AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

Faculty of Engineering

Project Report

Experiment Title: Avoiding Robot Car.

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Course Title:	MICROPROCESSOR AND EMBEDDED SYSTEMS LAB		
Course Code:	COE3104	**Section: G**	
Semester:		**Degree Program:**	BSc in CSE/BSc in EEE
Course Teacher:	DR. MD. RUKONUZZAMAN		

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Experiment Title: Avoiding Robot Car.

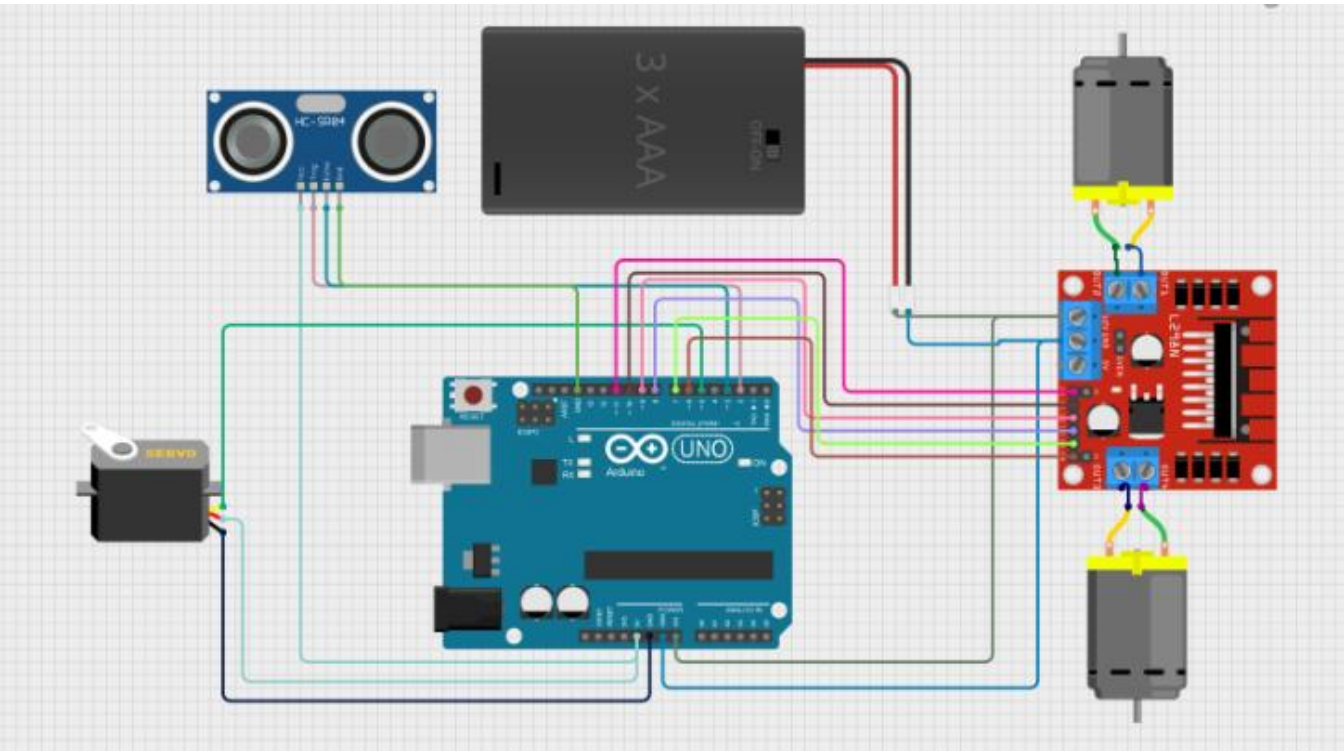
Objectives:

This project demonstrates the design and implementation of an Arduino-based obstacle-avoiding robot car. The system utilizes four DC motors controlled via a motor driver shield, an ultrasonic sensor for distance measurement, and a servo motor for directional scanning. The objective of the experiment is to build a robot capable of autonomous navigation by detecting obstacles in its environment.

