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ARTIFICIAL INTELLIGENCE BASED MACHINE LEARNING ASSISTANCE FOR SELF-DRIVING CAR USING RASPBERRY PI

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ABSTRACT

Now a day to drive a car is difficult task in urban areas due to increased traffic, driving for long distances is panic and also driving with too short of a safety distance is a common problem in road traffic, frequently with traffic accidents as a consequence to avoid these problems self-driving car is one of the solution. A self-driving car is a vehicle that is capable of sensing its environment and navigating without human input. These self-driving cars have mountable deviceskeeping a sufficient safe distance. A conceptual study was performed in order to selectthe components for the integration of the self-driving car. Based on the results of this study, a workingprototype of a flexible, self-driving car was designed, built and tested. The self-driving car is assisted by using artificial intelligence based machine learning. A Raspberry Pi single-board computer is used for dataacquisition and processing. The alerts are shown on an LED-matrix display mounted on the rear ofthe self-driving car. The device software is written in Python and provides automatic operation withoutrequiring any user intervention. The results indicate that prediction in autonomous mode gives an accuracy of 60-70% and in training mode gives an accuracy of 86%.

Keywords:safety distance; self-driving car; artificial intelligence; Raspberry Pi

I. INTRODUCTION

Driving at a too short of a safety distance is a common problem in road traffic and presents one ofthe principal causes of traffic accidents. The drivers often tend to drive too close to the leadingvehicle, because they are unaware of the distance required to stop the vehicle at the given velocity andbecause they inadvertently wish to increase the traffic throughput and, thus, shorten the trip time. Onthe other hand, the commonly-known scenario involves impatient drivers on multi-lane motorwayswho try to force the vehicles in front of them off the fast lane by intentional “tailgating”. The constantimprovement of road vehicle performance and the inclusion of driver-assistance systems may increasethe problem even further, as it gives the drivers a false confidence in their vehicle’s abilities to stopand prevent the impact consequences. This leads to frequent rear-end collisions, often withdevastating consequences and even fatal injuries.On selected spots on the highways, there are also test fields that allowthe drivers to self-evaluate their safety distance. To avoid the above mentioned problem one of the best solution is self-driving car. These cars use the Raspberry PI. Sunil Wankhade et.al use Raspberry PI for

Home Automation System. The main objective of these Home Automation systems (HAS) using internet of things (IoT) is to inhibit automatic and electronic control of household features activity and appliances. wide range connectivity and energy efficient control of the home appliances in a user-friendly manner, connectivity, scalability, power saving can be achieved by the use of Raspberry Pi, which acts as an interface between the hardware and the software of the entire system which can be connected to number of peripherals using USB ports or HDMI port and GPIO, it can be connected to the internet using the Ethernet port or by Wi-Fi connectivity. In 2016,Madhusudhanan. R andDivyaSubramaniyan etc. al use the Artificial Intelligence Algorithms for Home Assistant. In this they say that the major purpose of any automation system or artificial system is to reduce human labor, effort, time and errors due to his/her negligence. The major goal of this project is to design and implement an Intelligent Home Assistant in a same device (via world –wide-web) or even any mode of Internet-Access, which gives the ability to control your home appliances and to perform task or service for an individual. These tasks or may be services are based on user input, on location and also the ability to access information from variety of online sources. Various sensor based control for this application is being added to improve the security and also the ability to make more accurate decisions. In 2016,Vaishnavi S. Gunge and Pratibha S. Yalagi presents a low cost and flexible home control and monitoring system using an embedded microprocessor and microcontroller, with IP connectivity for accessing and controlling devices and appliances remotely using Smart phone application. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug, temperature sensor and current sensor can be integrated with the home control system.

