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IoT-based Autonomously Driven Vehicle by using Machine Learning & Image Processing

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Abstract:- *This paper aims to represent a miniature version of self-driving cars using the Internet of Things. The raspberry pi and Arduino UNO will function as the main processor chips, an 8MP pi high-resolution camera will provide the necessary information, raspberry pi will evaluate the results (demo), and raspberry pi will be trained in pi with neural networks and a machine learning algorithm, resulting in the detection of traffic lanes, traffic lights, etc., and the car will behave accordingly. In addition to these features, the car will overtake any obstacles with a proper LED signal.*

Keywords:- *Self Driving Car, Internet of Things, Machine Learning, Image Processing, Open CV, Raspberry Pi.*

1. INTRODUCTION

ADV, which stands for **AUTONOMOUSLY DRIVEN VEHICLE**, in human terms is called "**SELF DRIVING CAR,**" which is abbreviated as **SDC.** These cars probably don't need a driver; all they do is sense things going around them and act accordingly. Many multinational companies like Alphabet (Waymo), Uber, etc., use three types of things called cameras, Lidars, and sensors. The use of cameras and Lidars in an SDC requires a lot of manpower, in which a person has to instruct the SDC about the objects, obstacles, and signs. This kind of process exhausts a lot of capital and funding which we cannot spare.

2. LITERATURE SURVEY

So, what if there are no sensors and lidars?

In this project, we developed a process where the SDC is trained with a Convolutional Neural Network which is a class of Artificial Neural networks used to analyze visual imagery. So, there is no need of using sensors or lidars and just using cameras will be sufficient.

Let's dive into the topic, this project is based on IoT "**INTERNET OF THINGS**" which is used to access the data and control system over the internet.

3. SETTING UP HARDWARE

Using 4 DC gear motors and 4 non-slippery rubber tiers the assembling and disassembling will be easier. The unit's main process is assembling **RASPBERRY PI B3+** which handles image processing. Raspberry pi camera is hooked up with a CSC cable to the CSC port of Raspberry pi B3+.

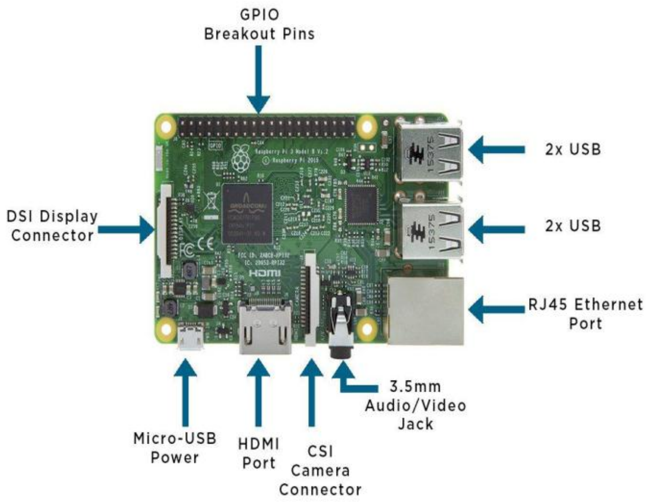

Fig -1: Raspberry Pi B3+

The **L298N motor driver** IC has many applications in the embedded field, especially in robotics. Most microcontrollers operate with very low voltage and current, while motors require higher voltage and current, microcontrollers cannot provide much higher current to them. We use L298N motor driver IC for this purpose.

