Abstract

The line follower robot is a mobile machine that can detect and follow the line drawn on the floor. Generally, the path is predefined and can be either visible like a black line on a white surface with a high contrasted colour or it can be invisible like a magnetic field. Therefore, this kind of robot should sense the line with its Infrared Ray (IR) sensors that installed under the robot. After that, the data is transmitted to the processor by specific transition buses.
Hence, the processor is going to decide the proper commands and then it sends them to the driver shield and thus the path will be followed by the line follower robot.

OBJECTIVE

The objective of a line-following car is to autonomously navigate along a predefined path, typically a line on the ground. This is often achieved using sensors, such as infrared or camera-based systems, to detect the line and adjust the car's direction accordingly.

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Introduction

A line follower robot car is a robot car which follows a certain path controlled by a feedback mechanism. This robot car has TWO IR sensors installed under the front part of the body, and two DC motors connected through shield driver. A circuit inside takes an input signal from two sensors and controls the speed of wheel rotation. A basic line follower robot car follows certain path and the motion of the robot along the path is controlled by controlling the rotation of wheels. The control circuitry involves the use of sensors to sense the path and the microcontroller (Arduino) to control the motor operation through the motor shield driver, based on the sensor output.

Components:

- Arduino UNO R3
- Motor Shield
- DC Motors
- Sensors (IR Sensors)

Components Explanation

Arduino UNO R3 :

Arduino UNO is the main controller in the project. The data from the sensors (IR Sensors) will be given to Arduino and it gives corresponding signals to the Motor Driver IC.

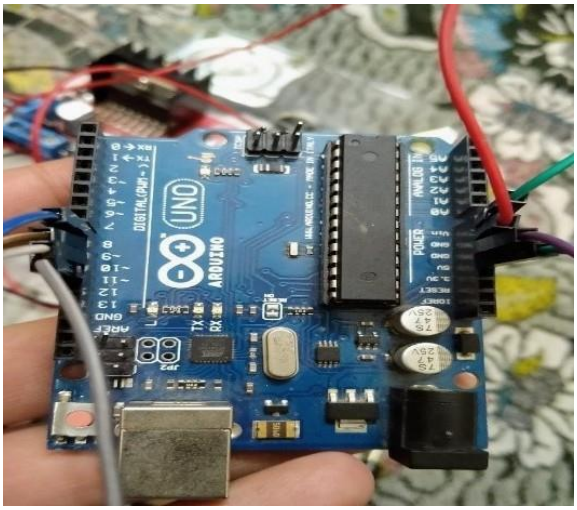

Fig 1

CONTROL SHIELD(L293D):

L293D is a Motor Driver IC used to control motors with a microcontroller. This motor shield consists of three ICs. We can control 4 motors with this shield. The motor shield is used for Arduino UNO board. The best thing about the shield is we don't need to write the whole function for driving a motor there is special library for this module. We just recall some command to run the motors.

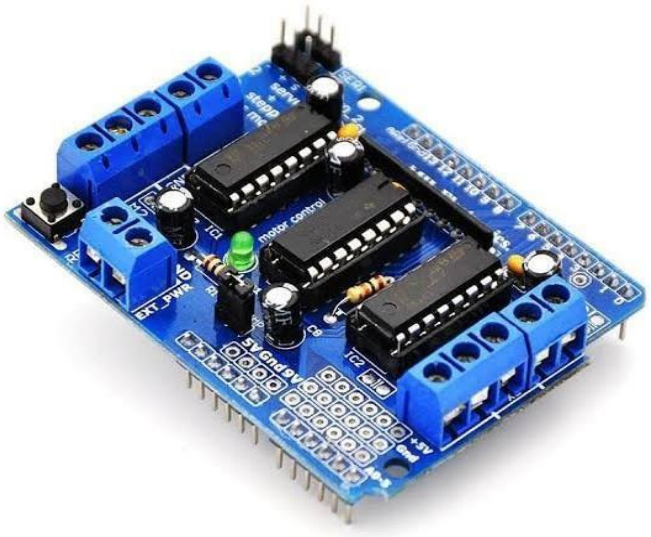

Fig 2

DC Motor :

A DC motor must not connect directly to the Arduino pin because it can burn your Arduino so we must use transistor or in our case we use shield between Arduino and motor. By using motor shield, we can control speed and as well as direction of the motor.

