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# Traffic light detection and control with connected vehicle for automated car using ML algorithm

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**Abstract**---The paper centers to plan a self-driving vehicle model with the assistance of Raspberry Pi as a handling chip. The model will perform five undertakings that remember self-driving for track, identifying traffic signal, rain identification, fog discovery and will help in impediment recognition and crash evasion. The essential information from this present reality to the vehicle is given by camera. It utilizes a HC-SR04 following sensor module that data to the framework through raspberry pi to our framework which is associated with PC with a similar organization. The gathered information is then prepared and examined and pertinent data and subtleties is made back aware of vehicle for proper moves to be initiated. The gamble of human blunders is in this way kept away from securely and keenly as the vehicle can arrive at the given destination. Path Detection, Obstacle Detection, Traffic Light Detection, Rain and Fog are distinguished. The vehicle is halted when impediment and traffic signal red is noticed. As a section one static is planned with Arduino to make Bluetooth (HC-05) communication between the vehicles. This association between two vehicles will keep away from accidents.

**Keywords**---lane detection, raspberry pi, obstacle detection.

## **Introduction**

Everyone, whether traveler, passenger, driver, or pedestrian would see on the sidewalk where a different signboard provided important data. These important road sign features help us as guides, warnings and traffic controllers. As a traffic control tool, signals require thorough consideration, respect and proper reaction of the driver. Road signs were discovered long ago in history. Landmarks, direction or distance were early road signs. In the Middle Ages, multi-sided signs at the crossroads were common, providing guidance in urban and suburban areas. With the advent of computerized cars and their increasing pressure on the roads, many have used common symbols and made their markings to encourage global travel, where language comparisons may be a burden to foreigners. It is often used to improve traffic safety through proper awareness, principles and indicators. Many of them use symbols instead of words and are recognized and accepted around the world.

## **II. Literature Survey**

### **Implementation of lane detection algorithm for self-driving car on toll road cipularang using Python language**

Mochamad Vicky ghaniaziz , proposed **“Implementation of lane detection algorithm for self-driving car on toll road cipularang using Python language”**.

In this paper they dealt with Deep Learning, Computer Vision, Fusion Sensor, Control, until Path Planning are utilized. Every one of these are the combination of the multitude of fields. Here in this paper we talks about the consequences of execution of path location calculation on expressway Cipularang. With the assistance of the camera which is put at top of the vehicle that Video will be taken. For the picture it is utilized to deal with technique python. These technique is combination of various strategies like variety area, line location, canny edge identification, and Hough transform. The outcome which has stopped by playing out the assignment shows that a few changes ought to be added like changing the boundaries during the constantly to these calculation. Since steady boundaries must be utilized in similar lighting conditions. The precision accomplished is 90%.

### **A Raspberry-Pi Prototype of Smart Transportation**

Shahab Tayeb , proposed **“A Raspberry-Pi Prototype of Smart Transportation”**. This paper proposed a model of a level 3 self driving vehicle utilizing Raspberry Pi, which is utilized for identifying the close by vehicles utilizing an IR sensor. Here the principal endeavor is to examine independent vehicle from tiny level and spotlight on every vehicle and there correspondence with different vehicles out and about. There are two arrangements of detached and dynamic trials has been performed on a couple of models, which shows the interconnectivity of the created

model. What's more, numerous sensors were utilized in these copying in light of System-on-Chip to additionally exhibit the achievability of the proposed model.

### **Traffic Light and Sign Detection for Autonomous Land Vehicle Using Raspberry Pi**

Priyanka D, proposed **“Traffic Light and Sign Detection for Autonomous Land Vehicle Using Raspberry Pi”**. This paper, point is to carry out traffic signal and sign recognition involving Image processing strategy for an autonomous vehicle. In this framework errands, for example, traffic signal and sign identification for independent vehicles has been played out The strategy which has been proposed is utilized for sending the data in regards to when the vehicle needs to take redirections when there will be any turns on street and begin/quit by traffic signals. The essential data will be caught by the camera which is interacted to the Raspberry Pi. The Images which are gathered by the camera are pre-handled with a few picture handling procedures, for example, Hue, Saturation and Value, variety space model strategy is utilized for distinguishing traffic signals, for the recognition of sign Hue Saturation Value model is. The signs are which are on street will be recognized in view of Region of Interest. The Region of Interest will be distinguished in view of the elements like tone and state of the article in the picture which contains traffic signs. The analysis which has led is exceptionally exact in order of various traffic sign examples on street which has complex foundation pictures and the outcomes achieved by playing out all errands has decreased computational expense.

