ECE4003 – EMBEDDED SYSTEM DESIGN

J-COMPONENT REVIEW-II

Fall 2021-2022

MOBILE REMOTE CONTROLLED ROBOT

GROUP MEMBERS:

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OBJECTIVE OF THE PROJECT

- The motive of the project is to construct a robotic vehicle that can be operated on a touch screen display unit for remote operation.
- The robot uses obstacle detection sensors.
- The bluetooth module helps to communicate with the robot to move.

EMBEDDED DESIGN PROCESS

Embedded design process includes the below stages.

- Requirements
- Specifications
- Architecture
- Components
- System integration

REQUIREMENTS

PURPOSE: The robot is used for storage management.

INPUT: User commands via app.

OUTPUT: The robot moves according to the user's command.

If an object is detected in its path, it alerts the user.

FUNCTIONS OF THE SYSTEM: The user sends commands to the system using an app via bluetooth module.

The user clicks the keys to move the robot.

POWER DISSIPATION: As required by mechanical units, display units and computer system.

PERFORMANCE: Yet to be decided.

PROCESS DEADLINES: The system does not move unless any input is given. The speed of the robot is constant.

USER INTERFACE: App used in touch screen mobile.

MANUFACTURING COST: Rs.1400

SPECIFICATIONS

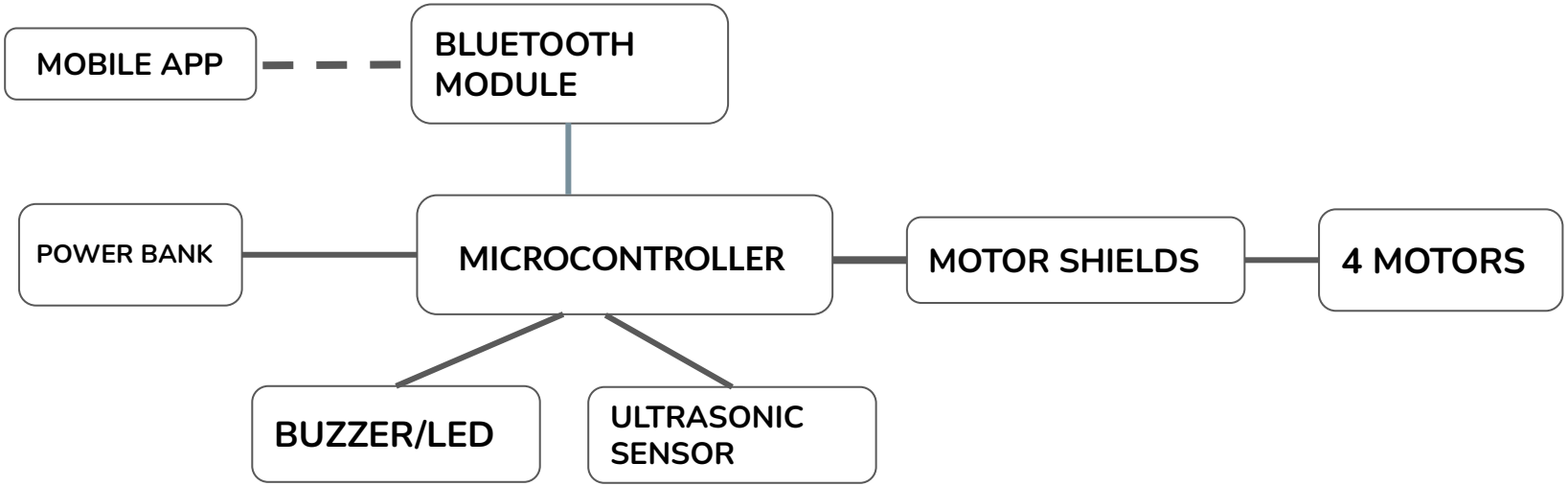
Mobile application: We use Arduino bluetooth RC car app to control the Robot Car. Owner can interact with the robot with this application and move it around.

Bluetooth module: HC05 bluetooth module uses serial communication. The use of a bluetooth module is to transmit and receive data using wireless communication between two devices. It is usually used for short-range connection. Use of 2.4GHz frequency band.

TOOLS REQUIRED

- Arduino Uno (ATMEGA328P)
- 4 Motors
- Battery for motor
- Power bank of 5v to power the Arduino
- HC-05 Bluetooth module
- 4 wheel Robotic chassis
- L298N DC Motor Driver Shield
- Ultrasonic sensor
- Buzzer

