TRAFFIC LIGHT AND SIGN DETECTION FOR AUTONOMOUS LAND VEHICLE USING RASPBERRY PI

Sandhiyaa S[1], Vijayan M[2]

[1]Dep of ECE,Velalar College of Engineering and Technology (India)

[2]Dep of ECE, Velalar College of Engineering and Technology (India)

ABSTRACT:

This work aims to implement traffic light and sign detection using image processing technique for an autonomous and vehicle. Traffic sign recognition system is used to regulate traffic signs, warn a driver and command certain actions. Fast robust and real time automatic traffic sign detection and recognition can support the driver and significantly increase driving safety. Automatic recognition of traffic signs is also important for an automated intelligent driving vehicles. The experimental result show highly accurate classification of traffic signs patterns with complex background images as well as the results accomplish in reducing the computational cost of this proposed letter.

Keywords—Hsv; Opencv ; Python; Roi; Raspberry Pi; Webcam

1. INTRODUCTION

In present day, sign detection is mainly used to assist the driver and give commands through audio feedback, consequently decreasing the number of accidents. The objective of this work is to formulate a method for traffic light detection and detection of sign boards. With the help of this method, one can accurately detect traffic light colors i.e., red and green, and different signs like forward, turn left, turn right and turn back. Road signs make use of colors as a basis for distinguishing it from other objects. Computer vision is used in the field of intelligent transport systems. Lately, the traffic sign recognition systems have become an integral part of Advanced Driver Assistance Systems (ADAS).

2.LITERATURE REVIEW

Gurjashan Singh Pannu et al, [2] proposed a "Design and Implementation of Autonomous Car using Raspberry Pi" the summary is as follows,

Algorithms like lane detection(two approaches namely feature based technique wherein it localizes the lanes in the road images by combining the low-level features, such as painted lines or lane edges and second is the model based technique wherein a few parameters to represent the lanes. Assuming the shapes of lane can be presented by either straight line or parabolic curve, the processing of detecting lanes is approached as the processing of calculating those model parameters), obstacle detection are combined together to provide the necessary control to the car. Here a combination of feature and model base is used.

How Google car works proposed by Erico Guizzo [10], Velodyne 64-beam laser generates a detailed 3D map of the environment. The car then combines the laser measurements with high-resolution maps of the world, producing different types of data models that allow it to drive itself while avoiding obstacles and respecting traffic laws. Components Used for design of google car are sensors, four radars, (mounted on the front and rear bumpers) 1 camera (positioned near the rear-view mirror), GPS, wheel encoder (that determine the vehicle's location and keep track of its movements), LIDAR, Velodyne 64-beam laser (generates a detailed 3D map of the environment).

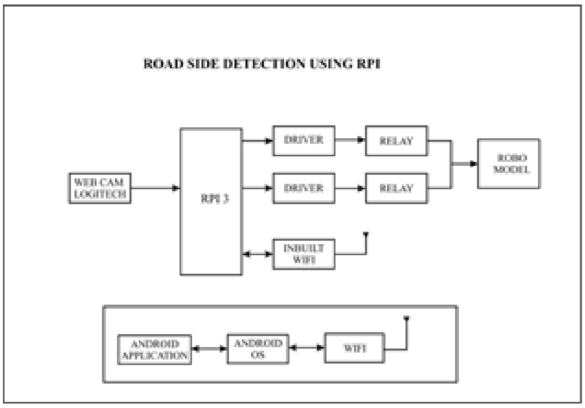

Fig.1. Proposed Block Diagram

In the proposed work, Raspberry Pi 3 is the heart of the system. Raspberry Pi 3 is a compact computer which hasmany ports to which Camera, Speaker, etc., is interfaced. With the help of Raspberry Pi, the Image processing is done through OpenCV using Python. The maximum resolution of the Webcam is 1280x720, in which the resolution of the processed image is 680x680 and the Line of Sight (LOS) is 600 - 1200. The operating range of the camera is 40cm to 130cm and with Raspberry Pi camera the range is 50cm to 400cm. When a sign or traffic light is detected audio command is played through the speaker

