University of Asia Pacific

Department of Computer Science and Engineering

CSE 437: Robotics Lab

LAB REPORT

Experiment Number: 01

Experiment Title: Design and Implementation of a Simple Circular Line-Following Robot Using Arduino

Submitted by:

Team Name : BOD

Name : H. M. Tahsin Sheikh

Student ID : 22201243

Section : E1

Submitted to:

A S Zaforullah Momtaz
Assistant Professor,
Department of Computer Science and Engineering

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1. Experiment Name

Mini Project: Design and Implementation of a Simple Circular Line-Following Robot Using Arduino

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2. Objective

The objective of this experiment is to design, implement, and test a simple line-following robot capable of moving along a circular path. The system uses an Arduino microcontroller and infrared (IR) sensors to detect a black line on a white surface and control motor movement accordingly.

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3. Apparatus / Hardware & Software Requirements

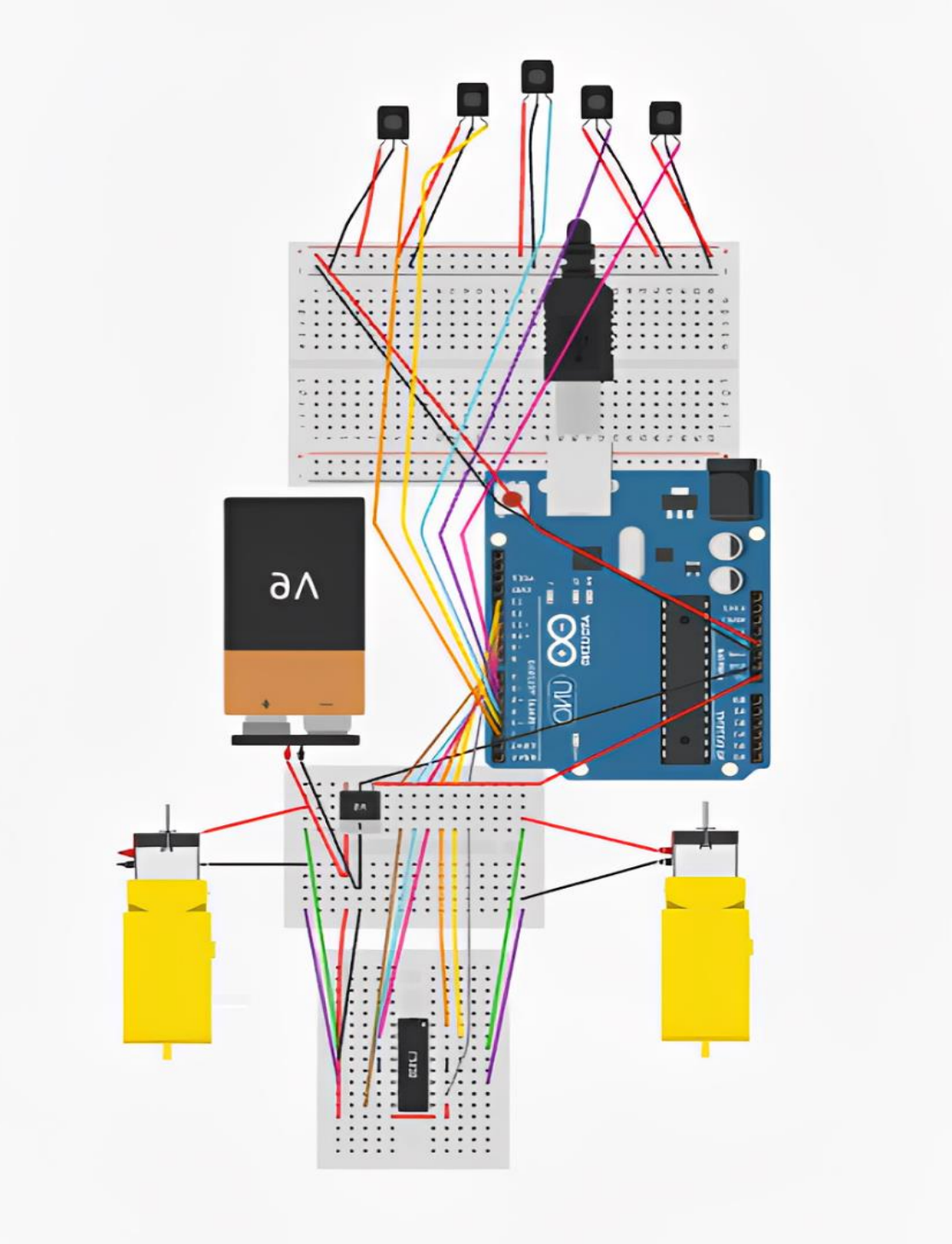
Hardware

- Arduino Uno microcontroller
- IR Line Sensor Module (2 units)
- DC Gear Motors (2 units)
- Motor Driver Module (L298N / L293D)
- Robot chassis with wheels
- Battery and power supply unit
- Breadboard
- Jumper wires

Software

- Arduino IDE
- Simulation platform (optional): Tinkercad / WOKWI

4. Circuit Diagram / Schematic



5. Code / Assembly Program

```
// Simple Circular Line Following Robot
// Arduino Uno with Two IR Sensors

#define LEFT_SENSOR 2
#define RIGHT_SENSOR 3

#define MOTOR_L1 5
#define MOTOR_L2 6
#define MOTOR_R1 9
#define MOTOR_R2 10

void setup() {
  pinMode(LEFT_SENSOR, INPUT);
  pinMode(RIGHT_SENSOR, INPUT);

  pinMode(MOTOR_L1, OUTPUT);
  pinMode(MOTOR_L2, OUTPUT);
  pinMode(MOTOR_R1, OUTPUT);
  pinMode(MOTOR_R2, OUTPUT);
}

void loop() {
  int leftSensor = digitalRead(LEFT_SENSOR);
