INFORMATION TECHNOLOGY UNIVERSITY

Course Title

ELECTRONICS WORKBENCH

(Semester -1)

Final Project Title

LINE-FOLLOWING AND OBSTACLE-AVOIDING ROBOT

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Presented To:

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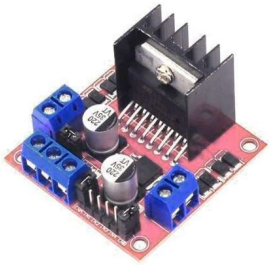
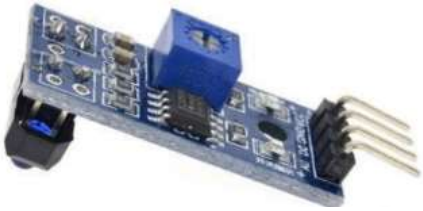
Date of submission:

December 12, 2022

COMPONENT TABLE:

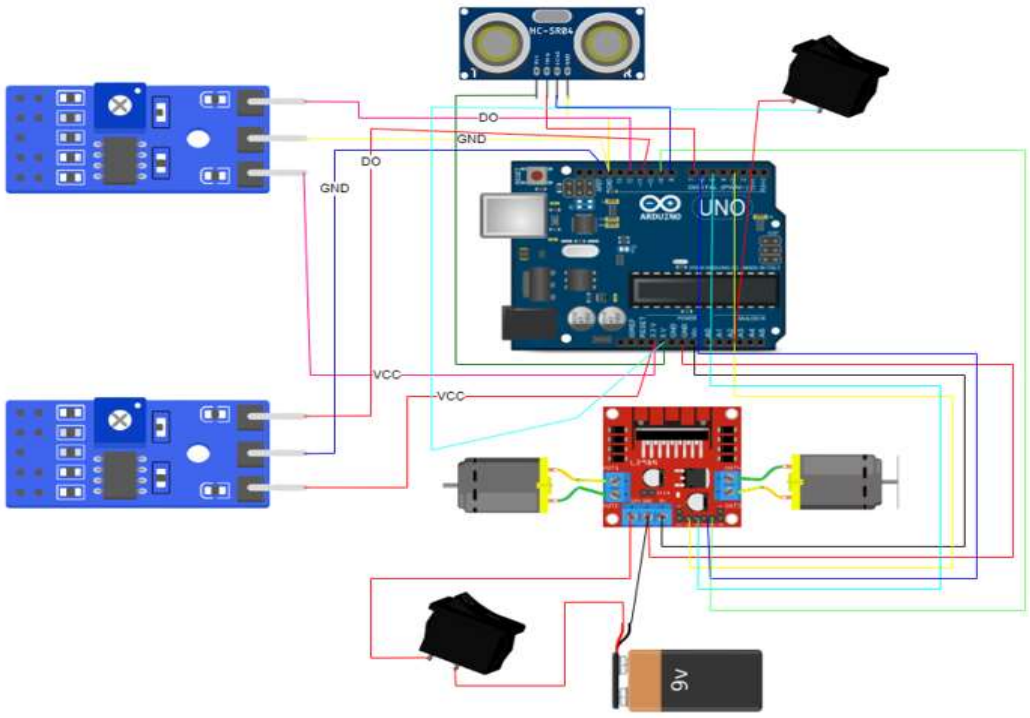
NAME OF COMPONENTS:	PICTURE OF COMPONENT	NUMBER OF COMPONENTS
1. ARDUINO UNO-R3 2. USB CABLE		**1**
3. ROBOT CAR CHASSIS		1
4.L298 MOTOR DRIVER		1
4. PIN-TO-HOLE JUMPER WIRE SET		1
6. JUMPER WIRE SET		1

