IJIRCCE

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

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 5, May 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005217|

Traffic Sign Recognition System for Autonomous Vehicle Using Raspberry Pi

Prof. A. S. Utane, Twinkle A. Gophane, Ruchita S. Jawanjal, Vishakha M. Deshmukh,

Department of EXTC, PRMIT&R, Amravati, India

Department of EXTC, PRMIT&R, Amravati, India

Department of EXTC, PRMIT&R, Amravati, India

Department of EXTC, PRMIT&R, Amravati, India

ABSTRACT:In this contemporary era people are continuously trying to save time in their life. People are spending lots of time driving and travelling. They can save their time by using public transport but not every country has good facilities. So, Self-Driving Cars are a boon for humans in terms of safety and time saving. People can do work in autonomous vehicles or they can take a nap which helps to increase working efficiency. It is an arduous job to make independent machines because we don't know the driving environment and situation. Computer vision and sensor fusion are parts and parcel of the auto driving. Based on the sensors and camera results the car will be moved. Carl simulator used for testing purposes. It provides the best environment to check all components of a self- driving car. We made a car using DC motors, batteries and that operates using Raspberry pi. Two neural networks are the backbone of this project. First network decides the move according to the track situation and the other one identifies objects on the scene.

I. INTRODUCTION

Every person, he may be a passenger, driver, pedestrian would have noticed along the roadside various sign boards that serve important purposes. These important road paraphernalia helps us as route guides, warning and traffic regulator. As control devices for traffic, signs need full attention, respect and adequate driver's response.

The road signs we wear around us that long back in history. the earliest Road sign where milestones giving a distance or direction in the Middle Ages the multidirectional sign at the intersection become a common giving the directions to the cities and the towns with the advent of motorised traffic and its increasing pressure on road many towns with the many have adopted pictorial sign and standard is there sign to facility international travel where languages differences will create a barrier. In general, it is used to help in hands traffic safety through approximate questions regulations and information sign. most of them used symbol in place of words and have international recognition and acceptation. the sign where Primarily evolved in the Europe and have been adapted by the most countries

A) Mandatory signs

b) Cautionary signs

C) Informatory signs

A further Guide to the function of a sign is its colour. blue circles give a mandatory instruction such as the "compulsory turn left" etc. blue rectangles are used for the information signs. all triangular sign is red there are few exceptions to the shape and colour rules to give certain sign greater prominence.

II. LITERATURE SURVEY

Since the appearance of the first paper in Japan in 1984, road sign recognition has become one of the important research fields. From that time until the present day many research groups have been active in the field and have tried to solve this problem using different approaches. Although initially the main steps towards a solution seem very well defined and straightforward, the details of the approaches used show that there are several alternatives and many ideas as to how better solutions, better robustness, or a better classification rate can be achieved. So far, no one solution method has dominated, and it will clearly take some time before systems are seen in the market. The identification of road signs can be carried out by two main stages: detection, and recognition. In 'detection' research groups are categorised into three groups. The first group of researchers believes that traffic sign colours are important information by which traffic signs can be detected and classified. The second group believes that detection of traffic signs can be achieved by traffic sign shape only, and the third believes that colour together with shape make the backbone for any road sign detection. Thus, there are three major approaches to detecting traffic signs: detection using colour

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

information, detection using shape information, and detection using both colour and shape information. All of the reviewed papers used images form real traffic scenes which are similar to the images collected during this research. 4.1.1 Colour-Based Detection of Traffic Signs Techniques invoked to carry out traffic sign detection varies from one author to another. There is a wide range of techniques used to solve this issue. o Ghica et al. [26] used thresholding to segment pixels in a digital image into object pixels and background pixels.

III. METHODOOGY

The development of the system for the recognition of signs is based on two main modules: a) Detection: It is used to detect the signs from a whole image frame. It includes the modules: data image acquisition, image pre-processing and sign detection. This phase greatly reduces the amount of information to be processed later. b) Recognition: It identifies road signs by comparing the information provided by the previous phase with the sign pattern stored in a database.