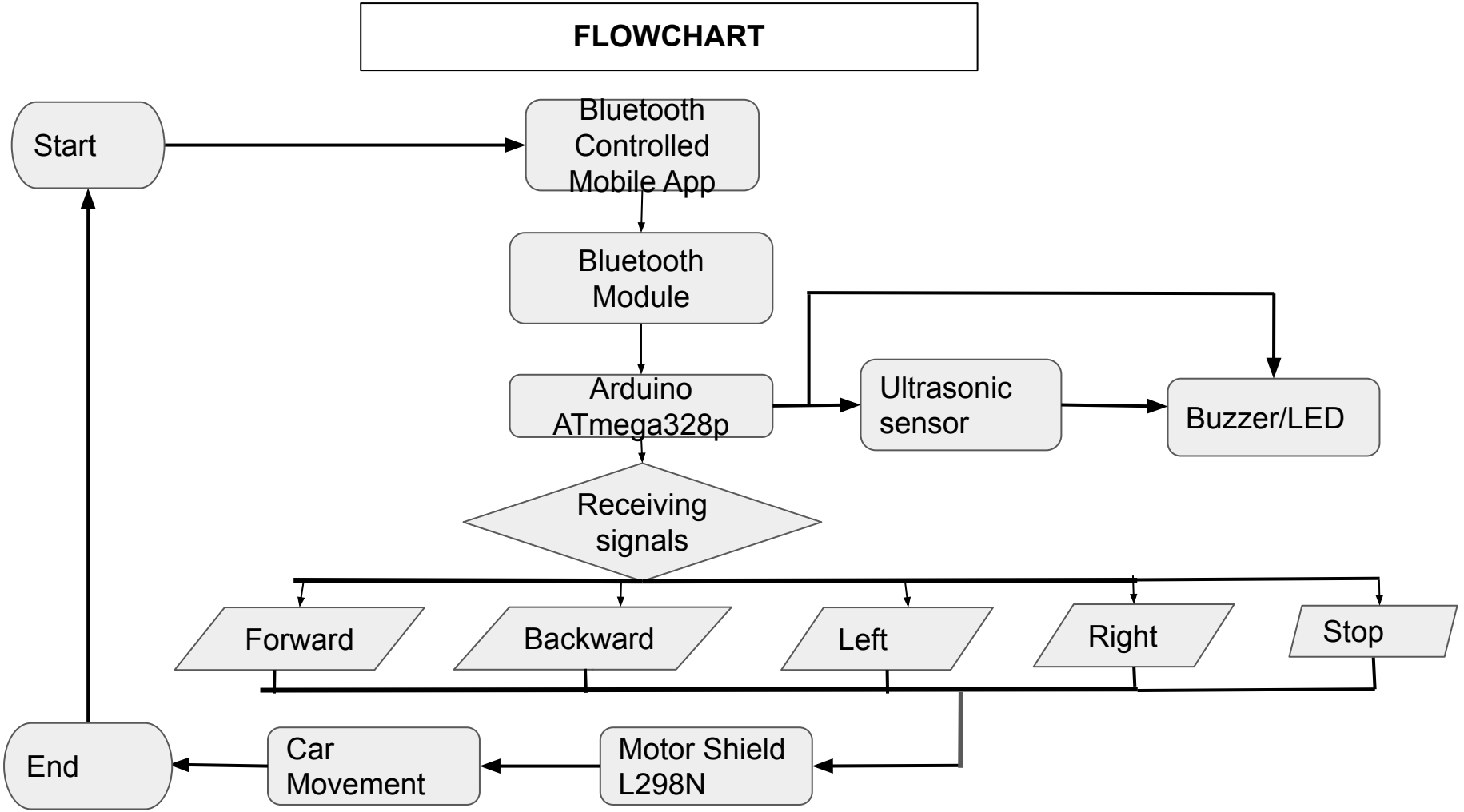
ARCHITECTURE



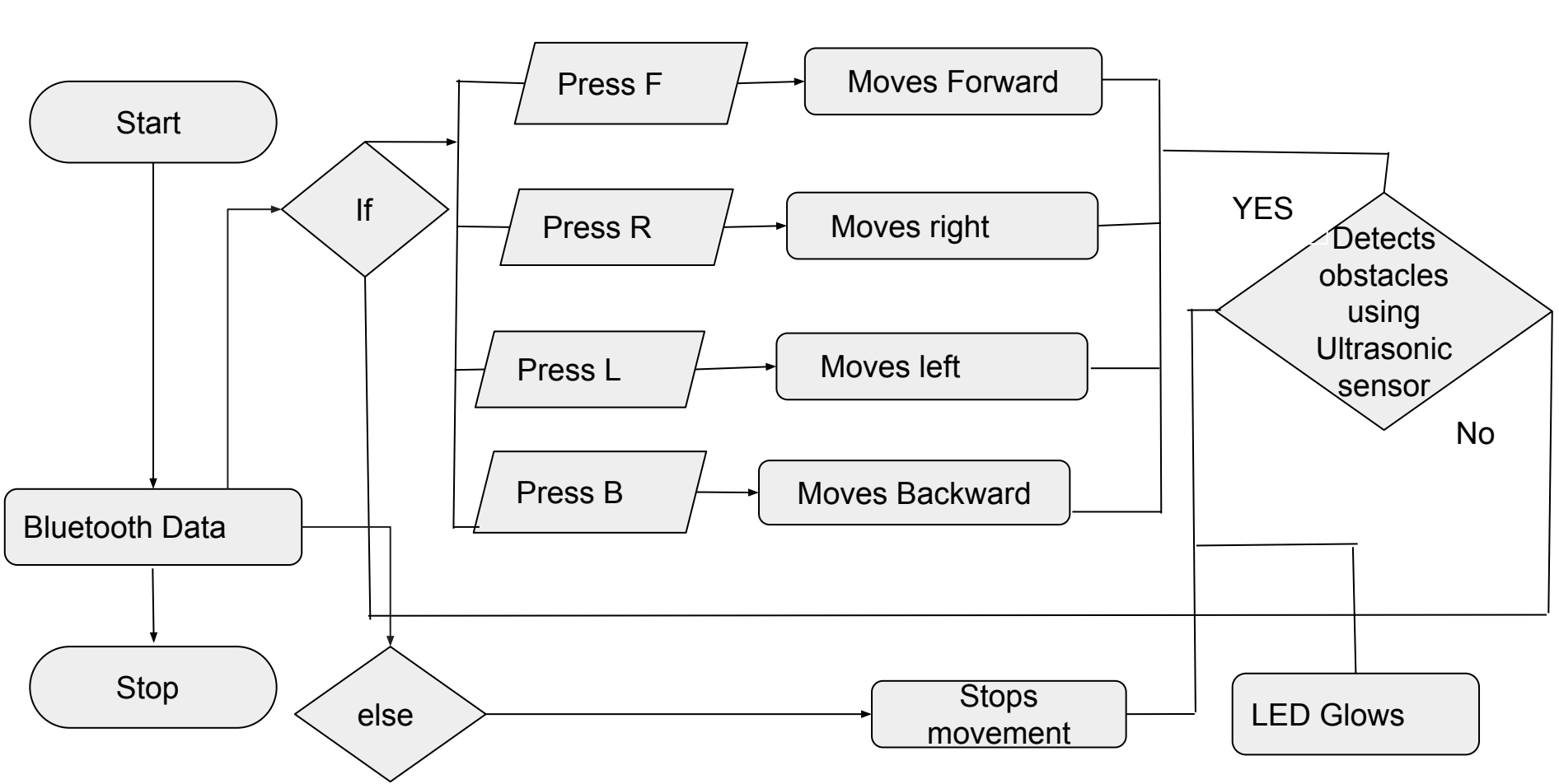
SYSTEM INTEGRATION

Test and validation conditions:

- When an obstacle is detected the buzzer must notify the user.
- All user commands must function correctly.
- The control commands must function properly.


FLOWCHART
Start
Bluetooth Controlled Mobile App
Bluetooth Module
Arduino ATmega328p
Ultrasonic sensor
Buzzer/LED
Receiving signals
Forward
Backward
Left
Right
Stop
Motor Shield L298N
Car Movement
End

SOFTWARE ALGORITHM



CODE

```
char t;
 const int echoPin = 6;                 // Echo Pin of Ultrasonic Sensor
const int pingPin = 7;                  // Trigger Pin of Ultrasonic Sensor
const int LED=8;
void setup() {
pinMode(13,OUTPUT);                     //left motors forward
pinMode(12,OUTPUT);                     //left motors reverse
pinMode(11,OUTPUT);                     //right motors forward
pinMode(10,OUTPUT);                     //right motors reverse
pinMode(LED,OUTPUT);
```

```
Serial.begin(9600);
 pinMode(pingPin, OUTPUT);                    // initialising pin 7 as output
  pinMode(echoPin, INPUT);                    // initialising pin 6 as input
}

void loop() {
  long duration, inches, cm;

  digitalWrite(pingPin, LOW);
  delayMicroseconds(2);

  digitalWrite(pingPin, HIGH);
  delayMicroseconds(10);

  digitalWrite(pingPin, LOW);
```

```
  duration = pulseIn(echoPin, HIGH);                  // using pulsin function to determine total time
  cm = microsecondsToCentimeters(duration);           // calling method
Serial.println(cm);


if(cm<20)
{
  digitalWrite(13,LOW);
digitalWrite(12,LOW);
digitalWrite(11,LOW);
digitalWrite(10,LOW);
 digitalWrite(LED,HIGH);
 }
```