Equipment List:

1) Motor Driver shield
2) Arduino UNO
3) DC TT gear Motor
4) Servo motor
5) Ultrasonic Sensor
7) Connecting Wires.

Circuit Diagram:



Code/Program:

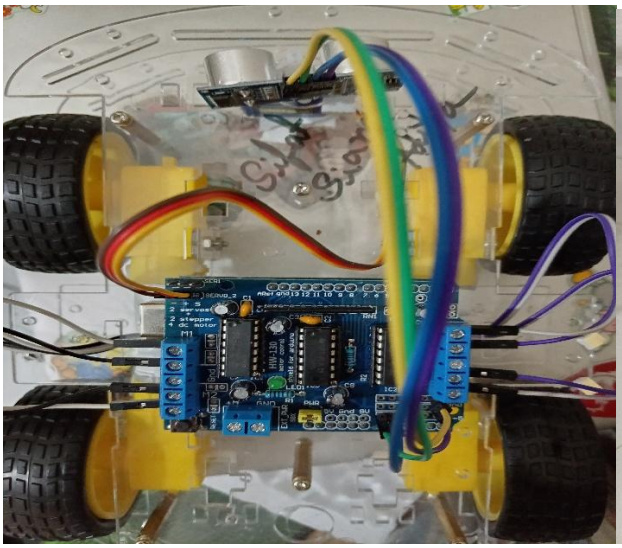
```
#include <AFMotor.h>
#include <Servo.h>

// Motors: M1–M4
AF_DCMotor motor1(1);  // M1
AF_DCMotor motor2(2);  // M2
AF_DCMotor motor3(3);  // M3
AF_DCMotor motor4(4);  // M4

// Ultrasonic pins
#define trigPin A0
#define echoPin A1

// Servo motor
Servo myServo;
#define servoPin 9  // Servo connected to D9

void setup() {
  Serial.begin(9600);

  // Set motor speeds (0–255)
  motor1.setSpeed(150);  // Increased from 100
  motor2.setSpeed(150);
  motor3.setSpeed(150);
  motor4.setSpeed(150);

  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);

  // Attach and center the servo
  myServo.attach(servoPin);
  myServo.write(90);
  delay(500);
  Serial.println("Setup complete. Servo centered.");
}

void loop() {
  int distance = getDistance();
  Serial.print("Distance: ");
  Serial.println(distance);

  if (distance < 20) {
    stopMotors();
    delay(300);

    Serial.println("Obstacle detected. Reversing...");
    moveBackward();
    delay(500);
    stopMotors();
```