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:

```
#define csL 11   //pin of left line sensor
#define csR 12   //pin of right line sensor
int mode = A2;   //pin of mode changing button
int in1 = 3;     //motor 1 terminal 1
int in2 = 5;     //motor 1 terminal 2
int in3 = 6;     //motor 2 terminal 1
int in4 = 9;     //motor 2 terminal 2
long distance;   //initializing variable to store distance of ultrasonic sensor
from obstacle
int pingPin = 7; //trigpin of ultrasonic sensor
int echoPin = 8; //echopin of ultrasonic sensor
int state;       //variable to store value of current state of button

long measure(){  //function to measure distance between obstacle and ultrasonic
sensor
digitalWrite(pingPin, LOW); //trigpin has no power i.e. no signal is send
delayMicroseconds(2);       //2 microsecond delay
digitalWrite(pingPin, HIGH);//trigpin has full power i.e. a signal is send
delayMicroseconds(5);       //5 microsecond delay
digitalWrite(pingPin, LOW); //trigpin has no power i.e. no signal is send
long duration = pulseIn(echoPin, HIGH);//function to measure the length of pulse
on echopin and store in variable
return duration / 29 / 2; // return value in centimeters
}

void motor_fwd(int fwd_speed){ //function to move car forward
  analogWrite(in1 ,fwd_speed); //move motor 1 in forward
  analogWrite(in2 ,0);
  analogWrite(in3 ,fwd_speed); //move motor 2 in forward
  analogWrite(in4 ,0);
  // delay(500);
}

void motor_back(int back_speed){ //function to move car backward
  analogWrite(in2 ,back_speed);  //move motor 1 in backward
  analogWrite(in1 ,0);
  analogWrite(in4 ,back_speed);  //move motor 2 in backward
  analogWrite(in3 ,0);
//  delay(500);
}

void turn_right(int right_speed){ //function to turn car right
```

```
  analogWrite(in1 ,right_speed);  //move motor 1 in forward
  analogWrite(in2 ,0);
  analogWrite(in4 ,right_speed);  //move motor 2 in backward
  analogWrite(in3 ,0);
  // delay(300);
}

void turn_left(int left_speed){  //function to turn car left
  analogWrite(in2 ,left_speed);  //move motor 1 in backward
  analogWrite(in1 ,0);
  analogWrite(in3 ,left_speed);  //move motor 2 in forward
  analogWrite(in4 ,0);
  // delay(300);
}

void stop(){  //function to stop the car
  analogWrite(in2 ,0); //stop motor 1
  analogWrite(in1 ,0);
  analogWrite(in3 ,0); //stop motor 2
  analogWrite(in4 ,0);
  // delay(500);
}

void obstacle_avoiding(int speed){ //function for obstacle avoiding mode
  distance = measure();            //calling function to find the distance
between car and obstacle
  Serial.println(distance);        //printing the distance
  if ( distance <= 30 ){          //if distance is less than 30
    stop();                        //stop the car
    delay (2000);                  //delay of 2 sec
    motor_back(speed);             //move the car back
    delay(1000);                   //delay for 1 sec
    stop();                        //stop the car
    delay(500);                    //delay for 0.5 sec
    turn_left(speed);              //turn the car left
    delay(1000);                   //delay for 1 sec
  }
  else{                            //if distance is greater than 30
  motor_fwd(speed);                //move the car forward
  }
}

void line_follow(int speed){                         //function for line
following mode
```

```
  if (!digitalRead(csL) && !digitalRead(csR)){        //if both sensor detect
colour other tha black
    motor_fwd(speed);                                 //move the car forward
  }
  else if (!digitalRead(csL) && digitalRead(csR)){    //if right sensor detects
black colour
    turn_right(speed);                                //turn the car right
  }
  else if (digitalRead(csL) && !digitalRead(csR)){    //if left sensor detects
black colour
    turn_left(speed);                                 //turn the car left
  }
  else if (digitalRead(csL) && digitalRead(csR)){     //if both sensors detect
black colour
    stop();                                           //stop the car
  }
}

void setup() {              //function to set pins and Arduino setting
  pinMode(pingPin, OUTPUT); //set pingpin to output
  pinMode(csL, INPUT);      //set csL pin to input
  pinMode(csR, INPUT);      //set csR pin to input
  pinMode(mode, INPUT);     //set mode pin to input
  Serial.begin(9600);       //serial.begin to write analog functions
}

void loop() {                       //loop to follow
  Serial.println(analogRead(mode)); //printing button state
  // delay(1000);
  state = analogRead(mode);         //storing value of mode in state
  if (state > 1000){                //if state is greater than 1000 i.e. button
is ON
   obstacle_avoiding(127);          //Makes the car obstacle avoiding
   Serial.println("1");             //print 1
  }
  else{                             //if state is less than 1000 i.e. button is
OFF
    line_follow(127);               //Makes the car line following
    Serial.println("0");            //print 0
  }
}
```

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.