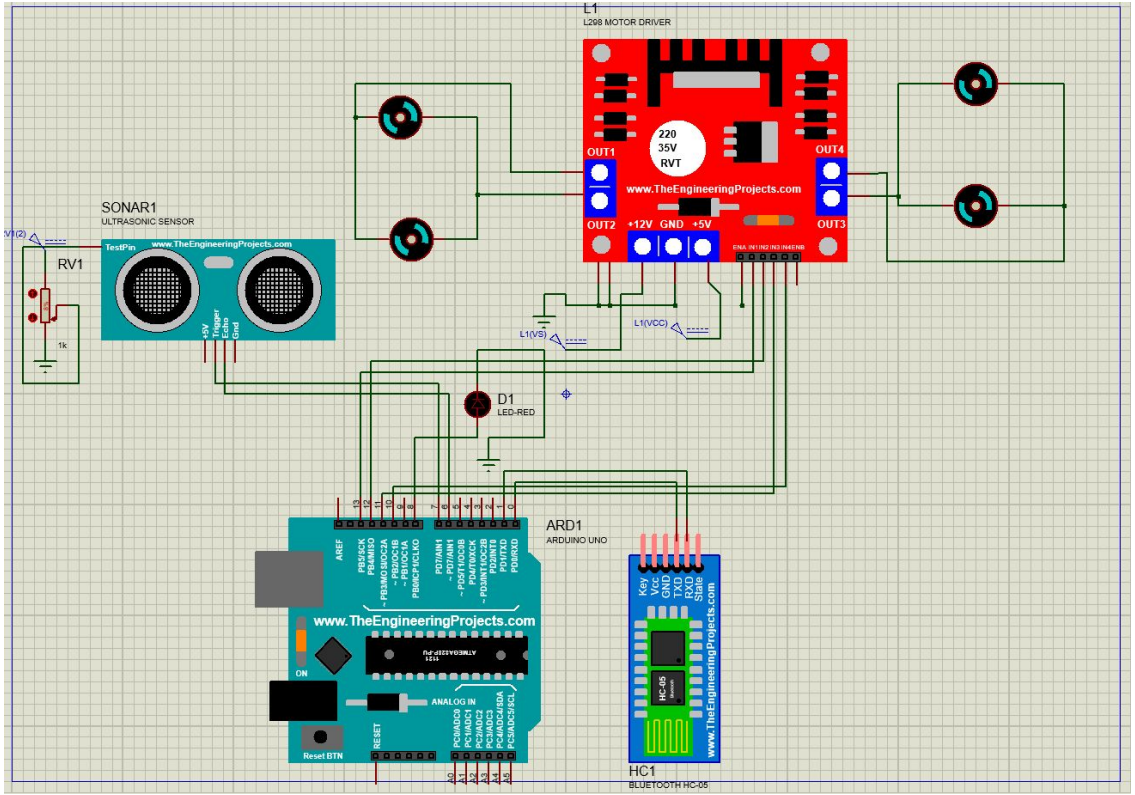
```
else
 digitalWrite(LED,LOW);
if(Serial.available()){
  t = Serial.read();
  Serial.println(t);
}
if(t == 'F'){                          //move forward(all motors rotate in forward direction)
  digitalWrite(13,HIGH);
  digitalWrite(11,HIGH);
}
else if(t == 'B'){                     //move reverse (all motors rotate in reverse direction)
  digitalWrite(12,HIGH);
  digitalWrite(10,HIGH);
}
```

```
else if(t == 'L'){        //turn left (right side motors rotate in forward direction, left side motors doesn't rotate)
  digitalWrite(11,HIGH);
}
else if(t == 'R'){        //turn right (left side motors rotate in forward direction, right side motors doesn't rotate)
digitalWrite(13,HIGH);
}
else if(t == 'S'){      //STOP (all motors stop)
  digitalWrite(13,LOW);
  digitalWrite(12,LOW);
  digitalWrite(11,LOW);
  digitalWrite(10,LOW);
}
```

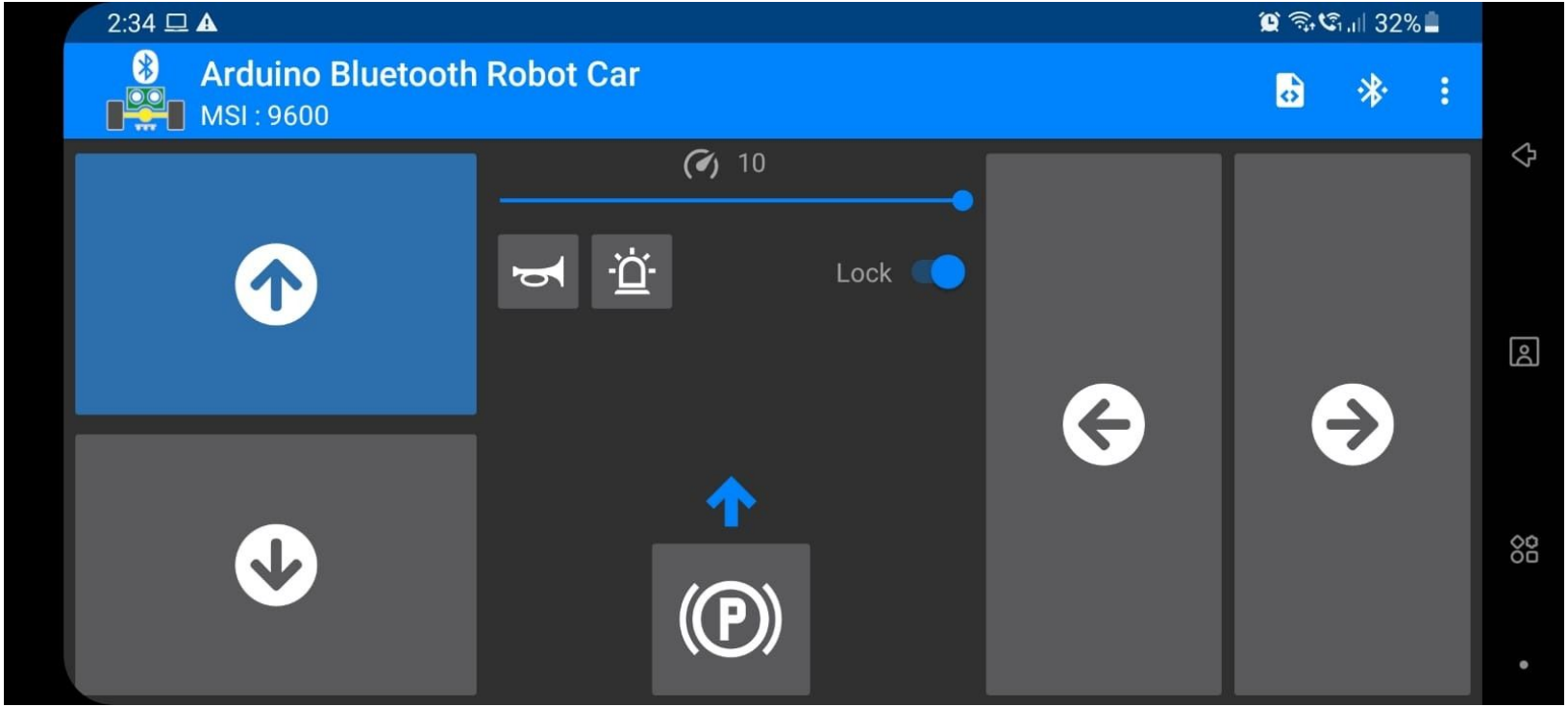
```
delay(100);
}

long microsecondsToCentimeters(long microseconds)          // method to convert microsec to centimeters
{
   return microseconds / 29 / 2;
}
```