Many authors apply the Raspberry PI for Home Automation, in this paper Raspberry PI is used for Self-driving cars with artificial intelligence. The work described in this paper was initiated to develop a device forcontinuous safety distance monitoring and proper movement of the traffic. The aim of this paper is to give an overview about raspberry pi based on intelligent systems and also to use for self-driving car. The main aim of future technology is to automate everything but coming to cars, automation is not sufficient to take real time decisions to drive the car because humans are able to learn from previous experiences but cars can't do it, so cars had to learn how to drive similar to humans. This can be achieved by using Machine Learning Algorithms and one of the ways to achieve machine learning is artificial neural networks. These are similar to neural networks in our brain.

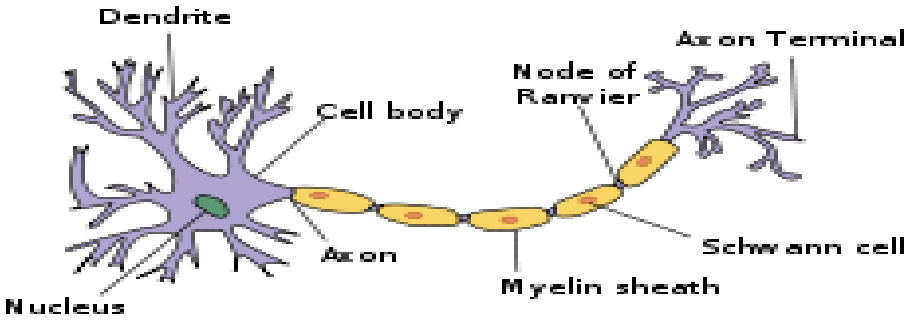

Fig.1. Single Biological Neuron in our brain

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Fig.2. Billions of neurons forms aNeural network

These neurons processes information and give corresponding response. An artificial neural network also works in the similar manner. A model diagram of both biological neuron and artificial neuron are shown below. The inputs to the neural network are images and the outputs are movements of car (left, right, forward, reverse). Therefore for collecting Images, processing and controlling the car we need a camera, small computer(raspberry pi) and a motor driver.

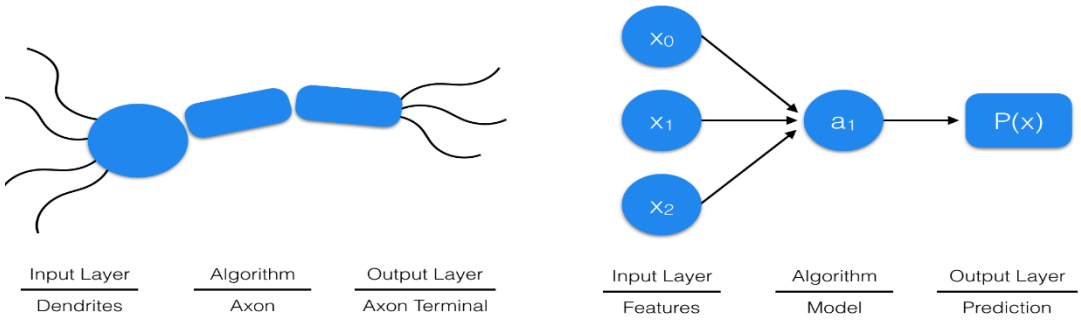

Fig.3. A model diagram of biological neuron and artificial neuron

II. WORKING

Raspberry pi: It is a single board, low cost, high-performance computer which can replaces normal computers for low and medium level computations and additionally it has 40 GPIO pins which can be used to take input or to give output just like a microcontroller.

Fig.4 Model of Raspberry pi

L293D: It contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. And the enable pins are used to control the speed of the motors.

Fig.5. Architecture of L293D

Selection of the Components

The first components that had to be selected carefully are the processing computer and a Camera, becausethese represents a significant cost and effects the performance of neural network, so a 8MP camera module and raspberry pi 3 are used for collection of required data and processing of collected data. The next component is power supply which is portable and supports the 2.1amps requirement of raspberry pi and around 1A for two motors, so a 20000mah, 3.1A MI power bank is chosen. Finally a motor driver which can act as an interface between raspberry pi and motorsis required so L293D is chosen because it is the most commonly used motor driver IC's from the L293 series.

