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Autonomous Driving Vehicle

Abhijeet Banerjee[1], Vignesh Bolar[2], Ankit Chaurasia[3], Shubham Maurya[4], Yogesh Gite[5]

[1,2,3,4]*Student, Dept. of Computer Engineering, Dilkap Research Institute and management Studies of Engineering and Technology, Neral, Maharashtra, India*

[5]*Assistant Professor, Dept. of Computer Engineering, Dilkap Research Institute and management studies of Engineering and Technology, Neral, Maharashtra, India*

Abstract - *In this era of advancement has led to cars driving themselves also known as "Self-driving cars". Driving conditions are becoming fairly difficult for a driver due to the terrible traffic, bad conditions of the road and pedestrians on the road. This makes driving a very stressful and tiring task. A self-driving car is very useful for the driver it allows the driver to take hands off the steering wheel and relax and it is also enables the vehicle to avoid any accidents and crashes from taking place. In this paper along with the model of a self-driving car, we highlight the benefits a of a self-driving car to the people in and outside the vehicle. The car has an ultrasonic sensor which helps to detect the objects ahead and an Arduino to control the motors and direct the car accordingly.*

Keywords- *Self-driving cars, ultrasonic sensor, Arduino.*

1. INTRODUCTION

In India, nearly 1,51,000 deaths in road accidents have been reported in the year 2018 [1]. And this numbers go up every year. This mainly happens because of the lack of attention of the driver, there are a lot of factors that affect the mental state of the driver such as the awful amount of noise, pedestrians walking or crossing the road or the phone ringing along with many other reasons. It can also be named as human error. The element of human error cannot be removed but it is definitely possible to stop accidents from happening [2].

Cars that are able to drive themselves take a lot of load off the driver. Now, along with the driver the vehicle is also paying attention to the surrounding conditions. The system of the vehicle is able to respond to the sudden change in situation quicker than the driver itself. Self-driving cars if implemented in a proper environment can tremendously reduce the number of accidents. As the system is prone to all distractions. The driver taking hand off the steering wheel for a while comes under the feature of adaptive cruise control in which the vehicle is able to be in current lane and maintain the current speed. Some of the additional in self-driving vehicle are lane detection, street sign detection which it uses to commute all by itself from one point to another.

So, for the vehicle to navigate itself through the streets filled with traffic it has to have some sort of eyes. The vehicle is given virtual eyes with the use of different sensors. Some of the sensors that are used are the LIDAR sensor, the RADAR sensor, ultrasonic sensors and cameras. These sensors are located at the front and rear of the vehicle and in some cases the LIDAR and camera are placed on the roof of the vehicle. The LIDAR sensor which uses light rays is a key component of the self-driving vehicles, but it is unable to read the street signs. A camera is used to view objects, interpret street signs and it is good for lane recognition, but it cannot detect collisions. The RADAR sensors are used for detecting the collisions by sensing of any object keeps on coming closer to the vehicle, if the object keeps on approaching the vehicle and the distance between the two is decreasing quickly then the RADAR sensor sends in a signal about the collision which is about to happen.

2. RELATED WORK

To initiate the research in the field of Autonomous cars, a literature survey was carried out to get an insight on the current approaches towards advancement in the field. The research carried out by Rasheed Hussain, and Sherali Zeadally [3] has provided information regarding the current situation of autonomous cars, their design models and it's issues and how it is being applied, tested for further advancement. The work done by Keshav Bimbraw [4] show the research done on the development on this field in the early staged and the historical antecedents before them. It also predicted by the year 2035, most of the cars seen on road will be self-driven cars.

The work done by Aditya Kumar Jain [2] and Ayesha Iqbal, Syed Shaheryar Ahmed, Muhammad Danish Tauqeer, Ali Sultan, Syed Yasir Abbas [5] highlights the benefits of a self-driving vehicle on the road and the safety of the surrounding peoples along with a working model of an autonomous car. One of the models uses ultrasonic and infrared sensors and the other consisting of Neural Networks, Raspberry Pi and Arduino. These models target the basic objectives of a self-driving vehicle such as reading traffic light/signs, lane detection and collision avoidance.

Research done exclusively on above mentioned objectives can be seen in the work done by Ruturaj Kulkarni, Shruti Dhavalikar, Sonal Bangar [6] in which they propose a model able to read traffic lights using Deep learning. The work done by Mochamad Vicky Ghani Aziz, Ary Setijadi Prihatmanto, Hilwadi Hindersah [7] shows the implementation of lane detection on an actual road in both day and night time.

Work on a cost effective map free lane following solution was done by Song Zhiwei, Huang Weiwei, Wu Ning, Wu Xiaojun, Wong Chern Yuen Anthony, Vincensius Billy

Saputra, Benjamin Chia Hon Quan, Chen Jian Simon, Zhang Qun, Yao Susu, and Han Boon Siew[8], to deal with the issue of lane keeping of self-driving vehicles. A car that drive itself should also be able to park itself, this was worked on by Shahroz Tariq, Hyunsoo Choi, C.M. Wasiq, Heemin Park[9] in which they address the issue of self-parking, suggest ways of implementation and demonstrate how a self-parking system is efficient in saving time and space for parking cars.

