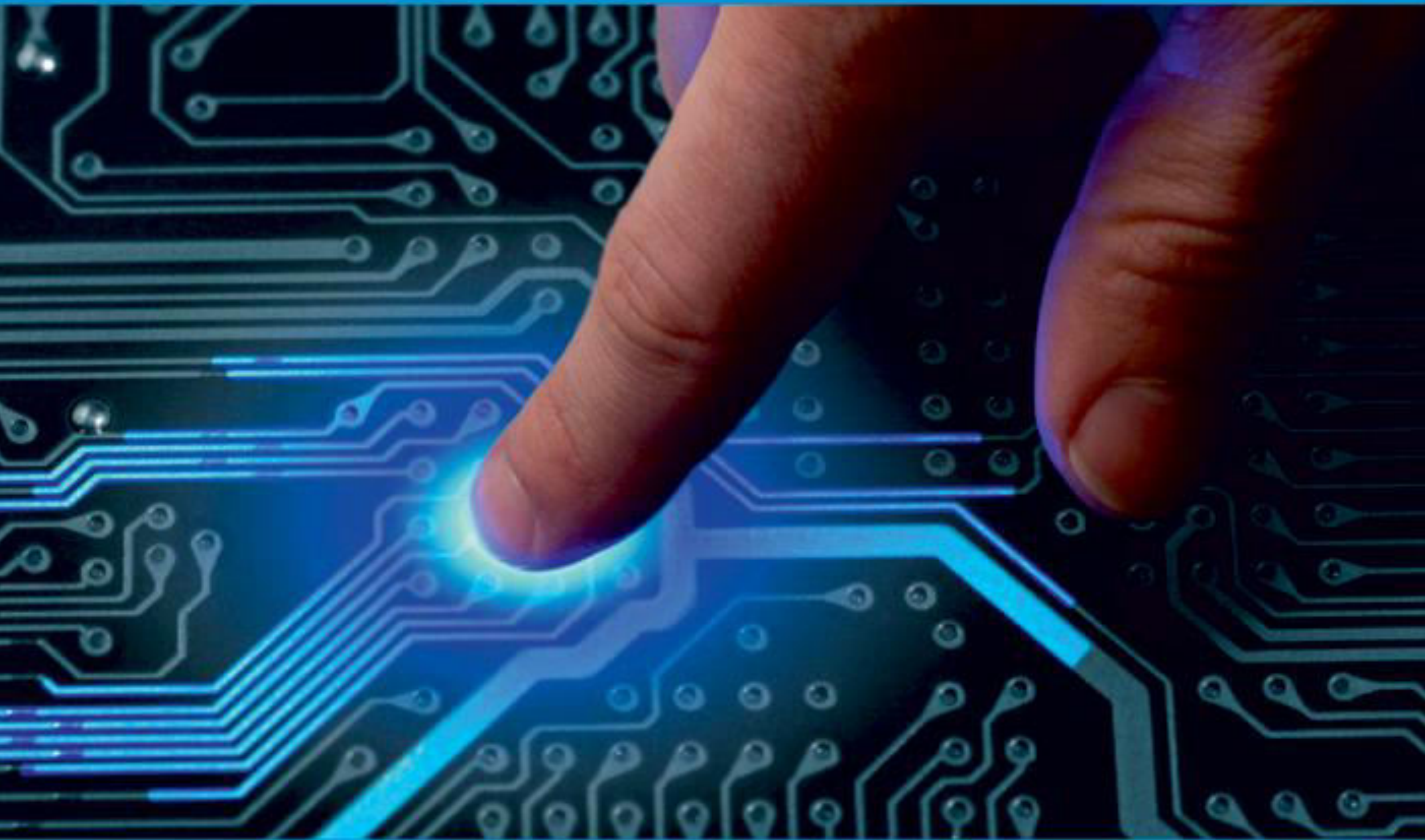
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 5, May 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

SELF DRIVING CAR USING CNN

Ashwinraj Dubey*1, Aditya Gaikwad*2, Shivam Prasad*3, Prof. V. B. Baru*4

Students, Department of Electronics & Telecommunication Engineering, Sinhgad College of Engineering, Pune, Maharashtra, India*1, 2, 3