Table 1: Components details

Component	Manufacturer and type	Cost Estimate in INR
Single board computer	Raspberry pi 3 model B	3000
Power supply	MI power bank (20000mah)	2200
Prototype vehicle	RC Car	1500
Camera	Camera module 8MP	1800
Motor driver	IC L293D	200
Total Cost:		7080

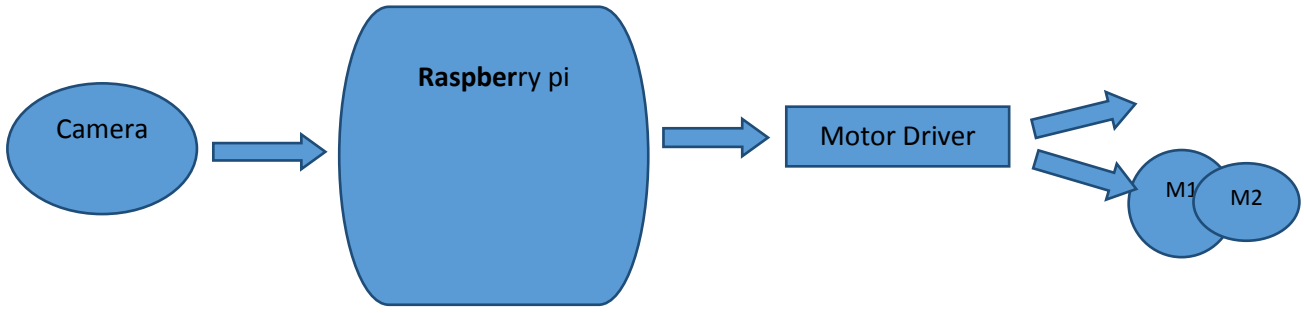

Fig.6. Block diagram of self-driving car

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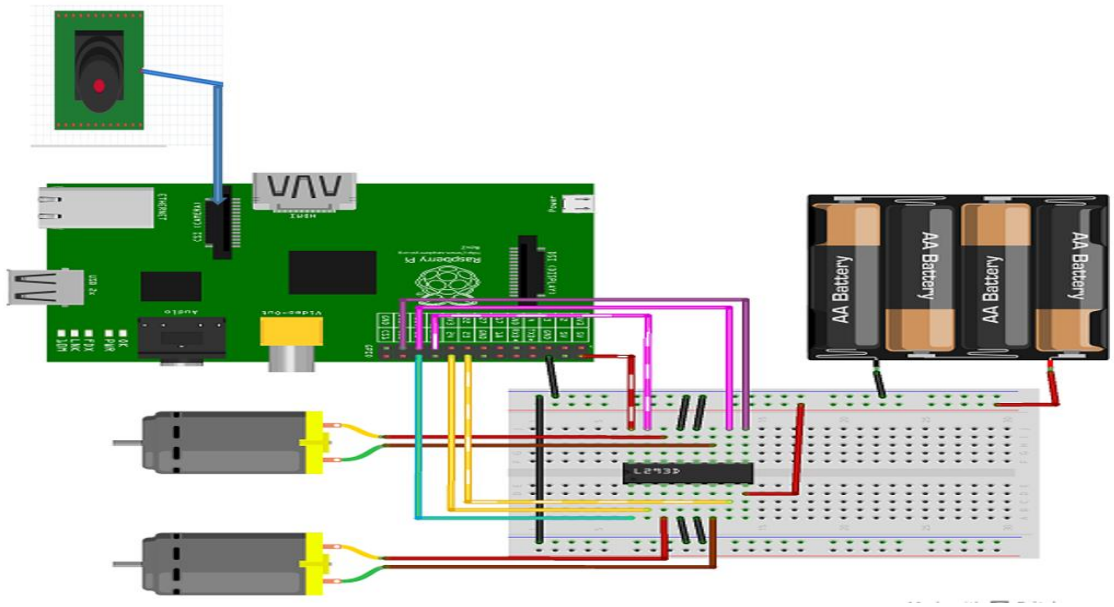