### **Real-Time Self-Driving Car Navigation Using Deep Neural Network**

Truong-Dong Do, proposed **“Real-Time Self-Driving Car Navigation Using Deep Neural Network”**. In this paper a self-driving vehicle model utilizing Deep Neural Network on Raspberry Pi is proposed. Here in this work, a model has been which straightforwardly maps the crude information pictures to an anticipated guiding point as result utilizing a profound brain network calculation. Two overlay specialized commitments are there in this work. Initial one is the Convolutional Neural here in these model boundaries were prepared by the assistance of the web camera which is put on top of the model, Raspberry Pi 3 Model B. The preparation information which is gathered are the street pictures which is taken by the camera these pictures matched with the time-synchronized directing point and create by physically driving. Second one is the street trial of the model on Raspberry to drive itself in the external climate, for example, oval-formed and 8-molded with traffic sign lined track. The outcomes accomplished by playing out these investigation are very adequacy and power of autopilot model in path keeping task. Camera inertness is the fundamental downside. It is characterized as the period from the time the camera sensor notices the scene to the time the PC really peruses the computerized image information.

### **Deep Learning Techniques for Obstacle Detection and Avoidance in Driverless Cars**

NischalSanil, proposed **“Deep Learning Techniques for Obstacle Detection and Avoidance in Driverless Cars”**. In this paper a scaled down RC which is a self-

driving vehicle has been executed by utilizing Convolutional Neural Networks. These RC vehicle has been prepared on an independent track which is 12 to 14 meters in length. The principal point of these work is to execute obstruction location and evasion in a self-propelled vehicle. This venture utilizes a Raspberry pi has been utilized which will control the vehicle and performing derivation utilizing CNN, in view of its feedback. This model has performed all around well yet when these will any sharp turns it is confronting a challenges which was because of the impediment of the engine's turning capacities. The vehicle had effectively recognized every one of the driving examples inside the extent of the dataset and would require more information collection for acclimating to new situations. These RC vehicle has got precision of 88.6% by utilizing deep learning strategy.

### **Autonomous Object Detection and Tracking using Raspberry Pi**

SampaJana, proposed **“Autonomous Object Detection and Tracking using Raspberry Pi”**. This paper presents the execution of an ongoing vision-based way to deal with identify and follow highlights in a climate utilizing an independent robot which will independently tracks and distinguishes the item which will be utilized for movement recognition of articles on a video which is gathered by robot utilizing camera. Object recognition will be finished by finding objects in the edge of a video which has been taken by the robot utilizing camera. Object location instrument is utilized by each following technique in which the article initially shows up in the video. By the better quality and savvy cameras and the rising requirement for robotized video investigation has created a lot of revenue in object following calculations. There are three assignments which we need to act in video examination, initial step is location of fascinating moving items, second step is to following of such articles from every single casing to edge, and third step is to make investigation of article tracks to perceive their way of behaving. In this way, the utilization of item following calculation will obtain great outcomes in the assignments of, movement based acknowledgment, Automatic discovery.

### **Lane detection technique based on perspective transformation and histogram analysis for self-driving cars**

Raja Muthalagu, proposed **“Lane detection technique based on perspective transformation and histogram analysis for self-driving cars”**. In this paper, there is show of an insight calculation which will be absolutely founded on the information which is gathered by camera. Also, it is centered around the exhibition of path recognition strategy involving contemporary PC vision methods for self-driving vehicles. Which presents a smaller than usual methodology in light of edge recognition and polynomial relapse which is the methodology that is made for recognizing just the straight path lines. Then, at that point, proposed a superior path identification method which depends on the viewpoint changes and histogram examination. These proposition of further developed path identification approach is superior to the regular strategies. For exhibiting the improved outcomes created by the proposed path recognition approach over the customary methodology, recreation results has taken from the various conditions.

### **Real-time Traffic Light Detection and Recognition based on Deep RetinaNet for Self Driving Cars**

Aneesh, proposed “**Real-time Traffic Light Detection and Recognition based on Deep RetinaNet for Self Driving Cars**”. In this paper for constant location and acknowledgment of traffic signals, they proposed RetinaNet (a profound brain network engineering) based model through the exchange learning. Here the profound brain network RetinaNet has been utilized as model and these framework has been executed in Keras with TensorFlow backend in Google Colaboratory cloud stage. These RetinaNet model was prepared and tried on Traffic Light Dataset containing traffic signal pictures of goal 1280 by 720 pixels, which has four kind of classes. By these the model has accomplished better precision of discovery and order than other profound learning strategies for ongoing activity. In this proposed framework, both traffic signal identification and its state arrangement from RGB pictures is accomplished by a solitary RetinaNet organization. This framework can run at constant speed with further developed precision.