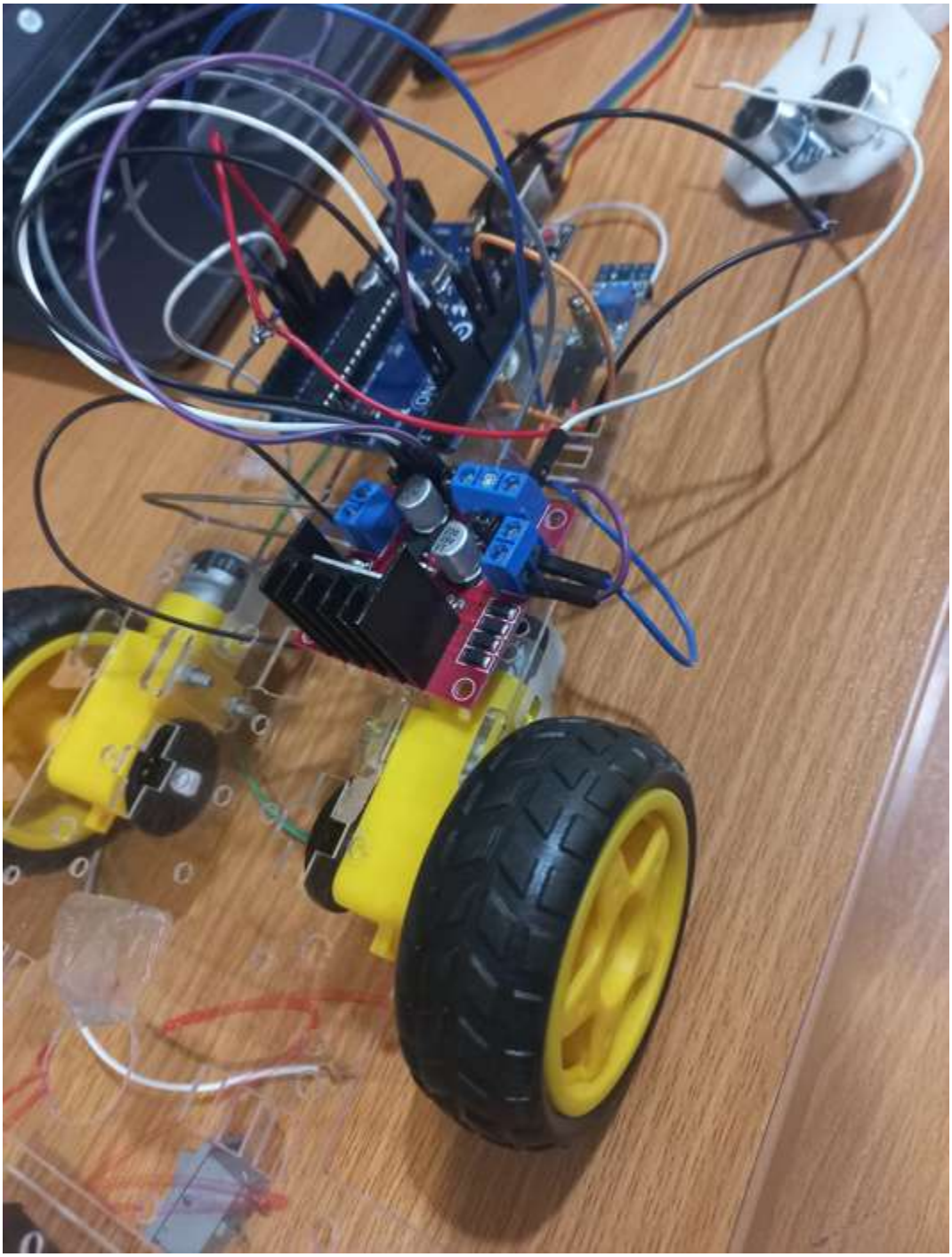
1. Obstacle Avoiding:

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.

