# CONVOLUTIONAL NEURAL NETWORK BASED WORKING MODEL OF SELF DRIVING CAR

**S. Priyanka**[1]
S J C Institute of technology
Chikkaballapura, India

**Gowthami T R**[2]
S J C Institute of technology
Chikkaballapura, India

**Lavanya M**[3]
S J C Institute of technology
Chikkaballapura, India

**Muskhan J A**[4]
S J C Institute of technology
Chikkaballapura, India

---

***Abstract*— Self driving car is an automated car which can drive without humans using environment. This car can sense the traffic signals, roads, breakages and seeing stop signs. Car moves along the lanes by capturing the images using pi cameras and sensors which are latest versions. By using the automated car we can reduce the traffic, can avoid accidents, because of human negligence we are seeing many accidents, to avoid such accidents we can use automated car. This is design using deep learning in which Convolutional Neural Network.**

***Keywords*— traffic signals, stop signs, Convolutional Neural Network**

## I. INTRODUCTION

Nowadays in the world we are seeing and listening about accidents which are occurring due to human negligence and also breaking the traffic rules. The main reason to develop the self driving car is to reduce the accidents, people time to travel from one place to another place, very safety for travelling, death rating, save fuel. Automated car senses the environment by capturing the videos and photos. It can sense the road, Breakages, stop signs, and also lanes that are used to move, because the cars travel by seeing the lanes. Cars can stop by seeing the traffic signals. It should stop by seeing the red signs. This helps in small places to avoid accidents. It can detect the lanes, traffic signals, accidents etc. This is happen by using the Convolutional Neural Network in deep learning. In this we are using the sensors like tesla, lidar and radar. Capturing the images by using Raspberry Pi. We are using the latest updated versions in this project.

## II. HARDWARE AND SOFTWARE REQUIREMENTS

The Software Requirements are Raspberry OS, Python IDLE and Open CV. The Hardware requirements are Raspberry pi, Pi-cam, Chassis, Motor Driver and Battery.
HAEDWARE SPECIFICATIONS

1. Raspberry pi OS
   It is free and open source model available in English and other languages. It is highly used for the Raspberry Pi lines. It improves the performance.
2. Python
   Python is a high level programming language. Its design is used to emphasize code readability. It is very easy and understandable for the programmers to write the code. We can write the code small. It also described as “batteries included” language due to its comprehensive library.
3. Python IDLE
   It is an application in class that is used to write the code very powerfully. Python IDLE contains many IDEs we can choose ant one which we required. It also used for installations on Windows and Mac. We can easily check the python code in the shell. Shell is a Read-Eval-Print loop. This helps to read the statements, to evaluate the statements and also to display the output on the screen. This is process for checking the statements. After checking all the statements we need to save these statements in the file. The files are saved with .py extension only.
4. Open CV
   Image processing libraries like OpenCV represent RGB images with height, depth and width. We always write the dimensions in the form of rows x columns, where as rows row represent height and column represent width of the image.

HARDWARE SPECIFICATIONS

1. Raspberry Pi 3

Figure 1: Raspberry Pi 3

Raspberry Pi is mostly used to learn python very easily. The price will be very reasonable and also affordable for everyone. It looks like a small debit card. The range of the raspberry pi is hundred meters.

2. Pi Cam

Pi Camera is used for video recordings; it can be used by anyone very easily. For learners it will be very easily to learn. It can operate any ranges.

