Line follower Robot

A

Skill-Based Mini Project

Submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING

In

ELECTRICAL ENGINEERING

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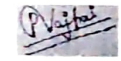
CANDIDATE'S DECLARATION

We hereby declare that the work presented in this skill-based mini-project entitled LINE FOLLOWER ROBOT which is being submitted in the MICROPROCESSOR AND EMBEDDED SYSTEM(220404) course for the partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering in Electrical Engineering is an authentic record of our own work carried out under the guidance of Dr. Bhavana Rathore, Assistant Professor, Electrical Engineering Department.

Pratham Bajpai



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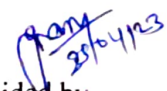

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ABSTRACT

A line follower robot is one kind of autonomous robot that follows a line until that line exists. Generally, the line is drawn on the floor. It can be either black or white. The line can also be normal visible colour or an invisible magnetic field or electric field. The robot follows the line by using Infra-Red Ray (IR) sensors. There are five IR sensors which makes it an IR sensor array. These sensors read the line and send that reading to Arduino and then control the robot's movement. In this paper, the authors will explain the robot design, implementation, coding, testing, problems they faced, and their solutions.

Keywords: Line Follower, Arduino Uno R3, Adafruit Motor shield, IR sensor array, DC Power Adapter (9V, 2A)

INTRODUCTION

Line follower robot is autonomous which means it automatically follows a line that is pre-defined. Generally, it follows a black line on a white surface or a white line on a black surface. Some of the basic operations of a line follower is given below:

· Reading the pre-defined line by the IR sensor array which is installed on the front-down side of the robot and sends those readings to the Arduino. The ATMega microcontroller which is built in on Arduino analyses those readings and do the particular operations.

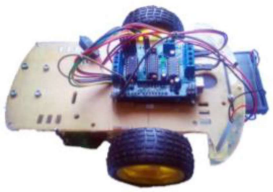


Fig. 1: Line Follower Robot

The steering mechanism is simple in this robot. Three wheels are used, two wheels are on the back part connected with the motors and one independent wheel on the front-middle part of the robot. · On Straight line, the speed is fast and, on a turn, speed is relatively slow depending on turn angel. Good motor quality and good sensing quality will increase the robot movement performance.

LINE FOLLOWER ROBOT EQUIPMENT:-

This robot is made of several parts:

- Arduino Uno R3 and IDE
- Digital IR sensor array
- DC motors
- Power supply (9V/12V DC)

Digital IR sensor Array:-

The line follower robot uses a 7-array digital IR sensor array to sense the line. Among them, five IR sensors are used because there are six analog pins on Arduino. For balancing the left and right sides four sensors are used and one middle sensor is for line detection. On each IR sensor, there are two diodes. One of them sends Infrared rays and another one receives them. If the receiver receives more reflected light than it is on the white surface and if it receives less reflected light (or doesn't receive any reflected light) that means it is on the black surface. One IR sensor includes one infrared transmitter and one receiver. IR sensor array is the combination of five IR reflectance-sensors

Arduino Uno R3:-

has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; by simply connecting it to a computer with a USB cable one can program it. It supports 5V DC to 12V DC. The safe power supply is 9V DC. Arduino controls the whole robot’s actions. The motor shield is placed above it. The motor shield's pins are connected to Arduino's pins.

Arduino IDE is used for writing a program and inserting the code into the Arduino is done by USB cable which connects Arduino and computer.

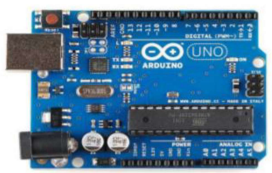


Fig.2: Arduino UNO R3

Motors and Wheels :-

Motors are a very important part of this robot. Because the movement system is the main part of the line following. Some most important things are that both motors must be the same kind, speed, power supply, and smooth. So choosing motors is very important as there are so many kinds of motors available in markets. Here the authors have used 4V DC gear motors. Wheels also have to be the same size and radius. Wheel size affects the robot's speed.

The authors are using three wheels. Among them, two are connected back side of the chassis with motors and one wheel is independent and connected to the front side of the chassis.