Professor, Department of Electronics & Telecommunication Engineering, Sinhgad College of Engineering, Pune, Maharashtra, India*4

ABSTRACT: The paper aims to represent a mini prototype of a self-driving car using image processing with Raspberry Pi 4 model B working as the main processor chip and an Arduino UNO, the 5mp high-resolution Raspbian camera will provide the necessary pictographic information, the raspberry pi will analyze and process the data and it will get trained with neural network and machine learning algorithm which would result in detecting road lanes, traffic lights, and stop sign and the car will take actions accordingly.

KEYWORDS: Self Driving Car, image processing, pictographic, CNN.

I.INTRODUCTION

The Project introduces a research and academic project towards autonomous vehicles and traffic congestion issues. The project focuses on building a model of an autonomous vehicle. The concept of self-driving isn't new or recent, Leonardo da Vinci has theorized this concept of a self-propelling cart in the late 15th century.

If we see the history of traffic-related issues, nearly 1.3 million people die in road accidents each year, and talking about India, the number of people who got killed in a road accident in 2017 alone was 1,37,000. Meanwhile, e-vehicles and automatic cars are one of the most discussed technologies in the current era. Self-driving Cars technologically is a reality and in the present decade, they are expected to achieve the highest level of automation.

The brain of the system is a Raspberry Pi 4 Model B which is capable of exchanging data with the associated sensors and fast enough to calculate millions of data bytes per second. Since our car will use deep learning, it will need heavy parallel computing power for that reason the Raspberry Pi will be essential. The car will be controlled by an L298N motor driver which is controlled by Arduino UNO, which is capable of varying its rotational speed. Raspbian Camera Module rev 1.3 will be used to find and detect objects that are then processed by the main controller (Raspberry Pi 4 Model B) within the car. Self-driving cars are a great development in the field of automobiles. Many companies throughout the world are making a serious and continuous effort to make driving a safe and risk-free process.

II. LITERATURE SURVEY

[1] WORKING MODEL OF SELF-DRIVING CAR USING CONVOLUTIONAL NEURAL NETWORK, RASPBERRY PI AND ARDUINO

The author proposed a model which takes an image with the help of a Raspberry Pi camera module mounted on the car which is interfaced with Raspberry Pi. The Raspberry Pi and the PC (laptop) are connected to the same network, and the Raspberry Pi sends the captured image to the CNN (Convolutional Neural Network).

The input image which is initially captured as 'RGB' is gray-scaled before passing it to the Neural Network. The model gives one of the four expected outputs i.e., left, right, forward, or stop. When the result is predicted corresponding signal is triggered for Arduino which in turn directs the car to move in a particular direction with the help of its motor-driver.

[2] SELF-DRIVING CARS: A PEEP INTO THE FUTURE

An innovative embedded controller design for a self-driving, electrified, crash-proof, and GSM destination-guided vehicle is provided in this study. The location of the vehicle, source, and destination are precisely tracked by a GPS module, and navigation is made possible by mapping the coordinates. By maintaining a safe distance, which is a function of velocity, and having the vehicle in front view, the speed of the vehicle is automatically controlled.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105137 |

Additionally, it avoids collisions caused by obstacles. In order to detect traffic signals and traffic density on the route, an 8-megapixel pi-camera with an image processing unit was used.

