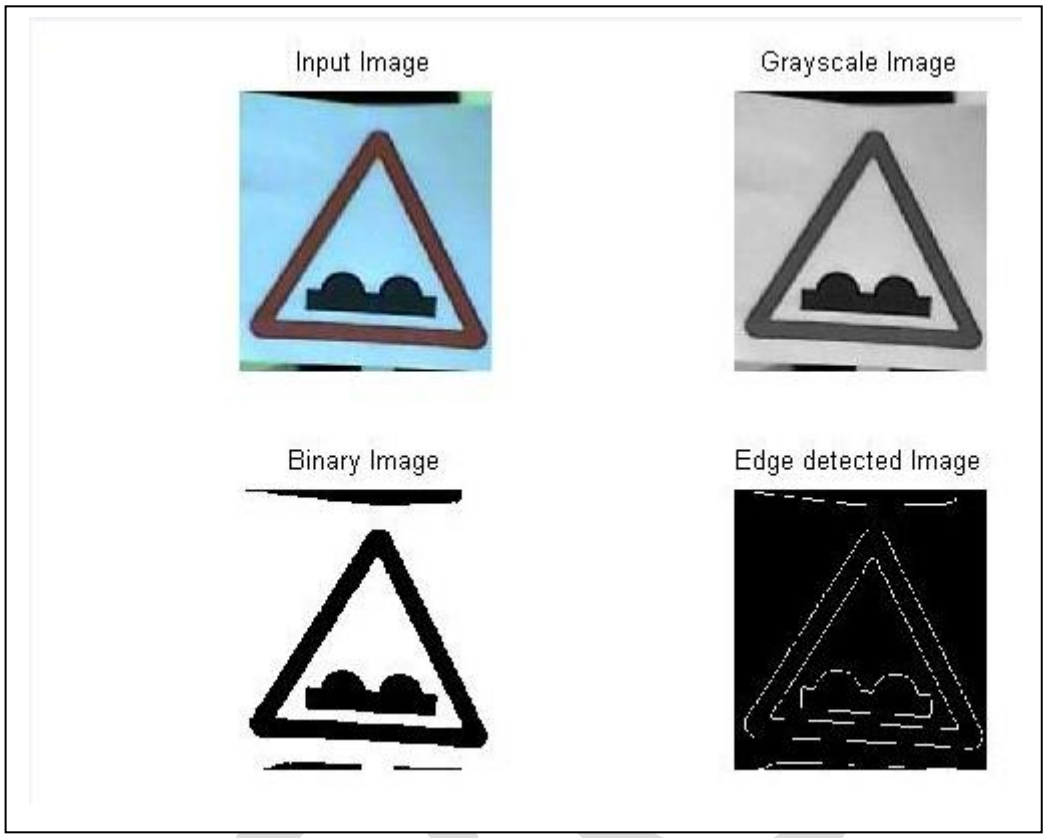

Fig II: Results of recognition of traffic sign board

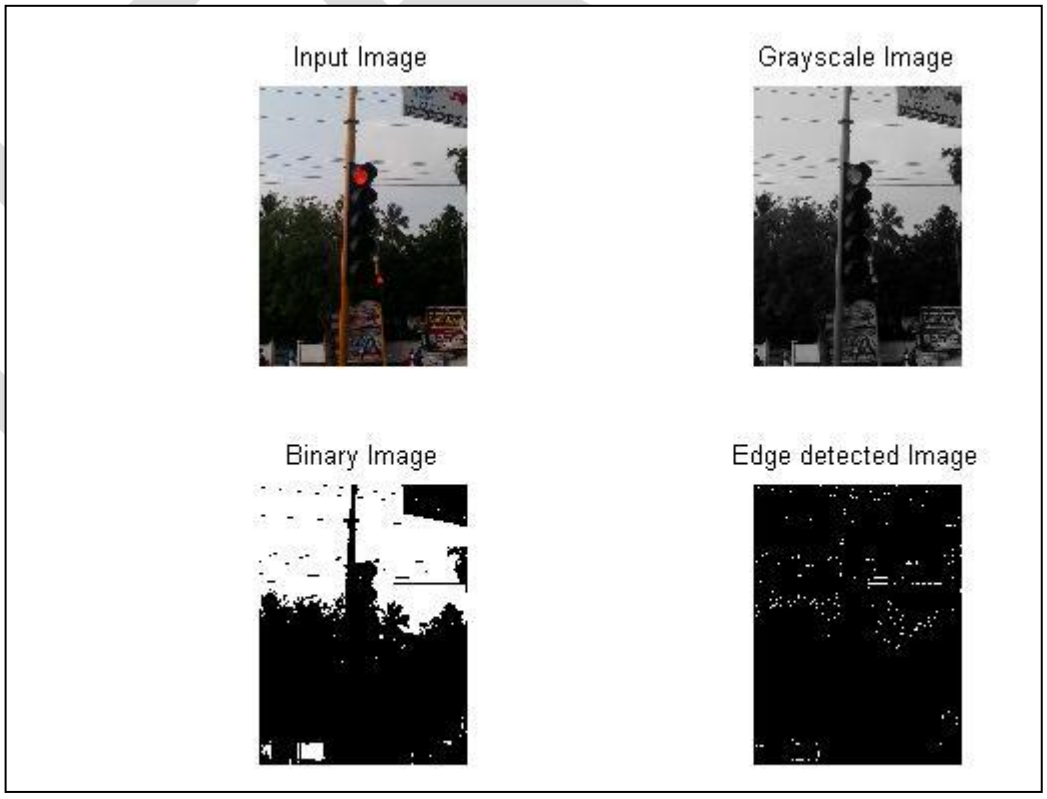

Fig III: Results of recognition of traffic sign board

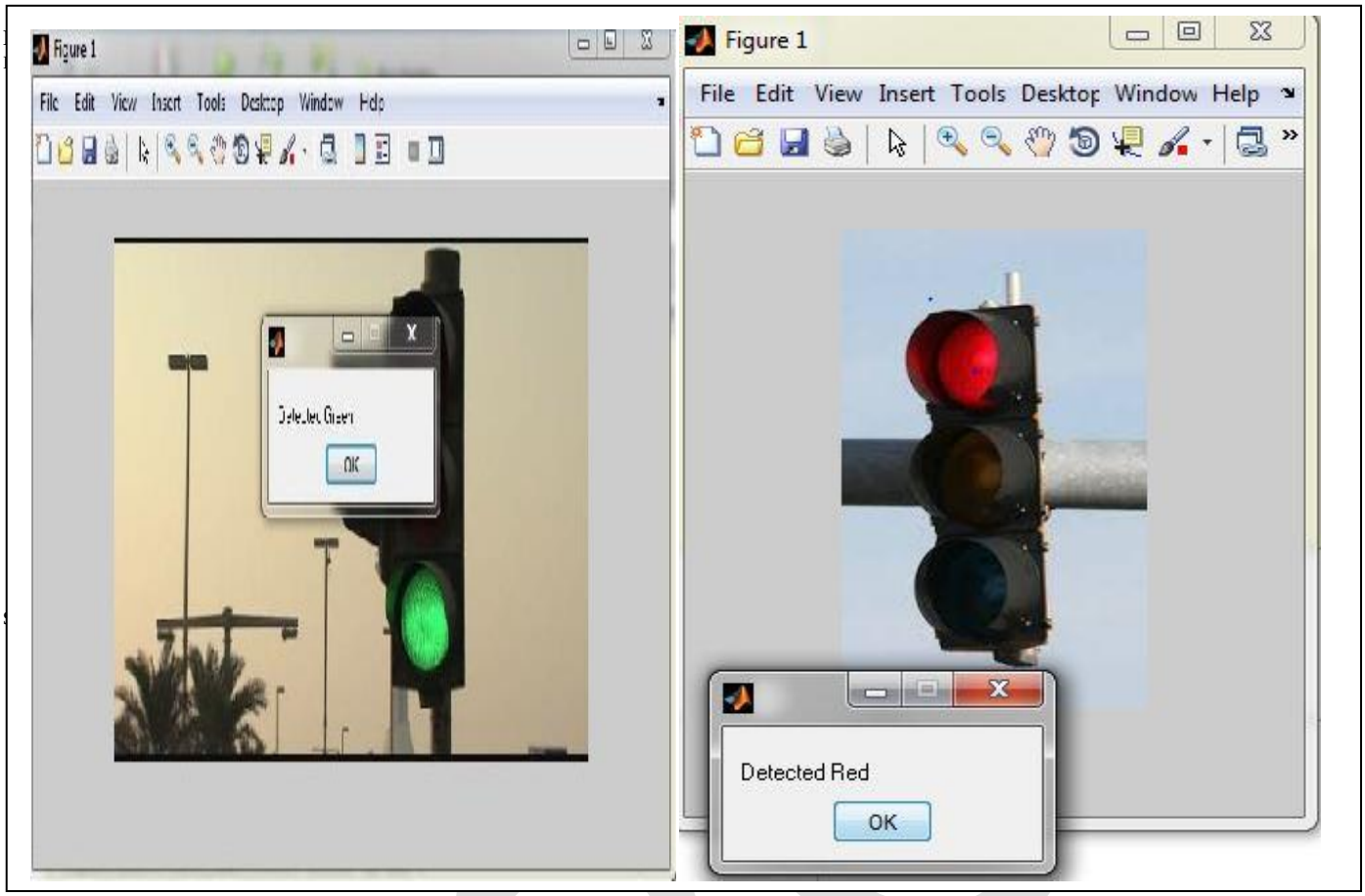

Fig IV: Results of detection of traffic lights

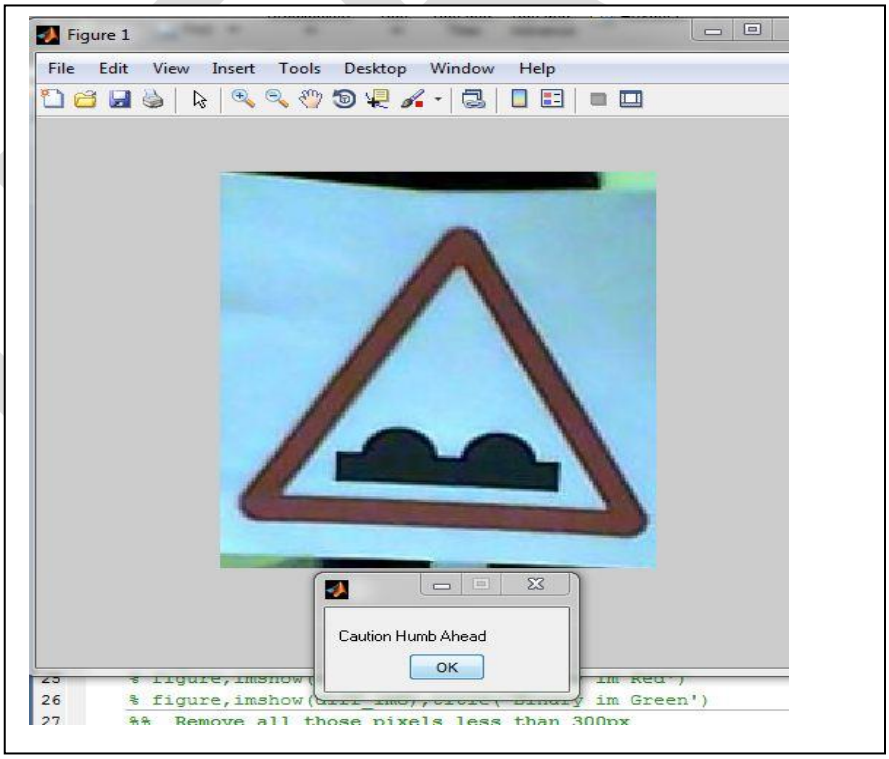

Fig V: Results of detection of traffic sign board

Sl.No:	TARGET	CAPTURE TIME	TRUE/FALSE
1	Red/Green	Midday	T
2	Red/Green	Afternoon	T
3	Red	Nightfall	T
4	Green	Nightfall	F

Table II: Details of traffic lights used for experiments and Detection results

Sl. No:	TARGET	CAPTURE TIME	TRUE/FALSE
1	Hump	Midday	T
2	Hump	Afternoon	T
3	Hump	Nightfall	T
4	Stop	Afternoon	F

Table III: Details of traffic sign boards used for experiments and Detection results

CONCLUSION

We propose a vision based method for traffic light and sign board detection which can be used under different illumination conditions. The main problem of existing system like failure in recognizing traffic signs under different climatic conditions were cured by using the proposed system. Here we suppress the background by setting a threshold for required area of interest depending on shape to detect the presence of traffic light and sign board. Experimental results provide that the method is fast and robust. The detection procedure is performed in real time. The proposed method can be implemented as hardware modules on vehicles.

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