Theory Assignment Report

Only for course Teacher						
		Needs Improvement	Developing	Sufficient	Above Average	Total Mark
Allocate mark & Percentage		25%	50%	75%	100%	5
Clarity	1					
Content Quality	2					
Spelling & Grammar	1					
Organization and Formatting	1					
					Total obtained mark	
Comments						

Semester: Spring 2024

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Batch: 38 **Section: B**

Course Code: SE 532

Course Name: Introduction to Robotics

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Designation: Lecturer (Senior Scale)

Submission Date: 09/06/2024

EscapeBot: The Shy Navigator

Summary:

EscapeBot is an affordable robot with an Arduino platform that can navigate on its own in dynamic environments. With its light-dependent resistors and ultrasonic sensors, EscapeBot is an introverted robot that stays away from moving objects and looks for cover in the dark or low light area. Having a playmate is beneficial for a lonely pet cat. The goal of this project proposal is to provide a workable solution for robotic applications in the real world by outlining the design, implementation, and testing of EscapeBot.

Problem Statement and Scope:

Robotic systems frequently encounter difficulties when attempting to navigate through cluttered environments, avoid collisions, and locate safe havens. The complexity and cost of existing solutions restrict their applicability for educational and recreational purposes. The goal of this project is to create a basic yet powerful robot that can move around its surroundings on its own, avoid obstacles, and hides itself.

Objectives:

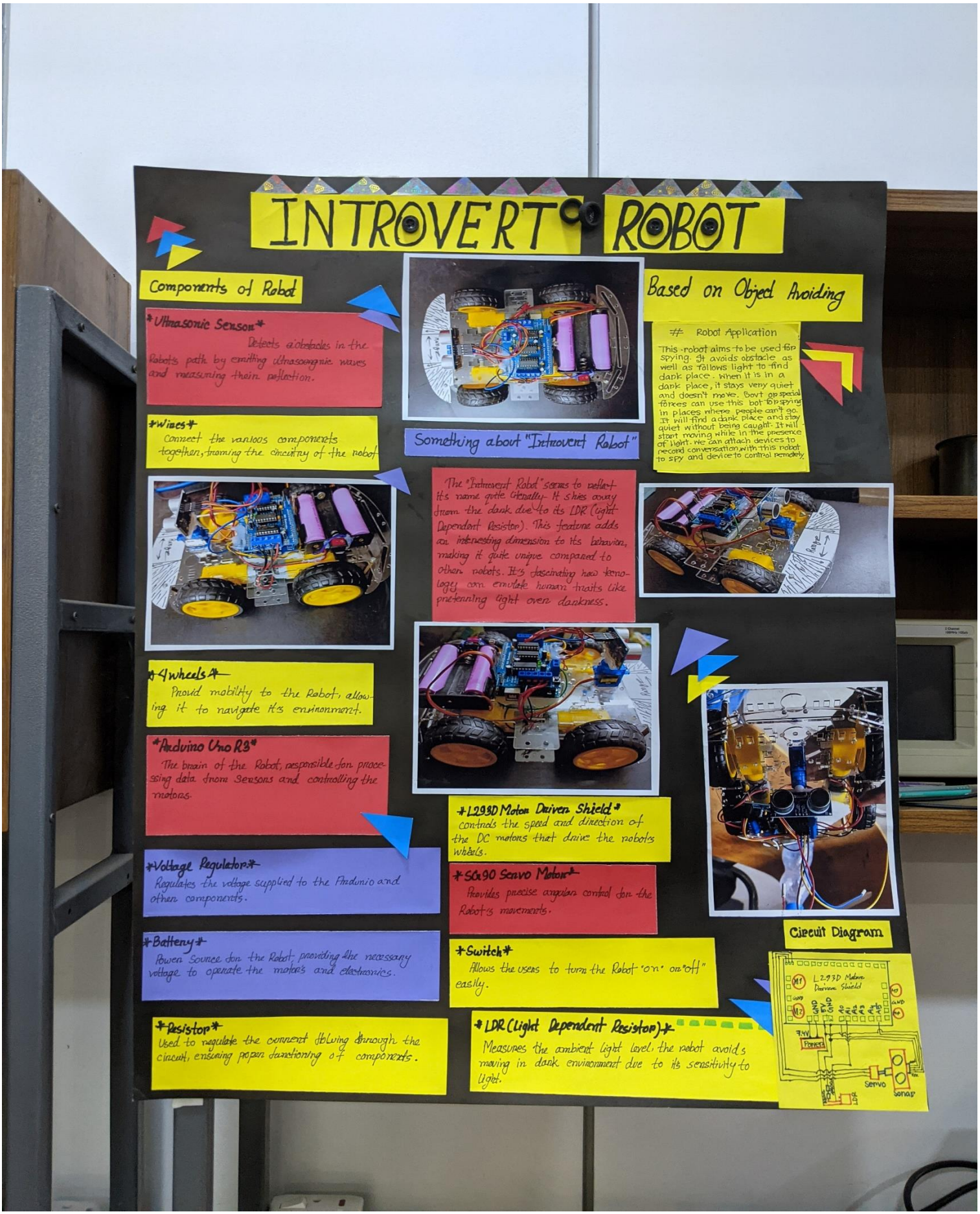
1. Design and assemble a three-wheeled robot platform capable of dynamic movement.
2. Implement obstacle detection and avoidance using ultrasonic sensors.
3. Incorporate light-dependent behavior for shelter-seeking in low-light environments.

4. Develop low-battery detection and alert mechanisms for user intervention.
5. Evaluate the performance and reliability of the EscapeBot in various scenarios.

Proposed Methods:

1. Hardware Design and Assembly: Construct a robot chassis with three wheels and mount Arduino board, motors, sensors, and speaker module.
2. Sensor Integration: Interface ultrasonic sensors for obstacle detection and light-dependent resistors for shelter-seeking behavior with the Arduino board.
3. Algorithm Development: Write Arduino code to control motor movements based on sensor inputs, implementing obstacle avoidance and shelter-seeking behaviors.
4. Testing and Evaluation: Conduct extensive testing to evaluate EscapeBot 's performance in simulated and real-world environments, assessing its effectiveness in obstacle avoidance and shelter-seeking tasks.
5. Documentation and Presentation: Document the project details, including circuit diagrams, code explanations, and testing results, for comprehensive understanding. Prepare a presentation to showcase EscapeBot 's capabilities during the final project presentation.

Picture of the presentation poster:



INTROVERT ROBOT

Based on Object Avoiding

Components of Robot

Ultrasonic Sensor
Detects obstacles in the robot's path by emitting ultrasonic waves and measuring their reflection.

Wires
Connect the various components together, ensuring the circuitry of the robot.

4 wheels
Provide mobility to the robot, allowing it to navigate its environment.

Arduino Uno R3
The brain of the robot, responsible for processing data from sensors and controlling the motors.

Voltage Regulator
Regulates the voltage supplied to the Arduino and other components.

Battery
Power source for the robot, providing the necessary voltage to operate the motors and electronics.

Resistor
Used to regulate the current flowing through the circuit, ensuring proper functioning of components.

L293D Motor Driver Shield
Controls the speed and direction of the DC motors that drive the robot's wheels.

SG90 Servo Motor
Provides precise angular control for the robot's movements.

Switch
Allows the users to turn the robot "on" or "off" easily.

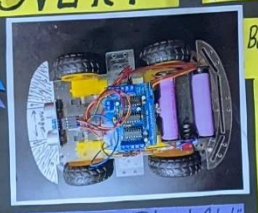
LDR (Light Dependent Resistor)
Measures the ambient light level, the robot avoids moving in dark environment due to its sensitivity to light.

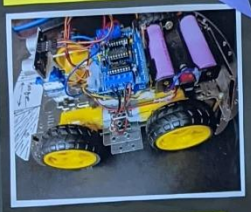
Robot Application

This robot aims to be used for spying. It avoids obstacle as well as follows light to find dark place. When it is in a dark place, it stays very quiet and doesn't move. Govt. agencies can use this bot to spy on places where people can't go. It will find a dark place and stay quiet without being caught. It will start moving while in the presence of light. We can attach devices to record conversation with this robot remotely to spy and device to control remotely.

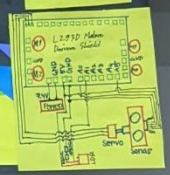
Something about "Introvert Robot"

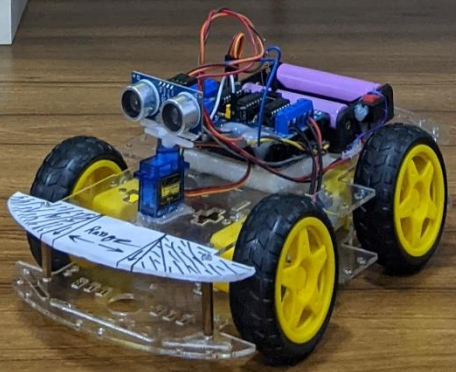
The "Introvert Robot" seems to reflect its name quite literally. It shies away from the dark due to its LDR (Light Dependent Resistor). This feature adds an interesting dimension to its behavior, making it quite unique compared to other robots. It's fascinating how technology can emulate human traits like preferring light over darkness.





Circuit Diagram





Screenshots of the Code used:

sketch_may10a.ino

```
#include "AFMotor.h"
#include <Servo.h>

// Pin definitions
const int ECHO_PIN = A0;  // echo pin
const int TRIG_PIN = A5;  // Trigger pin

// Motor definitions
const int MOTOR_1 = 3;
const int MOTOR_2 = 4;
const int MOTOR_3 = 2;
const int MOTOR_4 = 1;

// Servo object
Servo myservo;

// Motor objects
AF_DCMotor motor1(MOTOR_1, MOTOR12_64KHZ);  // create motor object, 64KHz pwm
AF_DCMotor motor2(MOTOR_2, MOTOR12_64KHZ);  // create motor object, 64KHz pwm
AF_DCMotor motor3(MOTOR_3, MOTOR12_64KHZ);  // create motor object, 64KHz pwm
AF_DCMotor motor4(MOTOR_4, MOTOR12_64KHZ);  // create motor object, 64KHz pwm

// Distance variables
int distanceLeft, distanceFront, distanceRight;

// Set distance threshold
const int SET_DISTANCE = 40;

void setup() {
  Serial.begin(9600);  // Initialize serial port
  Serial.println("Start");

  myservo.attach(10);
  delay(500);  // Allow servo to initialize
  myservo.write(90);

  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
```

Output

sketch_may10a.ino

```
38    pinMode(ECHO_PIN, INPUT);
39
40    // Initialize motor speeds
41    motor1.setSpeed(180);
42    motor2.setSpeed(180);
43    motor3.setSpeed(180);
44    motor4.setSpeed(180);
45  }
46
47  void loop() {
48    distanceFront = getDistance();
49    while (distanceFront > SET_DISTANCE) {
50      motor1.run(FORWARD);
51      motor2.run(FORWARD);
52      motor3.run(FORWARD);
53      motor4.run(FORWARD);
54      delay(10);
55      distanceFront = getDistance();
56    }
57    stopMotors();
58    scanAndAvoid();
59  }
60
61  // Get distance using ultrasonic sensor
62  int getDistance() {
63    digitalWrite(TRIG_PIN, LOW);
64    delayMicroseconds(2);
65    digitalWrite(TRIG_PIN, HIGH);
66    delayMicroseconds(10);
67    long duration = pulseIn(ECHO_PIN, HIGH);
68    return duration / 58.2;  // Correct distance calculation
69  }
70
71  // Move forward
72  void moveForward() {
73    motor1.run(FORWARD);
74    motor2.run(FORWARD);
```

Output

sketch_may10a.ino

```
  motor3.run(FORWARD);
  motor4.run(FORWARD);
}

// Stop motors
void stopMotors() {
  motor1.run(RELEASE);
  motor2.run(RELEASE);
  motor3.run(RELEASE);
  motor4.run(RELEASE);
}

// Scan and avoid obstacles
void scanAndAvoid() {
  myservo.write(180);
  delay(500);
  distanceRight = getDistance();
  delay(500);
  myservo.write(0);
  delay(900);
  distanceLeft = getDistance();
  delay(500);
  myservo.write(90);
  delay(500);

  if (distanceRight <= SET_DISTANCE && distanceLeft <= SET_DISTANCE) {
    turnAround();
  } else if (distanceRight > distanceLeft) {
    turnRight();
  } else if (distanceLeft > distanceRight) {
    turnLeft();
  }
}

// Turn left
void turnLeft() {
  motor1.run(FORWARD);
```

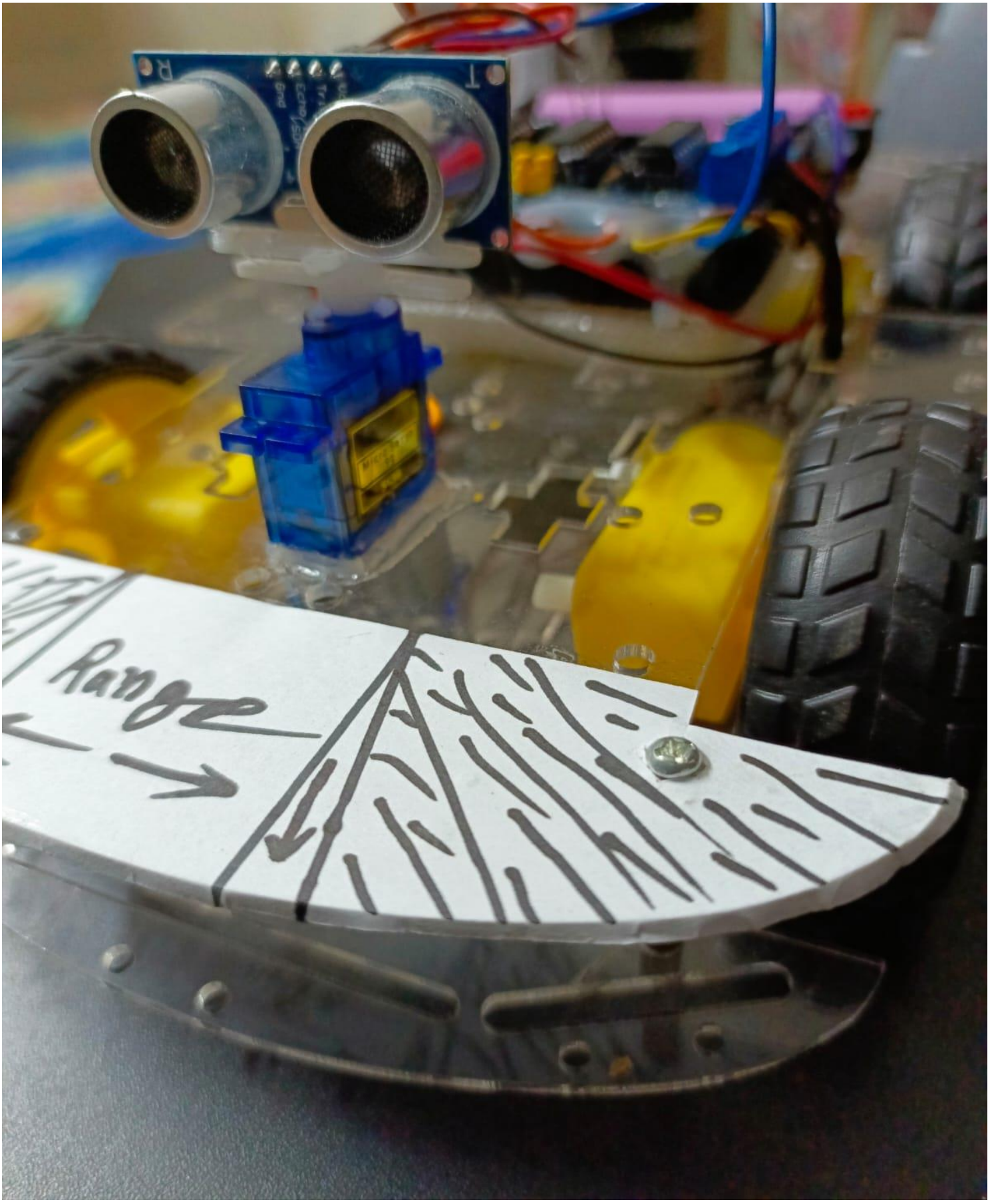
Output

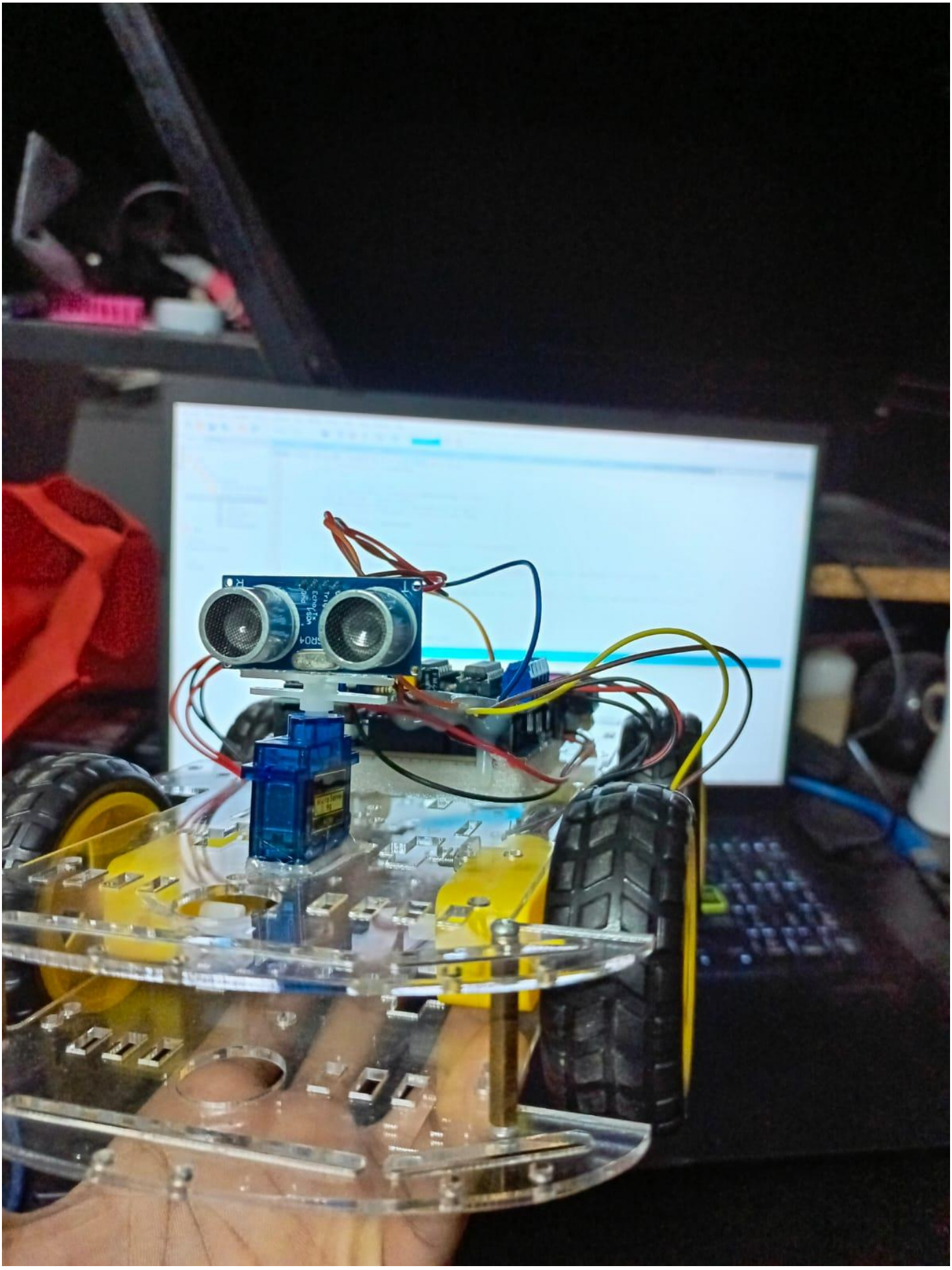
sketch_may10a.ino

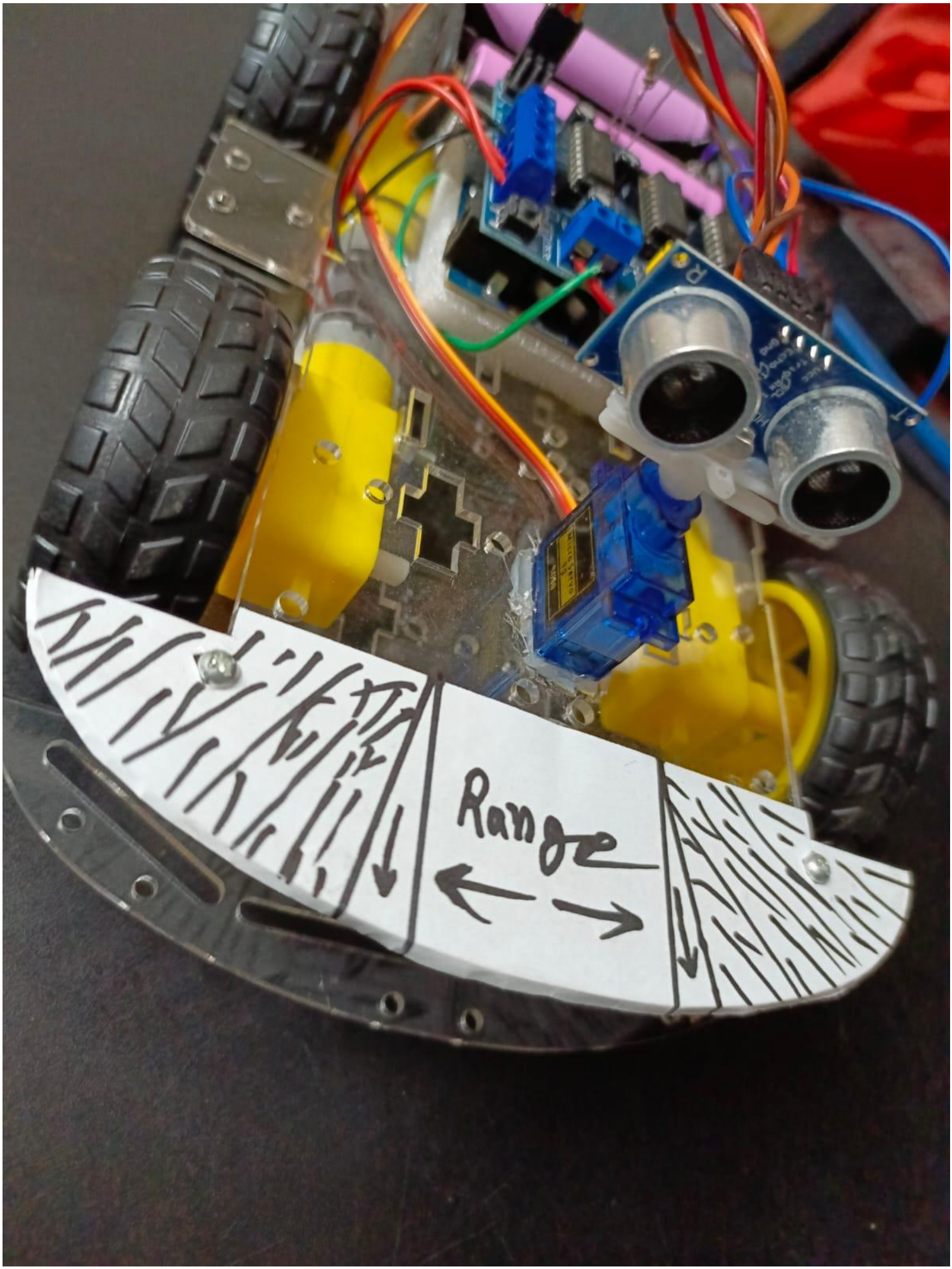
```
104     } else if (distanceLeft > distanceRight) {
105       turnLeft();
106     }
107   }
108
109   // Turn left
110   void turnLeft() {
111     motor1.run(FORWARD);
112     motor2.run(FORWARD);
113     motor3.run(BACKWARD);
114     motor4.run(BACKWARD);
115     delay(500);
116     stopMotors();
117   }
118
119   // Turn right
120   void turnRight() {
121     motor1.run(BACKWARD);
122     motor2.run(BACKWARD);
123     motor3.run(FORWARD);
124     motor4.run(FORWARD);
125     delay(500);
126     stopMotors();
127   }
128
129   // Turn around
130   void turnAround() {
131     motor1.run(BACKWARD);
132     motor2.run(BACKWARD);
133     motor3.run(BACKWARD);
134     motor4.run(BACKWARD);
135     delay(300);
136     motor1.run(BACKWARD);
137     motor2.run(BACKWARD);
138     motor3.run(FORWARD);
139     motor4.run(FORWARD);
140     delay(1000);
141   }
```

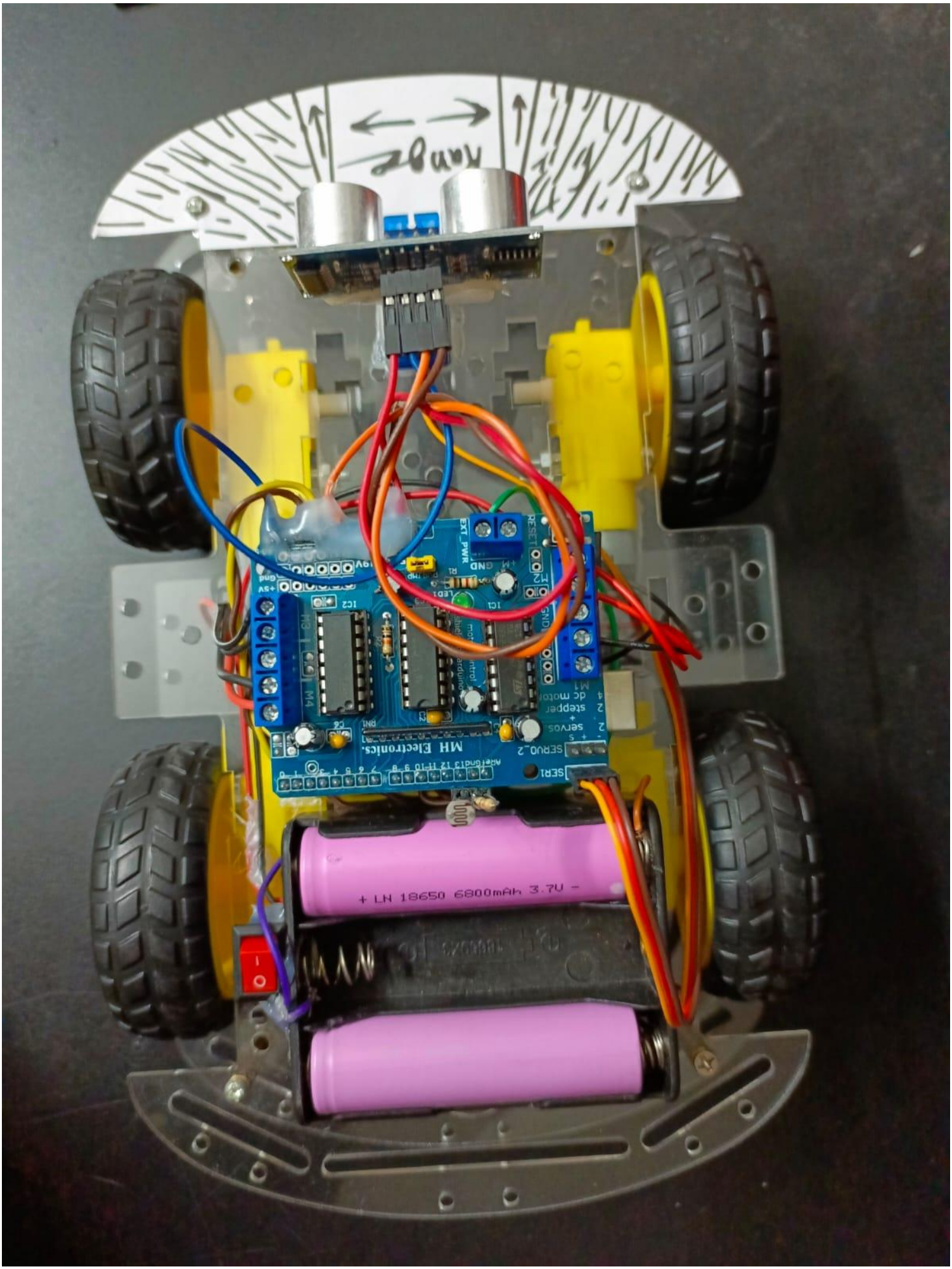
Output

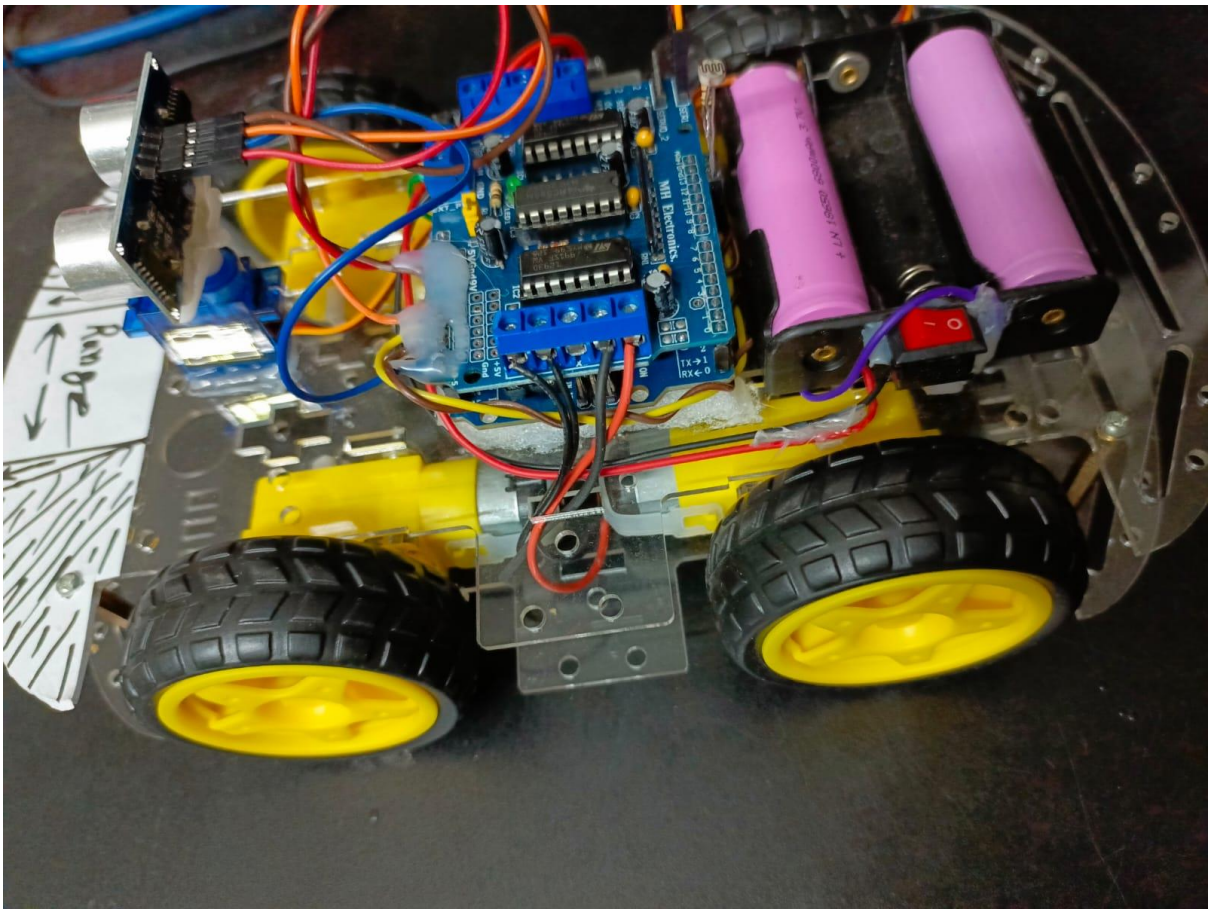
Pictures of our project:

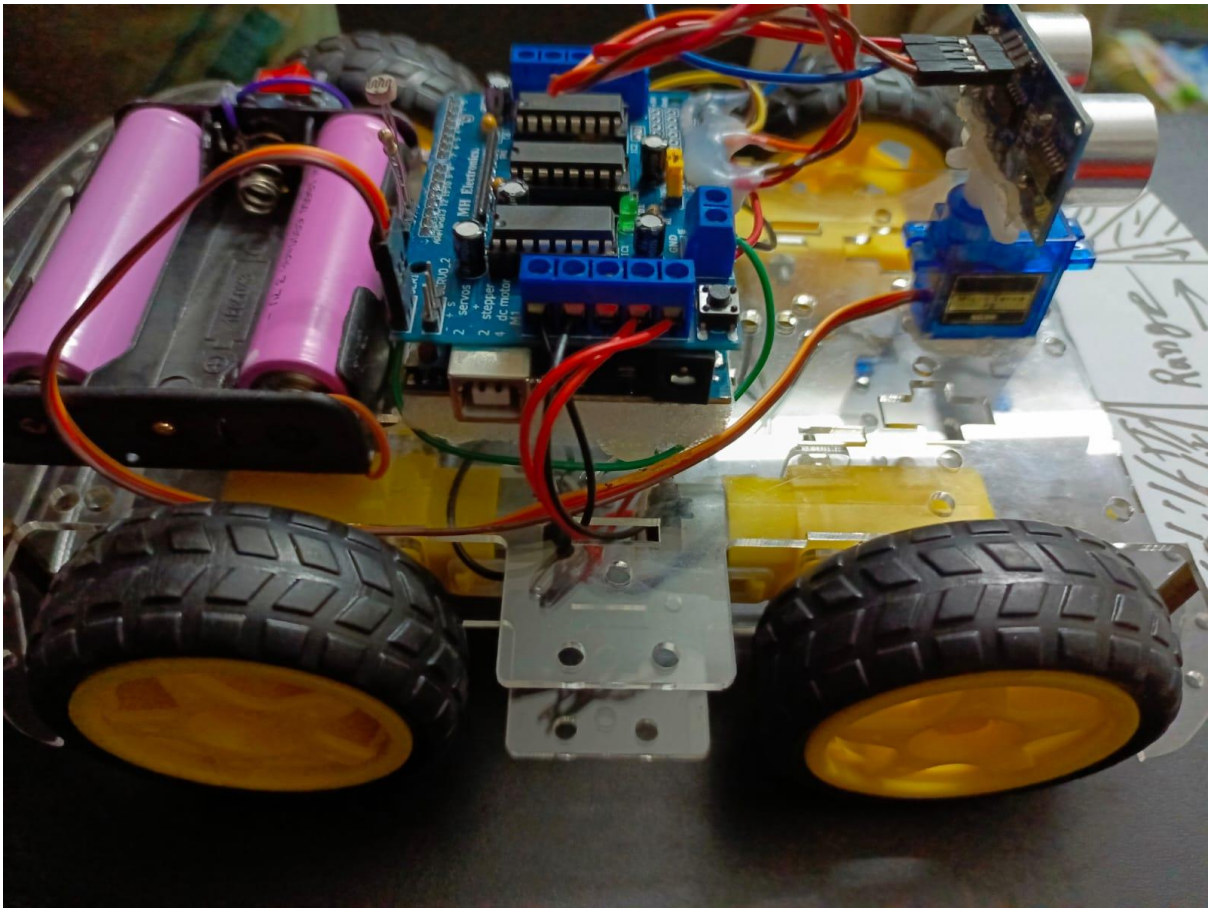





Range


+ LN 18650 6800mAh 3.7V -


Range
MH Electronics


MH Electronics
Range

Applications :

1. Warehouse Automation

Description: In warehouses, obstacle avoidance robots can be used to transport goods and materials from one location to another.

Benefits: Reduces the need for human labor, increases efficiency, and minimizes the risk of accidents.

2. Autonomous Delivery Systems

Description: These robots can be used for last-mile delivery services, delivering packages to customers' doorsteps.

Benefits: Improves delivery speed, reduces human labor costs, and can operate 24/7.

3. Elderly and Disabled Assistance

Description: Robots equipped with obstacle avoidance can assist elderly or disabled individuals by carrying items, helping with mobility, or providing companionship.

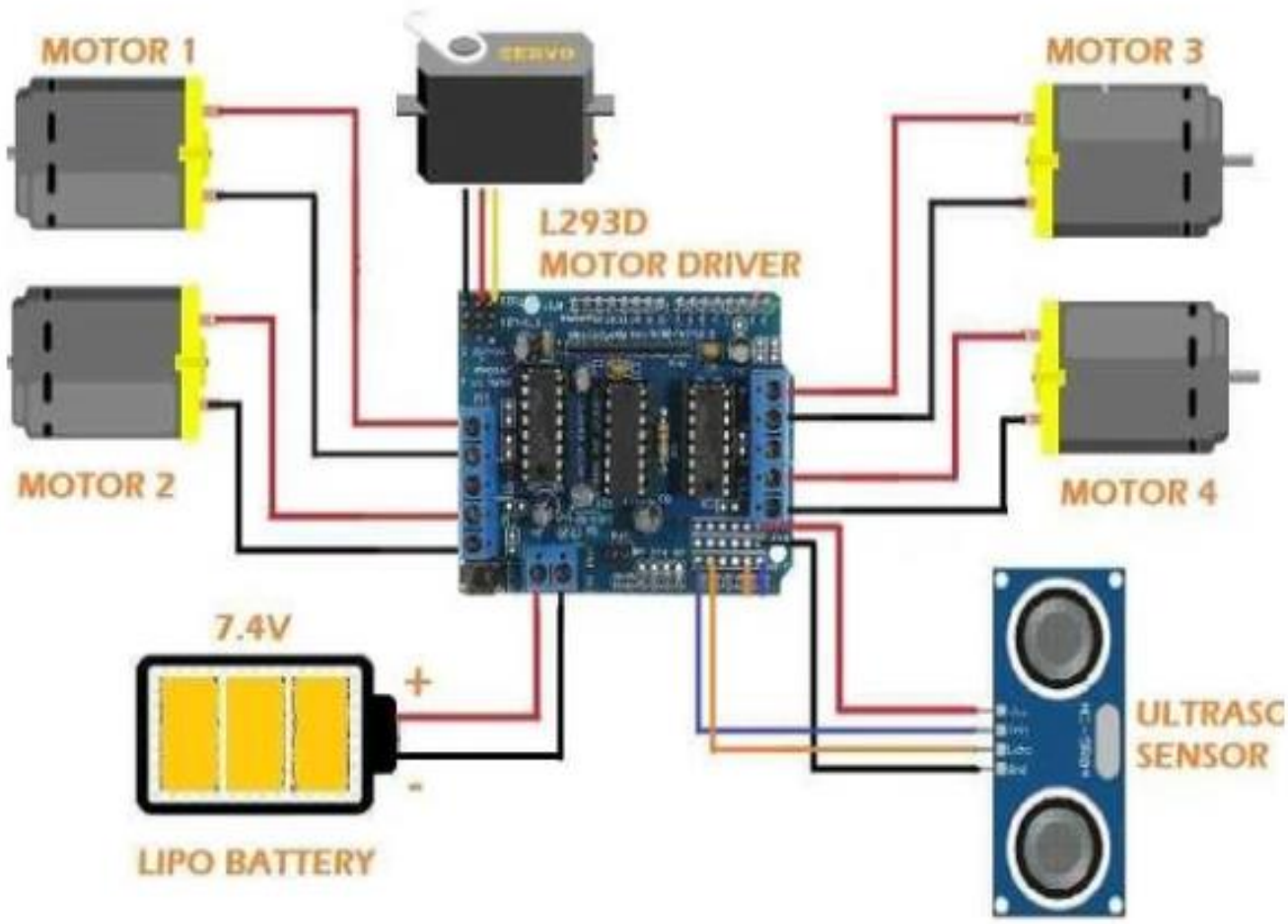
Benefits: Enhances quality of life and provides support for independent living.

4. Search and Rescue Operations

Description: In disaster-stricken areas, robots can navigate through debris to find and rescue trapped individuals.

Benefits: Enhances safety for human rescuers and can operate in hazardous environments.

Circuit Diagram:



Picture of our group before video presentation:

Project team members:

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3. *Sakib Hossain Rony (222-35-1122)*
4. *Sadia Hasan Meheru (222-35-1169)*
5. *Mahmuda Rahman Rupa (222-35-1203)*