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OBSTACLE AVOIDING CAR WITH WI-FI CONTROL SYSTEM

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1. ABSTRACT

The purpose of designing the obstacle avoiding car is to simplify and make the way of life easier. Due to increasing living standards of people, the demand of transportation and travelling is growing higher. As vehicles are the major sources of transportation and travelling so there has been a drastic increase in the number of cars and vehicles which ultimately led to serious problems like traffic congestion, increase in number of accidents, excessive air and noise pollution etc.

Hence, we have designed an obstacle avoiding car that will move automatically by detecting the obstacles in its path with the help of ultrasonic sensors and avoid any collision and hence it will reduce or minimize the probability of accidents. Also, since it will move automatically, so it will reduce the dependency on other people and drivers and in future it's extended version will let the elderly and physically disabled persons to travel hassle free. The Wi-Fi system installed in the car will help the car to be controlled from outside too and will facilitate the easy way to park the cars and control them if needed.

Traffic collisions are the largest cause of worldwide injury-related deaths. This car will help to reduce accidents. Self-driving cars are predicted to reduce traffic deaths by 90%, saving 30,000 lives a year. Even under normal circumstances, human drivers generally create stop-and-go traffic, even in the absence of bottlenecks, lane changes, merges or other disruptions. This phenomenon is referred to as the "phantom traffic jam". By controlling the speed of the autonomous car, the smooth traffic flow for all the cars can be maintained. Also there will be reduction in congestion that will most likely result in a reduction of CO2 emissions as well. A research by the State Smart Transportation Initiative (SSTI) shows potential for autonomous vehicles could increase highway capacity by 100% and increase expressway travel speeds by more than 20%. Autonomous vehicles technology can improve fuel economy, improving it by 4–10 % by accelerating and decelerating more smoothly than any human driver thus optimizing the fuel usage.

Keywords—Obstacle-avoiding Car, Arduino Nano, NodeMCU(ESP8266), Wi-Fi Control system, Ultrasonic sensors.

2. INTRODUCTION

A car is a wheeled motor vehicle used for transportation purposes. Most definitions of cars say that cars run primarily on roads, can sit one to eight people, have four wheels, and mainly transport persons rather than goods. Cars prominently came into global use during the 20th century. The year 1886 is acknowledged as the birth year of the modern car when German inventor Karl Benz patented his Benz Patent Motor-wagon. Cars became widely available and used in the early 20th century. One of the first cars accessible to the public was the 1908 Model T, an American car that was manufactured by the Ford Motor Company.

Cars have various controls for driving, parking, passenger comfort, and a variety of lights. Over the decades, many additional features and controls have been added to vehicles, making them more complex, but also more reliable and easier to operate. These features include rear-reversing cameras, air conditioning, navigation systems, and in-car entertainment systems. Most cars in use in the 2010s were propelled by an internal combustion engine, fuelled by the combustion of fossil fuels. Electric cars, which were invented early in the history of the car, became commercially and widely available in the 2000s and are predicted to cost much lesser to buy than gasoline cars before 2025.

There are many costs and benefits to car use.

The costs to the individual include acquiring the vehicle are:

- Fuel.
- Repairs and maintenance.
- Driving time.
- Parking fees.
- Taxes.
- Insurance.

The costs to the society include:

- Maintenance of roads.
- Land usage.
- Road congestion.
- Air pollution.

3. LITERATURE REVIEW

a. **Research Paper on "Self-Driving Autonomous Cars":-** The implementation of this idea in real world would result in a vast number of advantages. Prevention of accidents, a huge revolution in cost of transportation, a god solution to death of 1.3 million people world-wide death due to car accidents, are a few advantages of this idea. The car is built using Arduino Nano, Node MCU (ESP 8266 module), Ultra-sonic sensors (HC-SR04 module) and Motor Driver (L298N module). Thus this car is capable of producing very good results and thus the prototype can be further extended and implemented into real world. With fields like automation and artificial intelligence getting closer to humans day-by-day, there is no doubt that auto-driving cars will make human transportation system simpler and more comfortable. Considering the benefits that Self-driving cars have to offer in terms of both safety and in reduction of traffic jams, it is evident that they can withstand and change the future in a significant way. Thus this paper demonstrates the prototype working model of a self-driving car which can be further developed with add-on features and along with developments in mechanical & electrical sections of this project, it can be implemented into the real world.

