TOUCH SCREEN BASED REMOTE CONTROL ROBOTIC VEHICLE

by

S.R.SHIVARITHA	19BEC1130
SURYA.Y	19BEC1176
LALITHA.G	19BEC1371
KHAMALESH KUMAR.P	19BEC1405

A project report submitted to

Dr.PRAKASH V

SCHOOL OF ELECTRONICS ENGINEERING

in partial fulfilment of the requirements for the course of

ECE4003 – EMBEDDED SYSTEM DESIGN

in

B. Tech. ELECTRONICS AND COMMUNICATION ENGINEERING

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Vandalur – Kelambakkam Road

Chennai – 600127

NOVEMBER 2021

BONAFIDE CERTIFICATE

Certified that this project report entitled "**TOUCH SCREEN BASED REMOTE CONTROL ROBOTIC VEHICLE"** is a bonafide work of **SHIVARITHA.S.R – 19BEC1130, SURYA.Y-19BEC1176, LALITHA.G-19BEC1371 and KHAMALESH KUMAR.P-19BEC1405 who** carried out the Project work under my supervision and guidance for **ECE4003 – EMBEDDED SYSTEM DESIGN.**

Dr. PRAKASH.V

Associate Professor

School of Electronics Engineering (SENSE),

VIT University, Chennai

Chennai – 600 127.

ABSTRACT

Bluetooth technology has evolved over the years. It helps in establishing connection between devices. This project focuses on developing a robotic vehicle that uses Bluetooth for communication between the vehicle and mobile, which is used to control the movement of the robotic vehicle. These commands are sent from the Android mobile to the Bluetooth. An additional feature has been included, where the robotic vehicle detects obstacles present in its way. This project aims on developing a vehicle that is well suited for storage management purposes. In subsequent sections, we have elaborated the procedure of this framework.

ACKNOWLEDGEMENT

We wish to express our sincere thanks and deep sense of gratitude to our project guide, **Dr. Prakash V,** Associate Professor, School of Electronics Engineering, for her consistent encouragement and valuable guidance offered to us in a pleasant manner throughout the course of the project work.

We are extremely grateful to **Dr. Sivasubramanian. A,** Dean of School of Electronics Engineering, VIT Chennai, for extending the facilities of the School towards our project and for his unstinting support.

We express our thanks to our Head of the Department **Dr. Vetrivelan. P** for his support throughout the course of this project.

We also take this opportunity to thank all the faculty of the School for their support and their wisdom imparted to us throughout the course.

We thank our parents, family, and friends for bearing with us throughout the course of our project and for the opportunity they provided us in undergoing this course in such a prestigious institution.




SHIVARITHA S R **19BEC1130**

SURYA Y **19BEC1176**

LALITHA.G **19BEC1371**

KHAMALESH KUMAR P **19BEC1405**

TABLE OF CONTENTS

1. INTRODUCTION

1.1 OBJECTIVES AND GOALS

- To construct a robotic vehicle that can be operated with the help of a touch screen display unit for remote operation.
- To establish a Bluetooth connection between the robotic vehicle and a mobile application.
- To perform obstacle detection
- To alert the user when an obstacle is detected in the vehicle's way.

1.2 BENEFITS:

- Reduces the workload of manpower.
- Low cost to design the system.
- Easier detection of obstacles with the help of a suitable sensor.
- Can be used in storage management units.

1.3 FEATURES:

- This robotic vehicle uses ultrasonic sensor which measures the distance to an object with the help of sound waves for the detection of any obstacles present
- Proteus 8 Professional simulation shows significant results and the hardware prototype shows promising output.