3.IMPEMENTATION:

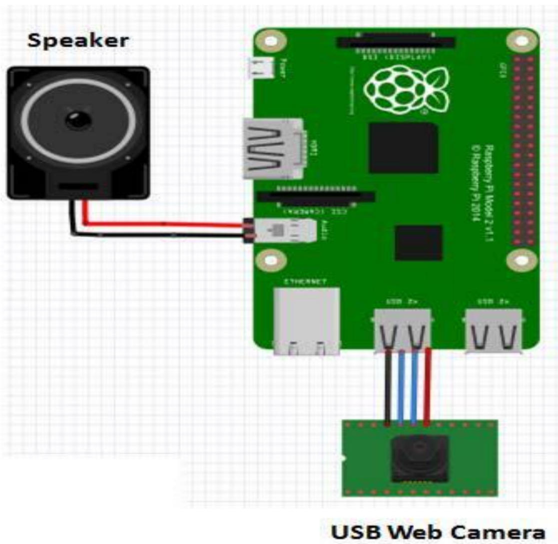

Fig.2.Interface Diagram.

The HSV values for the colors green, white and red are defined. In the image, the white colored blobs are identified. The largest square blob is the sign. The images are smoothened using Kernel Algorithm. Then, the contours in the mask are detected. If the detected contours are greater than zero then the contour of identified rectangle is drawn on the image. After this the ROI is selected where the sign part is expected to be present. The way in which ROI and segments are defined is shown in Fig.3. For marking the ROI's on the image the figures are shown below.