SIMULATION RESULTS

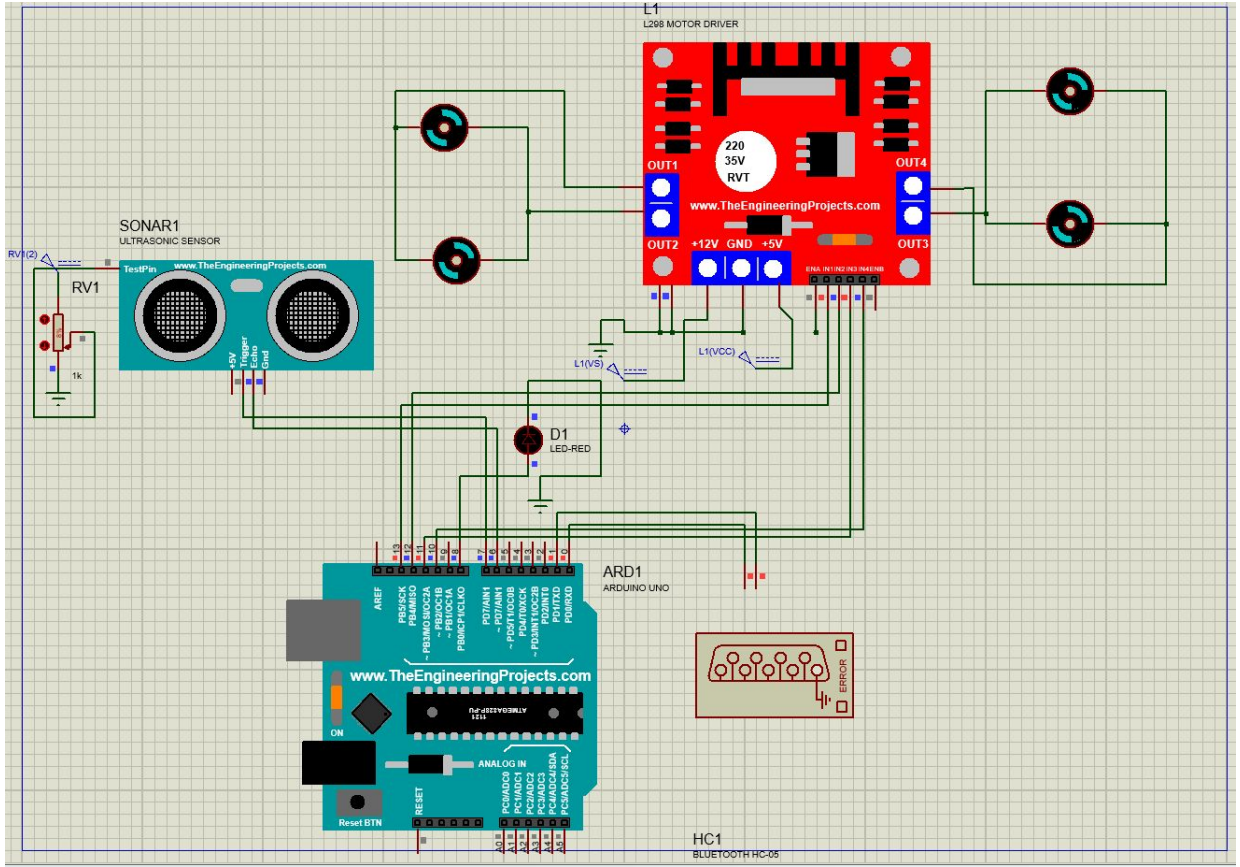
Proteus simulation:



Forward button in the mobile application is pressed:



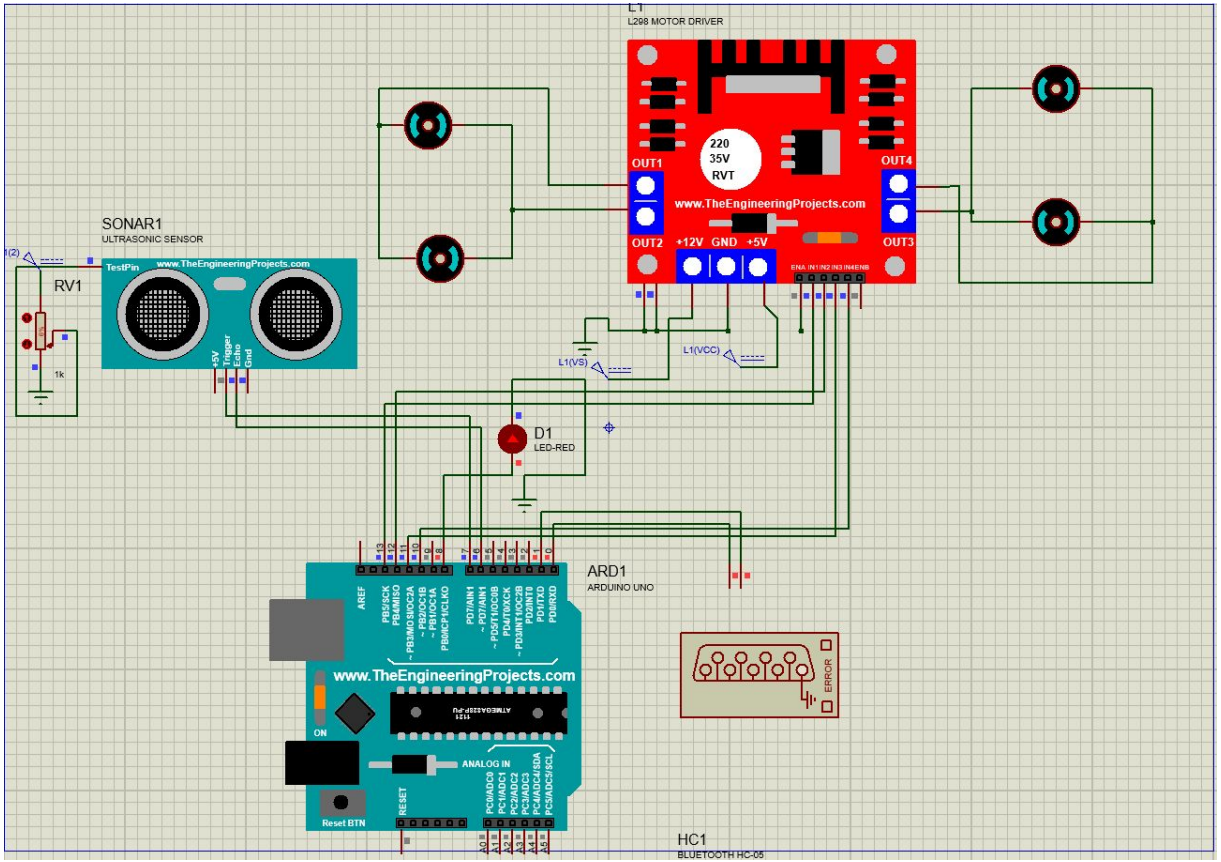
When we press the forward button in the mobile application all the motors will run in forward direction:



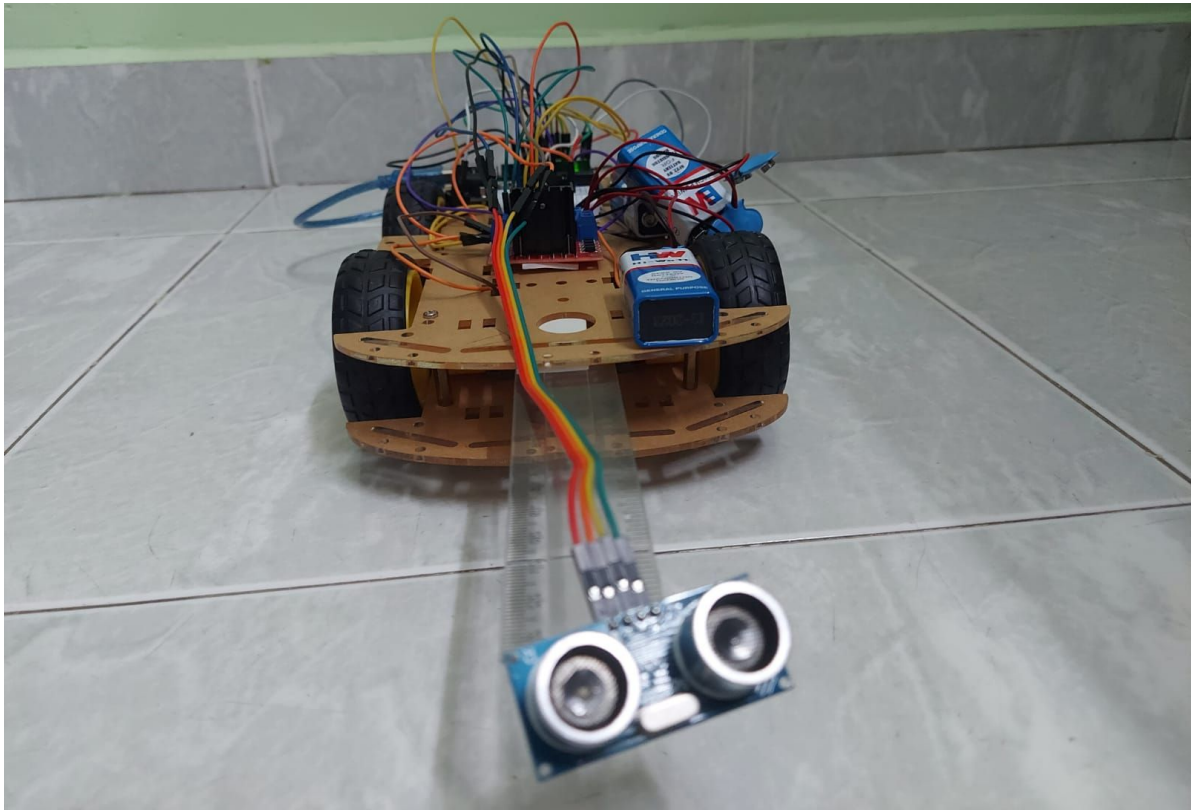
Similarly when we press

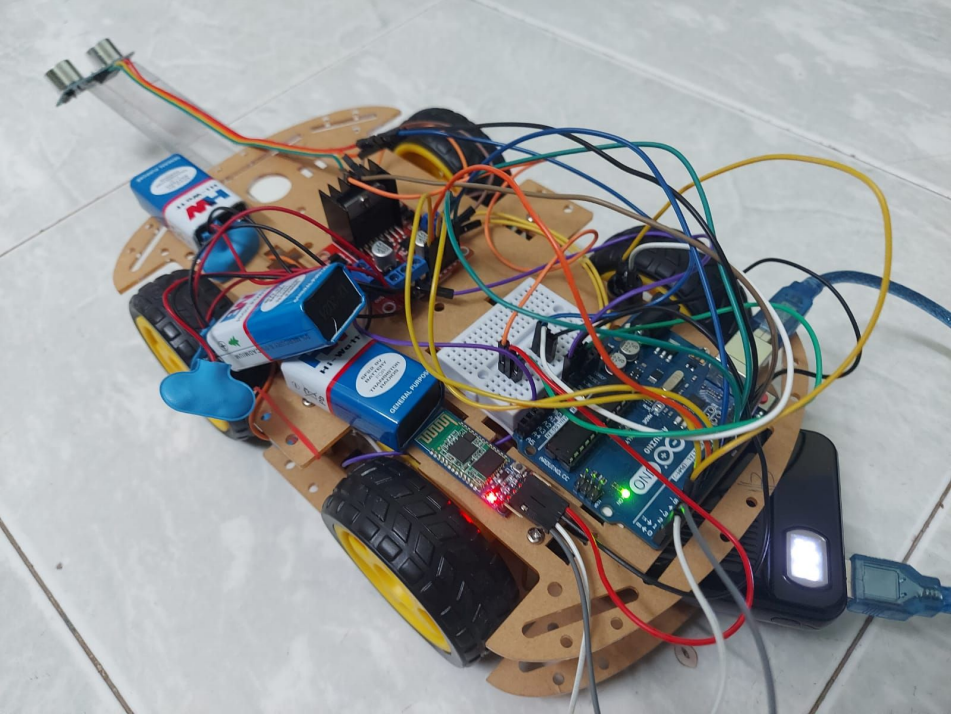
- **The reverse button in the mobile application all the motors will run in reverse direction.**
- **The left button in the mobile application both the right motors will run in forward direction.**
- **The right button in the mobile application both the left motors will run in forward direction.**

