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Real Time Accident Avoidance Using Image Processing

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Abstract

The increase in the number of vehicles has led to the rise in accidents. Most of these accidents are caused due to over speeding. According to World Health Organization (WHO) in 2017, speeding killed 4, 64, 910 people in India and this number is increasing day by day. Existing speed detection systems are installed on few roads hence is not efficient .Thus there is need for system which will be installed in individual vehicles rather than being installed on roads. Our system proposes a new data-driven system to recognize all speed limit signs captured by a camera mounted on a car. This camera captures images in real time and on performing image processing recognizes and provides relevant alerts to the driver driving the car. Also our system includes pedestrian detection to reduce fatalities to pedestrians crossing roads. It is achieved with the help of proximity sensor mounted on a car. In this way we attempt to design an automated system which is effective enough to compel drivers to maintain traffic discipline and reduce the number of casualties resulting from the same and to ensure pedestrians a safe commute.

Keywords — Image Processing, Raspberry Pi, Contour Detection, Optical Character Recognition, Region of Interest.

I. INTRODUCTION

Vehicle driving has become more common in the life of people. Thus, traffic security is very important. Traffic signs are used for traffic warning, regulation, routing and management of important information for autonomous vehicle. These signs are intended to affect the behaviour of drivers. Due to the tremendous increase of road vehicles all over the world, the number of road accidents has also increased significantly. Among different causes of accidents, some major causes are ignorance of the road sign, occlusion of the road sign and distraction of the drivers. Our work describes the design of an embedded system for the "the avoidance of accidents using road sign recognition". Traffic sign is a computer vision technique of driving assistance system in automatically recognition roadside traffic signs. Traffic sign detection and recognition (tsr) is an important research topic that continuously keeps wider interest to the research in the field of intelligent transport system because of its application in the driver assistant system that helps to regulate the traffic, indicate the state of the road, guiding and warning drivers and pedestrians. In resent past a lot of research is carried out for the robust tsr system in literature. Many of them used colour and shape segmentation for traffic sign detection. A driver assistant system like tsr helps the drivers to recognize the traffic signs and alert them to keep them safe from road accidents.

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II. RELATED WORK

A. Contour Detection

1. Gray scale Conversion:

The first step in image analysis was the conversion of the RGB image into gray scale using standard techniques [1]. An example gray scale image is shown in Figure 1.

Fig. 1 Gray-scale image

2. Median Filtering

After gray scale conversion, the median filter is used to smooth the noise in the image (Figure 2). A median filter is used to modify the pixels of the image so that the new pixel value will be selected as the median of the neighboring values within the range. This filter will be used to remove the random noise in images but it will still maintain the overall integrity of the image regions and boundaries. This type of filter will be categorizes as a blurring filter in many image processing toolkits [3].

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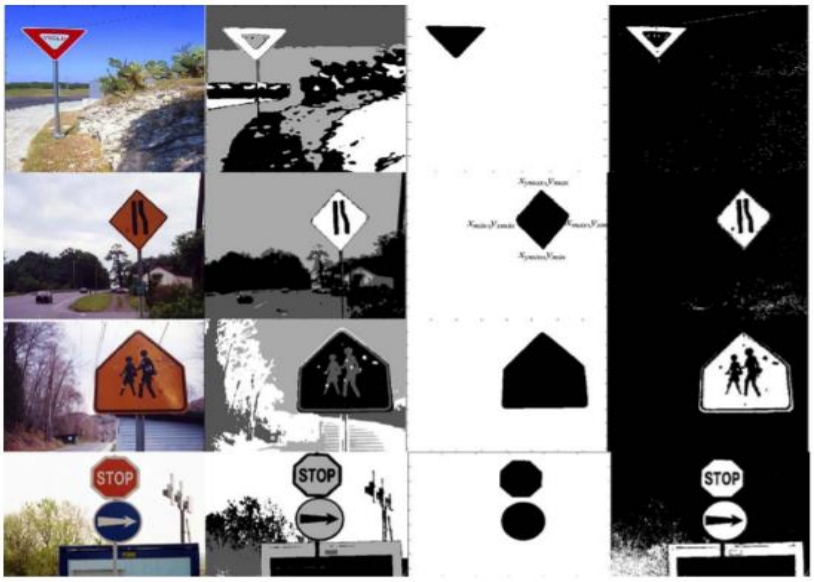

Fig. 2 Median Filtering

3. Thresholding

The conversion of gray scale image into a black and white image is the next processing technique which is called as thresholding. In this process a threshold value is selected from the gray scale image. It is takes as cut off to determine the pixels must be converted into white or black rom the image. The result is shown in figure 3. This image will show a clear flow of lines from the lower point of the right corner to the upper left vanishing point [6].