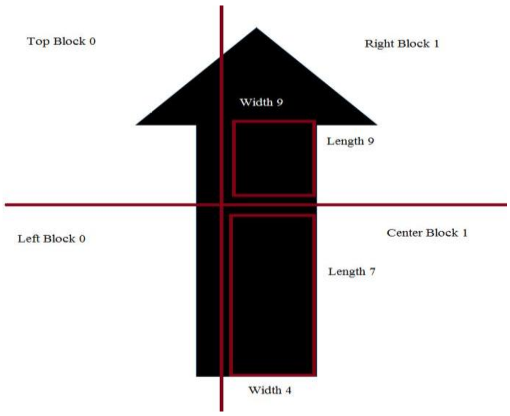

Fig.3.Straight direction image with ROI

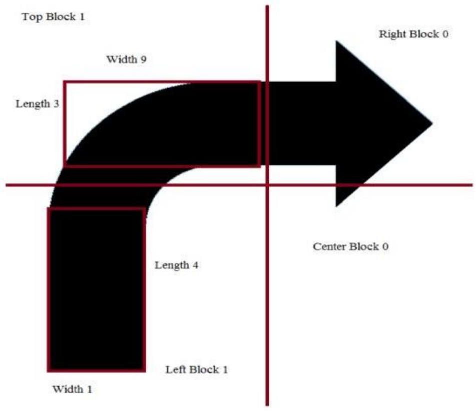

Fig.4.Right direction image with ROI

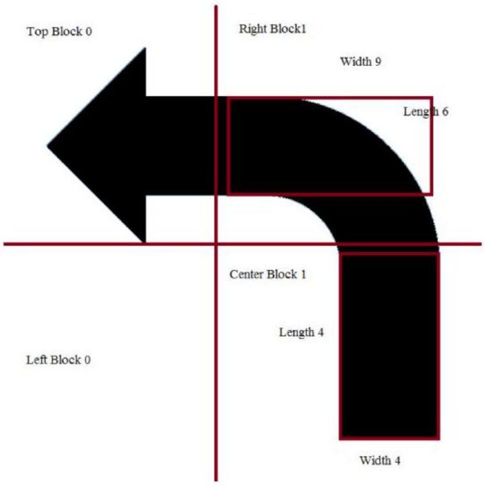

Fig.5.Left direction image with ROI

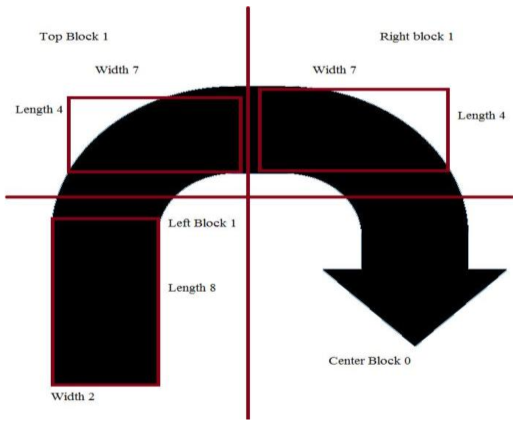

Fig.6.U-turn direction image with ROI

The equations for identifying the segments are given below.

a) For subtraction 4 ROI's in the sign threshold image:

Left Block = image [4 * sub Height : 9 * subHeight, subWidth : 3 * subWidth] centreBlock = image [4 * subHeight : 9 * subHeight, 4* subWidth : 6 * subWidt

right Block = image [4 * subHeight : 9 * subHeight, 7* sub Width : 9 * subWidth]

top Block = image [2 * sub Height : 4 * subHeight, 3* subWidth : 7 * subWidth]

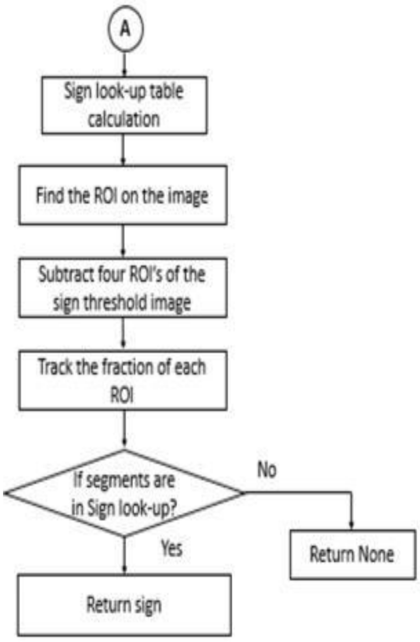

Fig.7. Flow Chart Of Sign Detection And Processing

b) Tracking the fraction of each ROI:

Left Fraction = sum(leftblock) / (left block.shape[0] *left block.shape[1])

Right Fraction = sum(rightblock) / (right block.shape[0] *right block.shape[1])

Center Fraction = sum(centerblock) / (center block.shape[0] *center block.shape[1])

Top Fraction = sum(topblock) / (top block.shape[0] *top block.shape[1])

If segment value is greater than threshold. Then assign it as 1, else assign 0 to it. The segment value must match with sign look up table. If it doesn't match then nothing is returned.

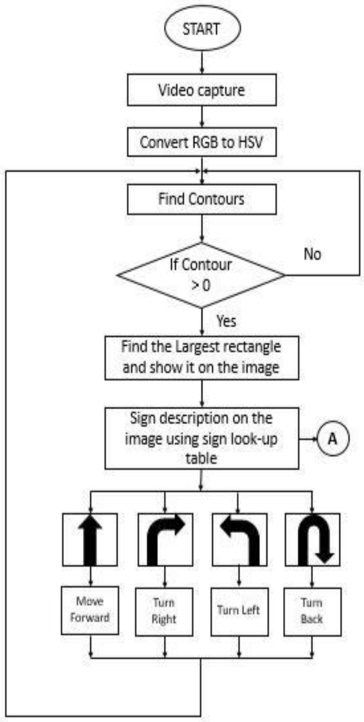

Fig.8. Flow Chart Of Sign Detection

4. RESULTS AND DISCUSSION

The HSV values for the colors green, white and red are defined. In the image, the white colored blobs are identified. The largest square blob is the sign. The images are smoothened using Kernel Algorithm. Then, the contours in the mask are detected. If the detected contours are greater than zero then the contour of identified rectangle is drawn on the image. After this the ROI is selected where the sign part is expected to be present. The way in which ROI and segments are defined is shown. The system presented in this paper is very efficient and robust. This system can process information within 10 microseconds. The results obtained are shown in the following images.Results are shown in below diagrams

Fig.9. Straight Image Identification

Fig.10.Straight Image Identification WithTurning Right” Message display

Fig.11.Turn Left Image Identificaion.