## III. PROPOSED SYSTEM

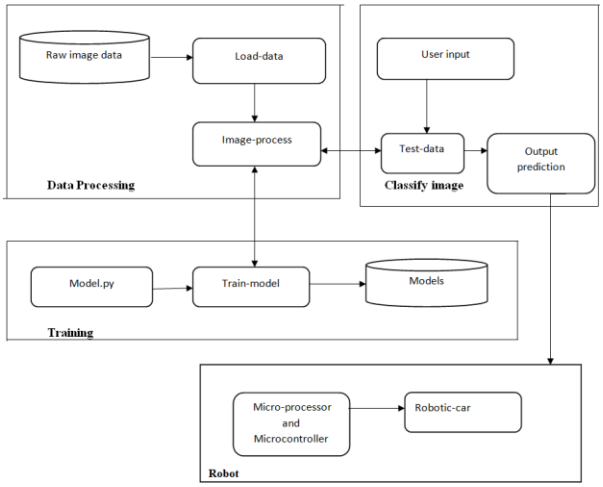


Figure 2: Architecture

The goal of the system is to implement an autonomous self driving car which could dense and moves through the lanes, stop signs and traffic signals. This proposed system mainly consists of input unit, proposed unit and control unit. Input unit consists of sensors and cameras, these cameras and sensors are connected to the B+ model for input data. Raspberry Pi contains the two running programs, one is used to collect the images and second one is used to send the data which are collected from sensors through local wi-fi. The main task is collecting the data from raspberry pi, steering prediction and neural network training, signal dectection and stop signs using monocular vision, and sending all this information to the Arduino using the USB connection. To receive the data from sensors and image frames the multithreaded TCP server program is executed.

The images which are received are converted into grayscale and then they are decoded into NumPy arrays. The CNN known as Convolutional Neural Network is trained to make steering predictions based on lane marking which are detected. The input and output will be in hidden. The output layer contains the four nodes; each node should be responded for the steering instructions that are forward, left, right and reverse. For training, each and every image should be cropped and then converted into NumPy arrays.

Then the trained image will be paired with the train label. And all these trained images and trained labels will be stored in npz file and weights will be stored in XML. The Arduino contains four pins that are used to connect four pins on the remote controller. The Arduino is connected to the computer through the USB cable and the output will be send by the computer and write high or low signals.

## IV. METHODOLOGY

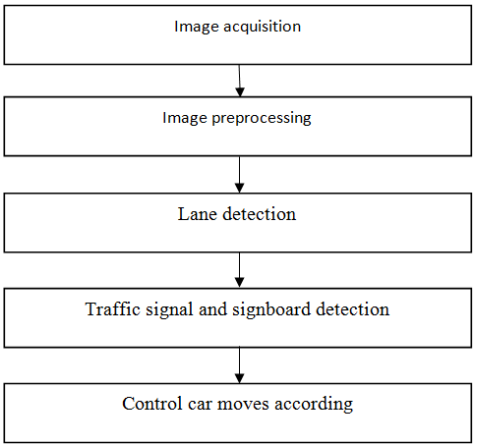


Figure 3: Methodology

Image Acquisition is the first step for any systems. It refers for the collection of the images and data required for the images. Image processing is the second step in the methodology. It also performs the operations on the images. It is increasing technologies in the world day by day. Lane detection is an important role in the self driving car, because by using the lanes only the car moves. The video frame is fixed on the car to detect the lanes and also to provide the information to take any decisions by its own. In lane detection we will remove the noise. Lane detection consists of five steps those are removing the noise is the first step. Figure 5 says the noise is removed by using the Gaussian Blur. The second step is discard color this will be converted to grayscale image. The result of the both Gaussian and grayscale will be in black and white images. The third step is to detect the edges. To detect the edges we are using the canny edge algorithm. The fourth step is for region of interest figure 9 consists of two images upper and lower lane will be detect by using the lower lane image because the upper lane consists other information.