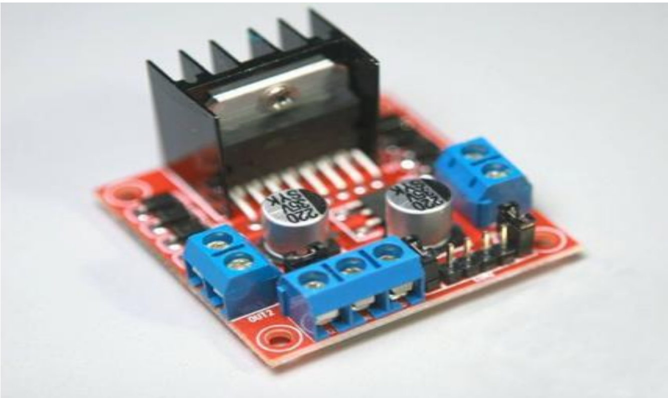

Fig -2: L298N motor driver

All **Raspberry Pi cameras** are capable of taking high-resolution photos along with full HD 1080p video and are fully programmable. There are versions for visible light and infrared radiation. However, there is no infrared version of the HQ camera. However, the IR filter can be removed if required.

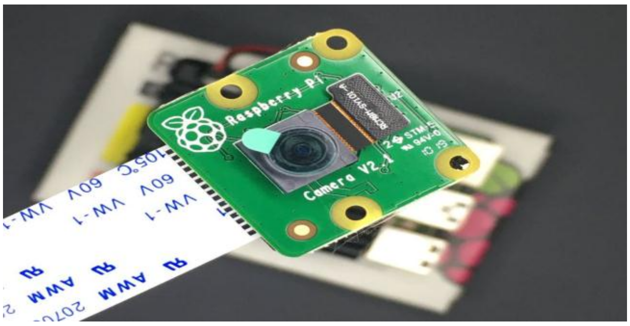

Fig -3: Raspberry Pi camera

The **74164 IC** is a serial input 8-bit edge-triggered shift register that has outputs from each of eight stages. SERIAL DATA INPUT PINS are serial input data entered on the SDA pin or the SDB pin as they are logically ANDed. Each input can be used as an active HIGH enable with data input on the other pin. The serial data on the DSA and DSB pins must be stable before and after the rising edge of CP to meet setup and timing requirements.

The **BC547 (NPN) transistor** has two operating states: forward bias and reverse bias. In the forward bias condition, the current can only pass when the collector and emitter are connected. In the reverse bias state, it acts as a disconnect switch and no current will pass.

LED Dynamic Turn Indicators are located at the rear of the chassis to indicate vehicle direction through lights that move across the car in the direction of intended travel. Especially for design-driven Front light functions such as Daytime Running Lights (DRL), LEDs are already the first choice in mid-range cars today, and more and more mid-range cars are getting standard LED headlights at least as an option.

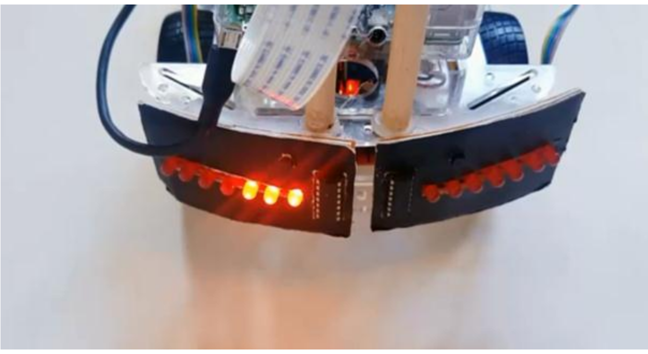

Fig -4: LED Dynamic Turn Indicators

4. SETTING UP SOFTWARE

To set up the Raspberry pi we used Raspbian Lite (300MB) to flash the micro SD. This micro SD was used to store our images. Then we connect to the Raspberry pi and PC using the internet.

Open CV is an image processing library that is free and easy to use. Open CV can be used in C, C++, and Python. We used C++ to write the code and compile it. Once assembled, an image view was opened for ROI creation, perspective transformation, thresholding operations, and calibration. We then installed Raspbian on the Raspberry pi and the pi cable library to access the GPIOs.

Gaussian Blur is a pre-processing process used to reduce any image noise. The proposed system uses this particular pre-processing method to erase multiple recorded boundaries and preserve most of the distinguishable image boundaries.