Fig. 3 Thresholding Image

4. Line Detection

Hough Transform (HT) is performed on the threshold image. Using the HT algorithm mapping of all points in the image space into sinusoids within an alternate polar coordinate parameter space is done. The polar coordinates defined within this parameter space define the angle and magnitude or length of vector normal for probable lines in the image space. Mapping in the HT parameter space to lines can be done using these parameters [4]. Every point corresponds to a numerical value that will relate to the likelihood of the line which is given by the polar coordinates that exist in the real image. The most prominent lines are defined by the local maxima within the image. In the resulting

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parameter space image the bright spots indicate the local maxima and the most well defined lines are being reflected in the image. On analyzing further, it is revealed that the single parameter space lines are being represented from the local maxima of the parallel lines. The appearance of the ridge in the parameter space image is being explained [10].

B. Text Detection

Text detection in natural scene images is a challenging and difficult task. Real time natural images contains image or sensor noises, different viewing angles, bad lighting conditions which causes the text detection mechanism to yield inaccurate results. To deal with this problem we are using an Efficient and Accurate Scene Text Detection (EAST) model [5]. EAST is a deep learning model which is capable of running at near real-time at 13.2fps on 720p images and obtains state of the art text detection accuracy [7]. EAST Text Detection implemented with the OpenCV is capable of localizing text even if it is blurred, reflective or partially obscured. Existing methods such as conventional or deep neural networks mostly consist of multiple stages thus they are very time consuming and cannot be implemented in a case of real-time application model [8].

In proposed system EAST Text Detection model is used to detect the exact value of speed limit from the speed limit sign. This is achieved by successfully distinguishing the text from the background. The detector model identifies the text using either rotated rectangles or quadrangles for text regions. It detects and localizes the bounding box coordinates of text contained in image. This deep learning model is trained to predict the presence of text in a natural scene image from the whole image itself, it doesn't slices or splits the image into multiples for the text detection purpose. This removes the intermediate stages such as text region formation and word partitioning leading to the model which outperforms the previously known methods in terms of accuracy and efficiency [11].

C. Optical Character Recognition (OCR)

Optical Character Recognition (Optical Character Reader, OCR) is a technique to recognise any kind of text (typed, printed or hand-written) from any a scene photo, image or scanned document. For this we are applying Tesseract-OCR. Tesseract is a very popular OCR engine which can be specific to a certain language. This decreases processing time and CPU power [2]. Tesseract works very well under controlled conditions but its performance decreases if there is significant amount of noise in image or image is not properly pre-processed and cleaned before applying Tesseract-OCR. Thus it is advised to apply any pre-processing technique such as EAST Text Detector as it not only detects the text present in an image but also removes the noise from an image [14].

Once the ROIs are identified in the form of box bounding (x, y) coordinates, the Tesseract-OCR starts to gather the outlines by nesting them into the blobs. Blobs are organized into text lines, and the lines and regions are analyzed for fixed pitch or proportional text. Text lines are broken into words differently according to the kind of character spacing. Fixed pitch text is chopped immediately by character cells. Proportional text is broken into words using definite spaces and fuzzy spaces [16].

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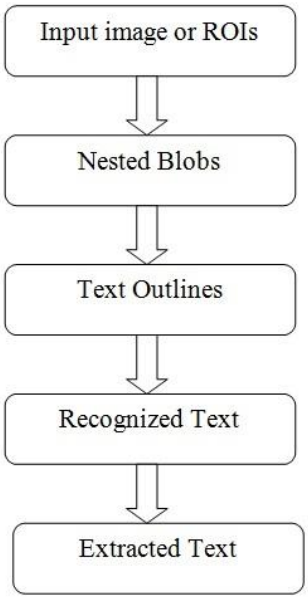

Fig. 5 OCR Flowchart

D. Working of EAST Text Detector with OCR

Image is provided to the EAST Text Detector as input. Then first the EAST algorithm will clean an input image if there is any noise present in image. This is done by using blur pre-processing method. The noise free image is then use by the algorithm to perform text detection. In this stage the output of EAST Text Detector is the ROI (x, y) coordinates [15]. Once the text is detected using OpenCV's EAST Text Detector, the ROIs of each detected text are extracted and they are passed to the Tesseract LSTM deep learning text recognition algorithm. The output of LSTM will give the actual OCR results [12].