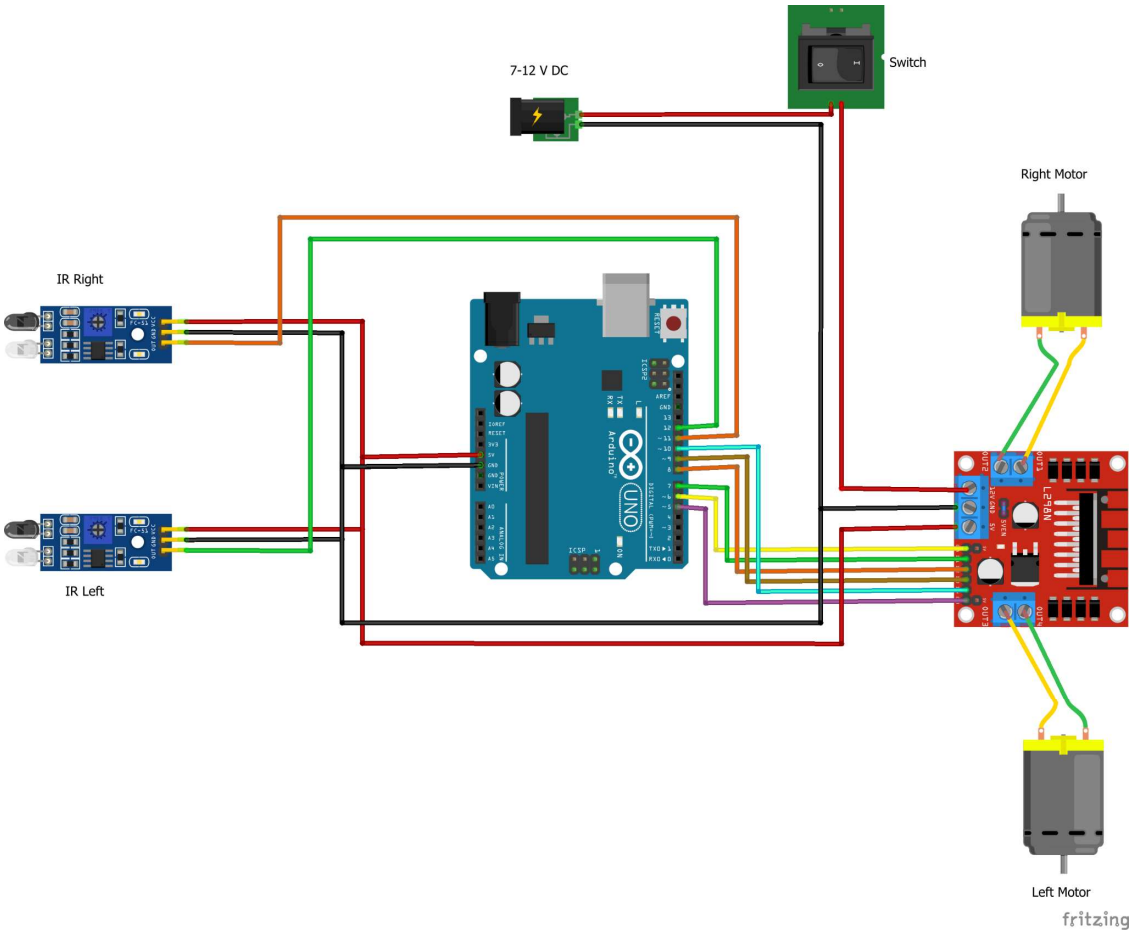
CODE:-

```
#define IR_SENSOR_RIGHT 11
#define IR_SENSOR_LEFT 12
#define MOTOR_SPEED 180

//Right motor
int enableRightMotor=6;
int rightMotorPin1=7;
int rightMotorPin2=8;

//Left motor
int enableLeftMotor=5;
int leftMotorPin1=9;
int leftMotorPin2=10;

void setup()
  {
 TCCR0B = TCCR0B & B11111000 | B00000010 ;

 // put your setup code here, to run once:
 pinMode(enableRightMotor, OUTPUT);
 pinMode(rightMotorPin1, OUTPUT);
 pinMode(rightMotorPin2, OUTPUT);

  pinMode(enableLeftMotor, OUTPUT);
 pinMode(leftMotorPin1, OUTPUT);
 pinMode(leftMotorPin2, OUTPUT);

 pinMode(IR_SENSOR_RIGHT, INPUT);
 pinMode(IR_SENSOR_LEFT, INPUT);
 rotateMotor(0,0);
  }


void loop()
  {
      int rightIRSensorValue = digitalRead(IR_SENSOR_RIGHT);
 int leftIRSensorValue = digitalRead(IR_SENSOR_LEFT);
```

```
  //If none of the sensors detects black line, then go straight
  if (rightIRSensorValue == LOW && leftIRSensorValue == LOW)
     {
    rotateMotor(MOTOR_SPEED, MOTOR_SPEED);
     }
  //If right sensor detects black line, then turn right
  else if (rightIRSensorValue == HIGH && leftIRSensorValue == LOW )
     {
      rotateMotor(-MOTOR_SPEED, MOTOR_SPEED);
     }
  //If left sensor detects black line, then turn left
  else if (rightIRSensorValue == LOW && leftIRSensorValue == HIGH )
     {
      rotateMotor(MOTOR_SPEED, -MOTOR_SPEED);
     }
  //If both the sensors detect black line, then stop
   else
     {
    rotateMotor(0, 0);
     }
    }



void rotateMotor(int rightMotorSpeed, int leftMotorSpeed)
    {

  if (rightMotorSpeed < 0)
     {
    digitalWrite(rightMotorPin1,LOW);
    digitalWrite(rightMotorPin2,HIGH);
     }
  else if (rightMotorSpeed > 0)
     {
    digitalWrite(rightMotorPin1,HIGH);
    digitalWrite(rightMotorPin2,LOW);
     }
    else
     {
```

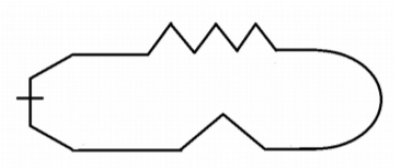
```
  digitalWrite(rightMotorPin1,LOW);
  digitalWrite(rightMotorPin2,LOW);
   }

if (leftMotorSpeed < 0)
   {
  digitalWrite(leftMotorPin1,LOW);
  digitalWrite(leftMotorPin2,HIGH);
   }
else if (leftMotorSpeed > 0)
   {
  digitalWrite(leftMotorPin1,HIGH);
  digitalWrite(leftMotorPin2,LOW);
   }
 else
   {
  digitalWrite(leftMotorPin1,LOW);
  digitalWrite(leftMotorPin2,LOW);
   }
analogWrite(enableRightMotor, abs(rightMotorSpeed));
analogWrite(enableLeftMotor, abs(leftMotorSpeed));
  }
```

CIRCUIT DIAGRAM: -



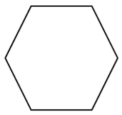
LINE FOLLOWER PATHS:-

Line follower robot follows path drawn on the floor. The line will be mainly black on a white surface. If it occurs any line break on its way, the robot will go forward. If it finds a cross line, the robot will stop. Lines and robot movements can be changed by using programming code easily. Some lines are that the robot can follow:



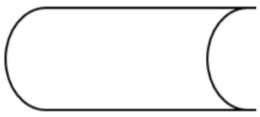
Sample path

The robot will follow a bad angle of 45° and cycle or bad curves. It will stop when it finds a cross black line.



Polygon shape

On any kind of Polygon, it can follow the line and maintain a particular speed.



Cycle and Hard Curve

The line may have cycles and unwanted curves that it has to follow on narrow space or moving one room to another.

FUTURE WORK:-

Line following robot-based industrial manufacturing processes in India can play a vital role in the field of industry. Using this robot in government organizations and manufacturing Companies, especially the RMG sectors in India, the cost of manpower can be reduced. This line-following robot can be used as carrying the load to deliver goods from one place to another smoothly without any damage. If any type of goods mishandling occurs then that system can stop its routine function and call the system administrator to check the occurred problem to repair.

For this purpose, a GSM module can be used to monitor the production process on a real-time basis. On a real-time basis, the functional work of any industry can be more efficient for supply chain management so that the industrial sectors of India will take a place in international markets.

CONCLUSION: -

Robotics has a significant role in the global economy and everyday life. Another concern of robotics research is to be competitive and design patents for global industries according to their nature of applications. The demand for robotics technology is expanding in a wide range of applications and human activities, especially for manufacturing, medical, service, defines, and consumer industries. The Designed robot has two IR sensors, an Arduino microcontroller board, and one L298N motor driver, one mini breadboard one 9V battery, a switch. Arduino mainly controls the robot to follow the line. This line follower robot is the prototype of robots for industrial use. By studying this one can build a line follower robot for industrial use.

Performance can be improved by using good materials and great sensing power also improves motor movement. The setup cost of a line follower robot majorly depends upon the expensive machinery, land, and building and round-the-clock staff to maintain and use that machinery. In India where the population is humongous and resources are scarce.

So, it becomes really difficult to set up such a capital extensive project without any financial support from the private sector. Skilled staffs are also necessary for that. This is an alternative to the existing system by replacing skilled labor with robotic machinery. This robot will be able to handle more goods in a manufacturing process in less time with better accuracy as well as lower per capital cost.

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