b. **Research Paper on "Driverless Cars":-** In this paper, it is stated that Driverless cars are standard passenger cars with additional capabilities of replacing the driver by an intelligent autonomous system to run the car. In such cars, GPS receivers and mapping technology are installed to navigate paths and destinations. Radar system is used to detect obstacles that the driverless car may encounter. A laser ranging system scans the outside environment in three dimensions. The car also comes with a video camera to identify various objects like signs, lights, humans, and other cars. The system of the car uses all the information to decide the behaviour of the car in a particular situation (Waldrop, 2015). Thus, driverless cars are capable of performing all the functions of a human driver through automatic processing units. Despite the rapid developments and technological advances in the accuracy and reliability of driverless cars, they are still not in common use and have not been presented for public transport yet. All the carmakers have been in a race, busy in testing their prototypes for quick delivery into the markets. Google has been ahead of all in this race. By 2013, Google car completed around 200,000 miles of accident free driverless test drives (Poczter & Jankovic, 2013). According to Mui (2015), more than 20 Google driverless cars have completed test drives of more than 1.7 million miles out of which around one million miles test drives were in driverless mode. To speed up entry in to the market, Google is continuously driving its autonomous cars approximately 10,000 miles per week in real environments, without controlled environments. Google is also doing simulated driving of its driverless cars for around 3 million miles a day. It is expected that Google's driverless cars will soon be into the market for public use.

4. BLOCK DIAGRAM

The block diagram of the obstacle avoiding car with Wi-Fi controlled system is shown below in Figure 1.

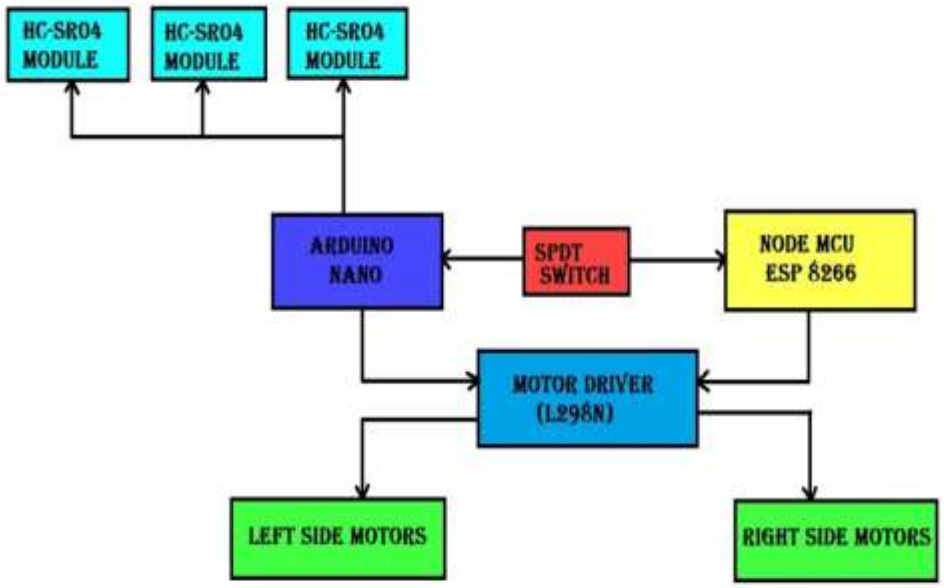

Figure 1- Block Diagram

5. WORKING

The working is basically divided into 2 modes. These modes are:

Mode 1: Obstacle avoiding mode:

In this mode ARDUINO NANO is used as controller which controls total motor driver when this system is ON and in this the sonar system HC-SR04 ultrasonic sensors are used to determine distance from an object just like the bats do. It offers excellent no-contact range detection from about 2 cm to 400 cm or 1feet to 13 feet. Its operation cannot be affected by sunlight or black materials. The ultrasonic sensor emits both short and high frequency signal. If the signals detect any object, then they reflect back an echo signal which is taken as input by the sensor through Echo pin. Firstly, user initializes a Trigger and Echo pin as low and pushes the car in the forward direction. When an obstacle is detected, the Echo pin will give input as high to microcontroller. Pulse In function is used to calculate the time of distance measured from the obstacle. Every time the function waits for pin to go high and then it starts the timing, the timing will then be stopped when pin go to low. It returns the pulse length in microseconds or when complete pulse was not received within the timeout it returns. The timing has been determined means that it has given the length of the pulse and will show errors in shorter pulses. Pulses ranging from 10 microseconds to 3 minutes in length are taken into consideration.

After determining the time taken, it converts into a distance. If obstacle is present in left side and the distance

between the obstacle and vehicle is less than the distance provided in the program of the controller then it will take right turn. If obstacle is present in right side and the distance between the obstacle and vehicle is less than the distance provided in the program of the controller then it will take left turn. If obstacle is present in front of the vehicle then the vehicle stop and with the help of left and right ultrasonic sensors the controller decide the safest route and by taking that route the vehicle return to its initial path. Then it starts moving again in forward direction. The circuit diagram of the obstacle avoiding mode is shown below in Figure 2.

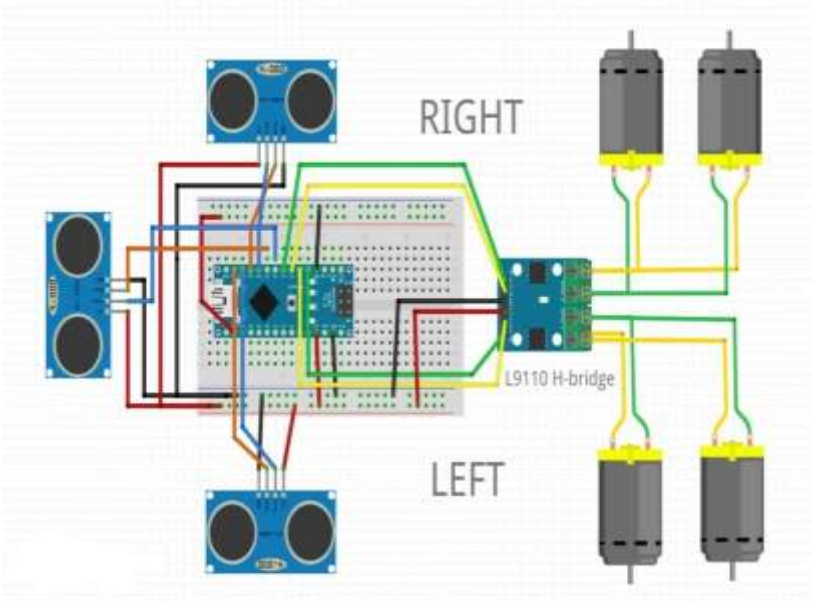

Figure 2- Circuit Diagram of Obstacle avoiding system

Mode 2: Wi-Fi controlled mode:

In this system, NodeMCU(ESP8266) is used as a controller which is connected to an android mobile via Wi-Fi (through same IP address) in which an app named with Node MCU Car is installed which is used to provide the direction and speed of the vehicle.

When this system is ON the total control of motor driver is shifted from ARDUINO NANO to Node MCU. Hence, the vehicle is controlled through Wi-Fi by Mobile client. The circuit diagram of the Wi-Fi controlled mode is shown below in Figure 3.

