A Novel Approach for Detection of Traffic Light Timer with Voice Based Assistance

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Abstract— An efficient method to detect traffic lights and recognize signal count-down timings is developed. Traffic scenes are often complex as it include lot of information, keeping constant attention on the traffic signs is not an easy task for drivers. Therefore some traffic data or signs can be missed for several causes such as the complexity of the road scene, the high number of visual information, or even the bad weather condition or visual fatigue. The countdown timings are segmented and extracted from the image based color segmentation. These signals also use specific shapes for each color, which aids visually impaired people in distinguishing signal aspects. Traffic light detection is done by color segmentation of the input image, based on the RGB color thresholding. The predominant glowing traffic light can be very well identified by this method regardless of the size and shape of the traffic lights. Although the shape of traffic lights is not considered, as a criterion for identification, only the round traffic lights are taken into account. Finally the detected digit in the timer is displayed on the screen and converted into voice.

Key words: RGB, Thresholding, Traffic Data

I. INTRODUCTION

Image processing is a technique of performing operations like enhancement and modifications on the two dimensional input image to get the desired result. Digital image processing deals with operations on digital images through a digital computer. The elements which constitute a digital image is called pixels. Each of these image elements gives a specific location and value of an image. A pixel gives an intensity value which is a number and location address of a two dimensional image. The location of a pixel is represented by its row and column coordinates in the two dimensional image. The intensity of a pixel is stored in terms of digital number. Due to limited storage capacity a digital number is stored as a finite number of binary digits (bits).

Image processing has evolved a lot in recent years mainly due to the digitalization of images by computer through the use of various complex algorithms. Digital image processing makes use of computer algorithms to perform operations on digital images. It's a subfield of digital signal processing. Various kinds of applications can be seen today mainly because of digital image processing. Image is a function of two real variables a(x, y) where, a is the amplitude of the image at the coordinate position (x, y). An image may be considered to have sub-images known as region of interest. Digital image contains fixed number of rows and columns of pixels. Pixels represent brightness of a given color at the specified point.

It provides various environmental information such as traffic signs, speed limits, traffic lights, crosswalks, or any other information like pedestrian or obstacles. The specific functionality of traffic lights detection shall be very useful since traffic lights state (go, stop or caution) provide good knowledge of the traffic environment. Traffic lights are sometimes accompanied by timers that indicate how much longer a certain phase will last [3] This is especially common for pedestrian crossing lights in high traffic areas. Countdown timers on traffic lights are useful for drivers/pedestrians to plan if there is enough time to attempt to cross the intersection before the light turns red and conversely, the amount of time before the light turns green.

In this paper, a solution to identify digits in the timer absolutely with limited conditions. Traffic scenes are often complex as it include lot of information, keeping constant attention on the traffic signs is not an easy task for drivers [4]. Therefore some traffic data or signs can be missed for several causes such as the complexity of the road scene, the high number of visual information, or even the driver's stress or visual fatigue. In order to assist this task intelligent transport solution has existed in recent years [2].

Traffic lights are the road signals that control the vehicular traffic through colored lights, usually green for go, red for stop and yellow for proceed with caution. Mainly these traffic lights are placed at road intersections, junctions or crossroads. If controller finds a problem then the traffic signals will go into flashing mode. The traffic lights also include a timer display for convenient calculation of remaining time for respective aspects. Like crossing time for pedestrians, time to stop and go for vehicle drivers. It avoids unnecessary problems.

More precisely, we illustrate architecture, to carry out the necessary segmentation and feature extraction in the coming sections. In different countries there are different color conventions and sign of traffic. For example, in US the yellow light provides warning that the signal will be changing from green to red while in UK red to green. The traffic lamps or lights are also seen at railways and fire stations.

The remainder of this paper is organized as follows: Section 2 discusses related work, whereas Section 3 illustrates detection of traffic lights. Section 4 describes the proposed approach. Section 5 introduces the three scenarios on which the digits are identified. Section 6 concludes the paper and future research directions.

II. RELATED WORK

Traffic Light detection has a vast number of applications. The predominant traffic light can be detected by various methods. One way of detecting the traffic light is by their color and edge information [1]. The input image with traffic light is normalized by color space conversion. Based on the threshold values for each color namely red, yellow and green may be extracted as candidate region. The edge information of the candidate regions were obtained by Sobel...
filter. And the shape of the traffic light is verified to be a circle by using Hough Transform [6]. But, the proposed method may not be applicable to the LED traffic lights due to the discontinuities in the light surface.