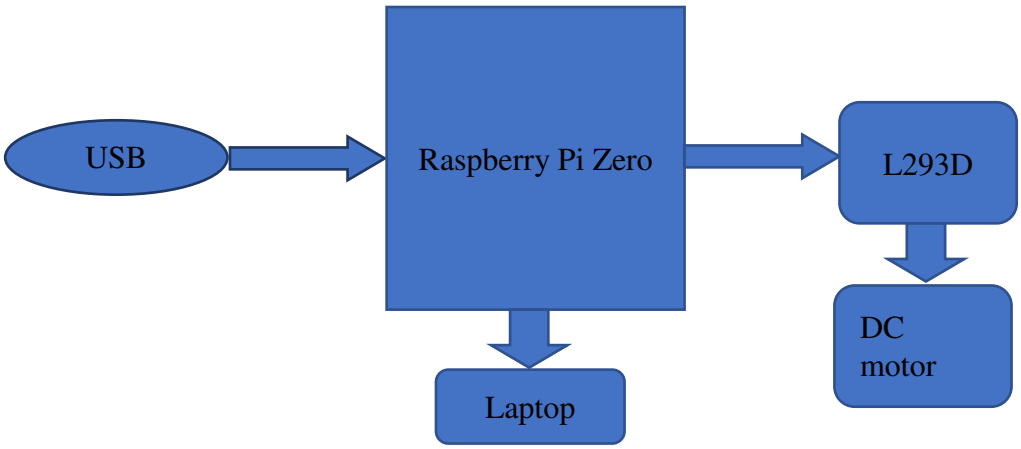

Fig No 3.1 Rasberry pi Component

3.1 Detection module

2.1.1 Image acquisition The tests were performed with a standard mobile phone with Android system (main camera parameters: 16 Mpix, f/1.9, 28mm, 1/2.6", 1.12µm, OIS, AF). The tests examined the influence of the input image size on the accuracy of road sign recognition and the algorithm operation time. The optimal size of the frame obtained fromthe camera and subjected to recognising road signs was 840x630 pixels. This value is approximate because the current frame size on a given device may be different.

2.1.2 Image pre-processing

The image subjected to the sign detection process may be noisy, distorted or too dark, which are the issues addressed at the pre-processing stage. The solution operates on a colour image that was originally stored in the RGB model. Attempts were made to equalise the histogram of such an image using the following methods: 1) equalising the histogram of each component of the RGB model; 2) equalising the histogram of the brightness and saturation component of the HSV model;

3) equalising the histogram

of the brightness and saturation component of the HSV model excluding the brightest pixels. Equalising the histogram using methods 1 and 2 may not always give the desired results. Images captured under the sun are generally well-lit, but objects such as road signs are very dark.

$T = 90\% * 256 = 230$ (1)

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

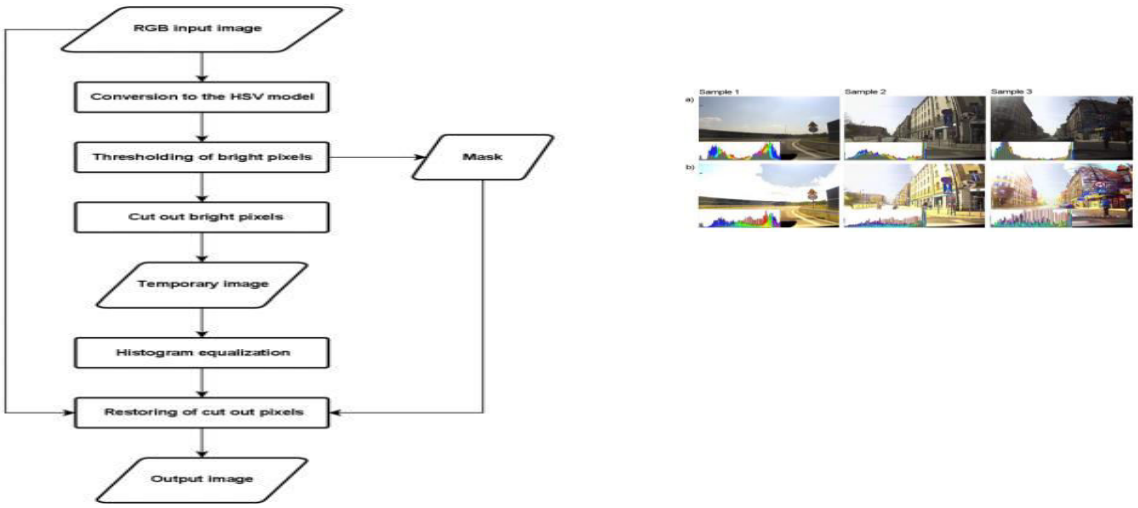

Fig. 3.1. Diagram of the operation of the modified histogram equalisation method.