2. DESIGN

2.1 BLOCK DIAGRAM

The four main features of the basic block diagram (given below) are

- The Microcontroller used – ATMEGA328P
- Ultrasonic sensor
- Bluetooth module
- Motor driver
- Buzzer

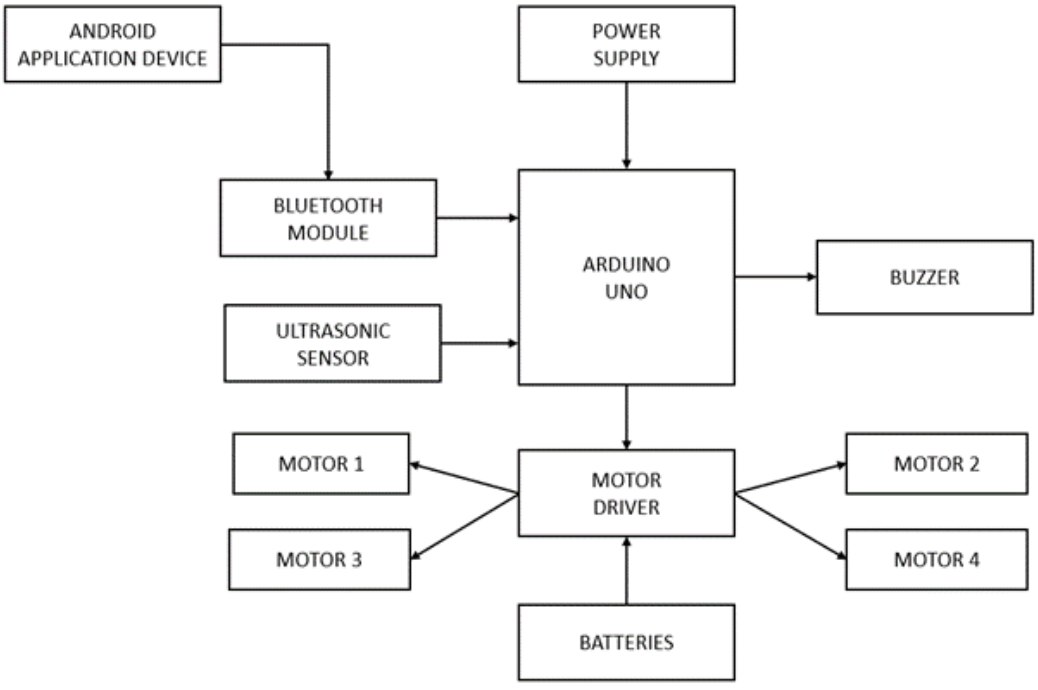

Figure 1 Block Diagram

The block diagram was drawn so as to give a vivid explanation of how the system works at a glance. As shown in (Figure 1), it can be seen that the main heart of this Bluetooth controlled vehicle system is Arduino. Ultrasonic sensor, Bluetooth

module and buzzer are connected to the digital pins of the Arduino along with the motor driver. For all inputs given from the android application through the Bluetooth module to the Arduino, the Arduino sends commands to the motor driver accordingly. The motors are activated depending on the input from the motor driver. The motors can move either forward or backward. The Bluetooth controlled car can turn activating motor 2 and 4. It can turn right by activating the motors 1 and 3. Whenever an obstacle is detected, the ultrasonic sensor becomes high and the buzzer buzzes for 2 seconds and moves backward. Then, the command is reset to user inputs.

2.2 REQUIRED EQUIPMENTS

- ATMEGA328P
- Ultrasonic sensor
- Bluetooth Module
- Motor Driver
- DC motors
- Wheels
- Chassis
- Buzzer
- Mini breadboard
- 9v Batteries
- Serial cable
- Jumper cables

2.3 HARDWARE ANALYSIS:

2.3.1 ARDUINO UNO:

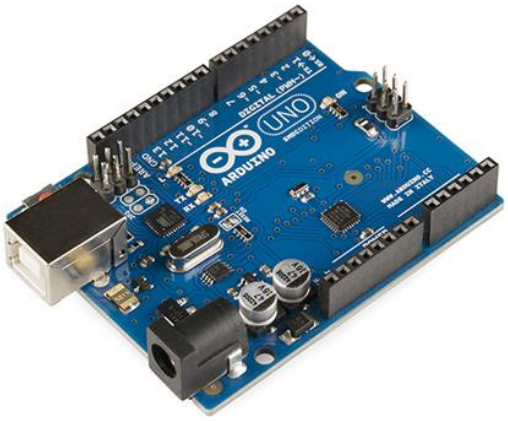

Figure 2 Arduino
NOTE: From Arduino, Wikipedia [1]