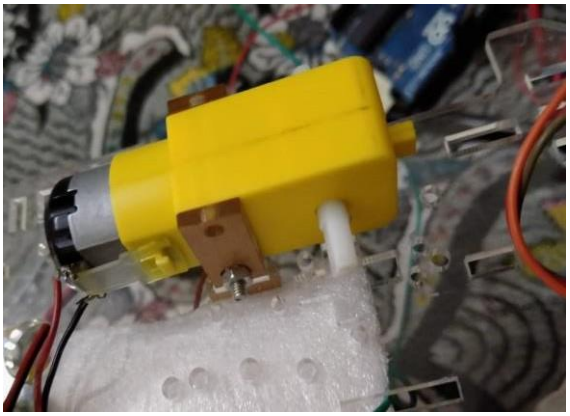

Fig 3

SENSORS (IR Sensors):

We have used Two IR Sensors as the line detecting sensor for the project that are mounted on left and right side of car. It consists of an IR LED and a Photo diode and some other components like comparator, LED etc.

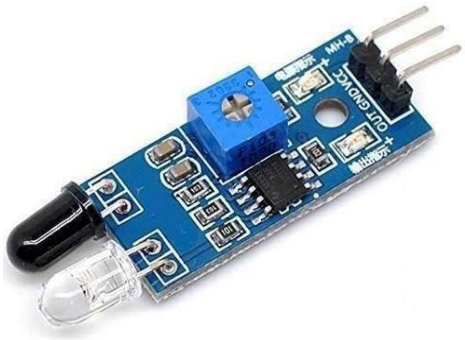

Fig 4

Block Diagram

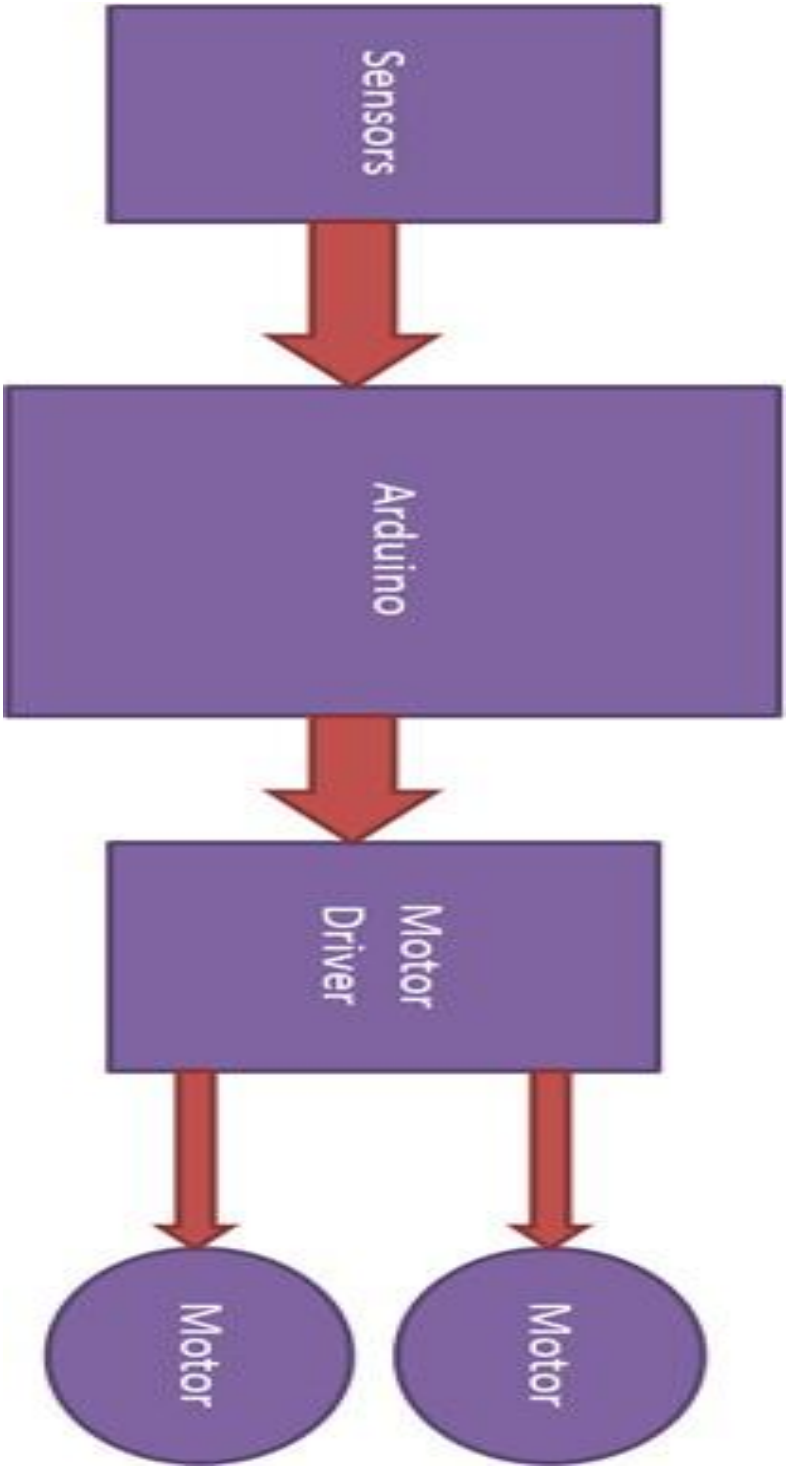

Fig 5

Working principle

As stated earlier, line follower robot (LFR) follows a line, and in order to follow a line, robot must detect the line first. Now the question is how to implement the line sensing mechanism in a LFR. We all know that the reflection of light on the white surface is maximum and minimum on the black surface because the black surface absorbs maximum amount of light. So, we are going to use this property of light to detect the line. To detect light, either LDR (light-dependent resistor) or an IR sensor can be used. For this project, we are going with the IR sensor because of its higher accuracy. To detect the line, we place two IR sensors one on the left and other on the right side of the robot as marked in the diagram below. We then place the robot on the line such that the line lies in the middle of both sensors. We have covered a detailed Arduino IR sensor tutorial which you can check to learn more about the working of IR sensors with Arduino Uno.