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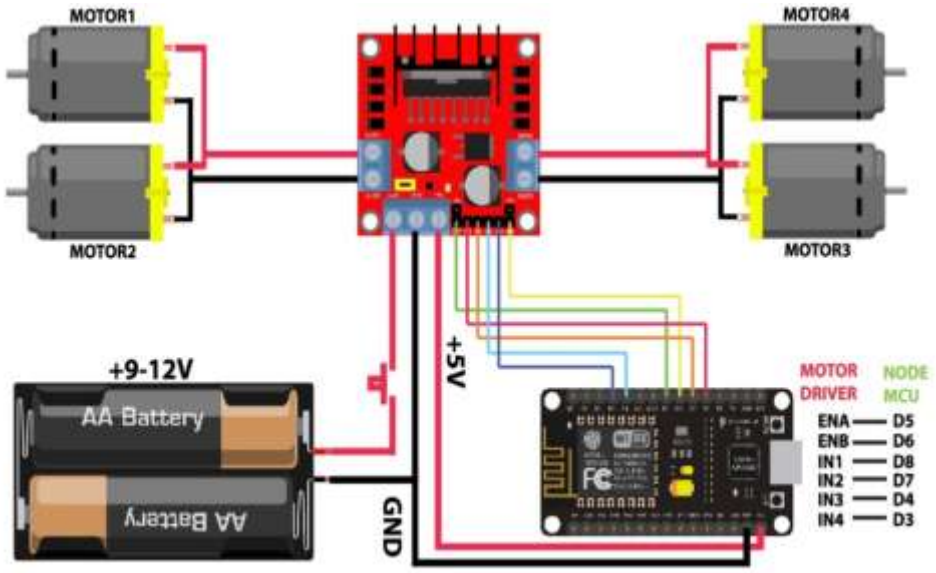

Figure 3- Circuit Diagram of Wi-Fi controlled system

6. PROTOTYPE

The prototype image of the obstacle avoiding car with Wi-Fi controlled system is shown below in Figure 4.

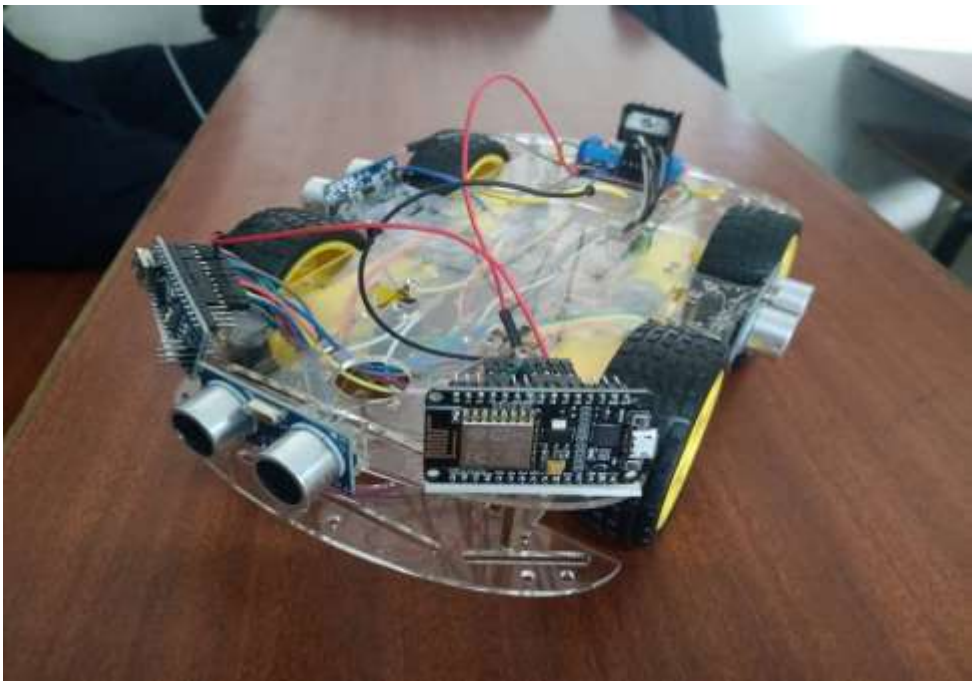

Figure 4- Prototype image of the car

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7. HARDWARE DESCRIPTION

I. Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Arduino Nano is open-source hardware. Each of the 14 digital pins on the Nano can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. The diagram of the Arduino Nano is shown below in Figure 5.

