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# IoT Based Lane Detection for Autonomous Cars

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**Abstract -** This paper aims to represent a mini version of self-driving cars using IOT with raspberry pi working as a main processor chip, the 8mp high resolution pi camera will provide the necessary information and the raspberry pi will analyse the data and get trained in pi with image processing and pixel summation concept which would result in detecting road lanes and the car will take turns accordingly.

***Key Words***: Raspberry-pi, Pi-Camera, H Bridge, Threshold, Warping, Histogram

## 1. INTRODUCTION

Self-driving cars is one of the most discussed technologies of the current scenario in which the lane line detection is a critical concept and a challenging task too. This project is used to detect the paths for self-driving cars. It focuses on building model of autonomous cars with lane detection algorithm implemented with image processing concept. The brain of the system is the raspberry pi which is capable of exchanging data with the sensors and fast enough to calculate millions of data per second. Camera will be used to find lane markings that are processed by the main controller within the card. The motion of the car will be controlled servo motor controllers that are connected with H Bridge, capable of controlling its rotational speed and direction and instruct the motors to take turns accordingly. These kind of intelligent system always make the safe travel but it is not always necessary that lane boundaries are clearly noticeable, as poor road conditions, inadequate quantity of paint used for marking the lane boundaries makes it hard for system to detect the lanes with accuracy and other reasons can include environmental effects like shadows from the things like trees or other automobiles or street lights , day and night time conditions, or fog occurs because of invariant lightning conditions. In order to deal with the above stated problems arising due to changes in lane boundaries an algorithm followed in this project deals with providing a video of the road as an input to the system and by using computer vision technology it gives the steering angle to take turns accordingly.

## 2. LITERATURE SURVEY

1. The lane detection algorithms on toll road shoulder lanes as parts of self-driving car systems is done using image processing methods. The video image is taken using an action camera mounted on top of the vehicle, with 1280x720 resolution. Average speed of the vehicle is 60 km per hour. Image processing methods are a combination of methods of region of interest, l canny edge detection, and Hough transform. The result shows this algorithm needs to add some method that can change the parameters during day and night adaptively.

2. A real time vision-based lane detection method was proposed using a deep-learning algorithm. Image segmentation method was used to remove the shadow of the road while processing. Canny edge detection was used to detect edges that represent road lanes or road boundaries. The lanes were detected using Hough transformation with restricted search area and the projection of their intersection will form the last scan point called the horizon. Furthermore, In order to search out for the left and right vector points that represent the road lanes, the region of interest uses the edge image and the left and right edges as inputs, to effectively allocate the lane points. The experimental results showed that the system is able to achieve a standard requirement to provide valuable information to the driver. Each lane boundary marking, usually a rectangle (or approximate) forms a pair of edges.

3. This paper considers two types of neural network and extends the idea of deep learning in detecting the lanes by developing a multi task deep Convolutional Neural Network. Further establishes both the Convolutional Neural Network and Recurrent Neural Network detectors are effective in detecting lanes. First a picture of the road is acquired with the assistance of a camera attached on the vehicle. Next one may reduce the processing time by translating the image to a grayscale image. Next, the existence of disturbance captured in the image will interrupt the accurate detection of the edges, so one can activate filters to get rid of noises. Some of the filters which can be used are bilateral filter, Gaussian filter, trilateral filter. Thereafter in order to produce an edged image, an edge detector can be used which makes use of a canny filter to get the edges by using machine generated threshold. Line detectors can then use it for the purpose of detection. It will generate a left side and right side segments of the lane boundary. As a result, yellow and the white lanes are obtained using the RGB color codes. Techniques that are used for detecting the lanes plays a compelling part in technologically intelligent transport setup. Methods that one may make use of have been studied in this paper. Many of them resulted in inappropriate conclusions. Hence, other enrichments can also be included in the present approach in a way to increase the efficiency of the setup. In the coming future, one can change the current Hough Transformation so that it can sum up curved and straight roads respectively. This approach cannot give accurate results in poor

environmental conditions like on hazy, cloudy, rainy and stormy days, therefore one needs to make amendments in it.

## 2.1 METHODOLGY

### 2.1.1 RASPBERRY PI CAMERA:

The pi-camera we are using has 8mp that supports up to 1080p30 resolutions along with IMX219 sensor (Fig – 1: Pi Camera). This pi camera record the video and send them to the raspberry pi for further processing.

**Fig - 1: Pi Camera**

### 2.1.2 RASPBERRY PI:

The raspberry pi (Fig -2: Raspberry Pi) is the main processor here. Popularly known as low cost single board computer. We are using raspberry pi 4B+ model for image processing. With the help of Open CV software, a machine learning algorithm is implemented and the videos are trained in various lighting conditions using image processing method. Further the decisions taken by the raspberry pi are sent as command to the H Bridge.

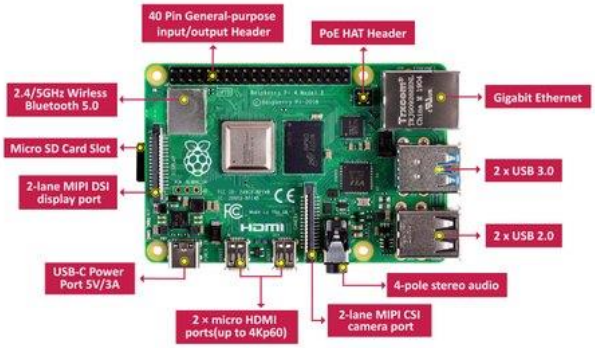



**Fig -2: Raspberry Pi**

### 2.1.3 L298N MOTOR DRIVER:

It is a basic motor driver module used to drive dc motors a well as stepper motors too. H Bridge is used along with L298N IC to drive motors. H Bridge is a circuit that can drive current in polarity and will be controlled by pulse with modulation [PWM].