### **Moving Object Detection and Tracking Using Convolutional Neural Networks**

Shraddha Mane, proposed “**Moving Object Detection and Tracking Using Convolutional Neural Networks**”. In these paper object location and following are the primary advances which will be performed by utilizing PC vision calculation. Here the powerful article discovery is the exceptionally large test because of varieties in the scenes and another greatest test is to follow the item in the impediment conditions. That is the reason in this methodology, the moving of the items location utilizing TensorFlow article discovery API. And afterward the area of the article which is distinguished is pass to the item following calculation. Convolutional Neural Network based object following calculation is utilized for these vigorous article recognition. The article can be recognized in various light and impediment by this proposed approach. Furthermore, this methodology of CNN has accomplished the exactness of 90.88%.

### **Traffic Light Detection in Autonomous Driving System**

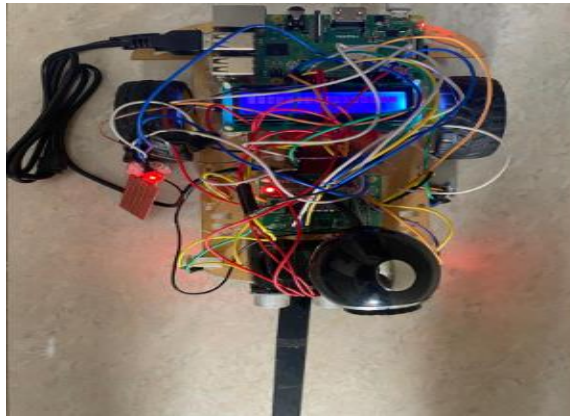
Dijana Vitas, proposed “Traffic Light Detection in Autonomous Driving Systems”. This paper proposes a traffic signal acknowledgment framework where versatile thresholding and profound learning are utilized for district proposition and traffic signal restriction, individually. These proposed framework has two unmistakable advances. The initial step is utilized for finding the locale proposition by utilizing versatile thresholding and mass identification. Second step involves a CNN for the exact confinement of TLs in the proposed districts. The LISA open-source dataset is utilized alongside custom expansion strategies to expand the quantity of accessible information tests. The exhibition of these proposed framework is introduced as obvious and misleading positive rates acquired on the test information. This proposed calculation gives 89.60% genuine identification rate, while the relapse part of the model created a right area of the traffic signal in 92.67% of cases.

### III. Objectives

- The Aim of this project is to make the system fully supported for self-driving vehicles, using the Raspberry Pi.
- The automotive system uses IR sensor, ultrasonic sensor, motors, rain sensor, gas sensor.
- The purpose of a private vehicle is to determine the speed of application in a particular route.
- Two different situations are considered: red light and green light.
- And to establishing connection between two cars arduino car and raspberry pi car by Bluetooth for avoiding accidents.

### IV. Proposed System

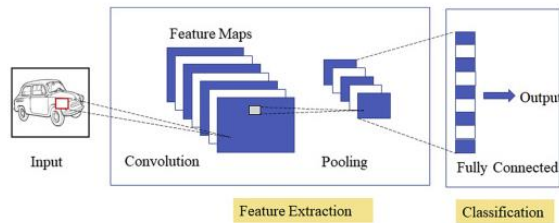
The main goal of this proposal is to make the project fully automated with other new features namely, route acquisition using an IR sensor, acquisition of material using an Ultrasonic sensor. Traffic detection through camera module and machine learning, rain detection and fog detection finally car-to-car communication is done using the Bluetooth module. This project provides additional user flexibility to use fully automated user interface which enables the user to use special side features. The stand-alone car using the Raspberry pi contains an ultrasonic sensor, IR sensor, rain sensor, fog sensor, camera module, 16x2 LCD display, dc motor, HC-05 module. A private car using the Arduino Uno contains a 16x2 LCD display, HC-05 module. The main feature of this model is the Raspberry pi 3 model B + is the latest product in the Raspberry Pi 3 series, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4 GHz and 5 GHz wireless LAN, Bluetooth 4.2 / BLE, fast Ethernet, and POE power with different POE HAT. Raspberry pi 3B + uses an SDHC port or USB storage device to boot and store files. We use the python IDLE in the programming language of the raspberry pi model. We use Arduino software in the programming language of the Arduino Uno pi model. The camera module is connected to the Raspberry pi 3 B + model to capture traffic signal commands to the user processed on the blueberry board. The IR sensor is used to find a route and transmit it to the raspberry pi module. Ultrasonic sensor is connected to the area in front of the private car and the sensor becomes a Detect object in front of our car. The GAS sensor is used to detect fog in a car. A rain sensor is used to detect rain.