Arduino UNO, shown in (Figure 2), is an open-source microcontroller board based on the microchip ATmega328P microcontroller. It has 5 analog input pins, 14 digital input/output pins from which 6 pins can be used as PWM outputs, a USB connection port, a power jack, a reset button and an ICSP header. In this project the digital pins 0,1,5,6,7,8,9,10,11,12 are used.

Using Arduino IDE, the Arduino UNO is programmed based on bluetooth controlled car code implemented to it.

2.3.2 L298N MOTOR DRIVER

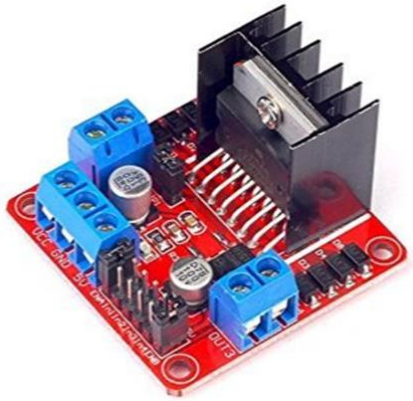

Figure 3 L298N Motor Driver
NOTE: From Hajare Electricals Engineer L298N Motor Driver Module, IndiaMART [2]

The L298N is a dual H-Bridge motor driver which controls directions and speed of two DC motors at the same time. The peak current is up to 2A and it can drive the DC motors voltages from 5V to 35V. The speed of the DC motors can be controlled by varying its input voltage and with the use of PWM pins. The input and the enable pins of the motor driver are connected to six digital output pins in the arduino.[3]

2.3.3 ULTRASONIC SENSOR HC-SR04

Figure 4 Ultrasonic Sensor HC SR04
NOTE: From Omatom Power Ultrasonic Sensor HC SR04 Module , IndiaMART [4]

The ultrasonic sensor is a device that is used to measure the distance to an object with the help of sound waves.

The HC-SR04 Ultrasonic distance sensor consists of two ultrasonic transducers. The one acts as a transmitter which converts electrical signals into 40 KHz ultrasonic sound pulses. The receiver listens for the transmitted pulses. If it receives them, it produces an output pulse whose width can be used to determine the distance the pulse travelled. The sensor is small, easy to use and offers excellent non-contact range detection between 2 cm to 400 cm with an accuracy of 3mm.[5]

2.3.4 HC-05 BLUETOOTH MODULE

Figure 5 HC-05 Bluetooth Module
NOTE: From Bluetooth HC-05 Module, IndiaMART [6]

HC-05 Bluetooth Module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with a controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.

2.3.5 DC MOTORS

Figure 6 Dual Shaft BO motor
NOTE: From Constflick Technologies dual shaft BO motor, Electronicscomp [7]

Bo motor (Battery Operated) is a lightweight DC geared motor. It has great torque and rpm at low voltages. It is suitable to operate lightweight robotics vehicles. The DC motor converts electrical energy into mechanical energy. The shaft is set in a way such that it helps to increase torque and reduce the speed of the motor.

2.3.6 BUZZER

Figure 7 Buzzer

NOTE: From Mini Piezo Buzzer Mini, pcboard.ca [8]

The buzzer converts audio signals into sound signals. It is usually powered by DC voltage.Piezo buzzers are simple devices that can generate basic beeps and tones. They work by using a piezo crystal, a special material that changes shape when voltage is applied to it.