Fig.7. Basic circuit diagram of self-driving car

The Working of this project is divided into three parts, they are Input unit, Processing unit and Control unit

1. Input unit: A Raspberry Pi 3 board (model B+), attached with a pi camera module is used to collect input data

2. Processing Unit: The processing unit (computer) handles multiple tasks: receiving data from Raspberry Pi camera, neural network training and prediction(steering) and sending instructions to motors through motor driver. Initially car is trained in a specific path, while training a path camera takes the images of the path and raspberry pi stores the images along with direction. These images and directions are used to train the Neural Network.The neural network is trained using the images from the camera at the time of training. Once it is fully trained, it only needs to load trained parameters afterwards, and thus prediction can be very fast.It has 3 layers, they areInput layer, Hidden layer and Output layer. The input layer takes the images as input and each image is of size 640x480 pixels. Only lower half of the input image is used for training and prediction purposes. So 640x240 pixels is fed to input layer. Therefore number of nodes in input layer=153600. There are 20 nodes in hidden layer. The number of nodes in the hidden layer is chosen fairly arbitrary.The Back Propagation Algorithm performs Training, Calculating Error, and Modifying Weights between 3 layers. The BP algorithm starts with computing the output layer, which is the only one where desired outputs are available. The error rate in the output layer is calculated based on the difference between the desiredoutput and the actual output.Sigmoid function has been used as a non-linear neuron activation function. Finally the Output Layer contain four nodes where each node corresponds to the steering control instructions: left, right, forward and reverse

3. **Control Unit**: The control unit takes the input from the output layer of the neural network and controls the car movement using motor driver.

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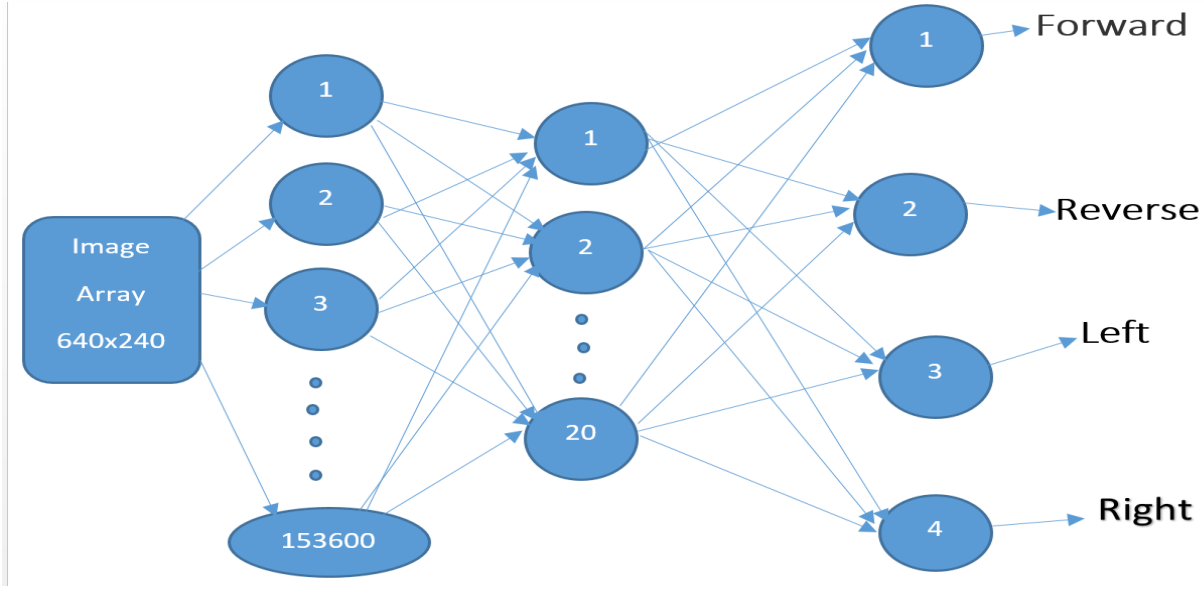

Fig.8. A Neural network with Single hidden layer.