  int rightSensor = digitalRead(RIGHT_SENSOR);

  if (leftSensor == LOW && rightSensor == LOW) {
    forward();
```

```
  }
  else if (leftSensor == LOW && rightSensor == HIGH) {
    turnLeft();
  }
  else if (leftSensor == HIGH && rightSensor == LOW) {
    turnRight();
  }
  else {
    stopRobot();
  }
}

void forward() {
  digitalWrite(MOTOR_L1, HIGH);
  digitalWrite(MOTOR_L2, LOW);
  digitalWrite(MOTOR_R1, HIGH);
  digitalWrite(MOTOR_R2, LOW);
}

void turnLeft() {
  digitalWrite(MOTOR_L1, LOW);
  digitalWrite(MOTOR_L2, HIGH);
  digitalWrite(MOTOR_R1, HIGH);
  digitalWrite(MOTOR_R2, LOW);
}

void turnRight() {
  digitalWrite(MOTOR_L1, HIGH);
```

```
  digitalWrite(MOTOR_L2, LOW);
  digitalWrite(MOTOR_R1, LOW);
  digitalWrite(MOTOR_R2, HIGH);
}

void stopRobot() {
  digitalWrite(MOTOR_L1, LOW);
  digitalWrite(MOTOR_L2, LOW);
  digitalWrite(MOTOR_R1, LOW);
  digitalWrite(MOTOR_R2, LOW);
}
```

6. Output / Observations

- The robot successfully detects the black circular line using IR sensors.
- When both sensors detect the line, the robot moves forward smoothly.
- When one sensor moves off the line, the robot automatically adjusts its direction.
- The robot continuously follows the circular path without manual intervention.
- Proper sensor alignment and motor speed calibration improve performance.

7. Result

The line-following robot was successfully designed and implemented.
The system correctly followed a circular path by detecting line positions and adjusting motor movement in real time.
Therefore, the objective of the experiment was achieved.

8. Conclusion

This experiment helped in understanding the basic principles of robotics, sensor-based control, and embedded system programming.
It demonstrated how sensor data can be used to make real-time decisions for motor control.
The project provided practical experience with Arduino programming and laid a foundation for more advanced robotic and autonomous system designs.