2.4 SNAPSHOTS

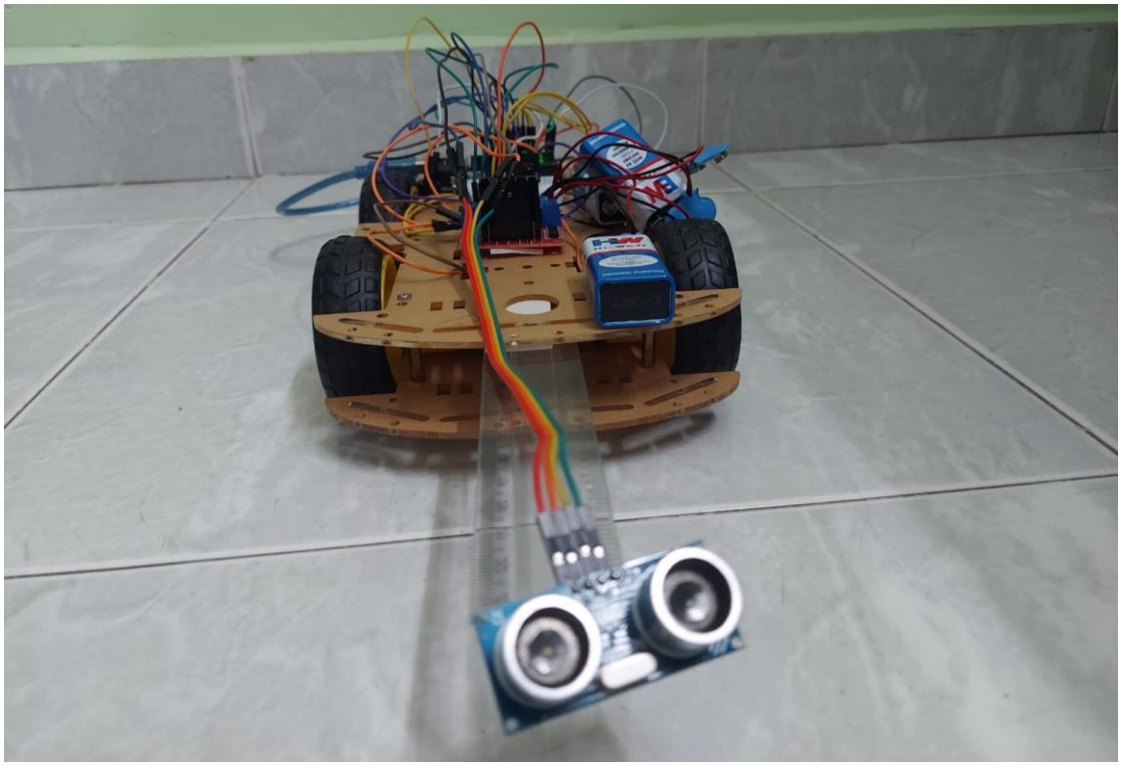

Figure 8.(a) Hardware implementation

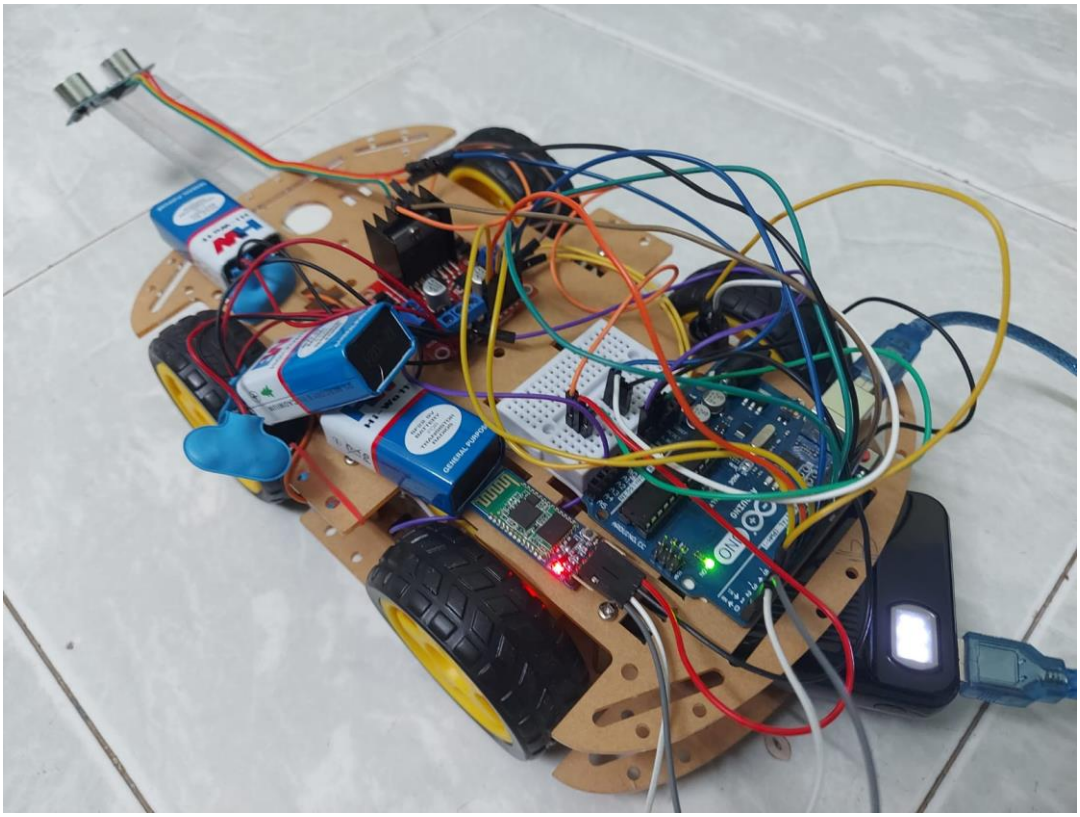

Figure 8.(b) Hardware implementation

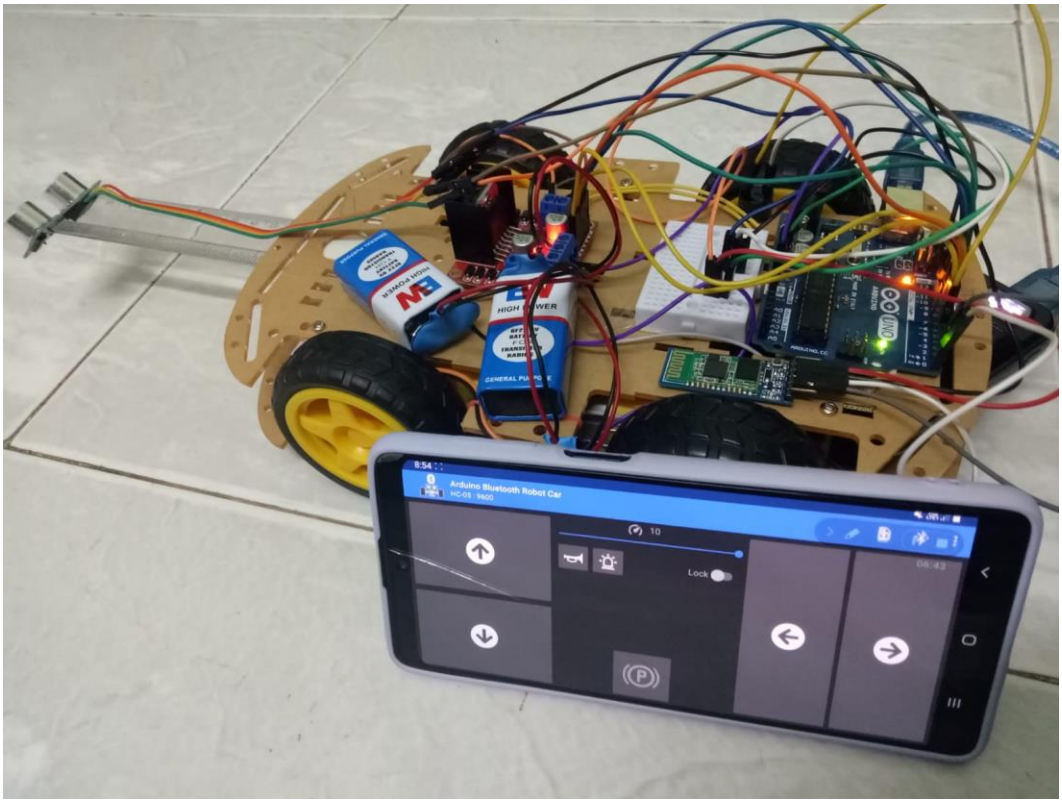

Figure 8.(c) Hardware implementation

3. SOFTWARE ANALYSIS

3.1 ALGORITHM

Step1: Start

Step2: Define necessary pins with suitable name

Step3: Define motors pins joined with arduino board

step4: Define pins in write or read type and define functions to run the rc car.

Step5: Non return function such as forwardMove(), reverseMove(), leftMove(), rightMove(), stop() and special function to stop using ultrasonic sensor is defined i.e objectdetected() in which each motors are digitally written to high or low according to the direction.

Step6: Start loop function, for perception of distance ultrasonic module calculation is given with invoking “trigger” and “echo pin’’ for transmitting and receiving.

Step7: Invoke if-else case to check if the percepted distance received from the ultrasonic sensor passes or falls short of the limit. If an object falls under the limit distance, pin Buzzer is set high and a special function objectdetected() is invoked with a delay of 2s.

