INFORMATION TECHNOLOGY UNIVERSITY

Course Title
ELECTRONICS WORKBENCH

(Semester -1)

Final Project Title

LINE-FOLLOWING AND OBSTACLE-AVOIDING ROBOT

Presented By:

1. Ahmad Waleed Akhtar (BSCE22003)
2. Muhammad Arham (BSCE22007)
3. Hadia Ahmad (BSCE22017)

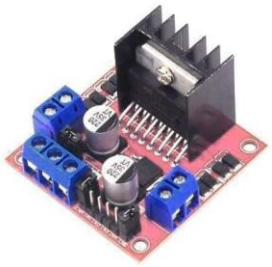
Presented To:

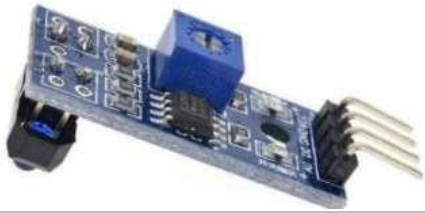
Sir Junaid Ashraf

Date of submission:

December 12, 2022

COMPONENT TABLE:

NAME OF COMPONENTS:	PICTURE OF COMPONENT	NUMBER OF COMPONENTS
1. ARDUINO UNO-R3 2. USB CABLE		1
3. ROBOT CAR CHASSIS		1
4.L298 MOTOR DRIVER		1
4. PIN-TO-HOLE JUMPER WIRE SET		1
6. JUMPER WIRE SET		1

NAME OF COMPONENTS:	PICTURE OF COMPONENT	NUMBER OF COMPONENTS
7. 3 X 18650 CELL HOLDER		1
8. SPST On-Off Switch		2
9. Ultrasonic Sensor Module		1
10. LINE FOLLOWING MODULE		2

WORKING OF COMPONENT:

1. Arduino Uno:

   Arduino Uno controls the whole car. All the components are directly or indirectly connected and controlled by it.
2. Robot Car Chassis:

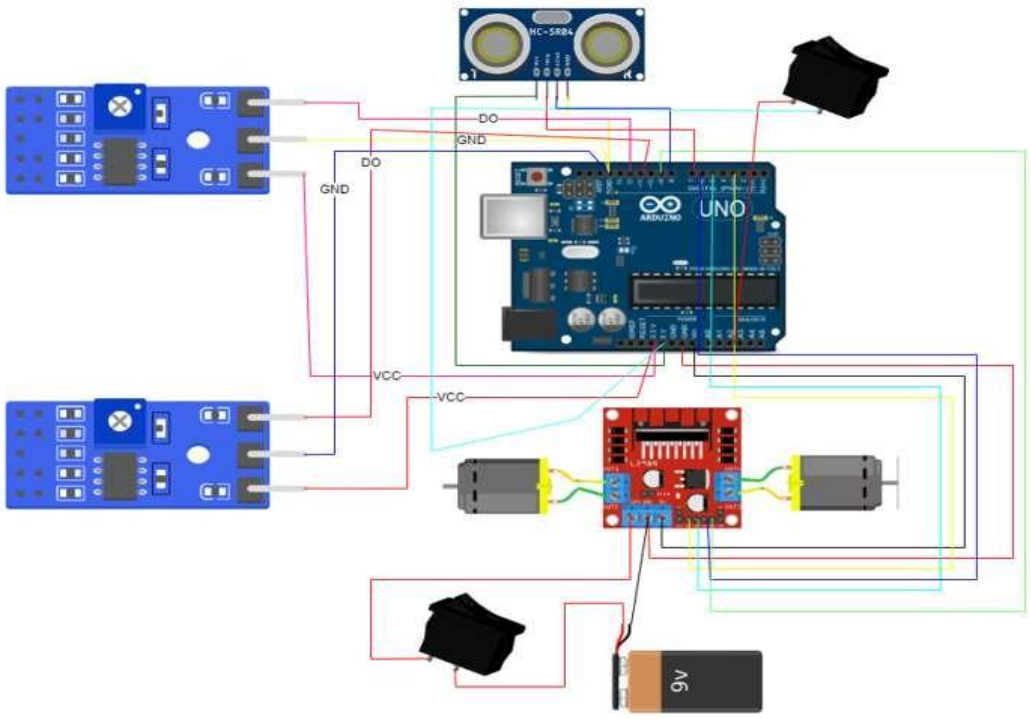
   All the components i.e. Arduino, DC motors, ultrasonic sensor, line following module, cell holder, and L298 are fixed on the car chassis.
3. L298 Motor driver:

   L298 motor driver is used to provide the necessary voltage required to run a DC motor. As the Arduino cannot supply more voltage than 5V, L298 is used to provide up to 12 volts to the DC motors. L298 can control 2 motors at a time.
4. Ultrasonic Sensor Module:

   The ultrasonic sensor module consists of a receiver, a transmitter, and a control circuit. The ultrasonic sensor uses sonar to determine the distance to an object like bats or dolphins do. The sensor. The transmitter sends a sonar signal which is received by the receiver. Its ranging accuracy is about 400cm.
5. Line Following Module:

   The line following module consists of a transmitter and receiver. The transmitter sends an infrared light which is reflected back from a surface and received by the transmitter. If the surface is black the light is absorbed by it and nothing is received by the receiver of the module in this way the module detects whether the surface is black or not.

SCHEMATIC DIAGRAM:



CODE EXPLANATION:

```
int left_forward = 3;                  // pin that moves the left motor forward
int left_backward = 5;                 // pin that moves the right motor forward
int right_forward = 6;                 // pin that moves the left motor backward
int right_backward = 9;                // pin that moves the right motor
backward
int sensor_2 = 8;                      // this is a pin for the right sensor
int sensor_1 = 7;                      // this is a pin for the left sensor
int send = 13;                         // this pin is the one attached to the
trigpin of the ultrasound sensor
int recieve = 12;                      // this pin is attached to the echo pin
of the ultra sound sensor
long distance;
int button = 11;                       // this is the pin of the switch
int forward_speed = 80;
int backward_speed = 63;

void forward(int speed)                          // function to run both the
motors forward
{
  analogWrite(right_forward, speed);
  analogWrite(left_forward, speed);
  analogWrite(left_backward, 0);
  analogWrite(right_backward, 0);
}

void backward(int speed)                         // to run both the motors
backward
{
  analogWrite(right_forward, 0);
  analogWrite(left_forward, 0);
  analogWrite(left_backward, speed);
  analogWrite(right_backward, speed);
}

void right_for()                       // to run the right forward at low speed
{                                      // and the left at full speed
  analogWrite(right_forward, 100);
  analogWrite(left_forward, 255);
  analogWrite(left_backward, 0);
  analogWrite(right_backward, 0);
}

void right(int speed)                            // to turn the bot right
{
```

```
  analogWrite(right_forward, 0);
  analogWrite(left_forward, speed);
  analogWrite(left_backward, 0);
  analogWrite(right_backward, 0);
}

void left_for()                          // to run the left forward at low speed
{                                        // and the right at full speed
  analogWrite(right_forward, 255);
  analogWrite(left_forward, 100);
  analogWrite(left_backward, 0);
  analogWrite(right_backward, 0);
}

void left (int speed)                              // to turn the bot left
{
  analogWrite(right_forward, speed);
  analogWrite(left_forward, 0);
  analogWrite(left_backward, 0);
  analogWrite(right_backward, 0);
}

void halt()                               // to stop the bot
{
  analogWrite(right_forward, 0);
  analogWrite(left_forward, 0);
  analogWrite(left_backward, 0);
  analogWrite(right_backward, 0);
}

long measure_distance()                  // to measure the distance from the
ultrasound sensor
{
  digitalWrite(send, LOW);
  delay(2);
  digitalWrite(send, HIGH);
  delay(5);
  digitalWrite(send, LOW);
  long duration = pulseIn (recieve, HIGH);
  return duration / 29 / 2;
}

void line_follow()                        // function for the line following bot
{
  if (digitalRead(sensor_1) && digitalRead(sensor_2))
```

```
  {
    forward(forward_speed);
  }
  else if (!digitalRead(sensor_1) && digitalRead(sensor_2))
  {
    left(63);
  }
  else if (digitalRead(sensor_1) && !digitalRead(sensor_2))
  {
    right(63);
  }
  else if (!digitalRead(sensor_1) && !digitalRead(sensor_2))
  {
    halt();
  }
}

void ostracle_avoiding()                  // function for the obstacle avoiding
bot
{
  Serial.println(measure_distance());
  if (measure_distance() <= 40)
  {
    halt();
    delay(500);
    backward(backward_speed);
    delay(500);
    halt();
    delay(500);
    left(127);
    delay(250);
  }
  else
  {
    forward(127);
  }
}

void setup()
{
  pinMode(left_forward, OUTPUT);
  pinMode(left_backward, OUTPUT);
  pinMode(right_forward, OUTPUT);
  pinMode(right_backward, OUTPUT);
  pinMode(sensor_1, INPUT);
```

```
  pinMode(sensor_2, INPUT);
  pinMode(recieve, INPUT);
  pinMode(send, OUTPUT);
  pinMode(button, INPUT);
  Serial.begin(9600);
}

void loop() {
  if (digitalRead(button))
  {
    line_follow();
  }
  else
  {
    ostracle_avoiding();
  }
}
```

WORKING OF THE PROJECT:

When the main switch button is turned on the whole car comes to life. The second switch determines the mode of the car i.e. whether it is in line following mode or obstacle-avoiding mode. If the second switch is 'ON' the car is in obstacle-avoiding mode and if the button is 'OFF' the car is in line following mode.