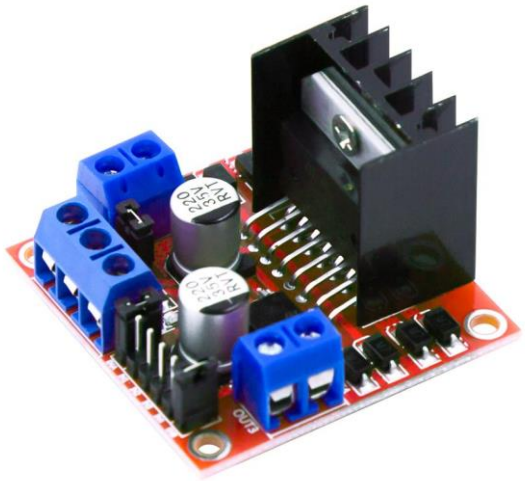


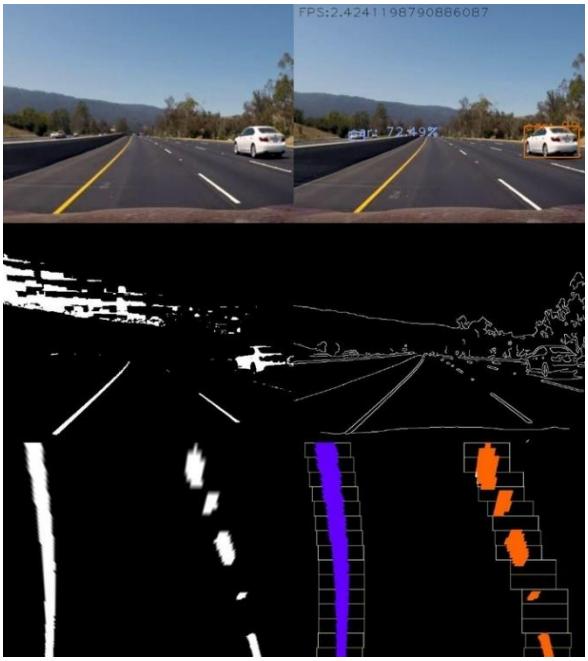
**Fig- 3: L298N motor driver**

## 2.2 WORKING

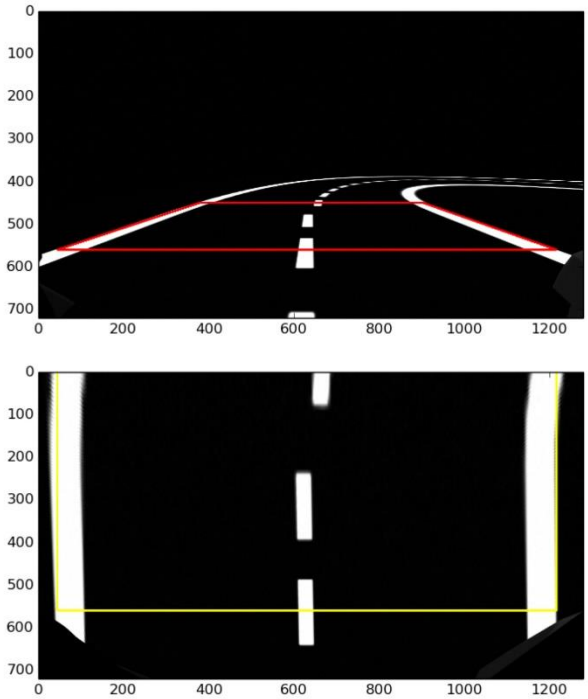
As the vehicle starts all the sensors and the hardware components gets activated. Camera will record videos and raspberry pi will start working and car will start to move. While processor starts processing the video it will search for the lane markings and turns. The raspberry pi sends the signal to motor driver module to work further. The lane markings in the road that is being recorded with a web camera is mounted so that bird-eye view of the lane cane derived using numpy method in OpenCV which is the input that are sent to the Raspberry pi which is loaded with lane detecting algorithms. Initially the video is converted into a binary one with the help of thresholding method and then warped with image processing concept. The entire image is now converted into an pixel matrix with high intensity values. Since the integer value ranges only from 0-255 the pixel intensity has to be reduced to integer range. This is done using Histogram method in order to done to avoid distortion and maintain the accuracy of the algorithm. Now the turns are detected using pixel summation concept which sums all the pixels in a column and decides whether to take left or right, also the number of pixel column is counted and the center of the lane is derived to make the vehicle over in a center path.

### 2.2.1 RESULTS

Image Processing




Pixel Summation




### 3. CONCLUSIONS

A real time IOT based lane detection method was proposed. The lanes were detected using an image processing algorithm with the concepts of warping, binary scale and histogram. The region of interest is captured from the image frames which are captured from the pi camera. The left and right turns can be detected using a pixel summation concept that deals with the left and right vector points that represent the road lanes. The region of interest can be adjusted using the track bars from which the values are taken as inputs, to effectively allocate the lane points. The value derived from the algorithm used is sent to the motor driver module which is responsible for the motion of the car.

### 3.1 FUTURE SCOPE

There is a huge scope of self-driving cars in future, the various automobile companies are improving their autonomous cars rapidly making them more accurate and secured. This model can further be developed by using multiple cameras and sensors so that the accuracy can be improved which provides valuable information to the automatic vehicles. The classical OpenCV approach is a better solution as the approach is efficient and can be further more developed with implementation of traffic control, traffic monitoring, traffic flow, collision avoidance, drowsiness detection and so on. This technology is being developed with increasing the number of applications and challenging tasks

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