Step8: For the bluetooth controlled direction, the input is read through Serial.read() and if-else is invoked to compare with user-defined commands and run the functions if matches.

Step9: END

3.2 CODING

```
#define trigPin 12

#define echoPin 11

#define buzz 4

#include <SoftwareSerial.h>

SoftwareSerial blue(0, 1);

char Incoming_value = 0;

long duration, distance;

char t;

int enA = 10;

int in1 = 9;

int in2 = 8;

// motor two

int enB = 5;
```

```
int in3 = 7;
int in4 = 6;

void setup()
{
  // set all the motor control pins to outputs
  Serial.begin(9600);
  pinMode(enA, OUTPUT);
  pinMode(enB, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
  pinMode(13, OUTPUT);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(buzz, OUTPUT);
}

void forwardMove()
{
  //forward
```

```
  digitalWrite(in1, HIGH);
  digitalWrite(in2, LOW);
  analogWrite(enA, 200);
  digitalWrite(in3, HIGH);
  digitalWrite(in4, LOW);
  analogWrite(enB, 200);
}

void reverseMove()
{
  //reverse
  digitalWrite(in1, LOW);
  digitalWrite(in2, HIGH);
  analogWrite(enA, 200);
  digitalWrite(in3, LOW);
  digitalWrite(in4, HIGH);
  analogWrite(enB, 200);
}

void leftMove()
{
digitalWrite(in1, LOW);
```

```
  digitalWrite(in2, LOW);
  digitalWrite(in3, HIGH);
  digitalWrite(in4, LOW);
  analogWrite(enB, 200);
}