III. RESULTS

Prediction in autonomous mode gives an accuracy of 60-70% and in training mode gives an accuracy of 86%

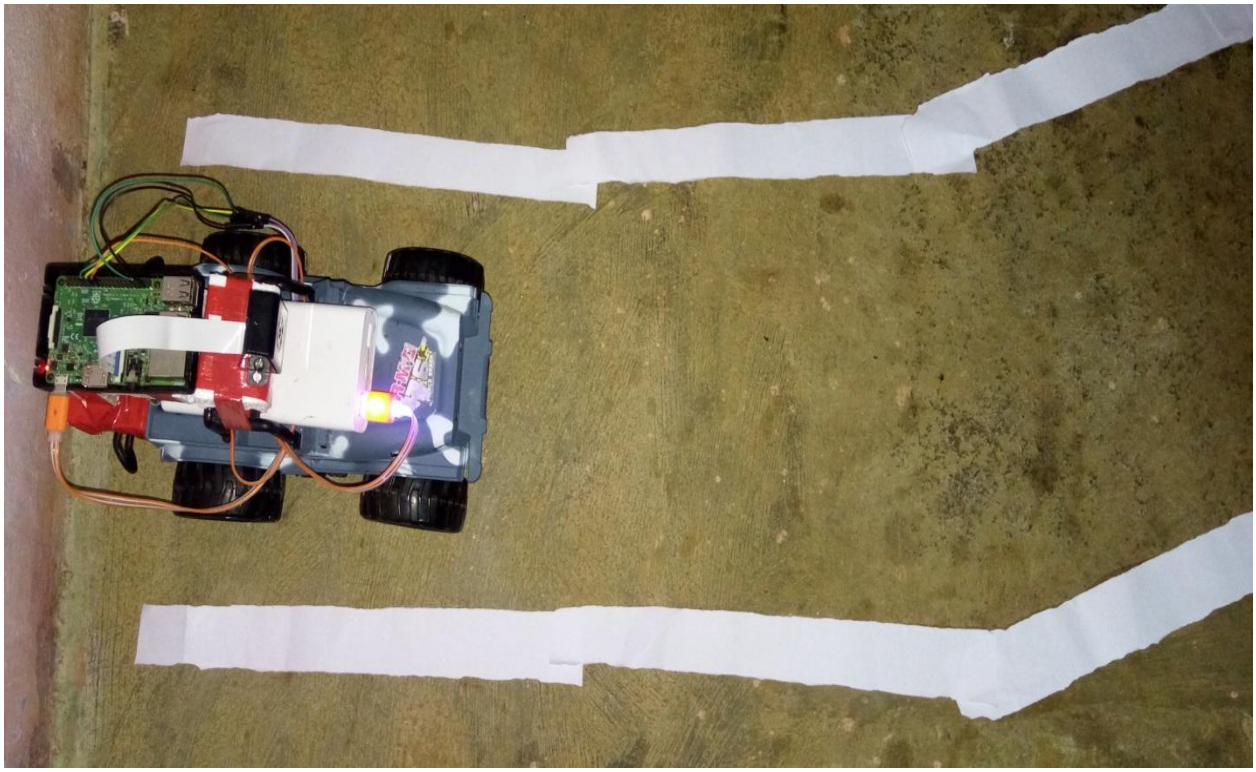

Fig.9. Proto type of self-driving car (a)