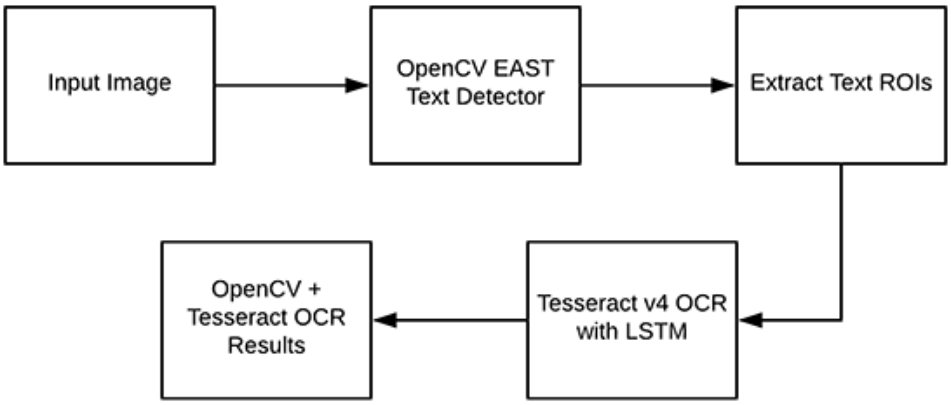

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Fig. 6 OCR Tesseract

III. PROPOSED SYSTEM

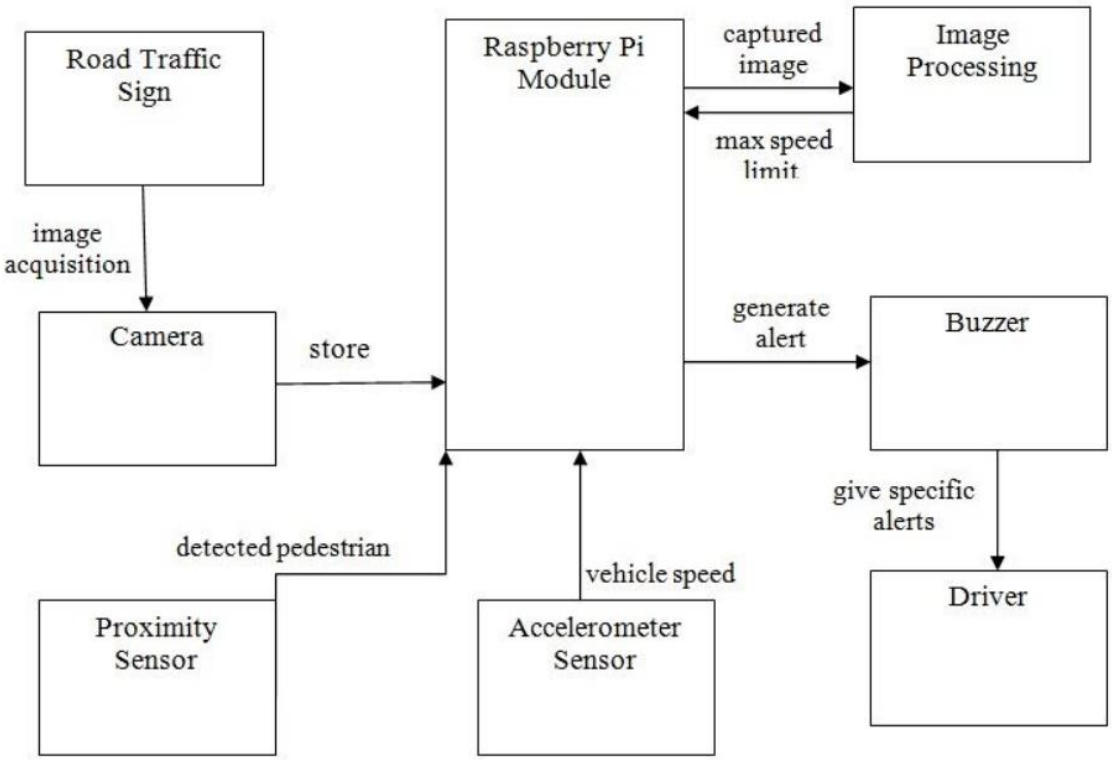

Fig. 7 System Architecture

The proposed system implements accident avoidance using image processing by capturing real time images of speed limit signs using camera and storing it in the raspberry pi module.These images are pre-processed, segmented and extracted to get the desired output i.e. max-speed limit sign which is all done by the raspberry-pi module. The accelerometer sensor is used to monitor the real-time vehicle speed. This max speed limit is compared with real time vehicle speed. If the vehicle speed is found to be more than the max speed limit then an alert is generated to the driver. In parallel to this a proximity sensor is continuously detecting pedestrians within its range. If pedestrian is detected then an alert is generated for the driver.

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TABLE I

EACH TRAFFIC SIGN IS ASSIGNED TO ONE OF THREE CATEGORIES. THE FOURTH COLLECTION CONTAINS ALL SIGNS WHICH ARE NOT RELEVANT TO THE COMPETITION

	prohibitory signs
	danger signs
	mandatory signs
	other signs

IV. CONCLUSIONS

Our projects aims to reduce the road accidents caused due to over speeding and enforce safety of driver and the pedestrians. To achieve this this goal, first the image of speed limit sign is captured using camera. This captured image then undergoes pre-processing which includes image noise removal and image enhancement which improves image quality. This image is then provided as input to segmentation phase. Here image region extraction is performed. Then the extracted part is used for classification to identify the speed limit sign to generate alert if driver is over speeding. In our project we are also generating alert if pedestrians come close to the vehicle to provide pedestrians safety.

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