void rightMove()
{
  digitalWrite(in1, HIGH);
  digitalWrite(in2, LOW);
  analogWrite(enA, 200);
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
  analogWrite(enB, 200);
}

void stopp()
{
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
```

```
}

void objectDetected()
{
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
  delay(1000);
  digitalWrite(in1, LOW);
  digitalWrite(in2, HIGH);
  analogWrite(enA, 200);
  digitalWrite(in3, LOW);
  digitalWrite(in4, HIGH);
  analogWrite(enB, 200);

}

void loop() {
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
```

```
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) / 29.1;
if(distance < 5 )
{ digitalWrite(led,HIGH);
objectDetected();
}
else{digitalWrite(buzz,LOW);}
Serial.print(distance);
Serial.println(" cm");
 if (Serial.available() > 0)
 {
   Incoming_value = Serial.read();
   Serial.print(Incoming_value);
   Serial.print("/n");
   if (Incoming_value == 'F')
   {
     forwardMove();
   }
   else if (Incoming_value == 'B')
   {
```

```
      reverseMove();
    }
    else if (Incoming_value == 'R')
    {
      rightMove();
    }
    else if (Incoming_value == 'L')
    {
      leftMove();
    }
    else if (Incoming_value == 'S')
    {
      stopp();
    }
  }

}
```