The digits in timer display are recognized by developing a real time display detector and digital character recognition application using techniques based on the connected components approach [7]. A computer vision system has been designed to automatically read the displays of digital instrumentation [8]. A combination of steps has been implemented and some newly added techniques contribute the proposed work.

Traditionally, incandescent and halogen bulbs were used. Because of the low efficiency of light output and a single point of failure, municipalities are increasingly retrofitting traffic signals with LED arrays that consume less power, increased light output, last significantly longer. The traffic signals can be mounted in different positions in different regions. Generally, the use of unusual shapes of traffic lights exists all over the world such as horizontal traffic lights with red to the left and green to the right. These signals also use specific shapes for each color, which aids colorblind people in distinguishing signal aspects.

III. DETECTION OF TRAFFIC LIGHT

The traffic lights also include a timer display for convenient calculation of remaining time for respective aspects. Like crossing time for pedestrians, time to stop and go for vehicle drivers. Traffic lights are the road signals that control the vehicular traffic through colored lights, usually green for go, red for stop and yellow for proceed with caution. Mainly these traffic lights are placed at road intersections, junctions or crossroads. If controller finds a problem then the traffic signals will go into flashing mode.

Traffic Light detection is done by color segmentation of the input image, based on the RGB color thresholding [5]. The predominant glowing traffic light can be very well identified by this method regardless of the size and shape of the traffic lights. Although the shape of traffic lights is not considered, as a criterion for identification, only the round traffic lights are taken into account. In case of arrow traffic lights, driver has to be assisted on its direction also. In any kind of traffic light detection system, the system can be proposed only based on some assumptions, regarding its appearance. This is because the traffic lights vary in their architecture in different regions. The traffic light is primarily detected by comparing the count of red pixels with green pixels.

IV. SYSTEM ARCHITECTURE

Image extraction is enabled by setting the name of the output file using the parameter image set. The name of the columns to use for the x and y axes of the input image is set using the parameters x column and y column. The identification of digits in the image is carried out in this step. Object recognition algorithms rely on matching, learning and pattern recognition algorithms using features based on the previous output.

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**Fig 1: System Architecture**

Template matching is a technique for finding areas of an image that match to a template image. Finally the shape of traffic light is compared and it is sent to further processing. After recognition of digits in the image, it will get converted into text information. Then a text to speech tool is used to convert text into audio.

V. LED DIGIT IDENTIFICATION

A. LED Digit Recognition

The timer values in the traffic signal, is going to be in either red or green or yellow color. Hence, the entire image is scanned, row by row, to find the red, green or yellow color. If any one of these colors is present in the image, then the entire row is selected and is stored in another variable. The next phase is to identify the timer values present just below the traffic lights.

B. Segmentation and Extraction

In order to extract the digit from the previously obtained image, horizontal and vertical scanning is performed. Thus the digit alone is segmented and extracted

Based on the various combinations of the segment state, each digit can be recognized easily. Thus, a bounding box of width 20 is created as shown in Fig 2. For our image, the bounding boxes are assumed to be at the following positions. Figure below shows the segment presence and absence in the box embedded.

Future work will be directed towards the implementation of few more techniques in detecting the traffic lights, for better performance in case of complex backgrounds. The system can extend its work towards the detection of traffic lights with arrows, night images and adverse weather conditions. The LED digits recognition may be compared with the existing techniques.
Bounding boxes are nothing but simple squares that is plotted against each LED segment. These boxes can be placed over each LED segment with the help of the (x,y) coordinates. Since, the image is resized & segmented digits to a standard 100x80 size, the presence of each segment can be predicted easily.

C. ON/OFF Status of Led Segment

In order to check the segment status of each segment in the LED, the presence of any pixel within the bounding box are checked. Once the segments are named, the status of each segment is found by checking the bounding boxes present over each segment of the LED.

VI. CONCLUSION

This paper describes an efficient method to detect the traffic lights and corresponding countdown timers. The changing traffic lights are detected by extracted by extracting region of interest and timer display by segmentation using thresholding.

The primary traffic light was detected by comparing the count of red pixels with the count of green pixels that is obtained as a result of thresholding. The LED digits in the timer display were recognized by color segmentation, and then segmented and extracted by horizontal and vertical scanning. The extracted image was then resized to a standard size and converted into its binary form. Bounding boxes of static width was placed over each extracted LED segment. The ON/OFF status of each LED segment was obtained for all the seven segments and based on the different combination of each LED segment status, the digits were recognized. Implementing in real systems is easy as compared to existing techniques which are limited.

REFERENCES


