Self-Driving Car Demo using Raspberry Pi

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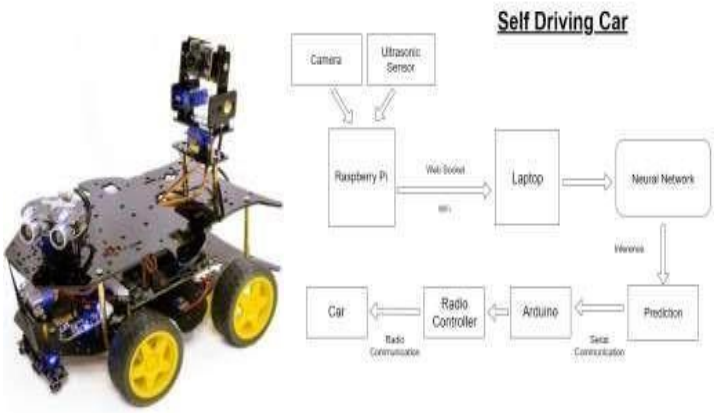
Abstract *This Research paper Aims to represent a Self Driving car prototype using the Raspberry-Pi 4 as a processing chip. In This car prototype will be able to provide real time obstacle detection and path planning in a dynamic environment with the help of a Raspberry-Pi controller.It is s capable of reaching the given target safely and intelligently thus avoiding the risk of human errors by responding to the real time traffic rules and obstacles of road. Many existing algorithms like Panda lane detection, obstacle detection and traffic light recognition are combined together to provide the necessary control to the car. Pi-camera used along with an ultrasonic sensor to provide all necessary data. cloud platform which will be basically used to train our raspberry pi board for real time applications and better tracking and decision model for offline computing for vehicle. Hence it would help minimizing errors in the probability of accidents.*

Key Words: Raspberry-pi, Pi-Camera, Obstacle detection, Machine learning, Image processing.

INTRODUCTION

Economy of a developing country like India there is a drastic increase with the growing needs of convenience, technology now tries to seek automation in every peak aspect possible. Also, with the growth in the number of accident in the recent years due to increased number of vehicles and some amount of carelessness mistakes of the drivers. Autonomous (selfdriving car) car is capable of sensing its surrounding environment and navigating without human intervene input . it would having inbuild features like lane detection, obstacle-detection and traffic sign and pedestrian detection. Raspberry-Pi 4 which can handle tasks like image processing and effectual selection of best path. We can monitor our car ,its movements as well as control them using a remote desktop/mobile. So this is a revolutionary step in the field towards automation and mobility.

Block Diagram



Working: Raspberry-pi-4 which is the central controller would be mounted on the car. The ultrasonic sensors would be placed on the front end of the car, while the picamera module would be placed on the upper roof of the car with specified distance . When there is any obstacle came in front of the car and lies within the predetermined set distance from the car, the raspberry-pi command sent the motor driver IC to stop supplying power to the wheels and hence stops the motion of the car depending upon the proximity of the according to obstacle. the decisions of lane observation, traffic sign and signal detection are carried by the use of enhaced neural networks algorithm to provide controlled motion of the vehicle. Lane detection module.

1. Preprocessing setup: Image processing is a computationally to be handled on a Raspberry-Pi 4. In order to reduce this heavy processing we crop the Region Of Interest from the original image and utilize it for further processing. We need to detect the lanes sign on the road between which our car is moving in vehicles. Crop it image according best angle and view.

2. Image parameter Gray Scale: edge detection and difference in the intensities of the pixels. Convert the RGB image into a grayscale.

Raspberry Pi 4: The processor used in this model is

Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz. It possesses 2 GB of RAM LPDDR4 and has extended 40 pin GP I/O header. It bears 2 USB 2.0 &3.0 ports and a power input port of 5V 2.5A. BLE 5 ,WIFI6.