Figure 2 presents: a) Sample input images with an unbalanced histogram. b) Results of histogram equalisation with a modified method based on the HSV model.Fig. 3.2. Sample input images before (a) and after (b) histogram equalisation with a modified method based on the HSV model.

2.1.3 Detection of Regions Of Interest To detect road signs and determine their shape, it is essential to know where potential signs are in the image; therefore, the Regions Of Interest (ROI) are located. To do this, special features of road signs that distinguish these objects from the surroundings can be used. The basic colours of most road signs in Poland are yellow, red and blue. Assuming the 40% of brightness threshold value and 65% of saturation threshold value, the image areas of individual colour sign (in the HSV model) are given as (2-4): $H\in(22°;76°)$ $\wedge S\in(65\%;100\%)$ $\wedge V\in(40\%;100\%)$ (2) $H\in(188°;250°)$ $\wedge S\in(65\%;100\%)$ $\wedge V\in(40\%;100\%)$ (3) $H\in(340°;22°)$ $\wedge S\in(65\%;100\%)$ $\wedge V\in(40\%;100\%)$ (4) where the ranges of hue component in HSV represent the colours of the road signs, respectively: yellow, blue, red. After preliminary tests on the characteristics of road signs, the next step is the image thresholding with the previously determined thresholds values. Separate binary masks are created for each colour, which are then merged by a logical sum operation. Figure 3 shows the result of thresholding of the example image. In an image prepared in such a way, the edges and ROI were detected using the Canny edge detector (multistage algorithm); next, lines (Hough transform) and circles (a modified version of Hough transform) will be searched in the ROI areas among the edges found in these areas. The lines found are then used to calculate triangles and rectangles – i.e. possible road signs. Figure 4 shows the scheme of the applied algorithm.

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

2.3 Detection of Regions Of Interest To detect road signs and determine their shape

A series of tests were carried out to determine the optimal value of the following parameters: a) ρresolution – distance resolution of the accumulator in pixels, b) θresolution – angular resolution of the accumulator in radians.

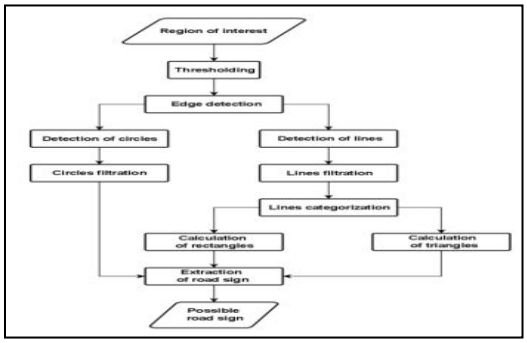

Fig. 3.4. Diagram of the algorithm for detecting shapes in an image.

Fig. 3.5. Line detection: a) sample image used for line detection b) detected lines for given parameters of Hough transform c) Reduced set of lines detected in the image.

Analysing the results from Table 1, as well as Figure 5b, it can be noticed that the detected lines with the parameter ρresolution = 1 match the most important edges of the object, and the ratio of the number of detected lines to the number of correctly detected lines is the best (this parameter value was chosen for further research). In the example image, 15 lines were detected (Figure 5b), only 5 of which were correct.

Table 1. The influence of ρ Hough transform parameter on the number of detected lines.

ρresolution	Number of detected lines	Number of correctly detected lines
1	15	5
2	69	7
3	62	7
4	52	6
5	40	5
6	33	5
7	27	5
8	28	4
9	23	4
10	19	3

2.2 Recognition module

The sign recognition takes place in two steps. The first is colour analysis, which allows determining which colours appear in the image. By combining information about the shape of a sign and its colours, the sign can be qualified for further recognition or rejected at this stage (algorithm optimisation).

