Autonomous Car using Raspberry PI and Ml

Yasir A, Aiman Salim, Arya Dileep, Anjana S

Abstract*: *The Proposed system's goal is to represent an Autonomous car prototype which uses Raspberry Pi as the core functioning chip and our system use Open CV and Machine learning technology. The proposed system will move automatically without any human help to the destination by itself. The car uses the core processing system as Raspberry Pi, which is interfaced with the Pi camera module, will stream the video to the Monitor as the local host. Based on which the detection like pedestrians, vehicles or road sign and signals are done and corresponding commands are sent to the Arduino serially to operate the car. The Raspberry Pi has functionalities like, traffic signal detection, vehicle detection, pedestrian detection, road sign detection, which aids the proposed system in arriving the proposed or specified place cautiously and timely. Every process is completed using the Raspberry Pi with C++ programming. The methods used for achieving autonomous movement of car are Gaussian Blur, CED and Region of Interest. Assembled robot body by assembling the chassis and wheels of robot car, soldering the motors and fixed them in the chassis, fixed Raspberry Pi, Arduino Uno, motor driver and made the required circuit connections. The proposed system will be a helping hand in the vehicle industry as it will aid in easing the observation needed and tension taken, thereby easing human efforts while driving and minimizes the chance of collisions arising out of human error or law breaking driving resulting in large mortality rates.

Keywords: **Raspberry Pi, Machine Learning.**

I. INTRODUCTION

Increase in the amount of collisions in the past years is because of increasing amount of vehicles and a few amount of carelessness from the drivers. To avoid this the proposed system introduces an autonomous car which would slowly restrict the humans from driving. The proposed system will move automatically without any human help to the destination by itself and it has functionalities like lane-finding, obstacle finding and traffic sign analysis. These functionalities will aid the vehicle move to the specified place properly by avoiding accidents, providing real world view ahead with the aid of camera attached on the top of the proposed system and find/spot traffic signs and obey them strictly so as to avoid accidents caused due to disobeying the traffic rules. This would ensure safer and more convenient mobility. The purpose of this project is to create a safe Autonomous car. Nearly every road accidents are due to human errors. Unluckily, going by the statistics, in the coming decade the sum of individuals lost annually will be increased. To limit such issues we are going towards Autonomous Car drive technology.

II. LITERATURE SURVEY

Johann Borenstein Yoram Koren, Obstacle Avoidance with Ultrasonic Sensor, IEEE Journal of Robotics and Automations, VOL. 4, NO. 2, APRIL 1988, pp. 213-218: A robot, efficient of executing numerous duties for the handicapped, has been made. To circumvent crash from upcoming objects, the machine enables ultrasonic radius spotters for spotting and plotting. The object avoidance measure applied for this robot is outlined. As the method is decided basically on the execution of the ultrasonic rangefinders, the sensors and the effect of their limitations on the object avoidance algorithm are discussed intimately [1]. Design and Implementation of Self driving Car using Raspberry Pi, International Journal of Computer Applications (0975 –8887) Volume 113 –No. 9, March 2015: The system's goal is to create a self-driving car prototype with Raspberry Pi as the main functioning chip. A camera along with an ultrasonic sensor is placed to determine needed data from the current feed ahead of the car. The car will reach the given place safely and intelligently by limiting the risk of human mistakes. Driver mistakes are the foremost common explanation of road accidents, and with mobile phones, in car entertainment systems, more traffic and more complicated road systems, it isn't likely to travel away. A strategy or measure to determine the uneven, marked or unmarked road edges/sides are explained in detail in Open CV. By using Open CV for distance calculation, the collisions with objects like vehicles and pedestrians are kept away. The methods specified in their proposed system has been rightfully executed on a self-driving car [2]. Lane Line Segmentation and Detection Method based on Inverse Perspective Mapping by Li, Chunxia Zhao, Yingkun Hou, Mingwu Ren: A road path line segmentation and spotting algorithm evolved from IPM. Results specifies that the proposed algorithm has strong robustness to non-track line sketching and automobile shadows, and the track line can be accurately detected under the complex pavement conditions. Nowadays we can notice an enlarging need for an in depth road protection method to scale back the danger of collisions. There are an outsized sum of vision systems evolved for automobile control, crash avoidance and lane leaving hazard, which have been grown throughout the past 20 years across the planet.

Revised Manuscript Received on July 22, 2019.

***** Correspondence Author

Prof Yasir A *, Department of Computer Science and Engineering, Younus College of Engineering and Technology, Kollam, Kerala, India. E-mail: yasircse007@ycet.ac.in

Aiman Salim, BTech Student, Department of Computer Science and Engineering, Younus College of Engineering and Technology, Kollam, Kerala, India. E-mail: aimansalim1@gmail.com

Arya Dileep, BTech Student, Department of Computer Science and Engineering, Younus College of Engineering and Technology, Kollam, Kerala, India . E-mail: aryapriyadileep@gmail.com

Anjana S, BTech Student, Department of Computer Science and Engineering, Younus College of Engineering and Technology, Kollam, Kerala, India. E-mail: ammusunilkumar5@gmail.com

The growth of latest motorist guidance methods and self-driving needs potential to analyze
traffic circumstance. Principal pre conditions that can be used are extracting the road tracks and road track sketching. There are measurements for the track and the track images are converted into grey scale [3].

III. HARDWARES USED

1. Raspberry Pi 3 B+
2. LN298 Motor Driver IC
3. Pi-Camera Module
4. Arduino UNO
5. Robot chassis
6. Robot wheels
7. Battery Pack

A. *Raspberry Pi 3 B+*

The processor used in the proposed system is the Raspberry Pi 3 B+ model with a 1.4 Giga hertz 64-bit quad-core processor. Raspberry Pi 3 B+ has 1 Giga Byte of Random Access Memory and has 40 pin General purpose Input /Output header. It consists of four Universal serial bus ports and a power input port of 5V of 2.5A. It is applied in the proposed system as the core central processor to synchronize the functionalities, take suitable inputs and then take actions accordingly.

Fig 1: Raspberry Pi 3 B+

B. *LN298 Motor Driver IC*

L298N motor driver Integrated Circuit is a fifteen-lead peak voltage, peak current motor driver Integrated Circuit. L298N motor driver Integrated Circuit is a dual full bridge driver Integrated Circuit which may manage 2 motors at the same time with separate inputs. The basic minimum supply voltage is 5V but the acceptable reserve energy are high as 45 volts and the highest output current per channel is at most 2 Ampere.

Fig 2: LN298 Motor Driver IC

C. *Pi- Camera Module*

Pi camera module is used for the real world streaming of the feed ahead of the car and to take picture of the traffic signs and traffic signals on which processing is done by the Raspberry-Pi later. It uses a Sony 5-mp sensor. It is mounted to the Raspberry-Pi 3 B+ via a fifteen cm ribbon cable. Pi camera supports videos of 1080 pixel per 30 frames, 720 pixel per 60 frames and VGA 90 modes.

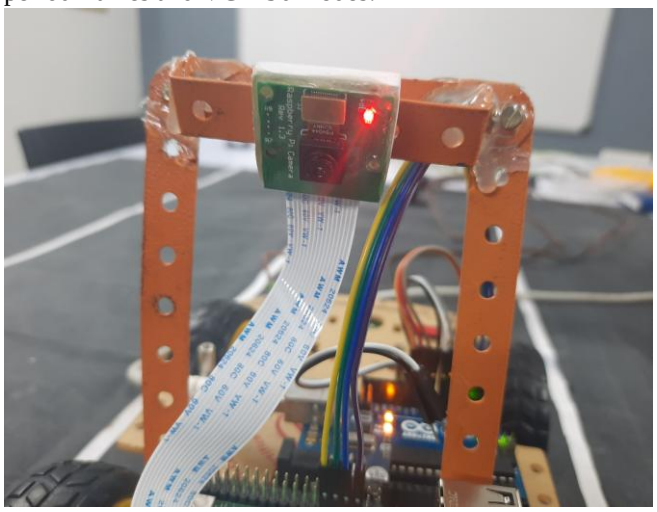

Fig 3: Pi-Camera Module

D. *Arduino UNO*

Arduino UNO is an open source microchip board based on 8-bit ATmega-328P microcontroller, it consist of components like Crystal oscillators, Serial communication and Voltage regulators to aid the micro-controller. Arduino Uno has fourteen digital ip or op pins that may be interfaced to different expansion boards (shields) and other circuits, of which six can be operated as Pulse Width Modulation outputs, six Analog ip pins, a Universal Serial Bus connection, an influence barrel jack, an In Circuit Serial Programming header and an adjust switch

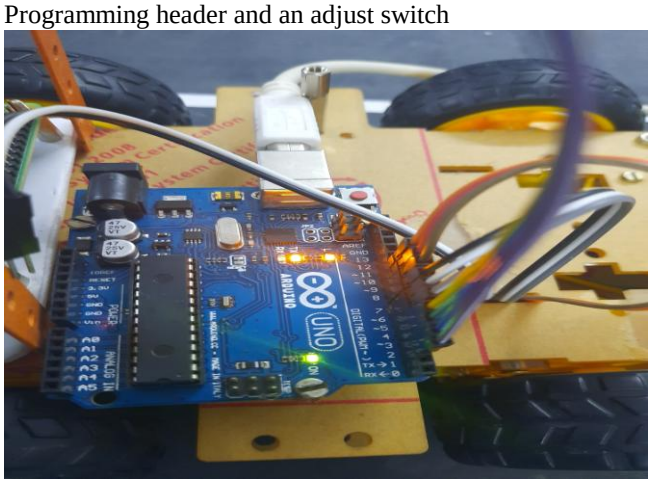

Fig 4: Arduino UNO

IV. SOFTWARE USED

A. *Open CV*

Open CV is a picture processing library developed by Intel and maintained by Willow Garage and it's available for C, C++, and Python. It is an Open Source library and is free. It is simple to use and incorporate. Open CV provides easier and helpful ways to read and write images.

B. *Gaussian Blur*

Gaussian Blur is a pre-treatment method utilized for lessening disturbance from picture. The proposed system utilizes this pre-treatment method to erase numerous found boundaries and maintain majority distinguished boundaries of the picture.

C. *Canny Edge Detection*

It is a method that finds boundaries evolved from gradient changes. It computes gradient in every directions of our blurred image and traces the edges/sides with large changes in intensity.

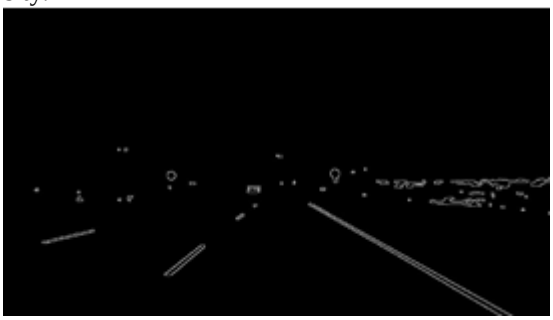

Fig 5: CED

D. *Region of Interest*

By doing CED, a lot of boundaries that have been found aren't tracks. It is a n sided structure that determines region within the picture, determining the interested boundaries.

V. METHODOLOGY

Assemble robot body by assembling the chassis and wheels of robot car, solder the motors and fix them in the chassis, fix raspberry pi, Arduino Uno, motor driver and make the circuit connections as per circuit diagram. Prepare the sample track for the robot to run. Bundle operating system to raspberry pi along with the Raspbian OS and it to a 16GB Micro SD card and put it to the raspberry pi. Using ethernet cable connect the raspberry pi to the computer and enable Wi-Fi function of pi so that it can connect and access the Pi using Wi-Fi and VNC viewer which is installed on pi OS. Install open CV library in raspberry pi and access the pi using your pc and Wi-Fi and use the commands in the command terminal of raspberry pi to install Open CV library. Link the open cv library to Geaney editor (C++ compiler software of Raspberry Pi).

Setup Raspberry pi camera and now adjust the camera position for best view and fix it on the robot car.

1. Process the camera output (video) in open cv library.
2. video out of camera and set a region of interest (the portion of video that we want to process to find the lanes of road).
3. Convert region of interest to perspective wrap (bird eye view).
4. Threshold operation- Use threshold operation to the color image to black and white image in order we can find the lanes.
5. Find the tracks using Canny edge detection.
6. Find lanes a from track and detect left and right side deviation of track.
7. Lane end detection.
8. Stop sign detection- We capture positive samples and negative samples of 'Stop' sign and load it in the Cascade trainer software the output of this software is used and the trainer data for our machine learning algorithm.
9. Obstacle detection and avoidance.
10. The same method is used to detect traffic lights.
11. Control the Arduino. From the above steps the proposed system can find the left and right deviation of track now we need to run the robot as per the conditions.
12. If the robot is in center of track go Forward.
13. If the track is deviated to left steer to Left.
14. If the track is deviated to right steer to Right.
15. If lane end detected take U turn.
16. If obstacle is detected follow stop, left, forward, right, then forward.
17. If traffic signal is red Stop.
18. If traffic signal is green Forward.
19. We use 4 GPIO pins of raspberry pi to send decimal values to Arduino in the form of binary data. In the Arduino these binary data's are received through its I/O pins and convert it to decimal and perform the movement operations.

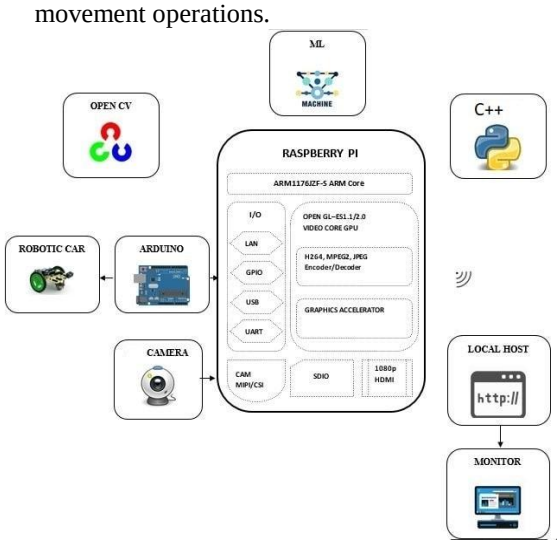

Fig 6: Block Diagram

VI. WORKING

The Raspberry-pi is the main core controller which will be attached on the vehicle. The module of pi-camera will be attached on the top of the prototype. The LN298 IC is used for the movement of the prototype. Computer Vision is utilized to find object in front of the prototype and take necessary movements. When there is any object in front of the prototype and is in a measurable distance from the prototype. The raspberry-pi gives instructions to the Arduino UNO and it gives orders to the L298N Integrated Circuits to halt giving power to the tyres and therefor halts the movement of the prototype contingent on the nearness of the object. The displacement calculated is also showed on the output window of the program. The following process is finding of lanes and road traffic signs.

VII. DESIGN

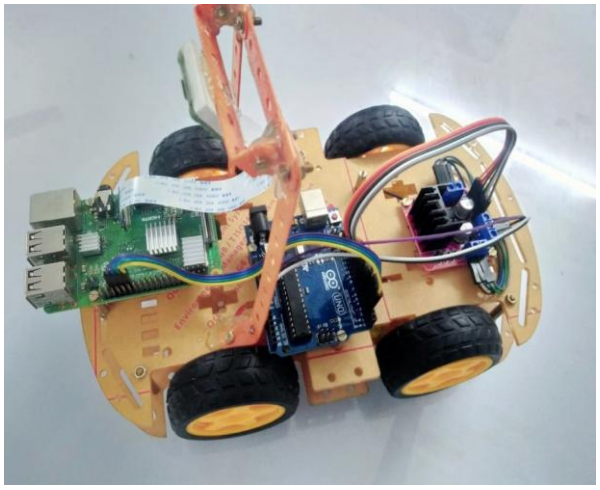

Fig 7: Prototype

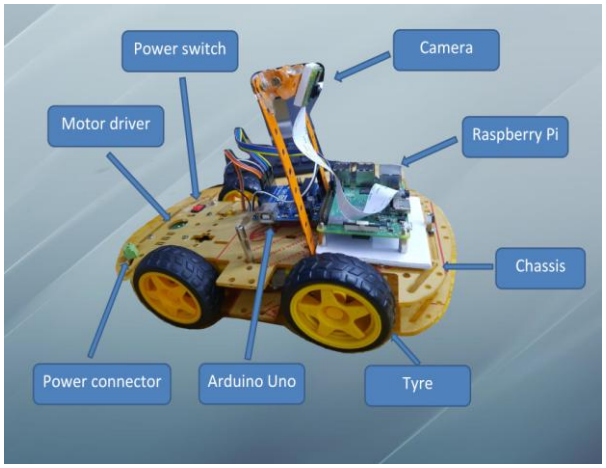

Fig 8: Prototype Layout

VIII. RESULT AND DISCUSSION

Lanes are detected successfully, obstacles are detected successfully and traffic signals are detected and according actions are taken . Key changes from base paper are Ultrasonic sensor is being replaced by open cv. The major demerits are their shorter range because of the disturbance of sounds in air, and their weak response time due to the weak propagation velocity. They are also majorly high flown by aerial variations, mainly by disturbances from air and car movement. LN293 Motor Driver IC is replaced by L298 Motor Driver IC. Arduino UNO is used to tackle Time delay while processing.

Table- I: Existing and Proposed

Existing System	Proposed System
Ultrasonic sensor was used for calculating distance.	Computer Vision is used for calculating distance.
In the existing system LN293 Motor driver Ic is used.	In the proposed system LN298 Motor driver Ic is used.
Usually time delay occurs during processing.	Arduino UNO is used to tackle the time delay problem.

IX. FUTURE ENHANCEMENT

Apart from automatic parking, GPS can be added to the system for avoiding traffic congestion and time can be saved. Emergency notifying systems can be implemented in case the passenger is not well or suffering from sudden illness.

X. CONCLUSION

The self-driving vehicle will come in handy for the people, which helps the drivers from less strain and reduce accidents caused by human errors. The proposed system was able to include or function features like Automatic parking, Obstacle avoidance, Traffic light detection, Sign detection, Lane end detection. Lanes were detected accurately and according to the vehicles in front or distance from the proposed system lanes were changed avoiding vehicles and obstacles. Traffic lights were detected and according actions were taken and traffic signs were obeyed accordingly. Pi Camera Module helped in taking live images and giving the feed to the raspberry pi for picture processing and methods like Gaussian Blur, Canny edge detection and Region of Interest were applied successfully.

ACKNOWLEDGMENT

We accept this open door to communicate our earnest thanks to each one of those without whom this project would not have been a success. First of all, we owe our thanks to the Almighty for providing us the strength and courage to complete the project. We express our deep and sincere gratitude to our guide Prof. Yasir A, Assistant Professor of Computer Science and Engineering Department, Younus College Of Engineering And Technology for providing valuable counsel and appropriate instructions, without which we would have never have been able to finish the project promptly.

REFERENCES

1. Johann Borenstein Yoram Koren, Obstacle Avoidance with Ultrasonic Sensors, IEEE JOURNAL OF ROBOTICS AND AUTOMATION, VOL. 4, NO. 2, APRIL I988, pp. 213-218.
2. Design and Implementation of self-Driving Car using Raspberry Pi, International Journal of Computer Applications (0975 – 8887) Volume 113 – No. 9, March 2015.
3. Li, M., Zhao, C., Hou, Y. Ren, M. , A New Lane Line Segmentation and Detection Method based on Inverse Perspective Mapping: International Journal of Digital Content Technology and its Applications. Volume 5, Number 4, April 2011, pp. 230-236.
4. Prof. Z.V. Thorat, Sujit Mahadik, Satyawan Mane, Saurabh Mohite, Aniket Udugade, Self-Driving Car using Raspberry-Pi and Machine.
5. Learning, Department of EXTC, Bharati Vidyapeeth College of Engineering, SEC-7 Opposite to Kharghar Railway Station, CBD Belapur, Navi Mumbai - 400614.
6. Matt Richardson, Shawn Wallace, Getting Started with Raspberry Pi, 2nd Edition, Published by Maker Media, Inc., USA, 2014. Book ISBN: 978-1-457- 18612-7.
7. Tan-Hung Duong, Sun-Tae Chung, Seongwon Cho, Model Based Robust Lane Detection for Driver Assistance, available at http://www.kpubs.org/article/articleMain.kpubsspotTyp e=low article A No=MTMDCW2014v17n6655.
8. 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.

9. 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.
10. 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.

AUTHORS PROFILE

Prof Yasir A is currently working as Assistant Professor of Computer Science and Engineering department, Younus College of Engineering and Technology, Kollam, Kerala. He is having 12 years of teaching experience in UG and PG level. He was post graduated from Annai Mathammal Sheela Engineering College, Tamil Nadu in MTech and has completed MBA from Global University.

Aiman Salim is currently pursuing BTech degree in Computer Science and Engineering from Younus College of Engineering and Technology, Kollam, Kerala under A P J Abdul Kalam Technological University, Trivandrum, Kerala.

Arya Dileep is currently pursuing BTech degree in Computer Science and Engineering from Younus College of Engineering and Technology, Kollam, Kerala under A P J Abdul Kalam Technological University, Trivandrum, Kerala.

Anjana S is currently pursuing BTech degree in Computer Science and Engineering from Younus College of Engineering and Technology, Kollam, Kerala under A P J Abdul Kalam Technological University, Trivandrum, Kerala.