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# Traffic Light and Sign Detection for Autonomous Land Vehicle

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**Abstract -** *The objective of this work is to implement the detection of traffic lights and signals using the image processing technique for an autonomous vehicle. The traffic signal recognition system is used to regulate traffic signals, warn a driver and order specific actions. The fast, robust and automatic recognition of traffic signals in real time can help the driver and significantly increase driving safety. The automatic recognition of traffic signals is also important for an intelligent automated vehicle or for a driver assistance system. This is a visual project i.e. the entry to the system consists of video data captured continuously by the webcam and connected to the Raspberry Pi. Images are preprocessed with various image processing techniques. e.g. The technique of modeling the color space for tone, saturation and tone (HSV) is used for the detection of traffic lights. For character recognition, the HSV color space model and the contraction algorithm were again used. The characters are recognized according to the region of interest (ROI). The ROI is captured based on characteristics such as the geometric shape and the color of the object in the traffic signal image. The experimental results show very accurate classifications of traffic signal patterns with complex background images, as well as the results obtained in the computational effort reduction of this proposed method.*

***Key Words***: Raspberry Pi; Webcam; Python; OpenCV; HSV; ROI;

## 1.INTRODUCTION

In a present day, sign detection is mainly used to help the driver and give orders via audio feedback, which reduces the number of accidents. The objective of this work is to formulate a method for the detection of traffic signals and the detection of bulletin boards. Using this method, it is possible to accurately detect the colors of the traffic lights, ie red and green, and different signals such as the front, the left turn, the turn to right and back. Traffic signs use colors as a basis to distinguish them from other objects. Artificial vision is used in the field of intelligent transport systems. Recently, traffic signal recognition systems have become an integral part of Advanced Driver Assistance Systems (ADAS).

## 2. LITERATURE REVIEW

Gurjashan Singh Pannu et al. proposed a "Design and implementation of an autonomous car with Raspberry Pi". The summary is as follows:-

Algorithms such as lane detection (two approaches, namely, a feature-based technique, in which you locate tracks on road images by combining low-level features, such as painted lines or roadsides.) Can be presented by a straight line or a parabolic curve, the processing of the detection channels is treated as the calculation processing of these model parameters, the obstacle detection is combined to provide the necessary control to the automobile. Here, a combination of function and template base is used.

As the Google car proposed by Erico Guizzo works, the 64-beam Velodyne laser generates a detailed 3D map of the environment. Then, the car combines laser measurements with high resolution maps of the world and produces different types of data models allowing you to drive simultaneously while avoiding obstacles and respecting the rules of the road. The components used for the design of google car are sensors, four radars (mounted on the front and rear bumpers), a camera (placed near the rearview mirror), a GPS, a wheel encoder (which determines the position of the vehicle and follows its movements)), LIDAR, 64-beam Velodyne laser (generates a detailed 3D map of the environment).

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|---|---|---|---|
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| Left | 0.5” | Right | 0.5” |
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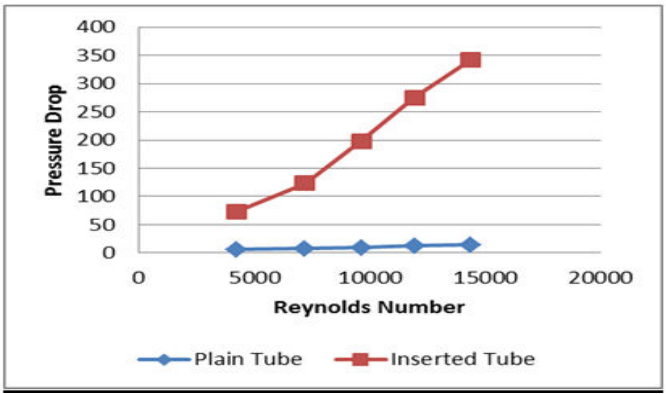


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**Fig -1**: Name of the figure

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## 3. PROPOSED BLOCK DIAGRAM