Fig.16. Turn Back Image Identification with message display

Fig.13. Turn Right Image Identification

Fig.17. Green Color Identification

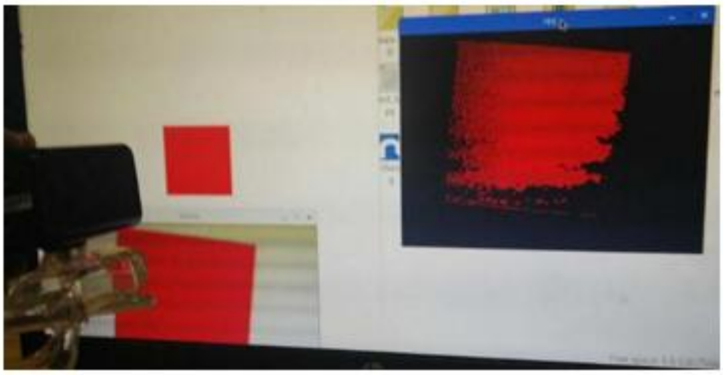

Fig 18. Red color identification

Challenges Faced-When two sign boards are present, the one which is closest to the system is considered. If sign boards are blocked due to some obstacle, such signs are not detected. And other challenges like light illumination, weather conditions, etc., are few of the challenges faced.

5.CONCLUSION:

This system deals with traffic light and sign detection on roads for intelligent autonomous vehicles and it is time effective. This method is used to convey information about, when the vehicle needs to take diversions and start/stop according to traffic lights. This technique is different compared to others. Variations in light intensity and shadows formed due to presence of objects are few of the major problems faced by this method. These hindrances need to be overcome in future for a more efficient system.

REFERENCES

[1] C. Fang, S. Chen and C. Fuh, "Road-sign detection and tracking". IEEE Trans. On vehicular technology, vol.52, pp. 1329-1341, 2003.

[2] Gurjashan Singh Pannu, Mohammad Dawud Ansari, Pritha Gupta, "Design and Implementation of Autonomous Car using Raspberry Pi", International Journal of Computer Applications (0975 – 8887) Volume 113 – No. 9, March 2015

[3] Ruben Laguna, Ruben Barrientos, L. Felipe Blazquez, Luis J. Miguel, "Traffic sign recognition application based on image processing techniques" The international federation of Automatic control cape town, South Africa, August 24-29, 2014.

[4] Hasan Fleyeh, "Road and traffic sign color detection and segmentation-A fuzzy Approach"MVA2005 IAPR conference on machine vision applications, May 16-18, 2005 Tsukuba science city, Japan.

[5] P. Foucher, P. Charbonnier and H. Kebbous, "Evaluation of a road sign pre-detection system by image analysis" in proceedings of international conference on computer vision theory and application VISAPP, pages 362-367, 2009.

[6] Vishal R. Deshmukh, G.K. Patnaik, Ph.D, M.E.Patil, "Real time traffic sign recognition system based on color image segmentation" International Journal of Computer Application (0975-8887) volume83-No3, dec 2013.

[7] K.H.Lim, Li-MinnAng, and K.P.Seng "New hybrid tech for traffic sign recognition", International Symposium on intelligent signal processing and communication vsystems (LSPACS2008) Bangkok, Thailand, 2008.

[8] Arturo de La Escalera, Luis E.Moreno, Miguel Angel Salichs and Jose Maria Armingol "Road traffic signs Detection and Classification", CICYT Project TAP94-0711-C0302, Jul. 1996.

[9] A de La Escalera, J.M Armingol, M.A.Salich, "Traffic sign detection for driver support systems", systems engineering and automation division, Universidad Carlos III de Madrid, Leganes, Madrid, Spain.

[10] Erico Guizzo , "How Google's Self-Driving Car Works", October 18, 2011