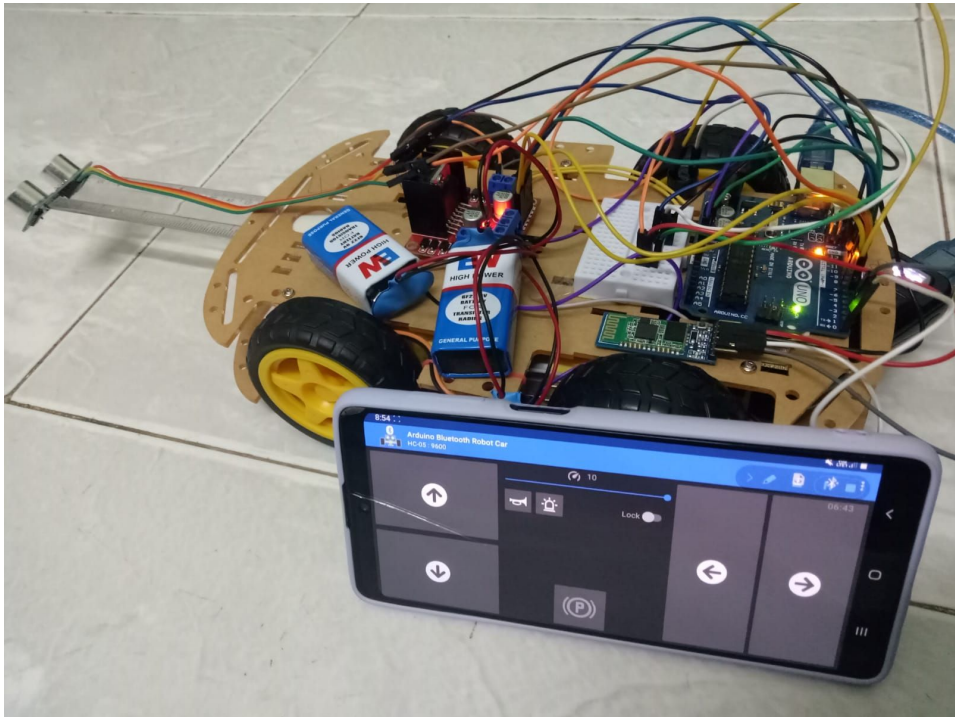
When the distance is less than 20cm which is measured by using ultrasonic sensor the LED light go HIGH indicating that there is an obstacle and stops the motors.