Canny Edge Detection is a technique that extracts useful structural information from various vision objects and reduces the amount of data to process. It calculates the gradients in each direction of our blurred image and tracks the edges/sides with large changes in intensity. It has been widely used in many computer vision systems. Canny found that the requirements for applying edge detection on different vision systems are very similar.

Fig -5: Canny Edge Detection

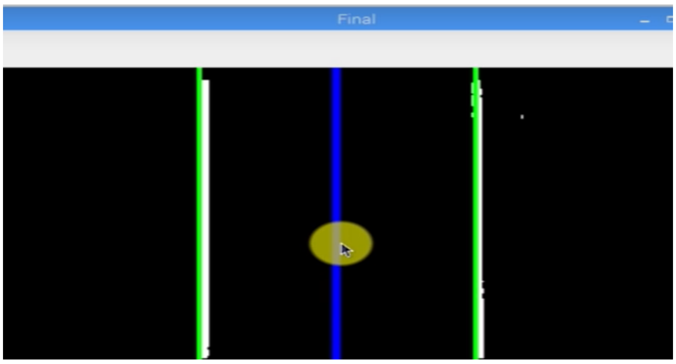

Fig -6: Canny Edge Detection(Computer View)

A **Region of interest** is the patterns in the data identified for a specific purpose. By performing Canny Edge Detection, many of the boundaries found are no traces. The concept of ROI is commonly used in many applications.

The endocardial border is probably defined on the image, possibly during different phases of the cardiac cycle to assess cardiac function.

In computer vision and optical character recognition, ROI defines the boundaries of the object under consideration. In many applications, symbolic labels are added to the ROI to compactly describe its contents.

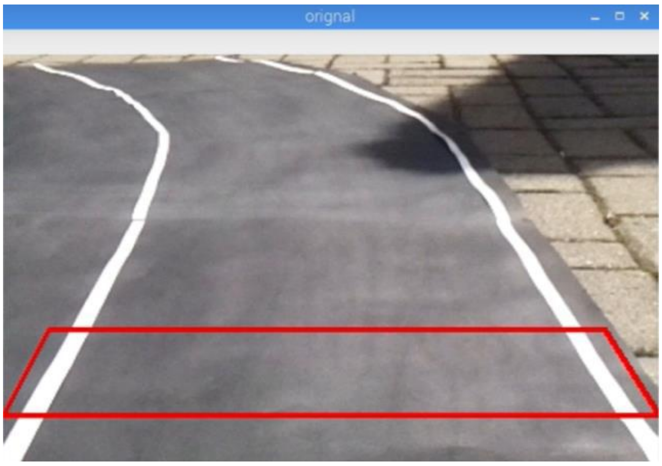

Fig -7: Region of interest

The **Cascade Trainer GUI** is a program that will be used to train, test, and improve cascade classifier models. It uses a graphical interface to set parameters and facilitates the use of OpenCV tools for training and testing classifiers.

After launching the Cascade Trainer GUI, a screen will appear. This is the initial screen and can be used for classifier training. Typically, to train classifiers, you have to provide the tool with thousands of positive and negative image samples, but there are cases where you can achieve the same with fewer samples.

5. METHODOLOGY

So connect the robot body to the chassis and the wheels of the automated car, solder the motors and fix them to the chassis, raspberry pi, Arduino UNO, and the motor controller and make the circuit wiring according to the wiring diagram.

Using an ethernet cable, connect the raspberry pi to the computer and turn on the pi's Wi-Fi function so that you can connect and access the Pi using Wi-Fi and the VNC viewer that is installed on the pi's operating system.