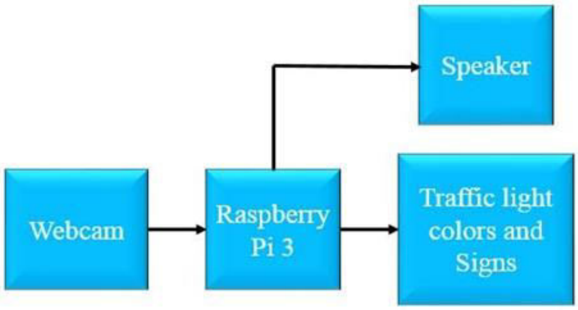


**Fig -1**: Block Diagram

In the proposed work, Raspberry Pi 3 is the heart of the system. Raspberry Pi 3 is a compact computer that has many ports with which camera, speaker, etc. are interconnected With the help of Raspberry Pi, image processing is done through OpenCV using Python. The maximum resolution of the webcam is 1280 x 720, the resolution of the processed image is 680 x 680 and the line of vision of 600 to 1,200. With the Raspberry Pi camera, the range is 50 cm to 400 cm. When a signal or a fire is detected, the loudspeaker plays an audio command, abbreviations and acronyms.

## 4. IMPLEMENTATION

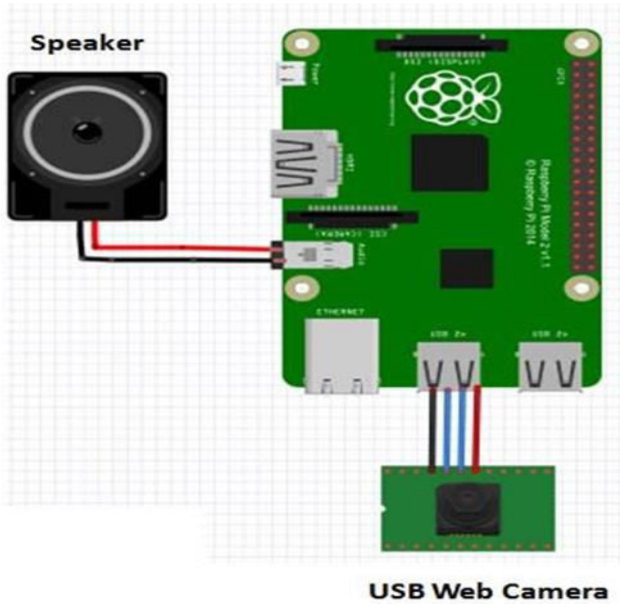


**Fig -2**: Interface Diagram

The HSV values are set for the colors green, white and red. In the image, white spots are identified. The biggest square fall is the sign. The images are smoothed using the kernel algorithm. Then, the contours in the mask are detected. If the detected contours are greater than zero, the outline of the identified rectangle is drawn on the image. After that, the return on the investment is selected where the part of the sign must be present. The way in which the return on investment and the segments are defined is illustrated in

Figure 3. To mark the ROI in the image, the figures are shown below.

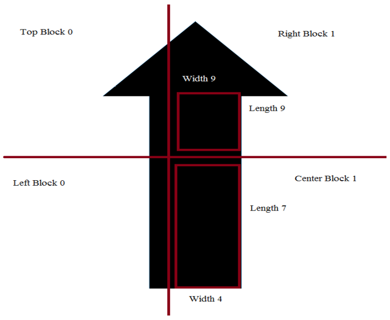


**Fig 3-** Straight direction image with ROI

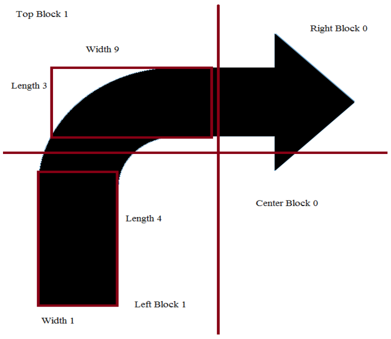


**Fig 4-** Right direction image with ROI

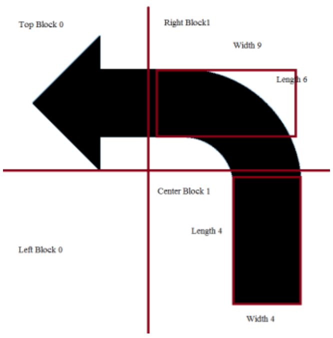


**Fig 5-** Left direction image with ROI

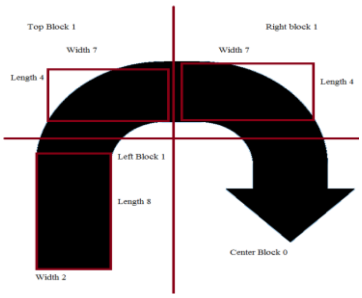


**Fig 6-** U-turn direction image with ROI

The equations for identifying the segments are given below.

