SEGMENTATION OF INDIAN ROAD SIGNS USING MATLAB

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Abstract-Driving in unknown roads and terrains is a difficult task. Traffic signs play a vital role in warning and guiding the driver towards a safe journey. The traffic signs which are located at predefined positions on the road guide the drivers and warn them of possible complexities. But the fatigue of the driver may lead to miss some of the signs which may cause accidents to occur. The various environmental conditions like haze, fog, poor light, rain, mist, occlusions, speed of the vehicle will make the detection of traffic signs a very difficult task for a normal observer. The driver assistance system located on board in the vehicle will monitor the traffic signs and alert the driver about the environment ahead and help in preventing possible accidents.On Indian Roads, the main focus of the driver is on the current traffic, while focussing on traffic there might be a chance of ignoring the traffic signs, which can lead to accidents if not been careful.Traffic Sign recognition system is a part of driving assistance system that automatically alerts and informs the driver of the traffic sign ahead.

Keywords-*Driver assistance system; traffic sign detection; lucy-richrardson algorithm; median filter*.

I. INTRODUCTION

Driverless cars are becoming more popular and common in near future because of advancements in Artificial Intelligence, Machine learning, deep learning etc.,. Intelligent transport systems play a vital role in saving the life of pedestrians and also minimising damage due to accidents [1-3]. These systems widely depend on smart sensors, Geographical Information systems (GIS), Global Positioning Systems (GPS) etc. The driver assistance systems onboard should be robust and should work in real time[4].

In this paper we implement a robust Indian traffic sign recognition system using MATLAB. A high resolution camera mounted on the vehicle captures the road scene ahead and sends it to the processor on board. The processor processes the information and alerts the driver with the sign information. Indian road traffic signs are designed such that they are easily detectable and recognizable. Indian traffic signs are 92 in total which may be divided mainly into four types, viz warning signs(40), compulsory signs(27), regulatory(10) and informatory signs (15). There are mainly two distinguishable phases for automatic traffic sign recognition system. First is the detection phase and the second is recognition phase. In the detection phase system searches the image for road sign. Detection algorithms are based on colour or shape or both for segmentation we use

colour segmentation in YCbCr colour space. Afterobtaining a frame with possible traffic sign it is pre processed for removal of atmospheric noise and de-blurred. It is further converted to gray scale, segmented it using threshold based segmentation, Morphological operations are performed to remove unwanted portions of

the image and highlighted the image with the sign information which is extracted using a bounding box and

the information is presented to the driver on the onboard display unit.

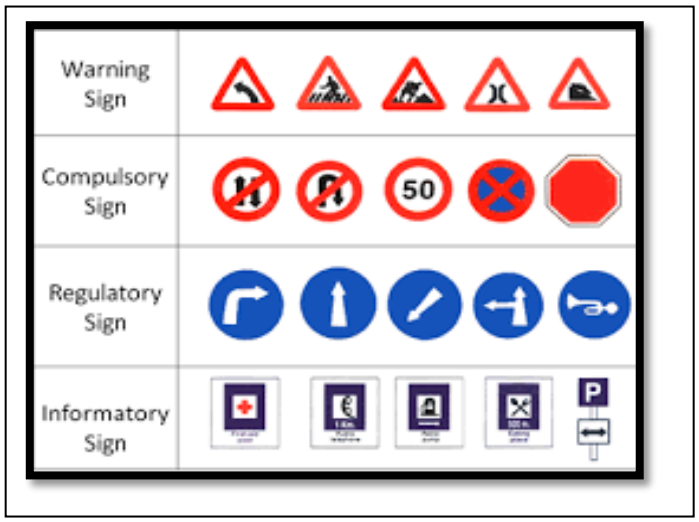

Fig. 1:Various classes of Traffic Signs

In section II a study about the characteristics of traffic signs have been done. Then, in Section III, we outline the methodology used, which includes detection and recognition of the signs from videos. In Section IV, we describe the experimental results to illustrate the performance of the system. Finally, conclusions are drawn in Section V.