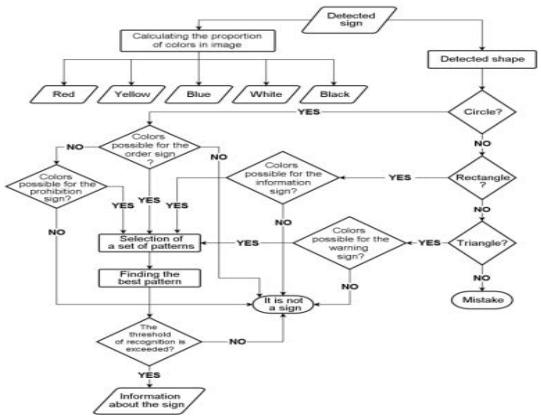

Fig. 6. Flowchart of the road sign recognition algorithm.

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

Fig. 7. Sample road signs symbols used during the recognition phase

IV. IMPLEMENTATION

The small camera mounted on the vehicle record the video signal and gives the primary input to this system the recorded video has to convert into Frames to identify and detect the desired Traffic sign.

4.1 Block Diagram

4.1 Block Diagram & Circuit Diagram

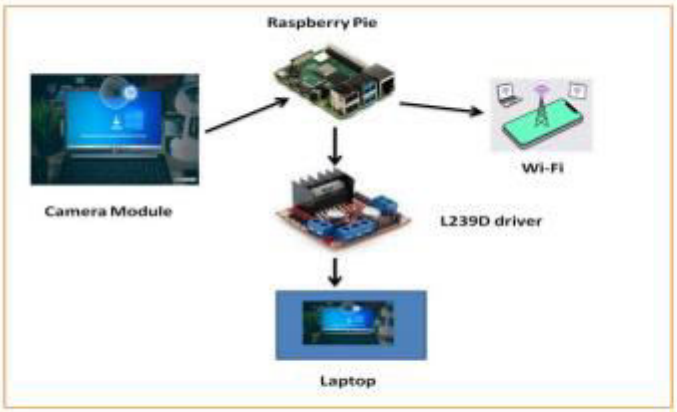

Fig 4.1 Traffic Sign Detection block Diagram

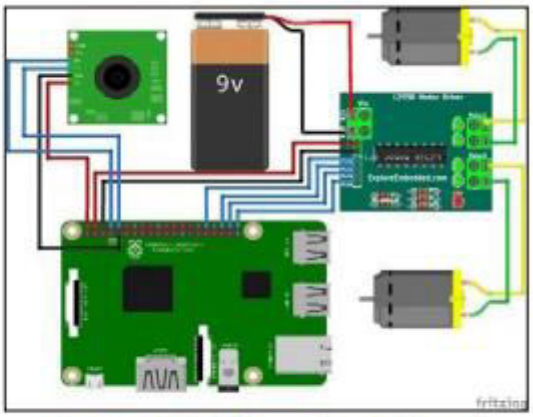

Fig 4.2 Circuit Diagram for Raseberry Pi

The small camera mounted on the vehicle record the video signal and gives the primary input to this system the recorded video has to convert into Frames to identify and detect the desired Traffic sign. while converting video signal into the frames approximately 30frames are place produce in 1 second 130 frames per second contain the redundant that is the datawise similar frames which take more time is for identify and detect of the desire Traffic sign. due to the system become sluggish and will not provide the fast response for control action .

Working

In this project run car(motor) automaticaly using raspberry pi. It run automatic, detectecobstacale, and follow lane(road). Firstly we make ultrasonic code to detect the obstacale. To run ultrasonic we use four gpio pins. To use Gpio pins of raspberry pi we import RPi.GPIO library. Use GPIO pins for vcc, ground, trigger, echo. trigger trig the sound waves and echo recived the sound waves. To run camera cv2 library is used. By using the cv2 we can capture the video, for image processing and detect the way.Then we write code to detect the way and signs on road, here firstly we captuer the video then then convert this video into gray scale and hsv to detect road.