*For subtraction 4 ROI's in the sign threshold image:*
Left Block = image [4 * subHeight : 9 * subHeight, subWidth : 3 * subWidth]

Centre Block = image [4 * subHeigh t: 9 * subHeight, 4* subWidth : 6 * subWidth]

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

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

*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 as1, else assign 0 to it. The segment value must match with sign look-up table. If it doesn't match then nothing is returned.

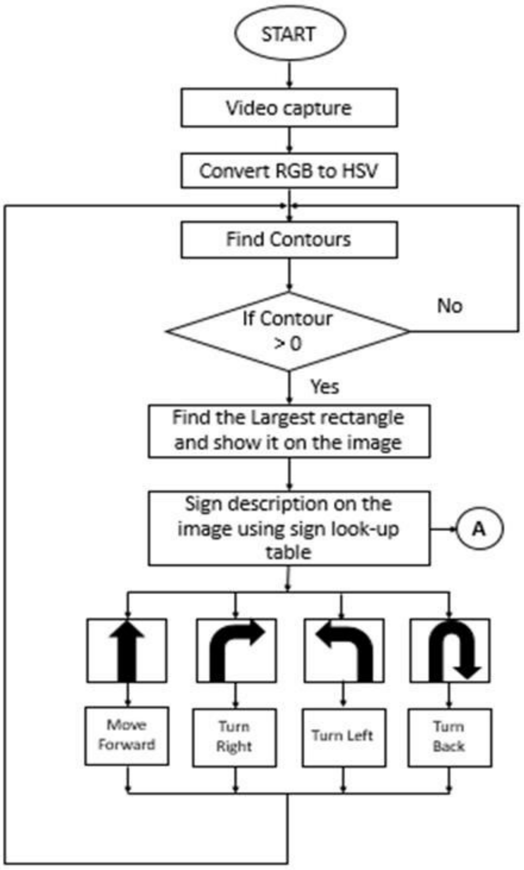


**Fig 7-** Flow chart of Sign detection and processing

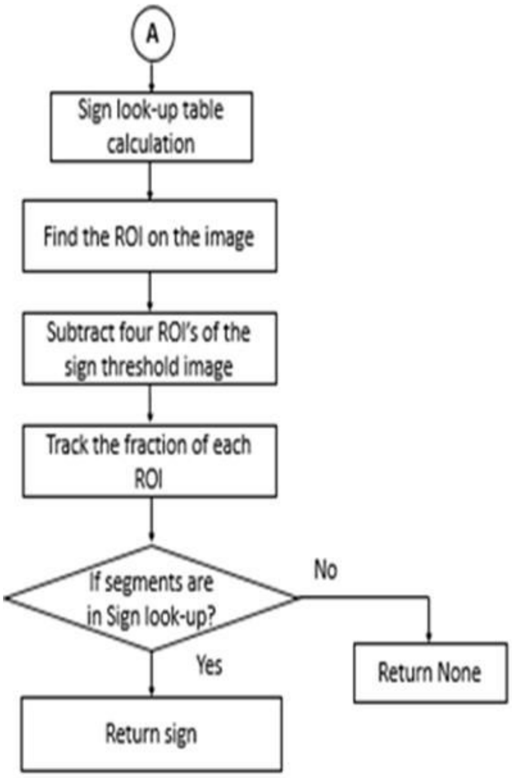


**Fig 8-** Flow chart of Sign detection

## 5. RESULT AND DISCUSSIONS

HSV values are set for green, white and red colors. In the image, the white dots are identified. The biggest square drop is the sign. The images are smoothed using the kernel algorithm. Then, the outlines in the mask are detected. If the detected contours are greater than zero, the outline of the identified rectangle is drawn on the image. After that, the return on investment is selected where the sign part is supposed to be present. It shows how the ROI and the segments are defined. The system presented in this article is very efficient and robust. This system can process information in 10 microseconds.

## 6. 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.

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