1. Obstacle Avoiding:

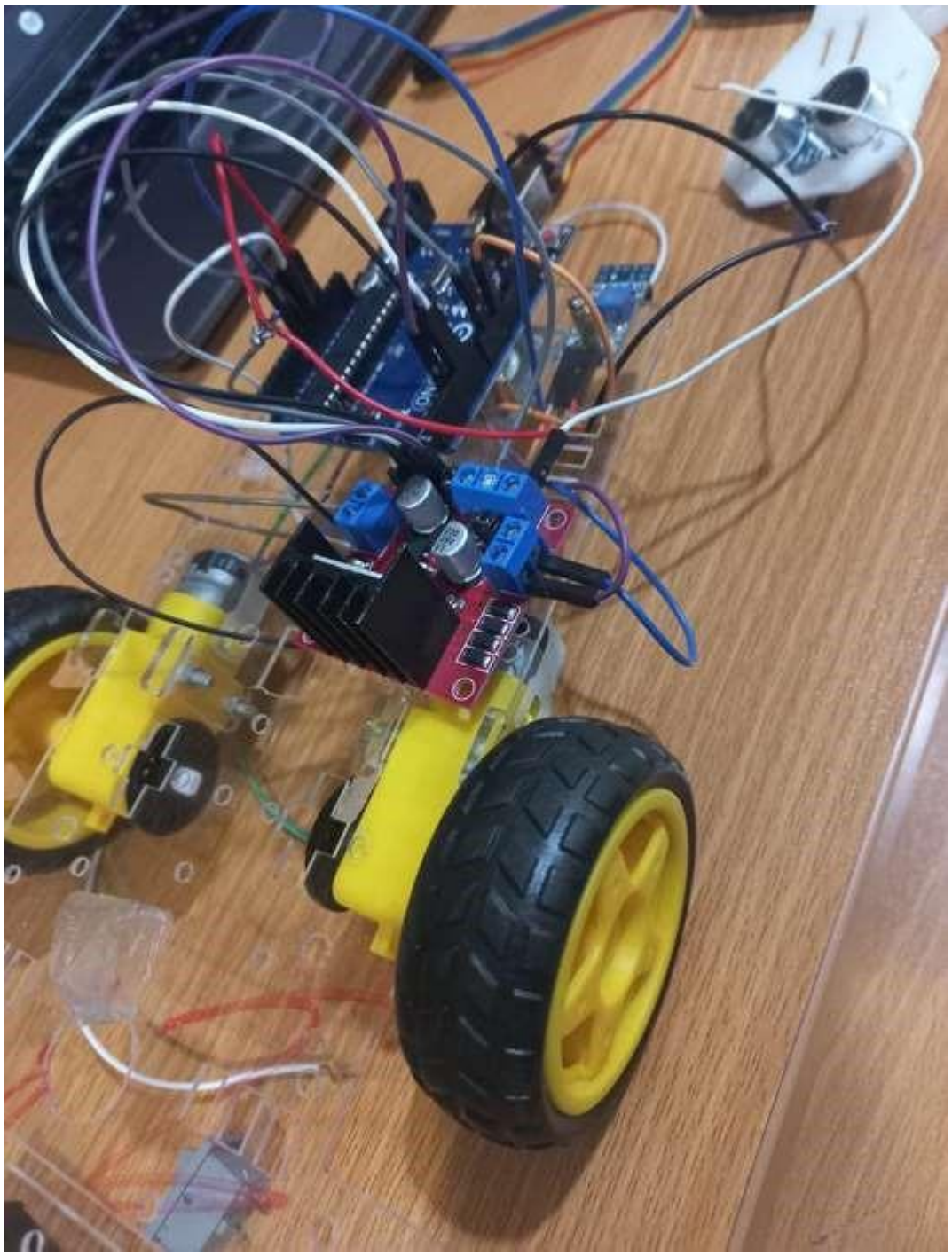
In this mode, the ultrasonic sensor sends a sonar signal. This signal bounces off a surface and returns to the receiver of the ultrasonic sensor after some interval of time. Depending upon this interval of time the distance between the sensor and the object, from which the sonar signal bounced back, is determined. If this distance is less than 30 cm the car stops, moves backward, turns left, and again checks the distance between the sensor and the object it is facing. This process is repeated continuously until the distance between the sensor and the object it is facing becomes greater than 30 cm. Once the distance becomes greater than 30 cm the car starts moving forward.