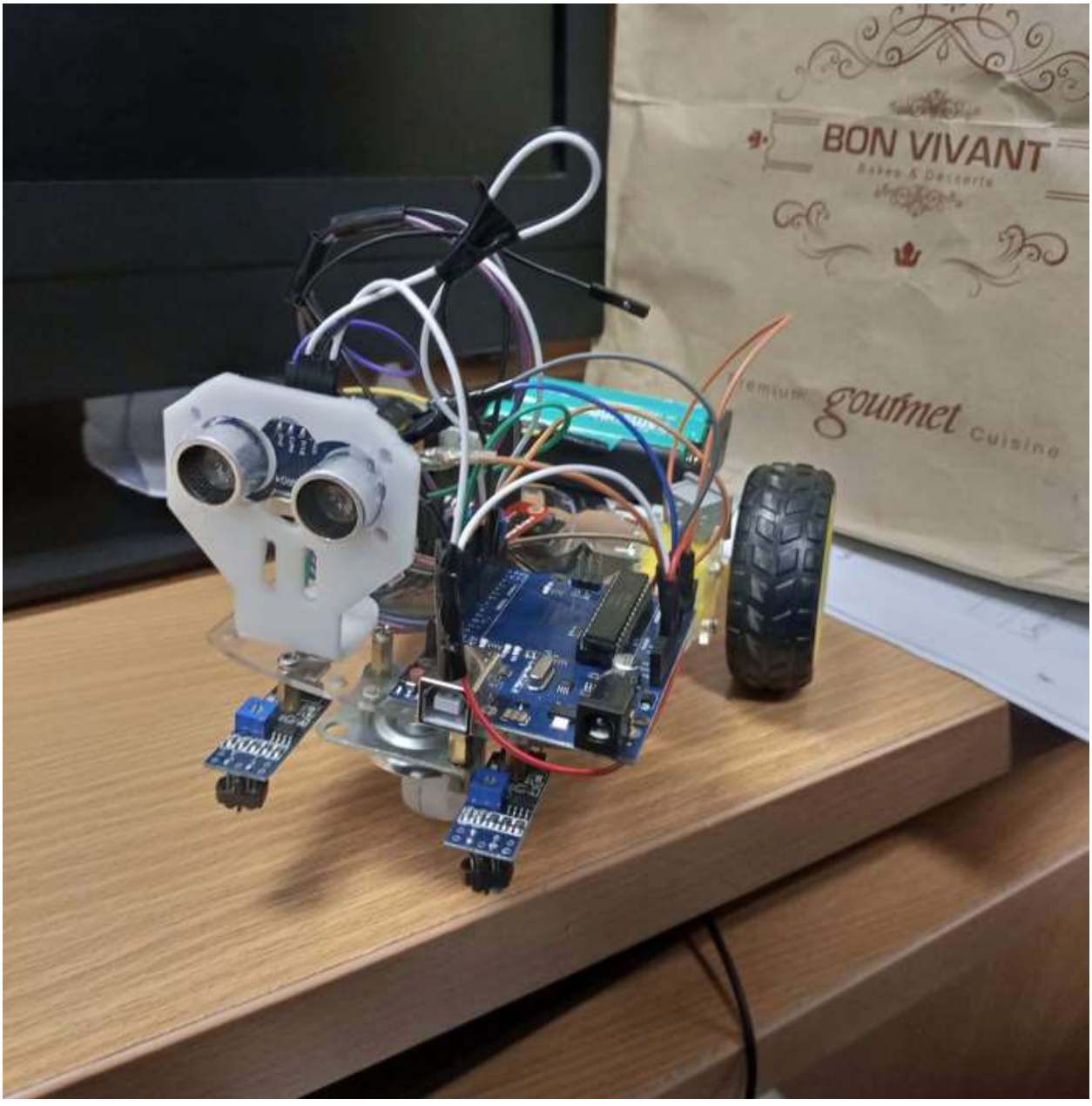
2. Line Following:

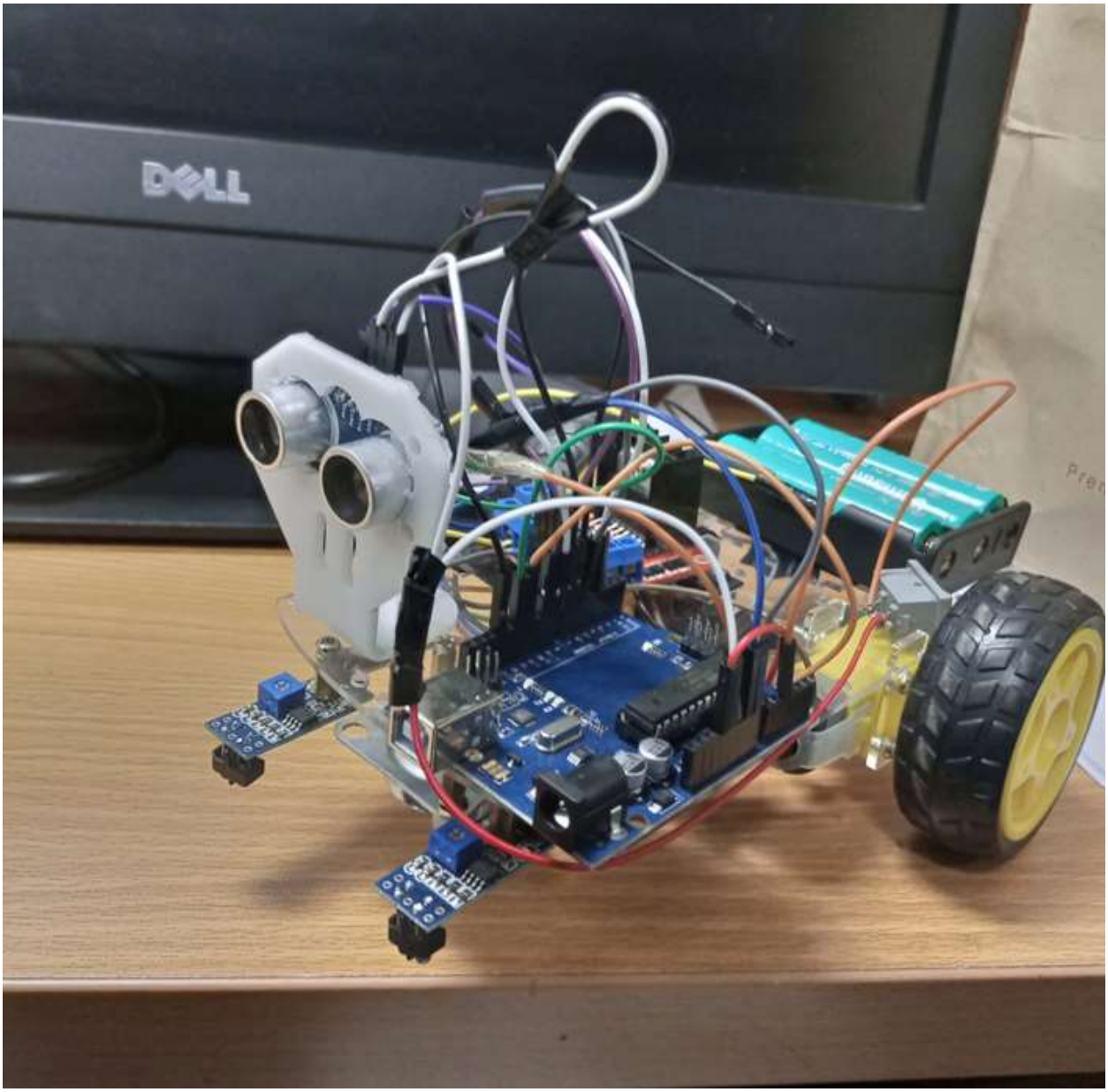
In this mode, line-following modules are used to make the car follow a specific black line. The line following module consists of a transmitter and receiver. The transmitter sends an infrared light which is reflected from a surface and received by the transmitter. If the surface is black the light is 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.