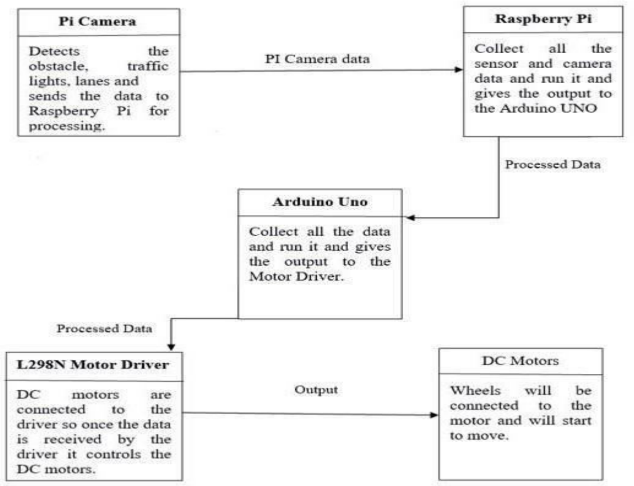
[3] REAL-TIME MULTIPLE VEHICLE DETECTION AND TRACKING FROM A MOVING VEHICLE.
Modules for detecting other vehicles on the road are present. The Rapidly Adapting Lateral Position Handler is used by the NavLab project at Carnegie Mellon University to identify the coordinates of the upcoming route and the best course of steering. Over 2800 miles from Washington, DC, to San Diego, California, RALPH guided a Navlab car 98% of the way automatically. A car tracking element has been introduced. To improve and increase the Navlab performance of the car, a module for recognizing overtaking vehicles and a trinocular stereo module (three-view vision) for identifying distant obstacles were included.

III. PROPOSED SYSTEM

[A] DESCRIPTION

The Raspbian Camera will be mounted on the car. It will be interfaced with Raspberry Pi 4 model B. This camera will capture all the images and send the data directly to the Raspberry Pi for processing, The Raspberry Pi will be powered by 10,000 mAh. We will install the Raspbian Debian 11 OS. The Genny editor will be used for programming purposes. The programming language will be C++, The Raspberry Pi will process the data received from the Pi Camera, and then using image processing techniques it will process certain outcomes regarding the objectives and the commands will be sent to Arduino UNO for further processing, The Arduino will receive the commands and it will send further instructions to the L298N motor driver, The L298N motor driver will start the dc motors according to the instructions received from Arduino UNO.

[B] BLOCK DIAGRAM OF PROPOSED SYSTEM



[C] METHODOLOGY

A. Setting up the raspberry pi OS:

The raspberry pi requires an operating system. This operating system is flashed into an SD card using a raspberry pi imager. This SD card is inserted into the raspberry pi. After the raspberry pi is booted from the SD card, it is configured for Wi-Fi and other settings. After certain necessary adjustments, the raspberry pi board is ready to use.

Note: During the configuration make sure to use a working and fast mirror site for proper downloading of the OS into the Raspberry.

B. Implementing lane detection:

Firstly, the project takes images as input via the Pi camera. This image captured is initially in BGR color format. Thus, the image is converted to RGB color format. After the image is captured, the region of interest is created and it is used to create a rectangular box around the lanes that help in lane detection in the first panel, this panel is called the original panel. In the second panel also called perspective, a top view over the path is created along with the rectangular box indicating the edges of the path. In the final panel, an image is created using the first two images and the canny edge detection technique to create three lines i.e., two corner lines indicating the edges of the road and a center line indicating the center of the road following which the vehicle moves on the road. The original image shows a result

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105137 |

parameter that is generated via the canny edge technology used in the final panel. The result indicates the deviation of the vehicle from the center path. If the result is zero, it indicates that the vehicle is on the center path. If it is more than zero, then the vehicle is instructed to move right whereas if it is less than zero then the vehicle is instructed to move left. Using this technique, the vehicle is able to detect the lanes while following the center path.

C. Implementing stop sign detection:

A high number of positive and negative samples are created using the Raspbian camera. The positive samples include the stop sign whereas the negative samples include the images of the surrounding. Using Cascade Training GUI software, a neural network having around 20 hidden layers is trained to detect stop signs. Once this cascade is created it is linked to the program as an XML file. After this step, the distance is calculated at which the vehicle stops after detecting the stop sign. Lastly, the Arduino is programmed to stop the vehicle once the vehicle has detected the stop sign.

D. Implementing object detection:

Similar to stop sign detection, positive samples of the object are collected and extracted, these samples are cascaded using the Cascade Training GUI, and a neural network is trained to identify the object. After this step, the distance is calculated at which the vehicle stops after detecting the obstacle object. Lastly, the Arduino is programmed to stop the vehicle once the vehicle has detected the obstacle.