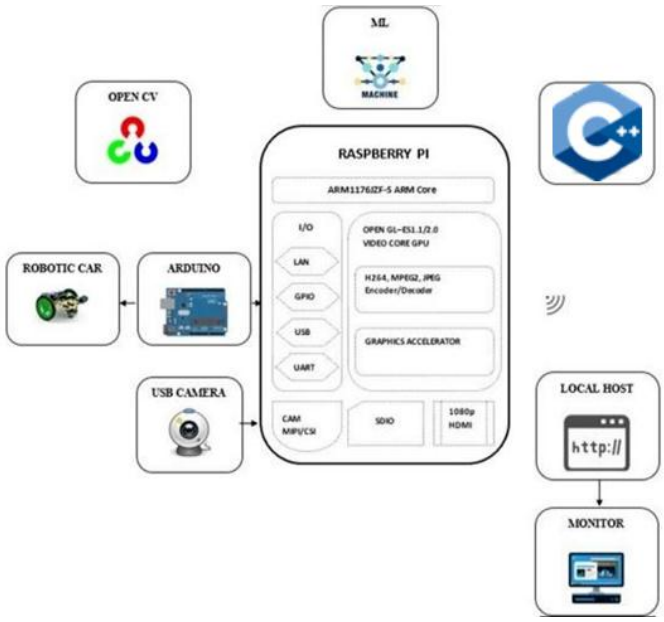

Fig -8: Methodology

6. WORKING

The Raspberry-pi instructs the Arduino UNO and it commands the L298N ICs to keep powering the tires and then stop the prototype contingent's movement depending on the object's approach. The calculated displacement is also displayed in the output window of the program.

6.1 IMAGE PROCESSING

Digital image processing provides a clear image for information extraction. Image processing in SDC is done using OPEN CV. This process includes various sub-processes such as image compression, object detection, and recognition. The captured image is enhanced, restored, and processed using both pseudo and full color.

6.2 LANE DETECTION SYSTEM

A lane detection system is used to assist the driver. It can detect streaks, which helps locate marks. Increases driver safety by detecting traffic lanes at night. Finally, the lane detection system is like an assistant that aims to improve driving.

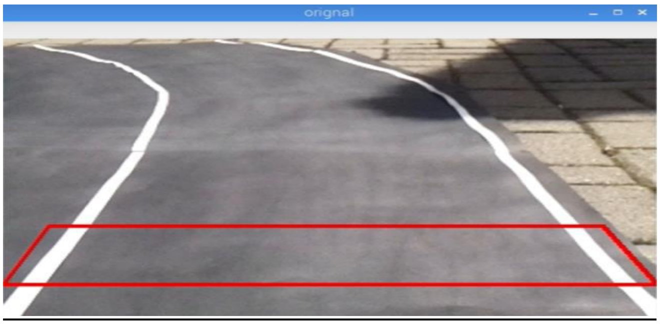

Fig -9: Lane Detection

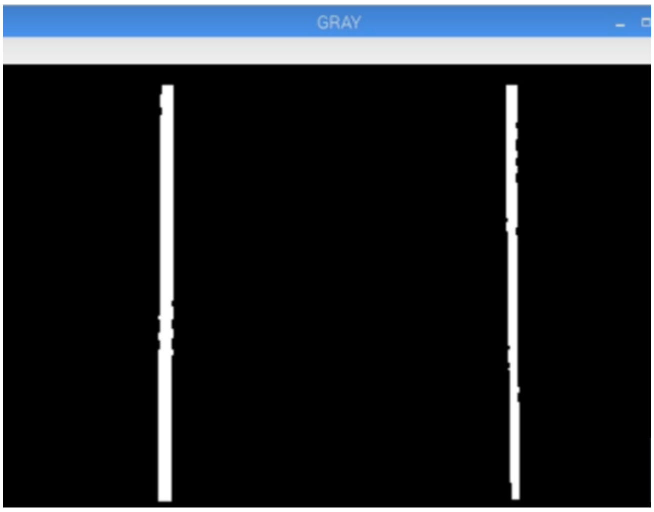

Fig -10: Lane Detection(Computer View)

6.3 MACHINE LEARNING:

Machines learn in different ways with different amounts of "supervision", supervised, unsupervised and semi-supervised. Supervised learning is the most commonly used form of ML and also the simplest. Thus, unsupervised learning does not require so much data and has the most practical users. convolutional neural network, which is a class of artificial neural networks used to analyze visual images. Computer vision is used to spot an object in front of a prototype and make decisions accordingly.