3. PROPOSED MODEL

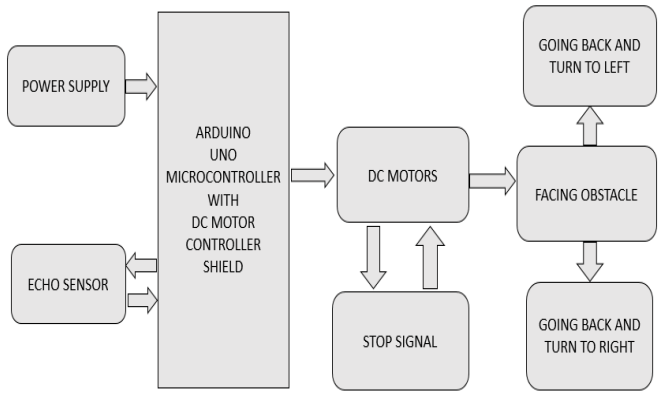

Fig.1-Proposed model of a Self-driving car

In the proposed model, the process begins as soon as the power switch is flipped and the power goes to all the components. The Arduino chip keeps interacting with the echo sensors which is actually the ultrasonic sensor, the sensor is able to detect any object coming closer to the vehicle and sends feedback to the Arduino chip accordingly. The Arduino is connected to a motor driver which then controls the movement of the motors. If the Arduino gets an input from the sensor that some objects is getting closer to the vehicle, then any one of the outputs which is either go back and turn left, go back and turn right or stop is executed by the motors. The motors are controlled and managed by the motor drivers which is connect directly to the Arduino chip.

4. HARDWARE AND SOFWARE

The hardware components used in this model are Arduino UNO, Arduino Motor Shield, servo motor, ultrasonic sensors and dc motors and software is Arduino IDE.

A. Arduino Uno

An Arduino microcontroller is used for the purpose of processing the information it gathers with the use of sensors about the surroundings. In this case it uses an Ultrasonic sensor to detect the objects in the surrounding and it also holds the program which processes the input information and gives the appropriate output by controlling the motors.

B. Arduino Motor Shield

It is also called as the Motor Driver and it is used to control the motors speed and direction. It is directly connected to the Arduino board and it protects the Arduino board from being in direct contact of the motors. It allows you to power a motor with a separate power supply.

C. Servo Motor

It is an electrical device used for the purpose of rotation. It has the ability to rotate an object in a specific angle with great precision. The sensor is place right on top of the servo so that is able to increase the scanning angle of the sensor by allowing the sensor to rotate and scan for objects. When the vehicle stops to avoid collision the servo rotates the sensor to look for any spot where there is no object to obstruct the vehicle.

D. Ultrasonic Sensor

It is an HC-SR04 ultrasonic sensor. It uses SONAR to determine the distance between the object and itself. It is placed on top of the servo and it looks for any object in the way of the vehicle. As soon as an object is detected it informs the Arduino board it is connected to and the board takes further care of the information. It acts as the virtual eyes of the vehicle.

E. DC Motors

It is an electric motor which turns direct current electric energy to mechanical energy. It is used to set the vehicle in motion. It drives the vehicle from one point to another. It uses current from the battery to power itself. The direction and speed for the motors is controlled by the Arduino board.

All the components should be connected in a proper manner so that all the pins are aligned correctly. If any pin is wrongly connected then that component might not function at all. Fig.2 shows the layout of all the pins and the order of connection to their corresponding pins.

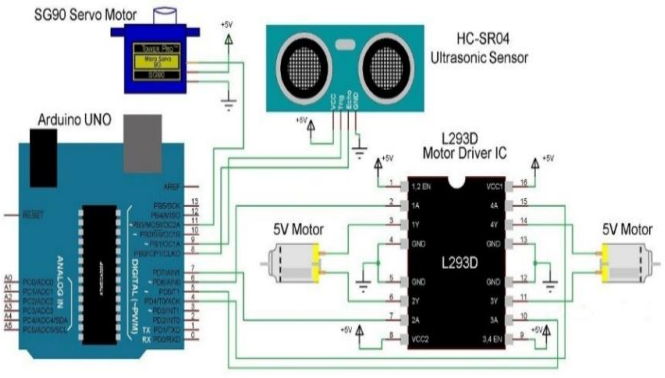

Fig.2-Circuit Connection

F. Arduino IDE

This software component is a platform on which the programs are written. These programs help to process the input from the surroundings and give the output accordingly. A particular output for every case is mentioned in the code. The program is the exported in the board via a particular cable that comes with the board. It connects the computer device to the board.

5. RESULT

The model of self-driving car was tested in different test conditions, such as when an object approaches from the front, from left side or from the right side. In all the case the model was successfully able to avoid any collision from happening.

6. CONCLUSION AND RECOMENDATION

In this paper, we have successfully given a model of a self-driving car that is able to detect and avoid collisions with the help of all the hardware and software components described. The features of the model can be further enhanced such as providing the function of lane recognition, street sign detection and self-parking. If such a system is created where most of the vehicles in the road are autonomous vehicles then the risk of accidents can be greatly reduced and safety of the people in the surrounding will also increase.

7. ACKNOWLEDGEMENT

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