3.3 SIMULATION

Circuit Simulation in proteus platform:

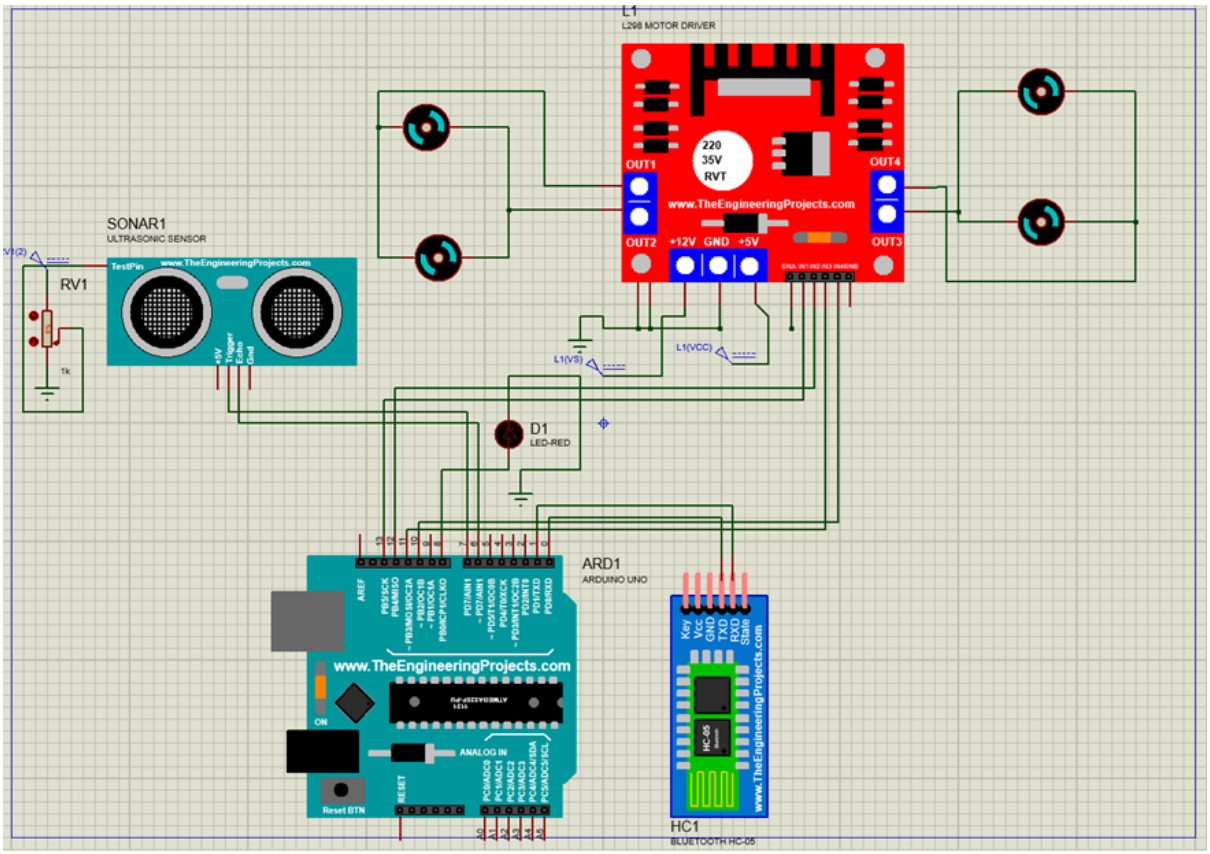

Figure 9 Software Diagram

[Software Simulation]