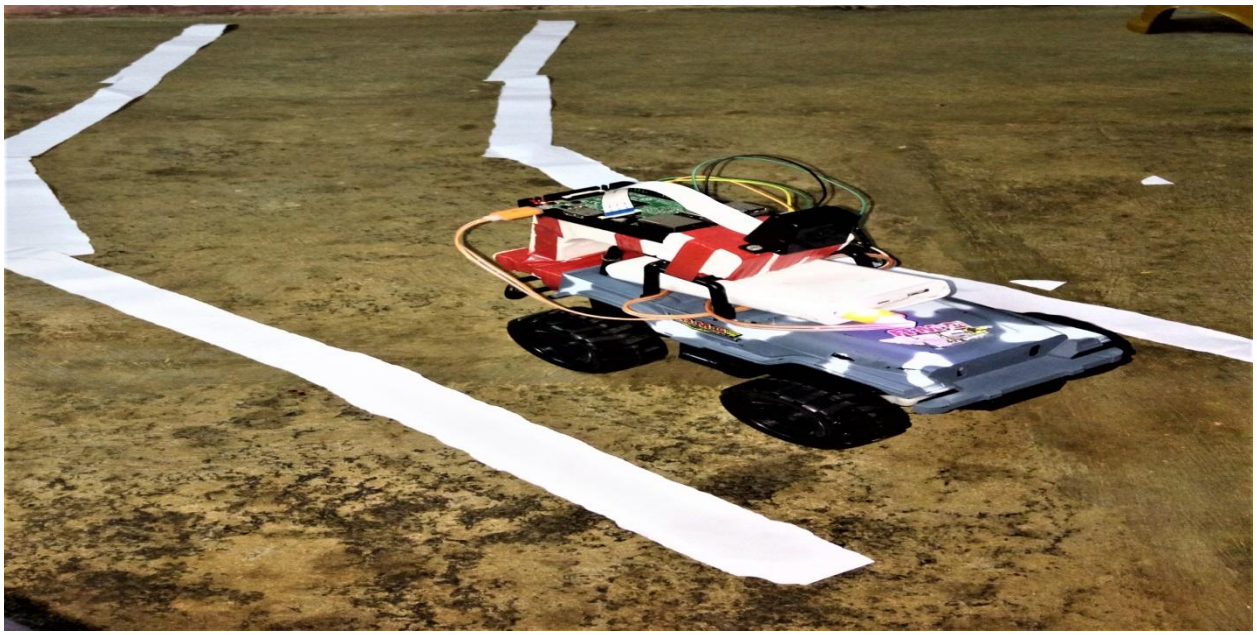

Fig.10. Proto type of self-driving car (b)

IV. CONCLUSIONS

This system is very useful for each and every human being. Mistakes are being done by each and every human being often. This will act as an error reducer for each and every human artificially. Mostly, useful for physically challenged person who are not able to drive the cars and those who need assistance in driving the cars.

REFERENCES

[1] Elaine Rich, Kelvin Knight, Shiva Shankar B-Nair, "Artificial Intelligence", MC Graw Hill Publication, "2013".

[2] Steven Hickson, "Voice Control and Face Recognition on the Raspberry Pi"[online], Available athttp://stevenhickson.blogspot.com.

[3] Raspbian[online], Available at http://www.raspbian.org/.

[4] Raspberry Pi 1 Model B. Available online: https://www.raspberrypi.org/products/model-b/ (accessed on19 January 2016).

[5] Jain, S.; Vaibhav, A.; Goyal, L. "Raspberry Pi Based Interactive Home Automation System Through E-mail", In Proceedings of the 2014 International Conference on Optimization, Reliability, and Information Technology(ICROIT), Faridabad, India, 6–8 February 2014; pp. 277–280.

[6] Upton, E.; Halfacree, G. Raspberry Pi User Guide;

[7] Chowdhury, M.N.; Nooman, M.S.; Sarker, S.,"Access Control of Door and Home Security by Raspberry PiThrough Internet". Int. J. Sci. Eng. Res. 2013, 4, 550–558.

[8] Monika M Patel, Mehul A Jajal, Dixita B vataliya, "Home automation using Raspberry Pi, "International Journal of Innovative and Emerging Research in Engineering, Volume 2, Issue 3, 2015.