4.2 SOFTWARE REQUIREMENT

1. **Python 3.6.4:**
   Python was not named for a snake even though we use the snake motif all the time. Python is the most popular programming language used by software engineers, analysts, data scientists, and machine learning engineers alike. This is an open source programming language with certain powerful libraries for designing neural networks and performing image processing.Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Often, programmers fall in love with Python because of the increased productivity it provides. Since there is no compilation step, the edit-test-debug cycle is incredibly fast.
2. **Image AI 2.0.3 Library:**ImageAI is a project developed by Moses Olafenwa and John Olafenwa , the DeepQuest AI team. ImageAI is an easy to use Computer Vision Python library that empowers developers to easily integrate state-of-the-art Artificial Intelligence features into their new and existing applications and systems.models that were trained on the COCO Dataset.
3. **TensorFlow 2.0.0:**TensorFlow is an end-to-end open source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries and community resources that lets researchers push the state-of-the-art in ML and developers easily build and deploy ML powered applications.

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

4. **Pillow:**Pillow is a fork of PIL (Python Image Library), started and maintained by Alex Clark and Contributors. It was based on the PIL code, and then evolved to a better, modern and friendlier version of PIL.
5. **Keras:**Keras is an API designed for human beings, not machines. Keras follows best practices for reducing cognitive load: it offers consistent & simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear & actionable error messages. It also has extensive documentation and developer guides.
6. **Matplotlib:**Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy.
7. **PyGame :**Pygame is a cross-platform set of Python modules designed for writing video games. It includes computer graphics and sound libraries designed to be used with the Python programming language. This library is used in the car driving simulator. Udamy simulator requires this library.
8. **Open-CV:**OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez.
9. **Carla:**CARLA is an open-source simulator for autonomous driving research. CARLA has been developed from the ground up to support development, training, and validation of autonomous driving systems.
10. **Timeit:**This library is associated with time related functions in Python. In real time application time plays a very crucial role and it is the responsibility of the developer to check delay and computation time in the project. Default_timer function returns the current time at the start of execution and at the end of the program.
11. **OS:**OS is a very popular and frequent use library in the python environment. We can communicate with the os using this library. This library is used in many models for loading data from the current working directory.
12. **tkinter:**Tkinter is a GUI toolkit for python developers. This name comes from Tk Interface. Like swing in Java, tkinter supports all major concepts such as frame, panel. It provides various components and event listeners for event triggers.
13. **Numpy;**Python language has Numpy for N-Dimension array processing. High level of mathematical operations can be performed using Numpy. Many functions are useful in array and matrix manipulation. Many mathematical operations are written very efficiently in this part of the bundle. It is very easy to use because of the high level of abstractions.
14. **Socket:**This is a low level networking interface in python programming. This package is used to connect two nodes via the internet or LAN. Socket programming helps to send images from smartphones to servers using TCP protocol.
15. **base64:**This python library is generally useful for cryptanalysis. This is an encoding technique in data transmission. We encrypted the image using this technology and sent data to the cloud decrypted using the same.
16. **Glob:**This is the UNIX path finding system. This python module is used in the Car Simulation. This function uses regular expressions to read files on the local storage.
17. **Pandas:**Pandas is the most popular among Data Analysts. This package helps to load a dataset in the python program for the model training. In Udacity model training this library was used because all the steering value, throttle value, image names stored in the CSV file. This tool handles dataframe very efficiently and supports many complex operations.

Sklearn: Every machine learning engineer is familiar with this library. This is a free package for the python developers. Sklearn used in the splitting data for training and testing of model.