II. CHARACTERISTICS OF ROAD SIGNS

Traffic signs have been designed so that they are easily recognisable from natural and driving environment. The colour for traffic sign is chosen such that, it serves different purposes and is also distinguishable for the driver while driving[5-6]. The signs are represented by fixed shapes like triangle, circle, octagon, and rectangle. The combined feature of colour and shape are used by driver to distinguish a traffic sign. Hence an automated system also uses the same principle of 'the colour and shape property of traffic signs'. With respect to the road the traffic signs are located at well-defined locations so that the drivers can more or less expect the position of the sign. The road sign may contain text as a string of characters or pictogram or both to represent the meaning of the sign. They are characterised by using fixed text fonts and character heights.

There are a number of traffic signs in India categorized as warning (40), compulsory (27), regulatory (10) and informatory (15). This makes a total of 92 traffic signs all together. These signs are mainly characterized by colour and shape. Figure 1 shows the different

types of Indian traffic sign and their description are discussed below.

A. *Warning Sign*: A triangle with red coloured border and white background represents a warning sign. Different pictograms in black are used to represent the various warnings. These signs alert the driver with hazards ahead.

B. *Compulsory Sign*: Compulsory signs uses circle with red border and white background. These signs restrict the action of drivers depending on the pictogram represented on the sign. Signs with a cross prohibit the driver from certain decision such as no left turn or no 'U' turn etc. Speed limit signs are also included in this category of traffic signs, with speed limit as the pictogram. Another exception is octagon with red background with STOP in white and blue circle with red border and cross represents 'no parking sign'.

C. *Regulatory Sign*: They are mandatory sign to control the action of the drivers on road. They are used to regulate the traffic flow and vehicles moving on road. Blue circle with white border represents a regulatory sign. While the arrows within it represent the movement of the vehicle on road.

D. *Information Sign*: Important information like nearby hospitals, telephone booth, first aid, petrol pumps etc. come under this category. This information helps the driver in emergency in need. White rectangle with thick blue border and the necessary pictogram represents the required pictogram. Parking information is also included in this category.

III. METHODOLOGY

A block diagram of the proposed system for the detection of the traffic signs is as shown below.

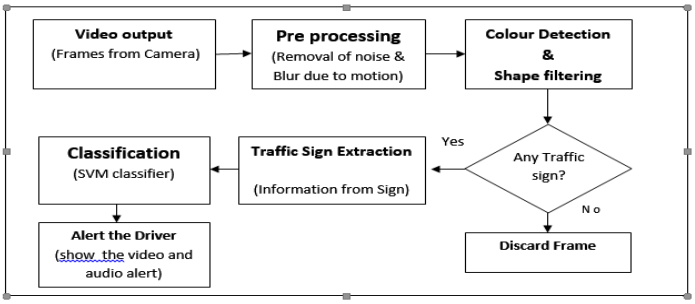

Fig .2: Block diagram of the proposed system

The on board camera acquires the video scene for the traffic ahead which is divided into frames and fed to on board processor for further processing. The frame acquired is contaminated by acquisition noise (Gaussian), the frame may be disoriented, damaged faded or occluded and may suffer with blur because of different environmental and speed of the vehicle. This frame is fed to pre-processing stage to remove the effects of environment. A median filtering is performed to remove the noise and wiener filtering is performed to remove the blur. The weiner filter being a linear filter and the blur being non linear, it is not effective. A lucy-richardson filter (non linear) is applied on the image and the results are promising. A comparative study is as shown below.

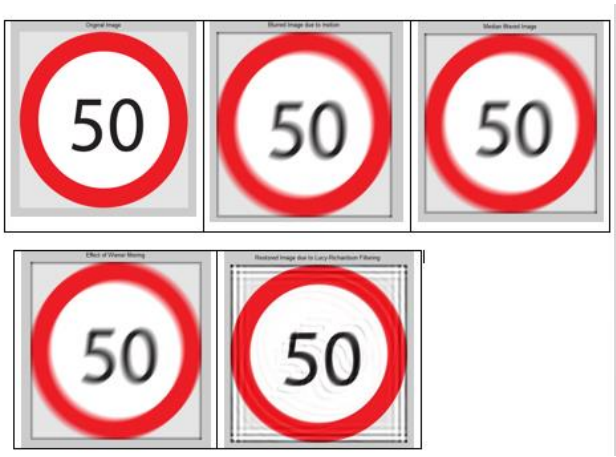

Fig. 3:Effect of median, weiner and Lucy- Richardson filters on the speed limit sign Image