Figure 5- Arduino Nano

II. Motor Driver

L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. **L298N Module** can control up to 4 DC motors, or 2 DC motors with directional and speed control. The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit. The diagram of a motor driver module is shown below in Figure 6.

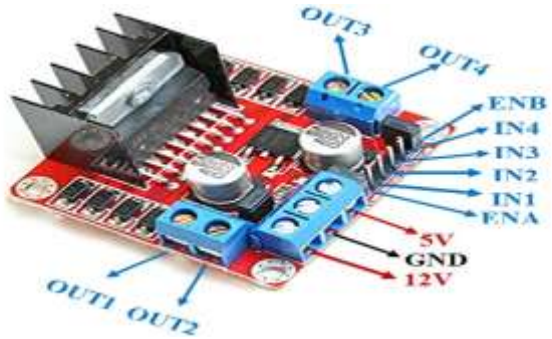

Figure 6- Motor Driver (L298N)

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III. Node MCU (ESP 8266)

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added. NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "Node" and "MCU" (micro-controller unit). The diagram of the NodeMCU module is shown below in Figure 7.

Figure 7- Node MCU (ESP 8266) module

IV. Ultrasonic Sensors (HC- SR04 module)

HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are V_{cc}, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that: **Distance = Speed × Time**

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module. The diagram of the ultrasonic sensor is shown below in Figure 8.

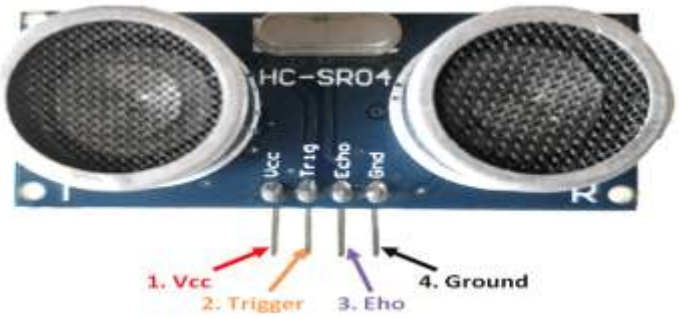

Figure 8- Ultrasonic Sensor (HC- SR04 module)

8. ADVANTAGES AND SOCIAL BENEFIT

- Increased road safety.
- Improved traffic flow will reduce traffic congestion.
- Environmental benefits like minimized harmful emissions, reducing both climate change and air pollution.

- Convenient parking benefit leading to maximizing the no.of vehicles that can fit in one parking lot.

9. FUTURE SCOPES

- **More safer roads:** Elimination of human element will drastically reduce traffic accidents.
- **More free time:** Letting your car drive you home will let you use your precious hours to do more productive works.
- **Improved fuel efficiency:** Cars will maintain constant speed for longer durations thus optimizing fuel efficiency.
- **Provides Independence:** Elderly and physically challenged persons can also be able to travel without depending on any other person or driver**.**

10. CONCLUSION

Our project, obstacle-avoiding car with Wi-Fi control system has been designed with the intention that eventually it will make the lives of human more easier. Some points that were kept in mind while designing this autonomous car were that it will not only bring revolutionary change in transportation system but also its implementation in real world will lead to reduced number of accidents thereby saving more than 30,000 lives in a year. Also, traffic congestion will be reduced hence smooth traffic will be maintained.

Implementation in real world will also help in reducing CO_2 emission, increased lane capacity and most importantly it will lower fuel consumption rate and offer some serious solution to the problem of decreasing petroleum reserves and increasing air pollution concerns.

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