4.3 UML DIAGRAM: UnifiedModeling Language is popular in the market because it is easy to understand.

4.3.1 Data Flow Diagram

4.4 Context Level (level-0) DFD

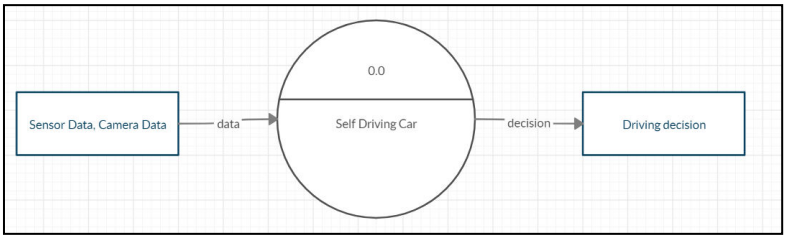

Fig. 4.3 Level-0 DFD

International Journal of Innovative Research in Computer and Communication Engineering

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

4.5 Level-1 DFD

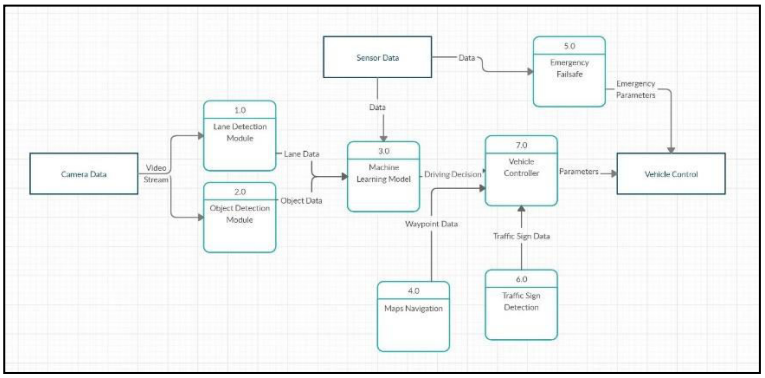

Fig. 4.4 Level-1 DFDS

4.6 Sequence Diagram

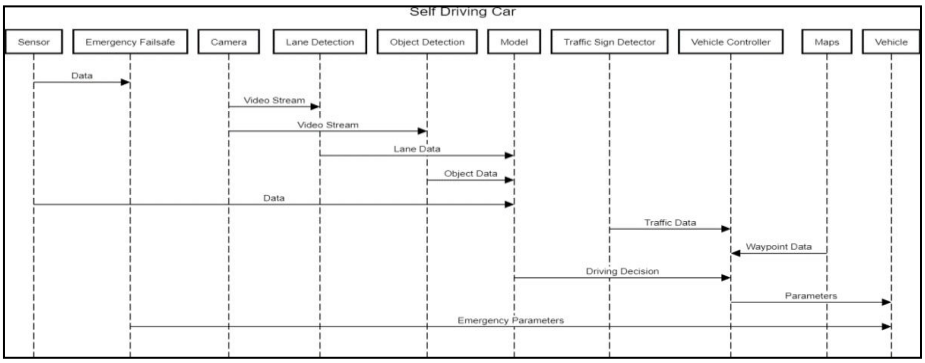

Fig. 3.8 Sequence Diagram

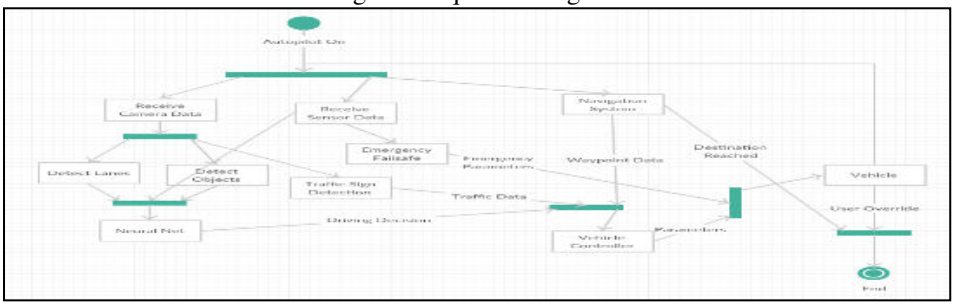

Fig. 3.9 State Diagram

V. COMPONENT DESCRIPTION

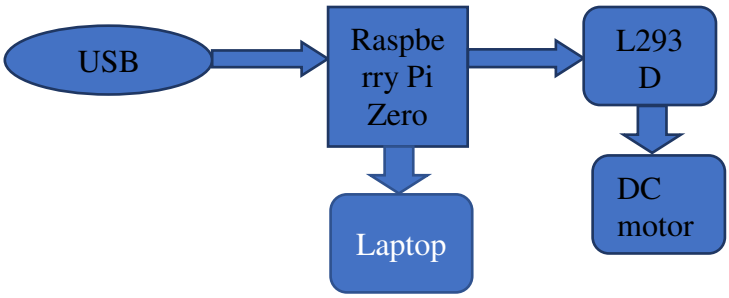

Fig 5.1 Component of **Raspberry Pi 0**

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

Raspberry Pi 0:

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It now is widely used even in research projects, such as for weather monitoring because of its low cost and portability. It does not include peripherals (such as keyboards and mice) or cases.[12]1.4GHz 64-bit quad-core processor, dual-band wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and Power-over-Ethernet support. The Raspberry Pi is a very cheap computer that runs Linux, and it provides a set of General Purpose Input/Output) pins that allow you to control electronic components for physical computing and explore the Internet of Thinks.

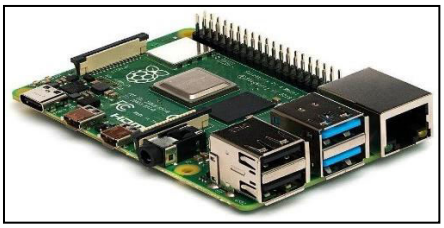

Fig. 5.2 Raspberry Pi 0

s a series of small single-board computers (SBCs) developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom.

Raspberry Pi Zero

- A Raspberry Pi Zero with smaller size and reduced input/output (I/O) and general-purpose input/output (GPIO) capabilities was released in November 2015
- On 28 February 2017, the Raspberry Pi Zero W was launched, a version of the Zero with Wi-Fi and Bluetooth capabilities,
- On 12 January 2018, the Raspberry Pi Zero WH was launched, a version of the Zero W with pre-soldered GPIO headers.

5.1 L298N Motor Driver: The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit.

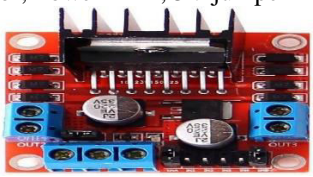

Fig. 5.3 Motor Driver-L298N

5.2 Camera: This is the eye of the car. Camera is the paramount part of the autonomous car. Computer vision is based on this device. Camera interfaced with the Raspberry pi and continuously captured images. These images feed to the neural network and identify objects and traffic signs in it.

Fig 5.4 Camera

5.3 **Motors** A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields.

International Journal of Innovative Research in Computer and Communication Engineering