Figure 4: Normal Image

Figure 5: After removing noise

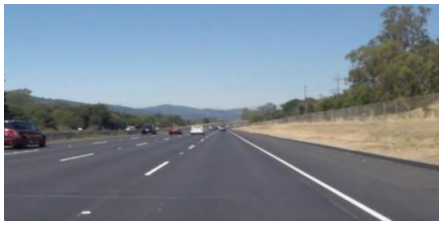

Figure 6: The blur image

Figure 7: grayscale to image

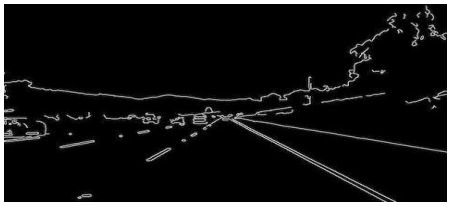

Figure 8: Canny detection to grayscale

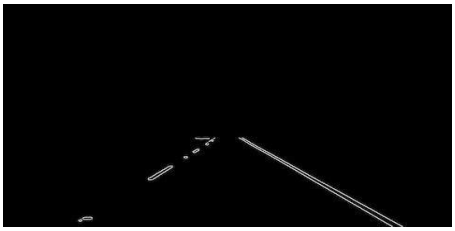

Figure 9: Region of interest

Traffic signal and signboard detection is also very important for autonomous vehicles because the car should follow the rules to avoid accidents. The rules are very strict which are conducted by government. If the rules are broken there will be punished or may provide to pay fines.

To avoid such incidents we need to follow the rules very strictly. The autonomous vehicles will recognize the sign boards and signals by using intelligent. Sign boards are placed beside the roads to avoid accidents. These all rules and sign board should be detected by the autonomous vehicles while driving. In this paper we are using artificial neural network to detect the signs and traffic signals which are trained with real-time datasets. Observation of the traffic signals and signs are two phases one is for detection and another is for to detect the signs within the boundaries of the signs. The pictures are converted into the gray scaled and then they are simplified by using Gabor wavelets.


Figure 9: Before Processing

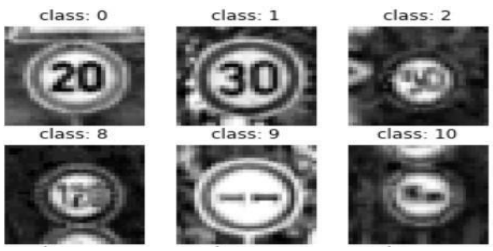


Figure 10: Image after gray scale applied

Figure 11: Before classification of signals

To be trained, the images are gathered. Then these images are trained for a certain amount of time. All these trained models are having two iterations and then they are validated for testing the dataset and then finally the label as we see in the figure 14.


Figure 12: After classification


Figure 13: Classified as red

## V. TESTING

For our experiment, we fed the system with the image captured by the camera. The camera was processed using image processing method to identify the lanes in which we need to move. The main aim is the autonomous car need to move along the lanes and also need to follow the traffic signals. We are using the cameras to capture the images. And these images will be detected and then the decision will be taken by the autonomous car to move. The cameras will detect the images, traffic signals. Once the traffic signal is detected it will check the color which is displaying. If the signal is red then it will stop moving and if it is green the car starts moving. Even it will detect the lanes and will move along the lanes.