## V. Methodology

The Raspberry Pi Microcontroller is used as the backbone of this project where all sensors including IR sensors, Ultrasonic sensors, rain sensors, gas sensors and other devices are connected to this module. The Arduino UNO Microcontroller is a type of controller that operates as an approaching vehicle. The project uses two left-handed IR sensors and R Right sensors to locate the route, enabling the autonomous vehicle to detect the route and drive properly. Ultrasonic sensor is used for object detection. When an object is found a private vehicle will stop. A rain sensor is used to detect rain when the person in the car will know that the rain is coming. The gas sensor is used to detect fog in moving vehicles that helps to detect fog easily. USB camera used to record traffic signal when the Red light is ON the car should be STOP, when the GREEN light the car should go. A Bluetooth device is used here to communicate a short distance, whenever a car is found near a moving car it will know that another car is approaching near this car. With the help of this module road accidents can be reduced. The Raspberry Pi has a built-in Bluetooth device (HC-05) so there is no need to connect an external Bluetooth device to this module. Arduino Uno does not have a built-in Bluetooth device so it is connected externally. The DC-motor is used to move the car independently with the help of which the car can move differently.

CNN is a type of neural network that feeds into AI. It is widely used for image recognition. CNN represents data entry in the form of multidimensional arrays. Works well with large amounts of labeled data. CNN releases each part of the inserted image, known as the reception field. It provides the weight of each neuron based on the critical role of the receiving field. In order to differentiate the importance of neurons to one another .The CNN structure consists of three layers: (1) convolutional, (2) pooling, and (3) fully connected.



CNN is a deep neural network designed to analyze imagery. Recently, it was discovered that CNN has excellent potential for successive data analysis such as native language processing. CNN always contains two basic functions, namely convolution and integration. The conversion function using multiple filters is able to extract features (feature map) from the data set, where their corresponding location information can be stored. The integration function, also called subsampling, is used to reduce the size of the map element from the convolution function. High integration and central integration are common integration functions used on CNN. Thanks to CNN's interaction, the jum is a common option for activation to transfer gradient to back-to-back training training.

Convolutional neural networks (CNNs) are widely used in many computer vision systems such as image classification, face recognition, object detection, and more. This chapter introduces some of CNN's most popular platforms, including LeNet, AlexNet, VGG, GoogLeNet, and ResNet. Then, it introduced two scenarios to launch Inception-v3, CNN's computer vision. In the first case, we create an Inception-v3 model using Keras Applications. In the second case, we use TensorFlow Hub to create an Inception-v3 model.

### Lane Detection:

Here we used two IR sensors to find the route. Left IR and Right IR are useful for navigation of the car so that car will move forward, backward, stop, left or right. The IR Transmitter looks at the dark area and the IR light is visible with an IR receiver. When the sensor receives a thread then the car controller is transferred to move it the way forward. If the right IR sensor detects a thread, the vehicle should move to the right. The left IR sensor receives a thread and the car should go to the left. It works on the concept of to find a line on the track.

```

Forward ←
14.527785778045654
OBJECT AHEAD STOP
NOT RAINING
FOG NOT DETECTED
Detecting For Vehicle Approaching

```

Here we can see in these figure forward because ir sensors has detected the lane so that the forward message has been displayed.

### Obstacle Detection:

Here we utilized HC-SR04 ultrasonic sensor is utilized for the impediment location. It has transmitter and recipient, transmitters. Here we utilized HC-SR04 ultrasonic sensor is utilized for the deterrent recognition. It has transmitter and beneficiary, transmitter ship off a particular repeat, when deterrent in the distinguishing proof bearing the beneficiary is reflected by the recipient chamber, following dealing with through the circuit