Since the colours to be detected in the traffic signs are mostly red, black, blue and white, A YCbCr plane is very suitable for processing the images. The Y component(luma) represents brightness, while Cb (Blue Chroma) component represents how close the colour of the pixel is to blue and the Cr (Red Chroma) component represents how close the colour of the pixel is to red. In the colour detection and shape filtering the image is converted to binary image using otstu thresholding. Then the image is subjected to morphological operations and removed all objects containing less than 30 pixels using bwareaopen. The result is further processed using bwlabel that is the connected components using 8 connected components and region props operation in MATLAB. A bounding box is drawn and the objects are extracted. The extracted objects are displayed on the video screen. A multiclass SVM classifier is used to classify the extracted symbols and an audio output is played corresponding to the extraction

IV. EXPERIMENTAL RESULTS

The driver assistance system is fed with a plane consisting of a speed limit symbol which is corrupted with motion blur and which is removed by Lucy- Richardson filter which is further converted to a gray scale image and then converted to a binary image using otsu thresholding. Morphological filling is applied to any area lesser than 30 pixels. A bounding box is drawn on the remaining clean binary image is applied to the traffic sign extractor and finally fed to the svm classifier to identify the correct symbol

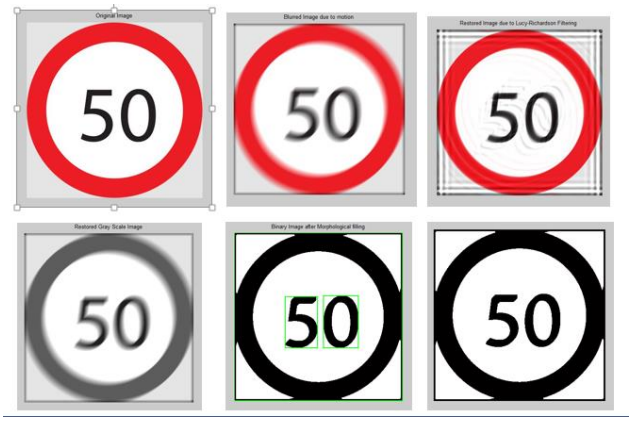

Fig. 4: Experimental Results

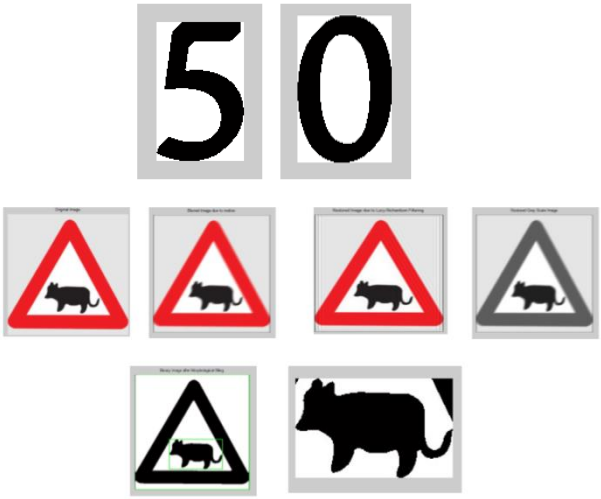

Fig. 5: Sample Segmented outputs

V. CONCLUSIONS AND FUTURE SCOPE

Traffic sign detection based on color and shape is presented in this work. YCbCrcolor space is used for color segmentation to overcome the illumination sensitive characteristic of RGB space. The corrupted frame is preprocessed and nullified atmospheric and other noises using lucy-richardson filtering. The otsuthresholdedimage is applied with morphological operations removing unwanted areas. 8 connected component analysis is performed to identify the potential symbols and they are extracted and a multi class SVM classifier is used to classify the symbols.

The recognition rate can be improved further by increasing training data or by going for neural network classifier or deep learning classifier. Deep learning classifier demands for more training data. Transfer learning can be applied to reduce the data requirements for training and improve the overall accuracy of the system

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