2. Line Following:

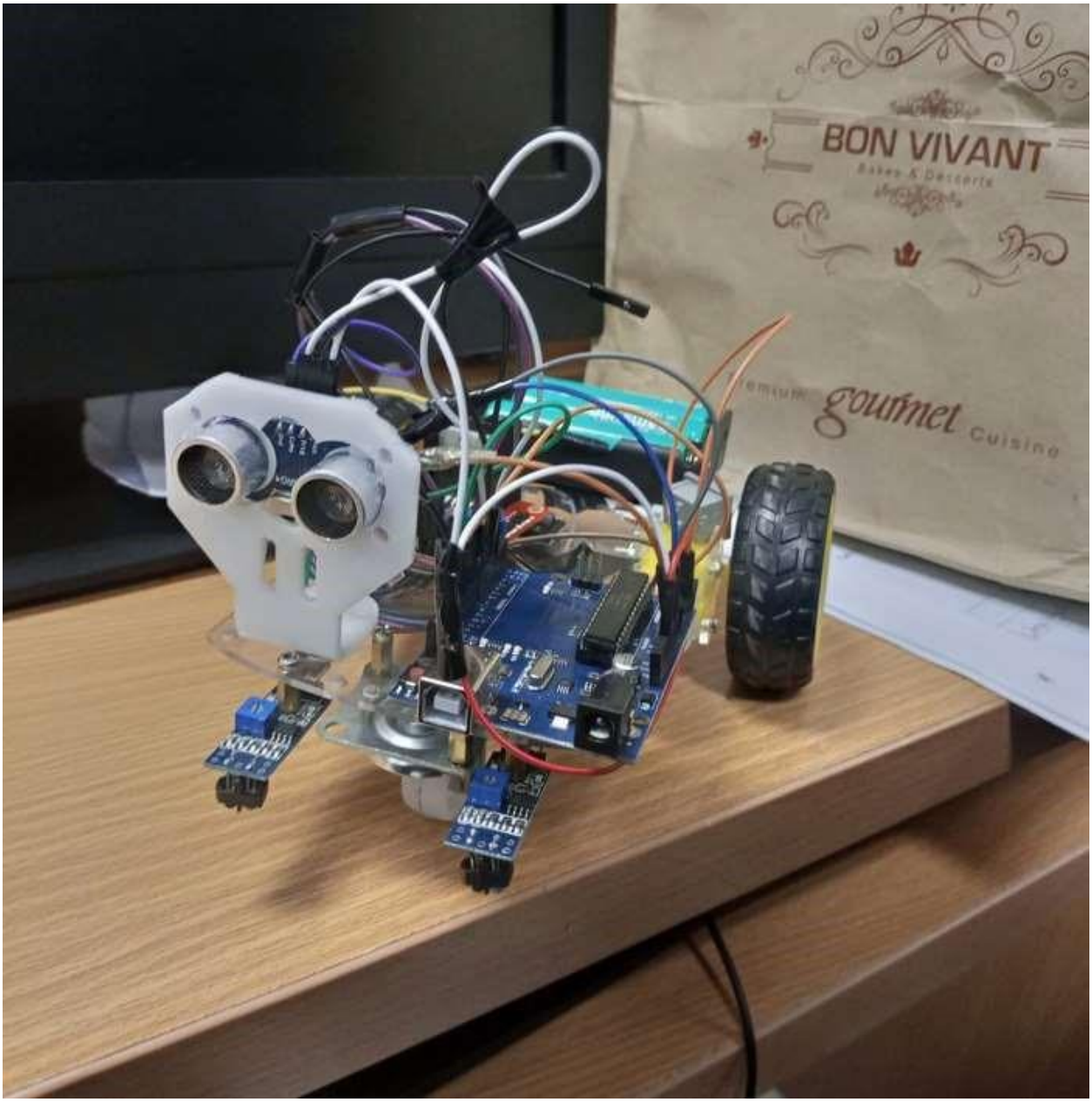
In this mode, line-following modules are used to make the car follow a specific black line. The line following module consists of a transmitter and receiver. The transmitter sends an