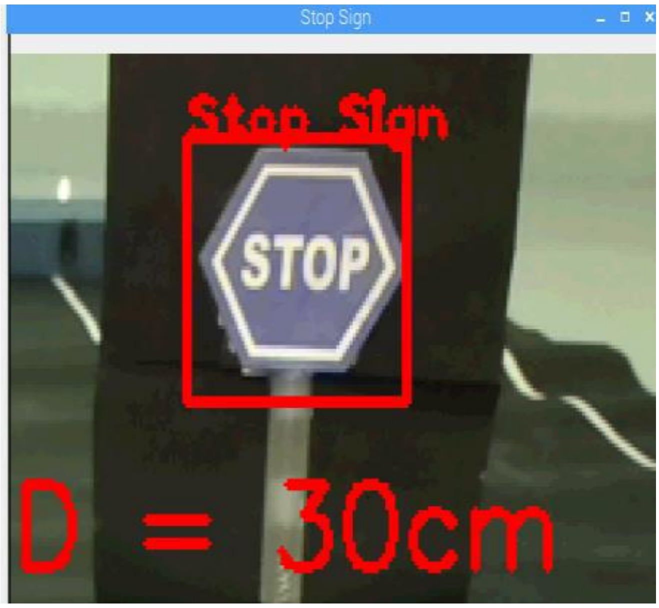

Fig -11: ML Example

7. RESULTS

When we start the engine, all the components start working and the camera starts taking pictures. Lane detection is successful, obstacle detection successful and traffic signals are detected and behaved accordingly. They are also mostly flown high by air deviations, more precisely air and car motion disturbances.

7.1 STOP SIGN DETECTION

If Self Driving Car detects a STOP sign in its path, it stops at a 10cm distance (as per programmed) before the STOP sign position.

Human View:

Fig -12: Stop Sign(Human View)

Computer View(Runtime Status):

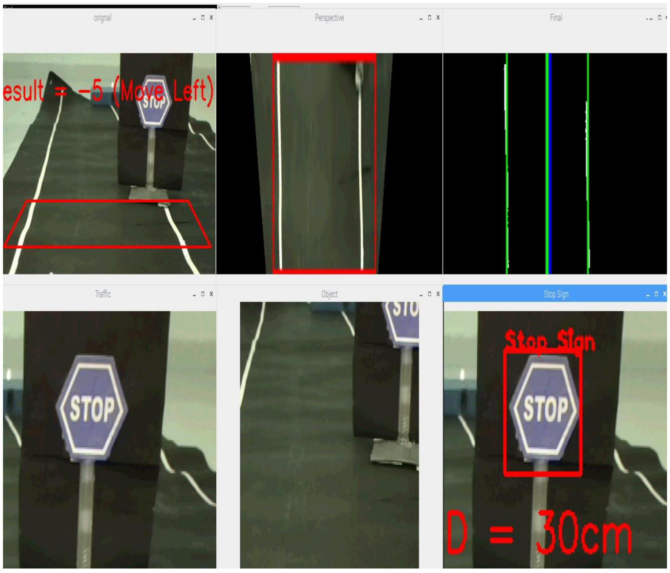

Fig -13: Stop Sign(Computer View)

7.2 OBSTACLE DETECTION:

If there is any obstacle in the path of Self Driving Car, then the car will overtake the obstacle at a specified distance and comes back to the same lane.

Obstacle detection in Self Driving cars can be achieved by using Machine learning.