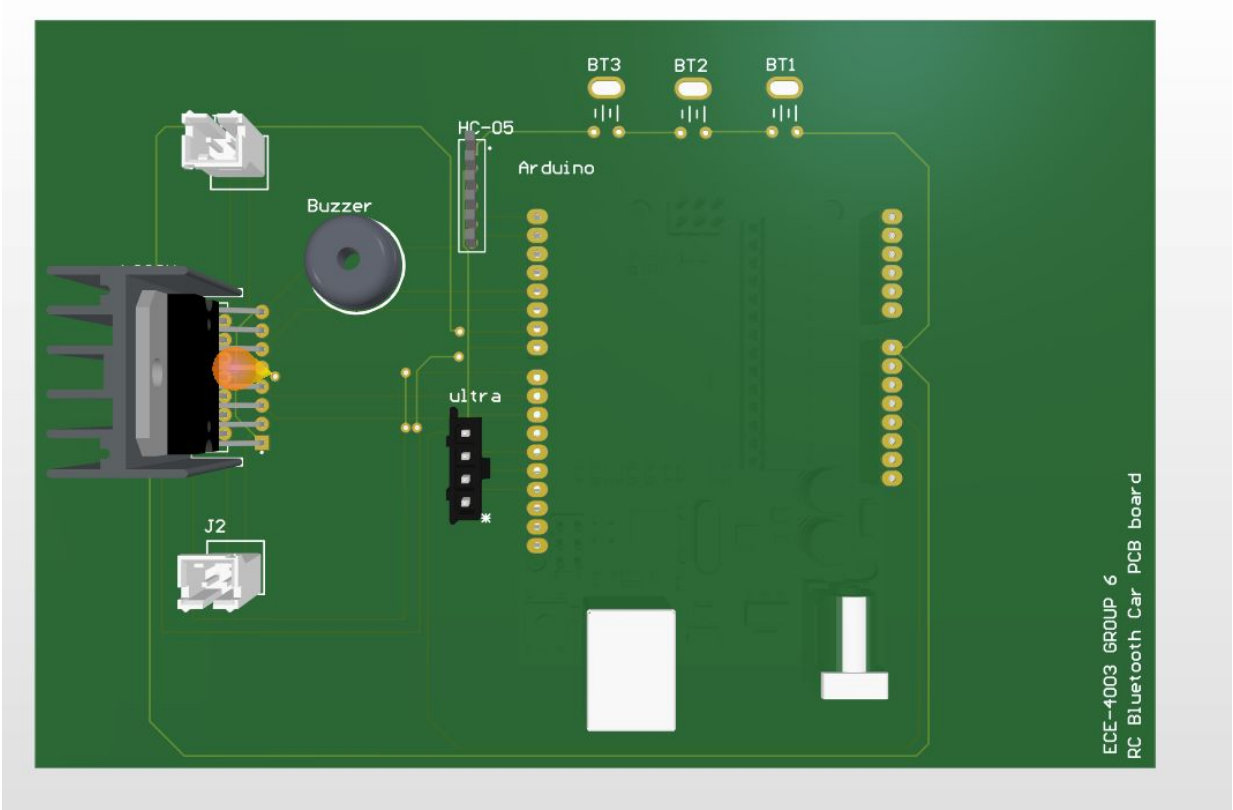
HARDWARE

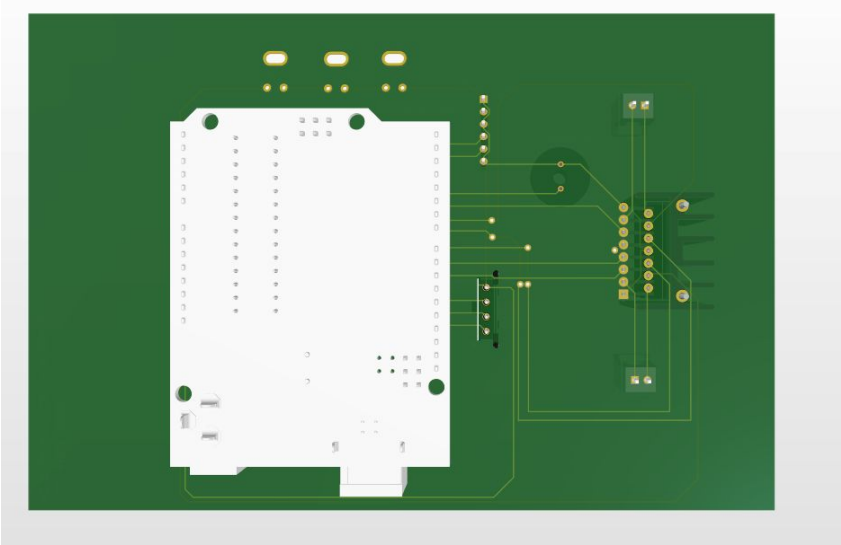


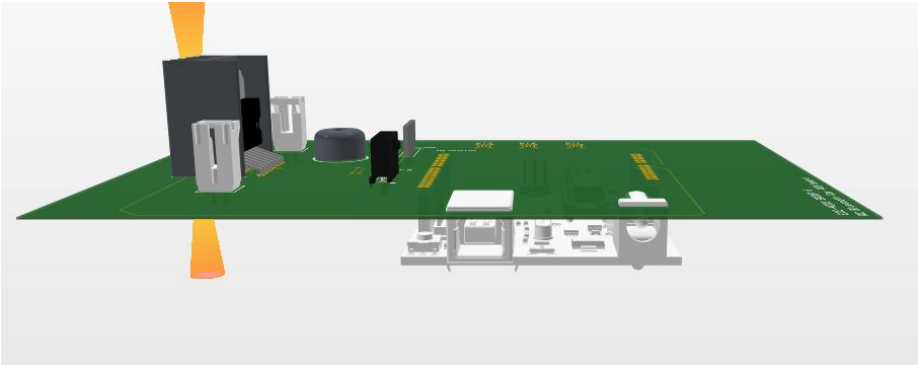


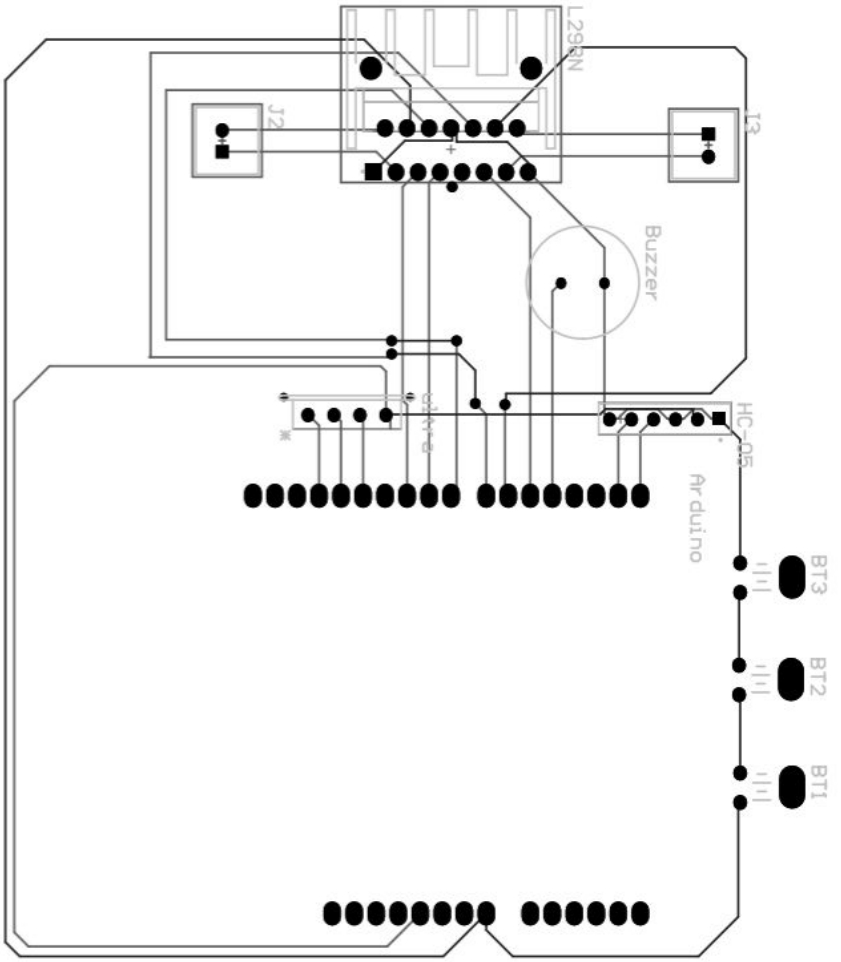

Arduino Bluetooth Robot Car
Lock

PCB DESIGN

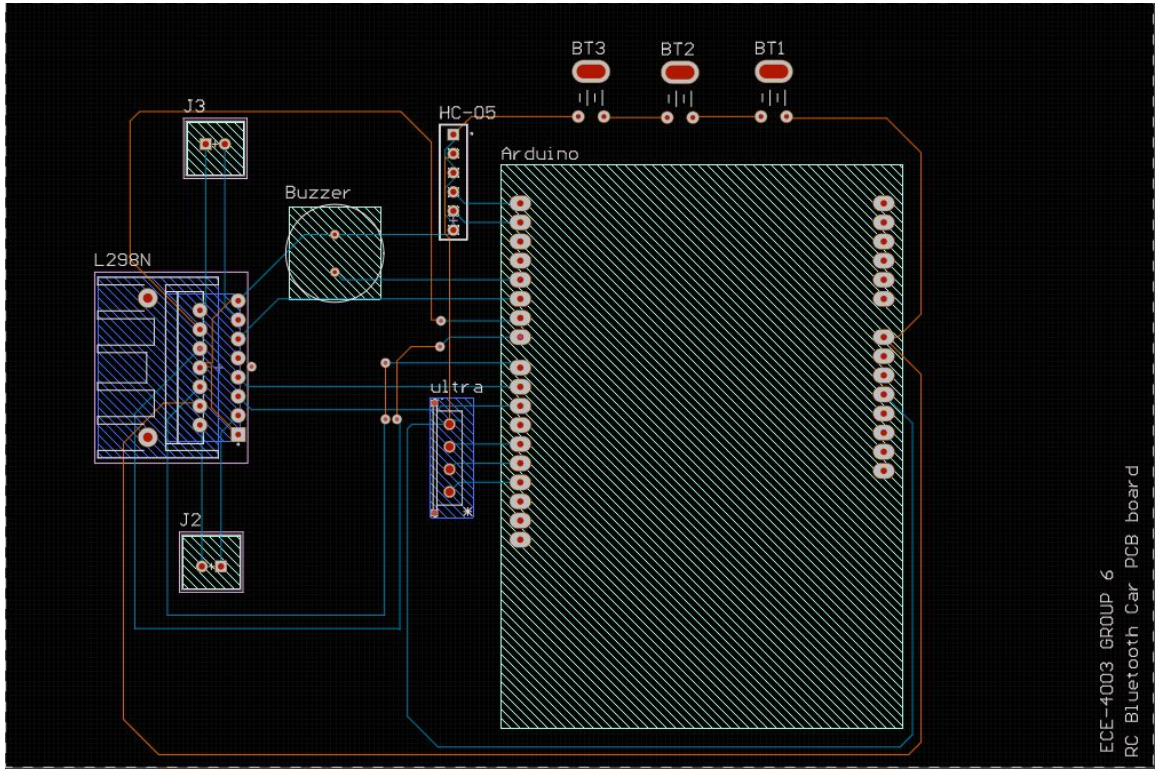

BT3
BT2
BT1
HC-05
Arduino
Buzzer
ultra
J2
ECE-4003 GROUP 6
RC Bluetooth Car PCB board



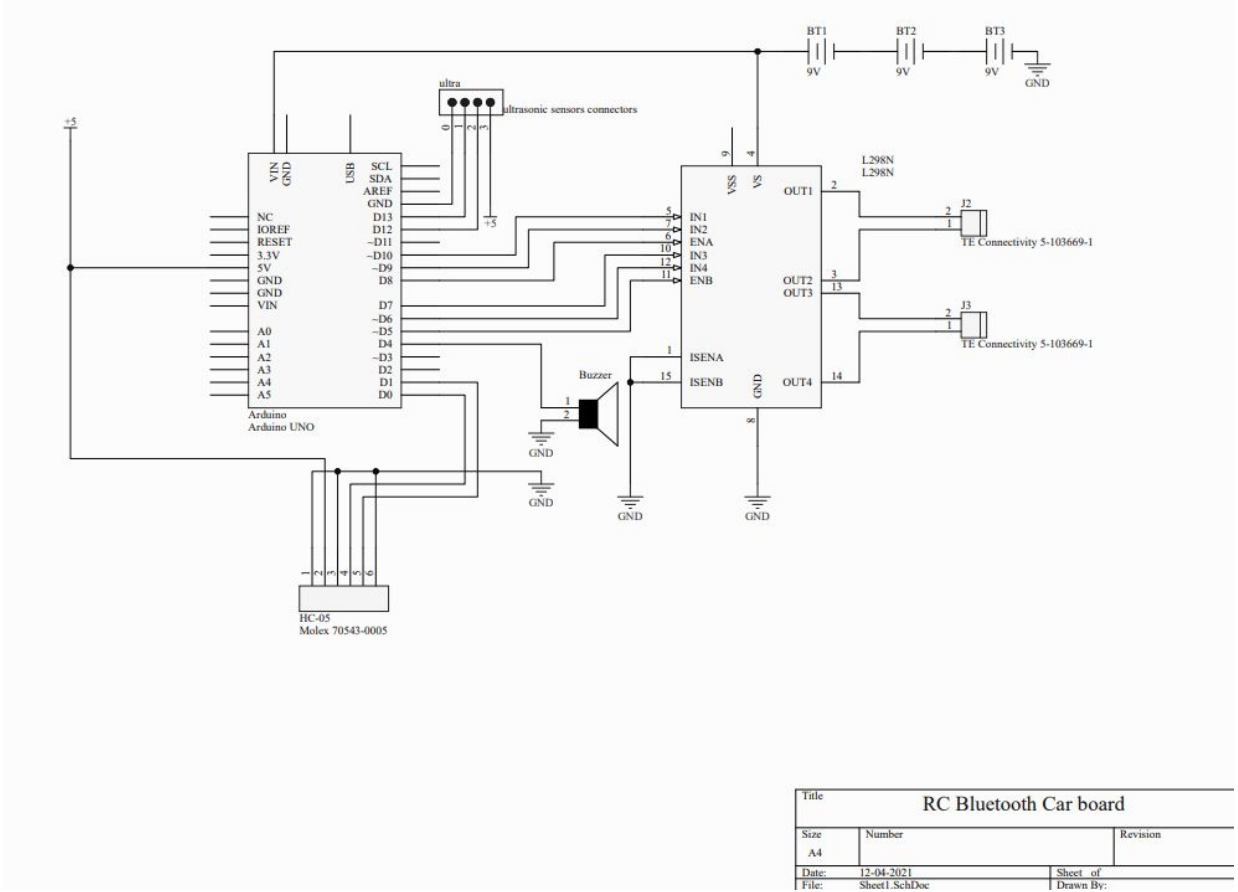




ECE-4003 GROUP 6
RC Bluetooth Car PCB board


BT3
BT2
BT1
J3
HC-05
Arduino
Buzzer
L298N
ultra
J2
ECE-4003 GROUP 6
RC Bluetooth Car PCB board

SCHEMATIC


BT1
BT2
BT3
9V
9V
9V
GND
ultra
ultrasonic sensors connectors
+5
VIN
GND
USB
SCL
SDA
AREF
GND
NC
IOREF
RESET
3.3V
5V
GND
GND
VIN
A0
A1
A2
A3
A4
A5
D13
D12
~D11
~D10
~D9
D8
D7
~D6
~D5
D4
~D3
D2
D1
D0
Arduino
Arduino UNO
L298N
L298N
VSS
VS
IN1
IN2
ENA
IN3
IN4
ENB
ISENA
ISENB
GND
OUT1
OUT2
OUT3
OUT4
J2
J3
TE Connectivity 5-103669-1
TE Connectivity 5-103669-1
Buzzer
GND
GND
GND
GND
HC-05
Molex 70543-0005
Title
RC Bluetooth Car board
Size
A4
Number
Revision
Date:
12-04-2021
Sheet of
File:
Sheet1.SchDoc
Drawn By:

COST ANALYSIS

Total cost of the project- Rs. 1349

- Arduino- Rs.399
- Chassis- Rs.576
- L298N- Rs.106
- Buzzer- Rs.11
- Ultrasonic Sensor- Rs.84
- Bluetooth module- Rs.223
- Jumper Cables- Rs.50

APPLICATIONS

- A similar system can be used for remote controlled vacuum cleaners.
- This system can be implemented as metal detectors.
- It can be implemented as a pick and place robot.
- It is used for storage management.