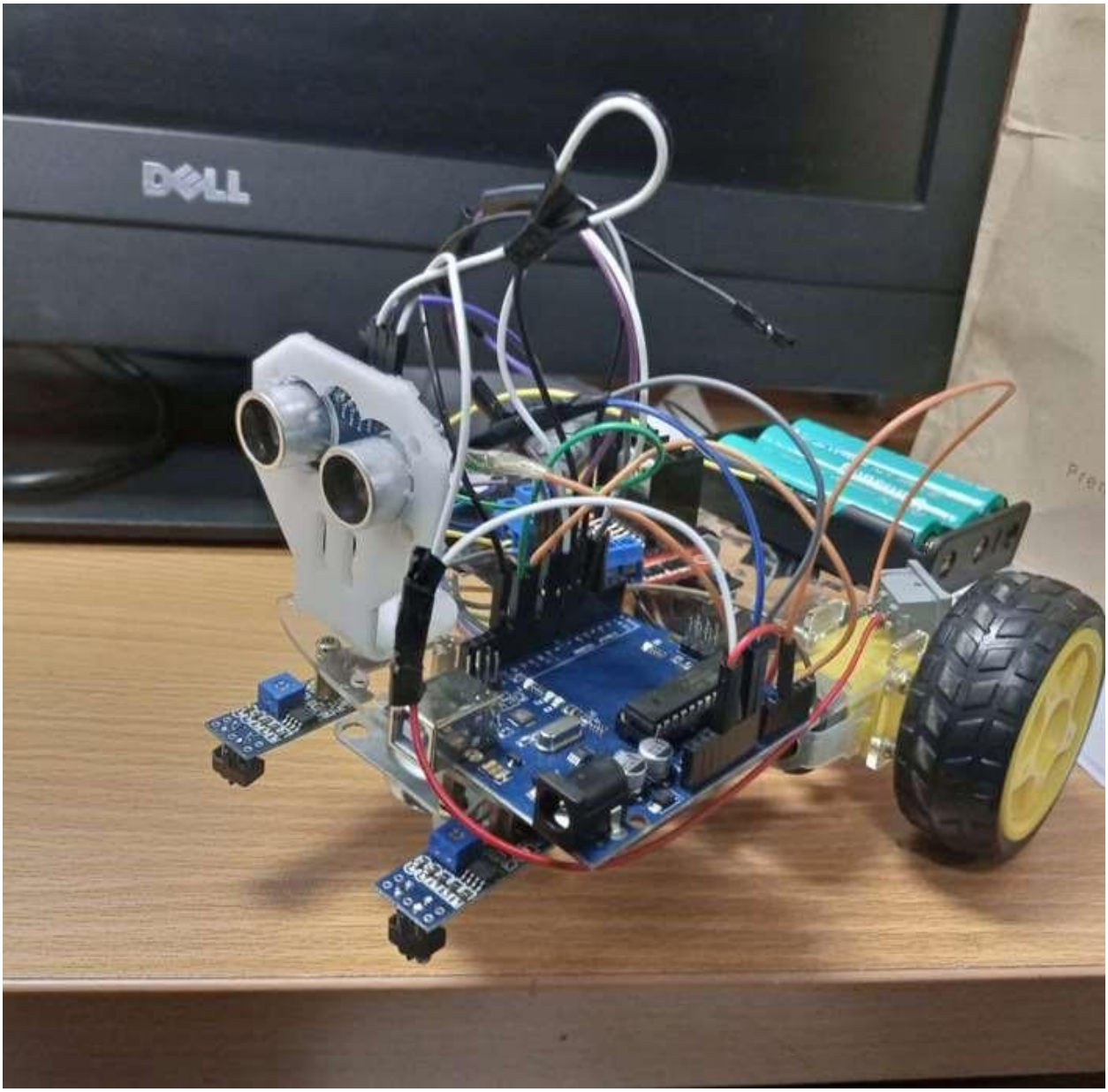
infrared light which is reflected from a surface and received by the transmitter. If the surface is black the light is absorbed by it and nothing is received by the receiver of the module in this way the module detects whether the surface is black or not. The car consists of a left and right module. If the left module detects black color the cars turn left, if the right module detects black color the car turns right, if both modules detect black color the car stops and if none of the modules detect black color the car moves forward.

WORKING ON PROJECT:



FINAL PRODUCT:





RESULT:

The car is working perfectly. It changes its mode from obstacle avoiding to the line following when the second button is turned ‘OFF’. In obstacle-avoiding mode, the car is able to avoid all the obstacles perfectly while in line-following mode the car is able to follow the black line perfectly.