4. CONCLUSION AND FUTURE WORK

4.1 RESULT

We have implemented a Bluetooth controlled robotic vehicle that uses Ultrasonic sensor to detect obstacles around its surroundings. The buzzer helps to notify the user the presence of obstacles and the vehicle automatically moves back to redirect the path. The communication is established between the vehicle and the app through the Bluetooth module.

4.2 INFERENCE

It can be observed from the hardware implementations that the Bluetooth control vehicle can detect any obstacle that comes in the radius of 15 cm. The vehicle stops immediately for 2seconds and goes in reverse to diverge away from

the path with the obstacle. The controls are set back to user input. All the commands from the app are sent to the vehicle without any delay. The vehicle can move in different directions: forward, backward, right and left.

4.3 CONCLUSION

Main objective of this project is to ease the human effort through mechanical help. This project works as a smart object as the remote-controlled car can be used wireless with Bluetooth module so the user can control it with more freedom. The project work has been studied and implemented a complete working model of using Arduino uno board which comprises of ATmega328p microcontroller. The programming and interfacing of the Arduino board with project components has been mastered during the project implementation. The project can move packages around small places and micromanage storage facilities with less human interaction. Therefore, such systems are very much useful when implemented on a large scale and can bring significant changes in the storage facilities as with added advantages such as simple circuit implementation and flexibility in design.

4.4 FUTURE WORK

As the advancement of technology is taking place at a fast pace. Project can be improved in the future in many ways.

Usage of robotic cars in military purposes, using it as metal detectors to do recon on land mines.

It can also be used in Mining area to sense poisonous gases or to search for someone who is missing in the place of mining.

REFERENCES

1. https://en.wikipedia.org/wiki/Arduino
2. https://lastminuteengineers.com/l298n-dc-stepper-driver-arduino-tutorial/
3. https://www.indiamart.com/proddetail/motor-driver-module-22586762355.html
4. https://lastminuteengineers.com/arduino-sr04-ultrasonic-sensor-tutorial/
5. https://www.indiamart.com/proddetail/ultrasonic-sensor-hc-sr04-module-for-arduino-18101779448.html
6. https://www.indiamart.com/proddetail/bluetooth-module-hc-05-12392814812.html
7. https://www.electronicscomp.com/60-rpm-dual-shaft-bo-motor-straight?gclid=Cj0KCQiAnaeNBhCUARIsABEee8UVWlHHClCENF8ZWs2PkKxs4_tix0xAQ8NOzQ1Gl3URgcQi8u54NXYaAllyEALw_wcB
8. https://www.pcboard.ca/minipiezo-buzzer

BIODATA

Name : SURYA Y

Mobile Number : 8754280344

E-mail :surya.y2019@vitstudent.ac.in

Permanent Address: No 2, Adhinadh nagar, kolathur,chennai-99

Name : KHAMALESH KUMAR P

Mobile Number : 7299967025

E-mail : khamaleshkumar.p2019@vitstudent.ac.in

Permanent Address:No.149, thirugnana sambandar street thiruvalleswarar , chennai -40

Name : S.R SHIVARITHA

Mobile Number : 9840457340

E-mail : shivaritha.sr2019@vitstudent.ac.in

Permanent Address: Flat No.1 G-block 9th street, Chennai-102

Name : LALITHA.G

Mobile Number : 9840020658

E-mail : lalitha.g2019@vitstudent.ac.in

Permanent Address: A4,VS Apartments, K.R.koil street, west mambalam, Chennai-33