E. Implementing traffic light detection:

Similar to stop sign detection and obstacle detection, positive samples of each signal light are collected and extracted, these samples are cascaded using the Cascade Training GUI, and a neural network is trained to detect each signal explicitly. After this step, the distance is calculated at which the vehicle stops after detecting the light signal. Lastly, the Arduino is programmed to stop the vehicle once the vehicle has detected the light signal.

F. Hardware description

Different components are used in order to build the self-driving car. The following are the major components used in the construction of this project:

1. Raspberry Pi 4 Model B: It works as the main processor, it takes data from the camera module, processes it, and takes required actions accordingly.

Fig 2: Raspberry Pi 4 Model B

2. Arduino Uno: It receives commands from raspberry pi and sends further instructions/commands to the motor driver shield. It also varies the PWM so that the vehicle can change directions.

Fig 3: Arduino Uno R3

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105137 |

3. Raspi Camera rev 1.3: This camera module is responsible for capturing pictographic information and sending it to raspberry pi as input.

Fig 4: Raspberry Pi Camera Rev 1.3

4. L298N Motor Driver Shield: It drives the motors according to instructions by the Arduino Uno.

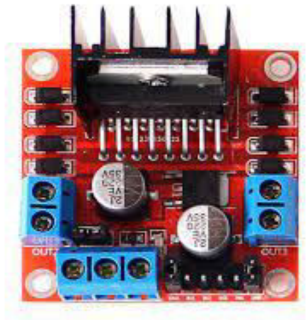


Fig 5: L298N Motor Driver Shield

G. Software description

The following development environments are used in the development of this project:

1. Raspberry Pi OS.
2. Arduino IDE.
3. Raspberry Pi Cam Interface.
4. C++.

IV. RESULTS AND DISCUSSION

After programming the model for expected outcomes, we got the following output:

1. The Self-driving car model:

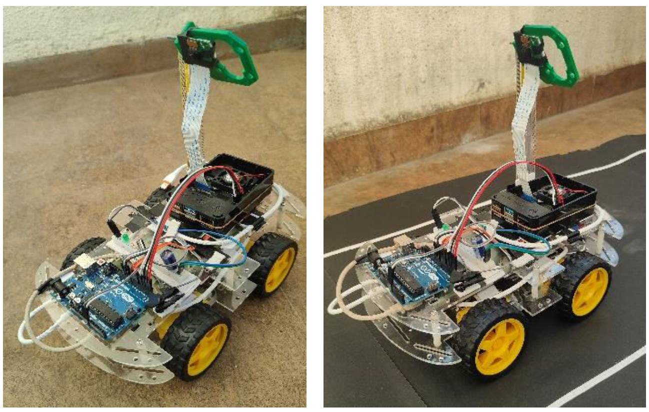


Fig 6: Self-Driving Car

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105137 |

2. Lane detection results:

1. The first output panel or the original panel gives the region of interest for the tracks.
2. The second output panel or the perspective panel provides the top view region of interest.
3. The final view after using Canny Edge detection is shown in the final view panel.
4. The last frame gives the FPS and the direction of the car that it needs to move to be at the center of the path.

Following are the images of the model:

Prototype:

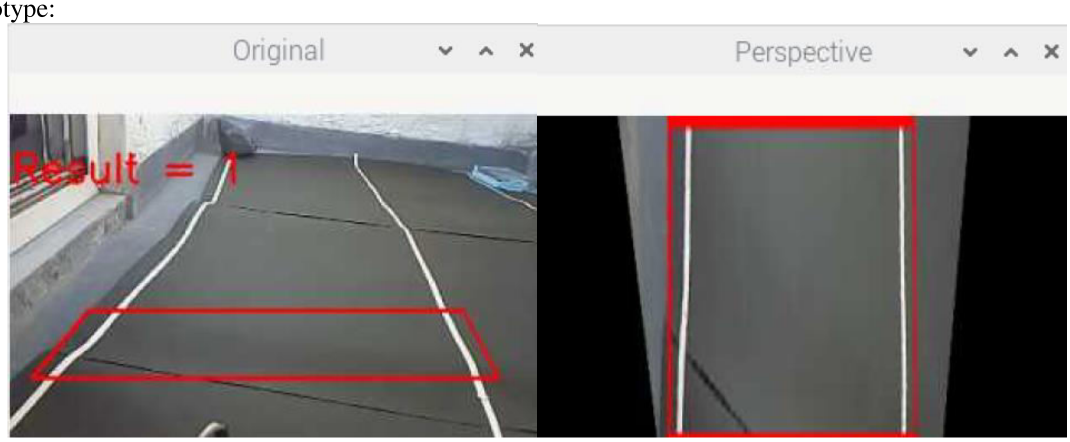


Fig 7: Original View

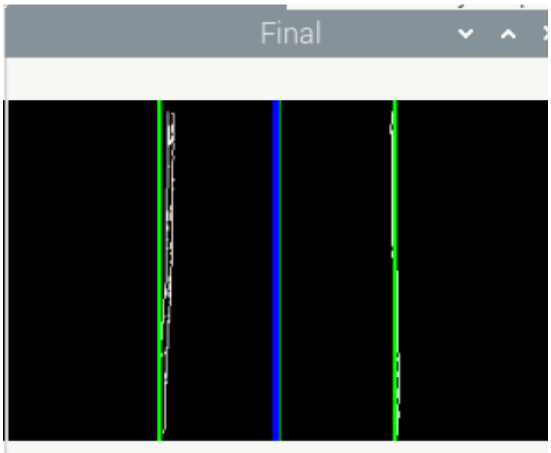


Fig 8: Final Canny Edge View

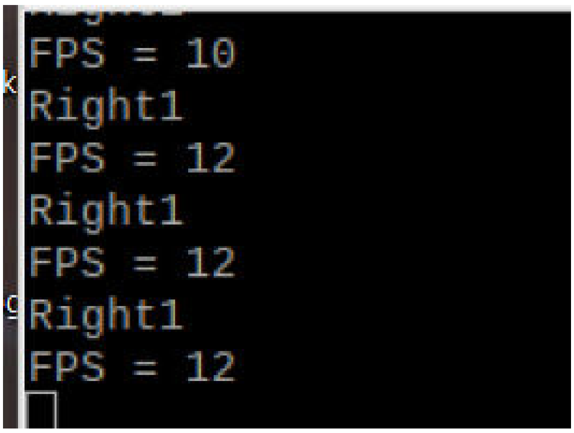


Fig 9: Output Panel

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105137 |

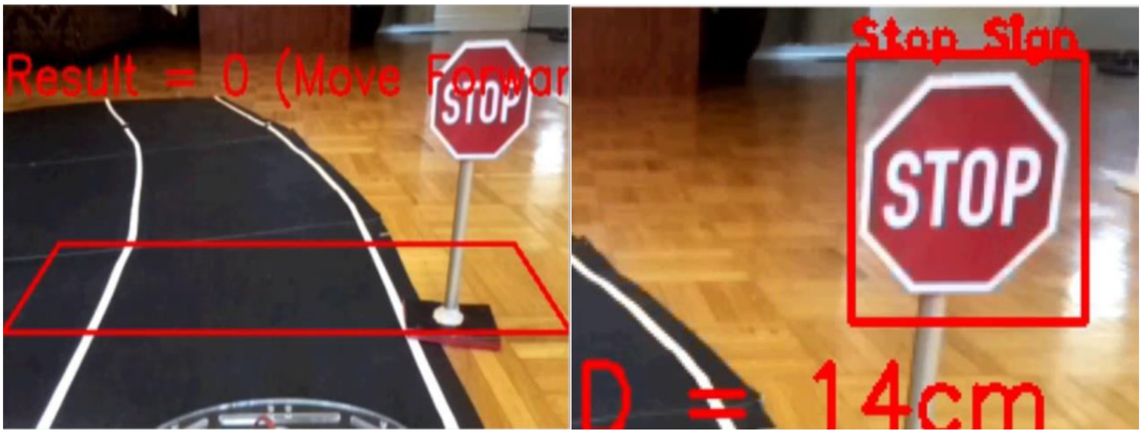


Fig 10: Stop Sign Detection.