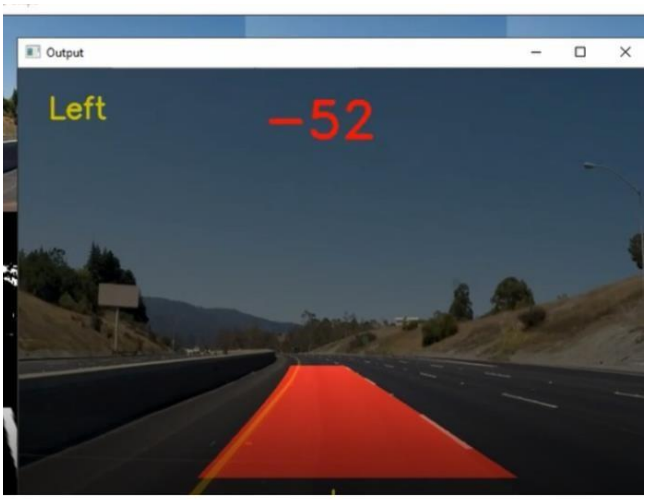


Figure 14: Image detected towards left

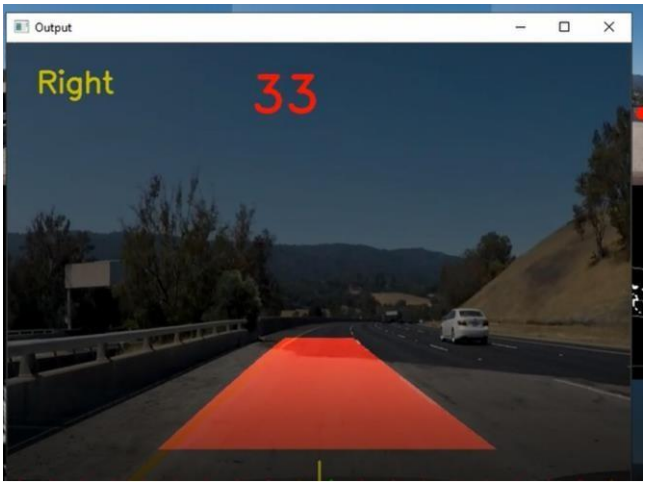


Figure 15: Image detected towards right

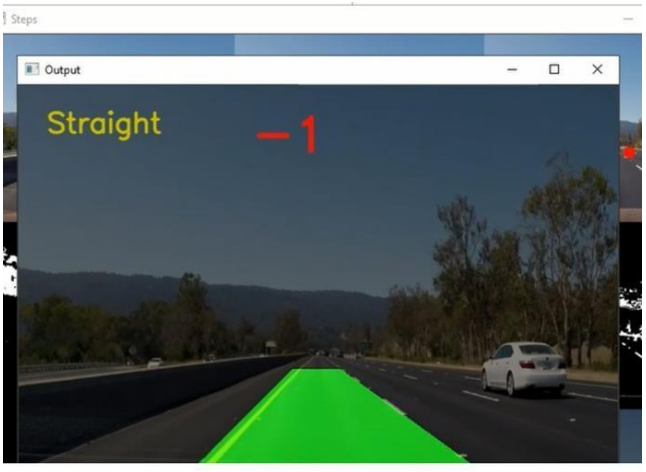


Figure 16: Image detected as straight

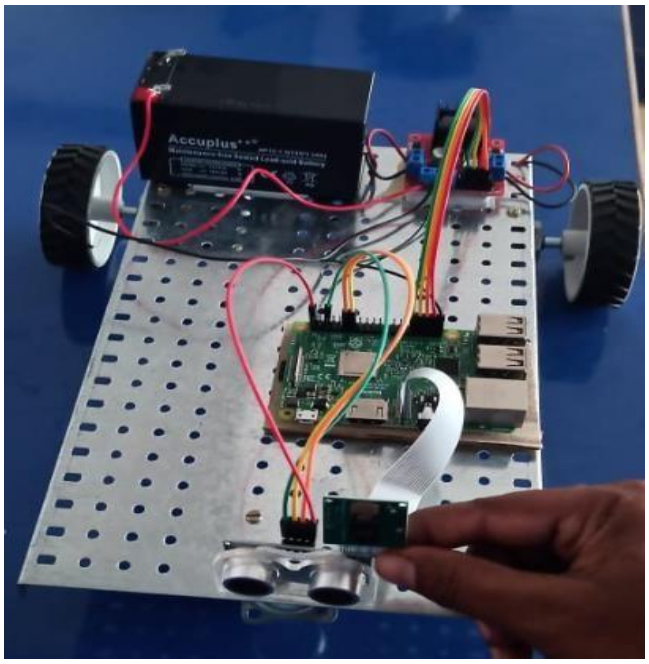


Figure 17: Hardware Component

## VI. CONCLUSION

In this paper we came to know that, how the Self Driving-Car will drive by detecting the traffic signals, sign boards and how the car will move along the lanes with deep learning using CNN known as Convolutional Neural Network. The Car should follow the rules and by detecting the traffic signals whether it is red or green. Mainly this is useful to reduce the accidents and time consumption of the humans will be less. We can travel to one place to another place very safely and quickly.

## VII. 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 educational 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, "SelfDriving 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 SelfDriving Cars in Bangladesh" in Regin 10 Humanitarian Technology Conference(R10-HTC), IEEE,2017, pp: 250- 254.

[6] Margrit Betke, EsinHaritaoglu, 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, PeiYung Hsiao "Driver Assistance System for Lane Detection and Vehicle Recognition with Night Vision".

[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.