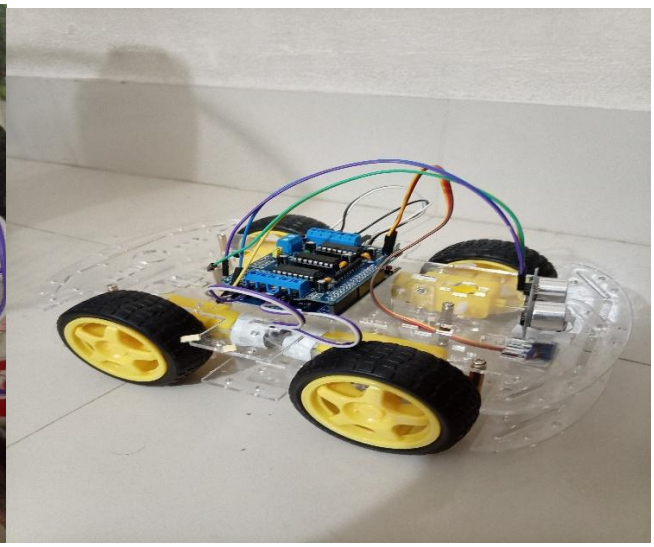
```
    delay(300);

    // Scan left
    myServo.write(0);
    delay(700);
    int leftDist = getDistance();
    Serial.print("Left distance: ");
    Serial.println(leftDist);

    // Scan right
    myServo.write(180);
    delay(700);
    int rightDist = getDistance();
    Serial.print("Right distance: ");
    Serial.println(rightDist);

    // Return to center
    myServo.write(90);
    delay(500);

    // Decide direction to turn
    if (leftDist > rightDist) {
      Serial.println("Turning left...");
      turnLeft();
    } else {
      Serial.println("Turning right...");
      turnRight();
    }
  } else {
    moveForward();
  }

  delay(100);  // Main loop delay
}

// Get distance from ultrasonic sensor
int getDistance() {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  long duration = pulseIn(echoPin, HIGH);
  return duration * 0.034 / 2;
}

// Move forward
void moveForward() {
  motor1.run(FORWARD);
  motor2.run(FORWARD);
  motor3.run(FORWARD);
```

```
  motor4.run(FORWARD);
}

// Move backward
void moveBackward() {
  motor1.run(BACKWARD);
  motor2.run(BACKWARD);
  motor3.run(BACKWARD);
  motor4.run(BACKWARD);
}

// Turn left with increased speed and duration
void turnLeft() {
  motor1.setSpeed(200);
  motor2.setSpeed(200);
  motor3.setSpeed(200);
  motor4.setSpeed(200);

  motor1.run(BACKWARD);
  motor2.run(BACKWARD);
  motor3.run(FORWARD);
  motor4.run(FORWARD);

  delay(1000);  // Turn duration

  stopMotors();
  delay(200);

  // Reset speed
  motor1.setSpeed(150);
  motor2.setSpeed(150);
  motor3.setSpeed(150);
  motor4.setSpeed(150);
}

// Turn right with increased speed and duration
void turnRight() {
  motor1.setSpeed(200);
  motor2.setSpeed(200);
  motor3.setSpeed(200);
  motor4.setSpeed(200);

  motor1.run(FORWARD);
  motor2.run(FORWARD);
  motor3.run(BACKWARD);
  motor4.run(BACKWARD);

  delay(1000);  // Turn duration

  stopMotors();
  delay(200);
```

```
  // Reset speed
  motor1.setSpeed(150);
  motor2.setSpeed(150);
  motor3.setSpeed(150);
  motor4.setSpeed(150);
}

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

Hardware Output Results:





Explanation:

An Arduino Uno microcontroller was used as the central controller of the robot car. A Motor Driver Shield was mounted on top of the Arduino Uno to drive four DC motors, which were connected to the M1, M2, M3, and M4 terminals of the shield. To detect obstacles, an ultrasonic sensor was employed, where the Trig pin was connected to analog pin A0 and the Echo pin was connected to analog pin A1 of the Arduino. For directional scanning, a servo motor was attached to the front of the chassis, and its signal pin was connected to digital pin 9, while its power pins were connected to 5V and GND. The ultrasonic sensor itself was mounted on the servo horn, allowing it to rotate left and right for obstacle detection. The entire system was powered using a battery pack connected to

the motor shield, and jumper wires were used to establish the necessary electrical connections. The robot car was then programmed through the Arduino IDE with logic to move forward, detect obstacles, reverse when necessary, and turn left or right depending on the available clearance

Discussion:

This project successfully demonstrated the development of an obstacle-avoiding robot car using Arduino Uno, a motor driver shield, ultrasonic sensing, and a servo motor. The prototype was able to autonomously navigate and avoid obstacles by making directional decisions in real time. The experiment highlights the potential of microcontroller-based systems for robotics education and lays the foundation for future advancements such as machine learning-based navigation and multi-sensor integration.

References:

1) Arduino.cc. (2025). *Arduino Uno Rev3 Documentation*. Retrieved from https://www.arduino.cc

2) HC-SR04 Datasheet. (2025). *Ultrasonic Ranging Module Technical Specifications*.

3) *Motor Shield and AFMotor Library Guide*.