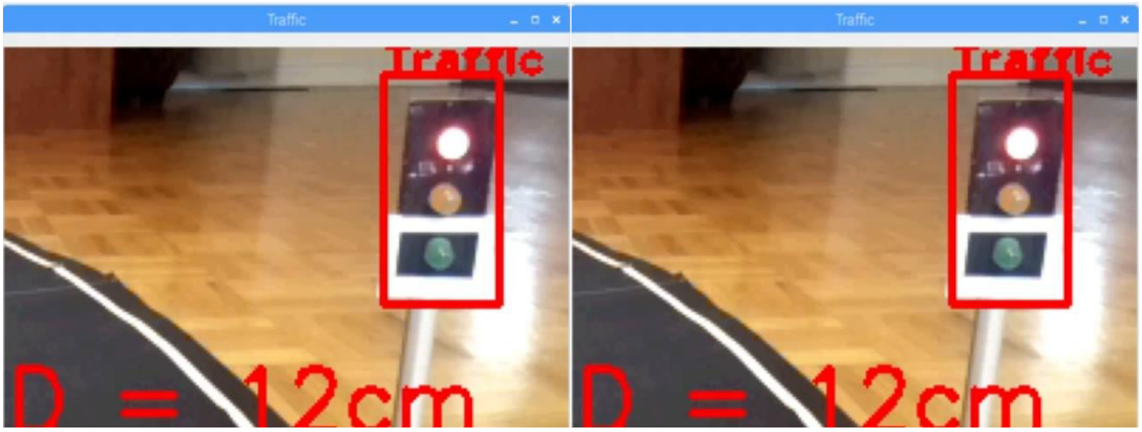


Fig 11: Traffic light detection.

V. APPLICATIONS

1. Delivery.
2. Defence and Military.
3. Health Sector.
4. Transport.
5. Mining and construction.
6. Agriculture and farming.
7. Mobility for the elderly and disabled.

VI. CONCLUSION

The proposed self-driving car is implemented and tested. The car is trained with more than 100 samples of images in different lighting conditions. In various testing done by us it is found that despite using high-resolution Rasp-Pi camera rev 1.3, lighting and different environmental conditions may affect the decision taken by the vehicle to overcome this minor issue. The training needs to be done precisely with perfect frame rates. This paper describes the working methodology of our self-driving car.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105137 |

REFERENCES

[1] Aditya Kumar Jain, "Working model of Self-driving car using Convolutional Neural Network, Raspberry Pi and Arduino", Proceeding of the 2nd International Conference on Electronics, Communication and Aerospace Technology (ICECA), IEEE, 2018, pp: 1630-1635.

[2] Raivo Sell, Anton Rassõlkin, Mairo Leier, Juhan-Peep Ernits,"Self-driving car ISEAUTO for research and education" in 19th international conference on Research and Education in Mechatronics (REM), IEEE, 2018, pp: 111-116.

[3] Dong, D., Li, X., &Sun, "A Vision-based Method for Improving the Safety of Self-driving", 12th international conference on Reliability, maintainability, and Safety (ICRMS),2018, pp: 167-171.

[4] T. Banerjee, S. Bose, A. Chakraborty, T. Samadder, Bhaskar Kumar, T.K. Rana, "Self-Driving Cars: A Peep into the Future", IEEE, 2017, pp: 33-38.

[5] Chun-Che Wang, Shih-Shinh Huang and Li-Chen Fu, Pei- Yung Hsiao "Driver Assistance System for Lane Detection and Vehicle Recognition with Night Vision", IEEE, 2017.

[6] Jeremy Straub, Wafaa Amer and Christian Ames, "An Internetworked Self-Driving Car System-of-Systems", 12th system of systems engineering conference, IEEE, 2017.

[7] Margrit Betke, Esin Haritaoglu, Larry S. Davis, "Real-time multiple vehicle detection and tracking from a moving vehicle", in Machine Vision and Application, IEEE, 2000, pp: 69-83.

INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.379

doi ref cross

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर
NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING