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Automatic Self Driving Car

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Abstract – This project deals with building an autonomous car that can travel safely and intelligently avoiding the risk of human errors. This raspberry Pi based project can detect the obstacles & traffic light. It can compare the data processed with the data provided to it and is able to take an intelligent decision whether to stop or continue its present path. Important components involved in this project are - the hardware platform which includes raspberry pi board, all the hardware like pi camera and the ultrasonic sensor for improved efficiency & the camera used along with an ultrasonic sensor to provide necessary data from the world for real time processing and application. Second being the cloud platform which will be basically used to train our raspberry pi board for real time applications. Cloud helps us to test as well as train better tracking and decision models & helps in providing the offline computing and storage capabilities for vehicle. Basically, it will be used to train the processor to differentiate between positive (green signal) and negative (red signal) images using various thousands of such signal images as an example. The third and most important part includes the algorithms for perception, control, localization, and recognition.

Key Words: Raspberry pi, L293D Driver, Machine Learning, Open CV, Ultrasonic Sensor & Pi Camera.

1. INTRODUCTION

Autonomous cars, also known as self-driving cars, are vehicles that can navigate, perceive their surroundings, make decisions, and operate without human intervention. The emergence of autonomous cars has been driven by several factors, including the need for improved driver and road safety, population growth, expanding infrastructure, increased vehicle volume, efficient time management, and resource optimization. The development of autonomous cars is the result of advancements in wireless communication, embedded systems, navigation, sensor technologies, ad hoc networks, data acquisition and dissemination, and data analytics.

The concept of autonomous cars dates to the 1920s with the introduction of "phantom autos," which were remotely controlled. In the 1980s, self-sufficient and self-managed autonomous cars started to emerge. Carnegie Mellon University's Nav Lab made significant contributions with the development of the Autonomous Land Vehicle (ALV). Around the same time, Mercedes' "Prometheus project" created a breakthrough by designing a robotic car capable of tracking lane markings and other vehicles.

Developing countries like India face additional challenges due to complex traffic conditions, varying road conditions, a mix of different vehicles, and chaotic traffic. In such countries, there is a pressing need for high-quality transportation infrastructure and services. Factors like speed breakers and potholes pose risks on Indian roads, resulting in accidents and loss of lives. To address these challenges and minimize human errors, alternative technologies like connected cars and autonomous cars are being explored.

Overall, the rise of autonomous cars is driven by the aim to enhance safety, optimize resources, and mitigate the negative impacts of human errors on the road.

1.1 OBJECTIVES

To design a model car which will be able to:

- Drive itself through a marked path
- Follow traffic signals and signs
- Avoid obstacles
- Avoid collision

2.LITRATURE REVIEW

Autonomous Cars: Research Results, Issues, and Future Challenges- Rasheed Hussain; Sherali Zeadally:- This research paper present a comprehensive review of state-of-theart results for autonomous car technology. And discuss current issues that hinder autonomous cars, cost-effective, safe, and efficient autonomous cars and challenges that must be addressed.

An Autonomous Driving System for Unknown Environments Using a Unified Map -Inwook Shim; Jongwon Choi; Seunghak Shin: - This research paperpropose algorithms and systems using unified map built with various onboard sensors to detect obstacles, other cars, traffic signs, and pedestrians. Using this map, the path planner can efficiently find paths free from collisions while obeying traffic laws.

Design of multifunctional autonomous car using ultrasonic and infrared sensors – Ayesh Iqbal; Syed Shaheryar Ahmed: - The daily routine problems that common man faces on roads while commuting are becoming a serious problem with each passing day. People get late and meet accidents. The model of autonomous car presented in this research paper aims to solve these issues by taking humans off the wheels, so that they do not have to drive anymore and the risk of accidents, getting late and traffic congestions can be reduced to a minimum. This car is able to follow the track, overtake other cars, detect obstacles, take sharp bends and turns, follow traffic signals and turn on its lights under low light conditions.

Indian Journal of Science and Technology April - May Jun 2016 " Vision Based Object Detection And Tracking Using Multi Rotor Unmanned Aerial Vehicle " Sarthak kaingade, Vikrant More, Dhirajdhule, Pradeepgaidhani, Nitin Gupta .

D. Bajpayee Aznd J. Mathur, "A Comparative Study About Autonomous Vehicle," In Innovations In Information, Embedded And Communication Systems (Iciiecs), 2015 International Conference On, March 2015.

Hordur K. Heidarsson and Gaurav S. Skhatme, "Obstacle Detection And Avoidance For An Autonomous Surface
Vehicle Using A Profiling Sonar" Ieee May 9-13, 2011.

Tan-Hung Duong, Sun-Tae Chung, Seongwon Cho, ModelBased Robust Lane Detection For Driver Assistance, (Iciiecs) 2005 .

Conclusion: Faults have been simulated to develop an automatic tripping mechanism for the three-phase supply system. Timer 555 has been used with relay for fault analysis, with short duration faults back to the supply immediately, while long duration faults result in permanent trips.

3.BLOCK DIAGRAM

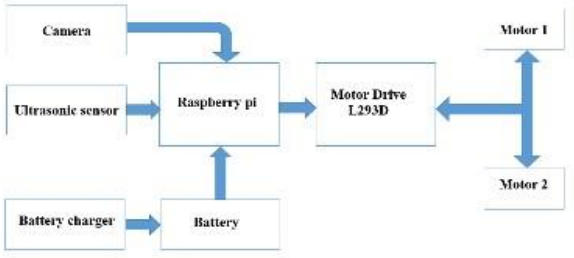


Fig 1: BLOCK Diagram

Ultrasonic sensor is used to detect obstacles and avoid collision. Camera is used to detect path, traffic signs and signals. Motor drive is used for direction change and for start and stop of motors

For the above functions are implemented with Raspberry pi processor, camera and ultrasonic sensor. Ultrasonic sensor is used to detect obstacles and avoid collision.

Camera is used to detect path, traffic signs and signals. Motor drive is used for direction change and for start and stop of motors.

3.1 DETAILED DIAGRAM DECRIPTION

- In this project camera continuously takes pictures and sends them to processor.
- Processor (raspberry pi) compares these pictures with the data fed to it and takes the action according to program fed to it.
- If there is any obstacle or any sign/signal in the picture then processor will process this information and will send signal to the L293D motor driver. And motor drive will control the speed of the motors accordingly.
- Ultrasonic sensors do the work of detection of obstacles in the left, right and back side of the car.
- And battery is provided to power the raspberry pi and motors.

3.2 COMPONENT USED

- **POWER SUPPLY**

The power supply circuit includes two additional pins dedicated to connecting a transformer. These pins serve the purpose of charging the battery and providing the necessary DC voltage to the bridge rectifier, which has a PIV (Peak Inverse Voltage) rating of 1000V. The rectified pulsating DC output is then directed to a 1000uF capacitor to achieve a smoother DC waveform. This smoothed DC voltage is subsequently fed into the 7805 IC, which outputs a stable 5V, and the 7812 IC, which outputs a stable 12V. Additionally, a 470-ohm resistor is incorporated into the circuit as a means of controlling current.

- **RASPBEERY PI**

The central component employed in the project is a compact single-board computer with dimensions like a credit card. This computer is specifically designed and programmed to perform image recognition tasks, enabling it to analyze and

compare images. Once the analysis is complete, the computer

executes an algorithm to determine the most appropriate

course of action based on the input image. In essence, it leverages its training and processing capabilities to swiftly

- **MOTOR DRIVE**

The purpose of this circuit is to control the movement of the model by driving two DC motors. The motor driver utilized in this circuit is the L293D, capable of independently operating two DC motors simultaneously. Input signals for controlling the motor driver are received from the GPIO (General Purpose Input/Output) pins, specifically pins 12, 16, 20, and 21. These input signals dictate the desired movement and speed of the motors, allowing for precise control and coordination.

- **ULTRASONIC SENSOR**

It is used to measure the distance. The trig& echo pin of the ultrasonic is connected to the raspberry Pi GPIO pin number 17& 18 respectively.

Fig2: Experiment Setup

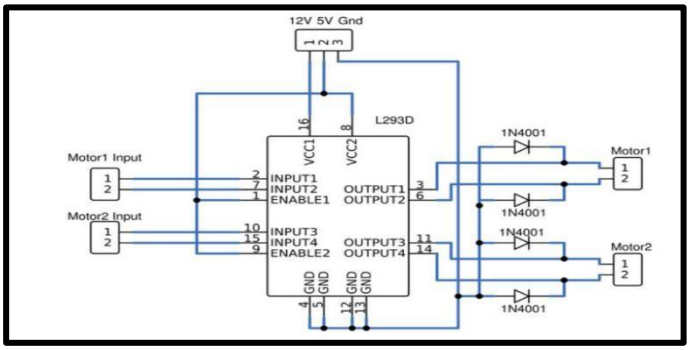
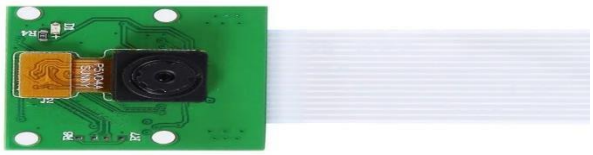


Fig 2: Motor Driver And Motor Connection

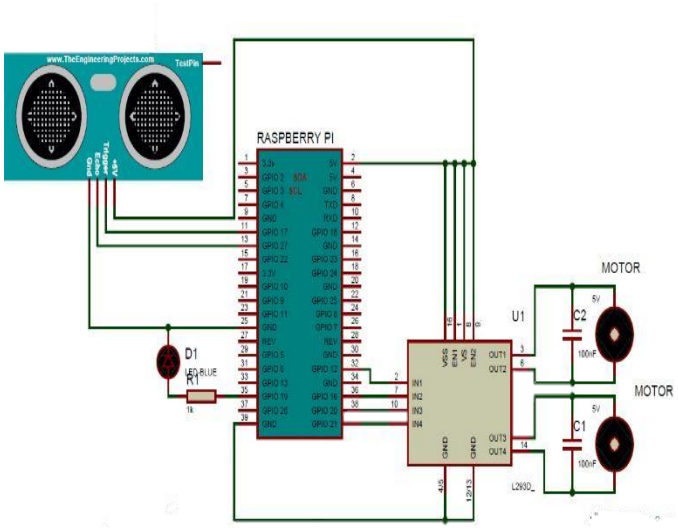
4.METHODOLOGY

The camera is connected to the raspberry pi through USB connectivity and will capture images from the surrounding and respond to the given visual information. provide it to raspberry pi for further processing.



- **CAMERA**

3.4 DETAILED DIAGRAM



- Define the project scope. What are the goals of the project? What features do you want the car to have? What kind of environment will it be driving in?
- Gather the necessary hardware and software. You will need a Raspberry Pi, a camera, a motor controller, and some sensors. You will also need to install some software on the Raspberry Pi, such as a Linux operating system and a self-driving car software stack.
- Design the car's architecture. How will the car's sensors and actuators be connected to the Raspberry Pi? How will the software be structured?

- Implement the software. This is the most challenging part of the project. You will need to write code to control the car's movement, detect obstacles, and make decisions about how to navigate.
- Test the car. Once the software is implemented, you will need to test the car in a safe environment. This will help you to identify and fix any bugs in the software.
- Deploy the car. Once the car is tested and working properly, you can deploy it in a real-world environment.

5.DIFFERENT TECHNIQUES USED

- Object detection: Utilize pre-trained deep learning models (e.g., YOLO or SSD) to identify objects in the video stream.
- Traffic signal detection: Train a model using machine learning algorithms to detect and recognize traffic signals.
- Lane detection: Implement algorithms to detect and track lanes on the road, estimating curvature and vehicle position.
- Decision-making and control: Combine outputs from the object detection, traffic signal detection, and lane detection modules to make intelligent decisions and control the car's movements (e.g., acceleration, braking, and steering).

CONCLUSION

The project utilizes cost-effective and accessible technologies, including Raspberry Pi, ultrasonic sensors, and a camera, to enable a safe and autonomous driving experience. It incorporates mode selection features, making it a reliable solution for addressing the increasing challenges on today's roads. This project has the potential for further advancements using new technologies and can be applied in both private and public sectors.

Autonomous cars can mitigate traffic congestion caused by human drivers' stop-and-go patterns, such as lane changes and merging. By controlling traffic flow and minimizing oscillations, these vehicles can significantly reduce traffic jams. Additionally, they contribute to a substantial decrease in fuel consumption. Even a small percentage of autonomous cars on the road can have a profound impact, eliminating traffic waves and reducing overall fuel consumption by up to 40% and braking events by up to 99%.

RESULT

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