Human View:

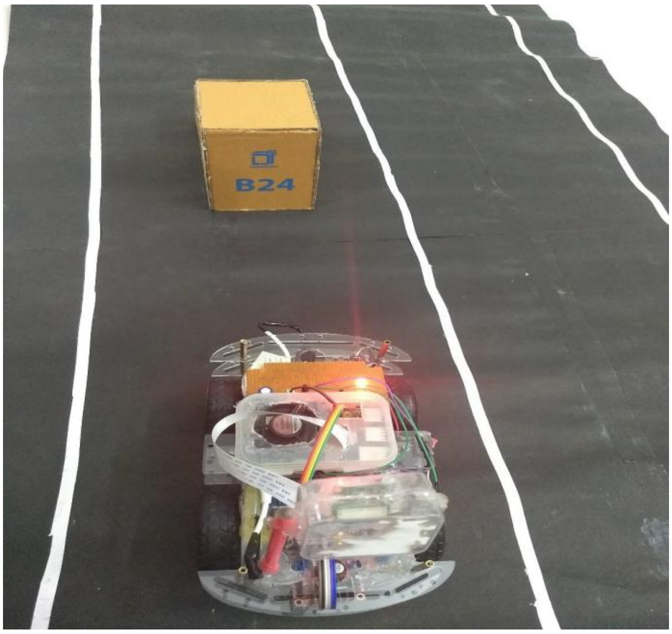

Fig -14: Obstacle Detection(Human View)

Computer View(Runtime Status):

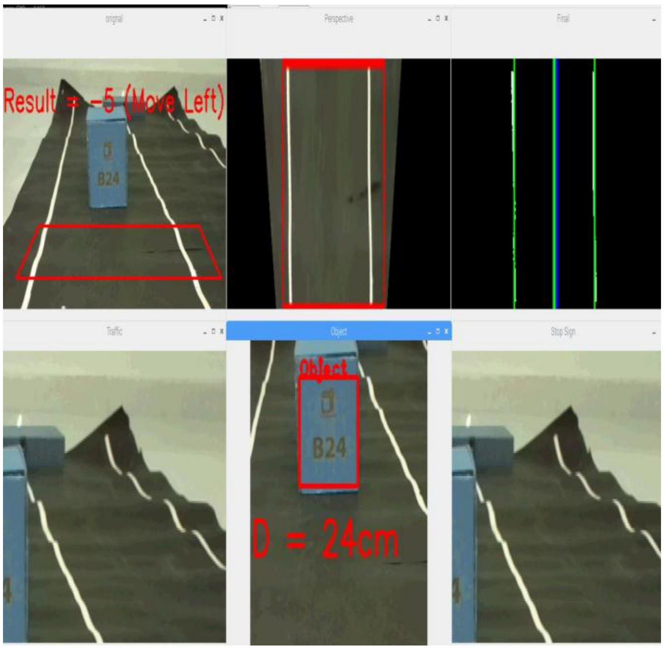

Fig -15: Obstacle Detection(Computer View)

7.3 TRAFFIC LIGHT DETECTION:

When Self Driving Car detects a traffic light in its path, it checks the color of the light and acts accordingly. If the red light is detected, Car stops until the green light appears. If it's a green light, then Car continues to move forward without stopping.

Human View:

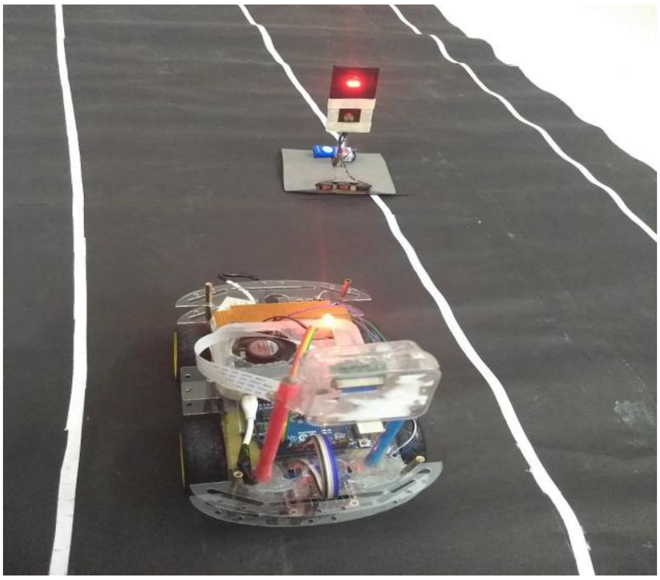

Fig -16: Traffic Light Detection(Human View)

Computer View(Runtime Status):

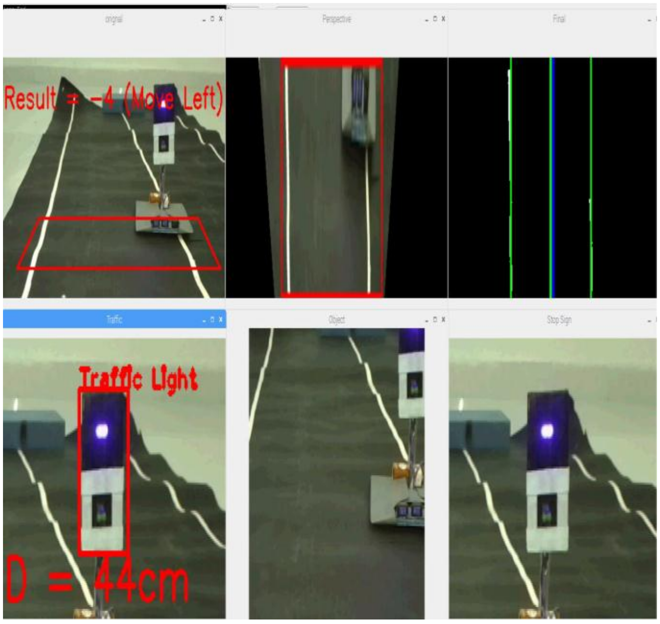

Fig -16: Traffic Light Detection(Computer View)

8. CONCLUSION

This Self Driving Car is trained and tested using a normal resolution raspberry pi camera with a lot of samples and in a safe environment. To avoid typical environmental changes and conditions which are unpredictable, the Self Driving Car must be trained perfectly to be able to perform perfectly without any false decisions. The operation of our self-driving car is outlined in this paper.

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] 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.

[4] Qudsia Memon, Muzamil Ahmed and ShahzebAli, "Self- Driving and Driver Relaxing Vehicle", in IEEE 2016, pp:170-174.

[5] Mohammad Faisal Bin Ahmed, Md. Saef Ullah Miah, Md. Muneef Anjum Timu, Shakura Akter, Md. Sarker.b, "The Issues and the Possible Solutions for Implementing Self- Driving Cars in Bangladesh" in Regin 10 Humanitarian Technology Conference(R10-HTC), IEEE,2017, pp: 250- 254.

[6] 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

[7] 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

[8] Ruturaj Kulkarni, Shruti Dhavalikar, Sonal Bangar, "Traffic Light Detection and Recognition for Self Driving Cars using Deep Learning" in 4th International Conference on Computing Communication Control and Automation(ICCUBEA), IEEE, 2018

[9] R. Mohanapriya, L.K. Hema, Dipesh warkumar Yadav, Vivek Kumar Verma, "Driverless Intelligent Vehicle for Future Public Transport Based On GPS", in International Conference on Signal Processing, Embedded System and Communication Technologies and their applications for Sustainable and Renewable Energy (ICSECSRE `14), Vol. 3 Special Issue 3, April 2014, pp: 378-384

[10] Giuseppe Lugano, "Virtual Assistants and Self-Driving Cars", IEEE, 2017, pp: 1-5.

[11] 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.

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