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

V. RESULT

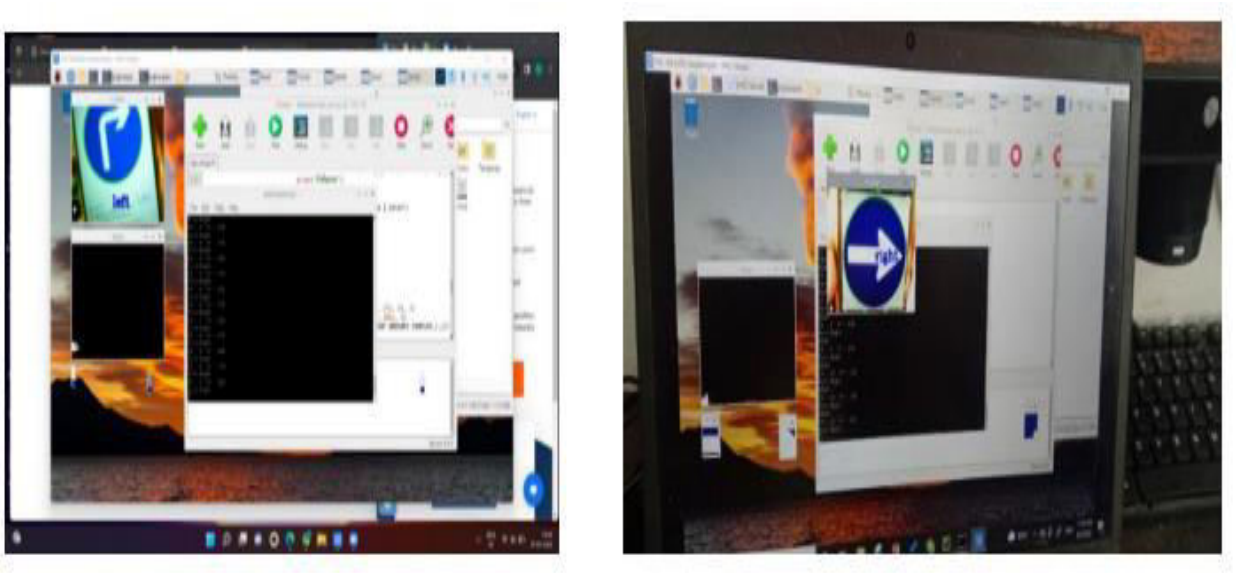

FIG NO 6.1 RESULT OUTPUT 1

We have successfully built a self-driving car using Raspberry Pi and Machine Learning models. Here we write codecalculates to the distance and also gives stop Command to the vehicle. It is important to detect the LANE from theimage of road and to detect road sign. And check their position in the form of pixel coordinates for the decision ofturn. After performing various operations, we got the following output.

FIG NO 6.2 RESULT OUTPUT 1

p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005212|

VII. CONCLUSION

Based On The Test Results, It Can Be Concluded That The Proposed Method Of Equalizing The Image Histogram In The Hsv Model That Does Not Include The Brightest Pixels Of The Image, Positively Influenced The Quality Of The Obtained Results. This Method Enables The Detection Of Signs In Unfavorable Lighting Conditions, In Which Such An Operation Would Be Impossible Or Difficult For Images With No Aligned Histogram. Unfortunately, The Increased Accuracy Of Road Sign Detection Negatively Affects The Time It Takes To Perform The Operation. The Process Of Detecting The Sign Shapes Unfortunately Involves Certain Drawbacks. The Main Disadvantage Of Such A Solution Is The Excess Number Of Areas That Are To Be Recognized; As It Is Confirmed By Test Results, Which Clearly State That 0.38% Of Detected Triangles And Only 0.05% Of Detected Rectangles Are Finally Recognized With An Accuracy Exceeding The Set Threshold. This Has A Negative Effect Both On The Duration Of The Algorithm Realization And The Correctness of The Results. On The Other Hand, Detection And Recognition Of The "Stop" Sign Is Faultless In The Examined Data Set. This Sign Is Very Characteristic, And The Sets of Patterns Taken Into Account When Calculating The Match Are The Smallest.

REFERENCES

1] S. Aigerim, Z. Askar, Z. Meirambek et al., IEEE 8th International Conference on AICT, 1-6 (2014)
2] E. Onat and Ü. Üzdil, 23nd Signal Processing and Communications Applications Conference (SIU) 2161-2165 (2015)
3] A. Salhi, B. Minaoui, M. Fakir, ICMCS, 433-437 (2014)
4] P. Shopa, N. Sumitha, P. S. K. Patra, ICICES2014, 1-6 (2014)
5] M. Kobayashi, M. Baba, K. Ohtani et al., IEEE/SICE International SII, 455-460 (2015)
6] J. Duan, M. Viktor, ICCAIS, 107-112 (2015)
7] F. Ren, J. Huang, R. Jiang, et al., 24th International Conference Image and Vision Computing, 409-414 (2009)
8] K. Fu, I. Y. H. Gu, A. Ödblom, IEEE Intelligent Vehicles Symposium, 443-448 (2015)
9] C. H. Lai, C. C. Yu, International Conference on Technologies and Applications of Artificial Intelligence, Hsinchu City, 195-202 (2010)
10] B. Yavas, M. M. Özbilen, Y. Yilmaz, IEEE 8th International Conference on AICT, 1-4 (2014).
11] T. Zamojski, (Image source) KONTROLA: Drogaprzezmękę. NIK skontrolowałaznakidrogowe. http://www.tygodnikzamojski.pl/artykul/47938/kont rola-droga-przez-meke-nik-skontrolowala.html (2014)

INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor: 8.165

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details