Ultrasonic sensor: Supply voltage is 5V

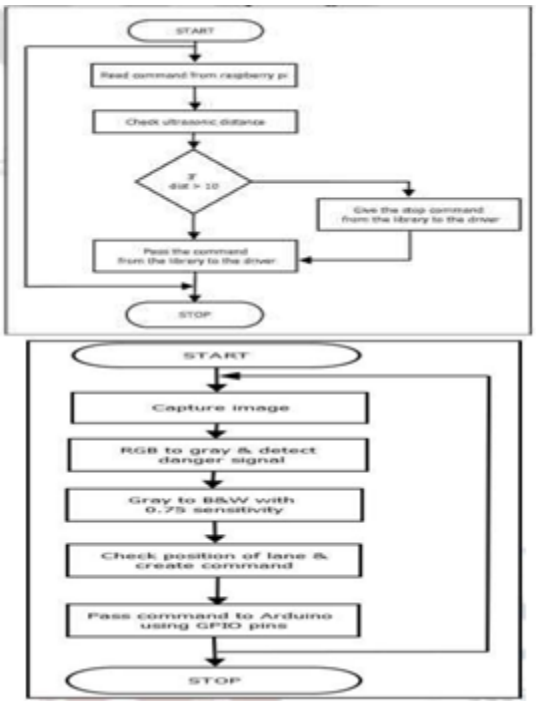


Fig-1: Flow Chart

15mA.Modulation frequency is 40Hz.Output is 0 – 5V (Output high when obstacle detected in range).Beam Angle is Max 15 degrees. Distance is 2cm – 400cm.

1.1 Flow Chart:

Accuracy is 0.3cm. Trigger Pulse Width 10 µs Outline

1. Image processing sub-system algorithm Dimension 43x20x15 mm Speed ultrasonic sensor is noncontact distance measurement module.

2. Obstacle detection sub-system algorithm

2. HARDWARE USED

1. Raspberry pi 4

Fig -2: Raspberry Pi

2. LN293 Motor Driver IC

3. Pi-Camera module

4. Ultrasonic Sensor

5. **Pi Camera** : 5MP Omnivision 5647 Camera Module.

Still Picture Resolution: 2592 x 1944. Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90

Recording. 15-pin MiPi-Camera Serial Interface - Pluging into the Raspberry Pi Board.

Fig -3: Ultrasonic Sensor

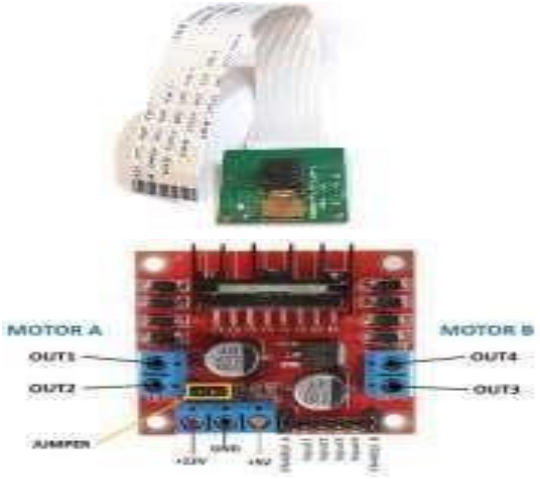


Fig -4:Pi Camera

2.4 **L298N Driver** : It is a high voltage and high current motor drive chip which receives TTL logic signals. It is needed to operate different types loads like 2 DC motors with directional and speed control. where an H-Bridge is required. High power motor driver is required.

3. SOFTWARE USED :

3.1 **OPEN CV**: OPEN CV is the abbreviation for open computer-vision and is a library and is helpful for real-time optimized applications. It provides both, a trainer and a detector. Both, positive and negative results are feding to obtain appropriate real-time detection of the traffic signs and pedestrians.

3.2 **TensorFlow:** This is an open-source library developed by Google primarily for deep learning applications. It also supports traditional machine learning. TensorFlow was originally design for huge numerical computations without keeping deep machine learning in mind.

3.3 **Raspberry Pi OS:** Raspbian is a Debian-based operating system for Raspberry Pi. Since 2015, it is officially provided by the Raspberry Pi Org.

CONCLUSIONS

This paper presents a system for a self driving car which is able to reach a given destination specified they won't require any drivers, the accidents caused by the carelessness of the vehicles would be reduced and efficiently detects and avoids any obstacles on its way. Also reducing the total fuel consumption by up to 40 % and the braking events up to 50%. Its highly beneficial for better regulation in the goods and people mover's section. self-driving modules will pave the way for a bright future for self-driving cars.

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