then, at that point, the sign gives the outcome. The convincing distance range 2-80cm, it is 3.3V-5V to work voltage. The recognizable proof extent of the sensor can be changed by the potentiometer. The transiter conveys the message in forward heading. Assuming that the article is before the sign, the signs get reflected from the outer layer of the article. The location point +/- 45. The location point can be changed by the potentiometer, the recognition can be expanded by changing potentiometer in clockwise heading, and will be diminished when changed in counter clockwise end off a particular repeat, when block in the ID bearing the beneficiary is reflected by the recipient chamber, right after dealing with through the circuit then the sign gives the outcome. The convincing distance range 2-80cm, it is 3.3V-5V to work voltage. The ID extent of the sensor can be changed by the potentiometer. The transiter conveys the message in forward heading. On the off chance that the article is before the sign, the signs get reflected from the outer layer of the article. The discovery point +/- 45. The discovery point can be changed by the potentiometer, the discovery can be expanded by changing potentiometer in clockwise course, and will be diminished when changed in counter clockwise.

```
Forward
14.527785778045654
OBJECT AHEAD STOP ←
NOT RAINING
FOG NOT DETECTED
Detecting For Vehicle Approaching
```

Here we can see in these figure that Object ahead stop has the ultrasonic sensor has detected the object which is ahead of car and passes message to stop car.

### Rain and Fog Detection:

Here we are using rain sensor for the detection of rain. And fog sensor for detection of fog.

```
Forward
330.34050464630127
RAINING ←
FOG NOT DETECTED
Detecting For Vehicle Approaching
```

Here in these figure we can see raining.

```

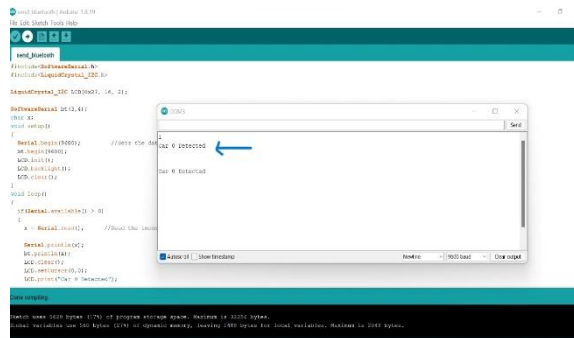
Forward
2515.903377532959
RAINING
FOG DETECTED ←
Detecting For Vehicle Approaching

```

Here in these figure we can see fog detected.

### Bluetooth module:

Here we will be using HC-05 module to make the communication between raspberry pi car and the arduino car. So that both cars can communicate with each other and there can be avoidance of accidents.



```

//With the Arduino
Serial.println("Car 0 detected");
//Without the Arduino
Serial.println("Car 1 detected");

```

Here we can see car 0 detected because the here raspberry pi is car 0 it is nearing to the arduino car. As it nears to arduino car we can see in the led display of arduino car that car 0 has detected.

### Traffic Signal Detection:

The working of the street traffic signal disclosure computation is according to the accompanying:

It gets the edges reliably from the pi camera and sends it to the system through Raspberry pi. It then, at that point, changes the image from RGB over totally to grayscale, which is a norm advance in estimations using OpenCV. The attention to the image is also different to 0.75. Then, it segments the image into different squares and each square is then taken care of freely. It then perceives any traffic sign models present in the image, and returns the potential gains of the bearings for the skipping enclose (x, y, w, h) plan. At last, it shows a picture including the traffic signal sign, passed the stopping request to the motor using 10 pins and stop or run the vehicle. The working of the computation is in like manner sorted out as a stream chart underneath. The dataset used given by OpenCV which contain arranged pictures of traffic signals.

Prediction: Traffic Sign: green  
GREEN SIGNAL DETECTED ←

Here in these figure we can see that the green light has been detected has the signal detected is green the car will move.

Prediction: Traffic Sign: red  
RED SIGNAL DETECTED ←  
STOPPING

Here in these figure we can see that red light has been detected has the signal detected is red the car will stop.

## VII. Conclusion

The Self-driving vehicle was effectively ready to explore itself through the path while identifying road sign, deterrent and path and making moves as needs be with practically no human intercession. Raspberry pi is utilized here which expands the exhibition and the handling speed. It utilizes both Open CV and sensor. It tends to be seen that the arrangement proposed in this paper has better precision and execution contrasted with different methodologies . The utilization of sensor assists with decreasing the general expense and builds the presentation. The independent vehicle utilizing Raspberry pi contains a ultrasonic sensor, IR sensor, downpour sensor, haze sensor, camera module, 16x2 LCD show, dc engine, HC-05 module. Furthermore, by creating the correspondence between two vehicles we can keep away from the accidents.

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