Infrared sensors consist of two elements, a transmitter and a receiver. The transmitter is basically an IR LED, which produces the signal and the IR receiver is a photodiode, which senses the signal produced by the transmitter. The IR sensors emits the infrared light on an object, the light hitting the black part gets absorbed thus giving a low output but the light hitting the white part reflects back to the transmitter which is then detected by the infrared receiver, thereby giving an analog output. Using the stated principle, we control the movement of the robot by driving the wheels attached to the motors, the motors are controlled by a microcontroller.

Code

```
#include <AFMotor.h>


// YOU HAVE TO INSTALL THE AFMOTOR LIBRARY BEFORE UPLOAD THE CODE//
// GO TO SKETCH >> INCLUDE LIBRARY >> ADD .ZIP LIBRARY >> SELECT AF MOTOR ZIP FILE //


//including the libraries
#include <AFMotor.h>

//defining pins and variables
#define lefts A0
#define rights A1

//defining motors
AF_DCMotor motor1(1, MOTOR12_1KHZ);
AF_DCMotor motor2(2, MOTOR12_1KHZ);
AF_DCMotor motor3(3, MOTOR34_1KHZ);
AF_DCMotor motor4(4, MOTOR34_1KHZ);



void setup() {
  //Setting the motor speed
  motor1.setSpeed(180);
  motor2.setSpeed(180);
  motor3.setSpeed(180);
  motor4.setSpeed(180);
  //Declaring PIN input types
  pinMode(lefts,INPUT);
  pinMode(rights,INPUT);
  //Begin serial communication
  Serial.begin(9600);

}

void loop(){
  //Printing values of the sensors to the serial monitor
  Serial.println(analogRead(lefts));
  Serial.println(analogRead(rights));
  //line detected by both
  if(analogRead(lefts)<=350 && analogRead(rights)<=350){
```

```
  //Forward
  motor1.run(FORWARD);
  motor2.run(FORWARD);
  motor3.run(FORWARD);
  motor4.run(FORWARD);
 }
 //line detected by left sensor
 else if(analogRead(lefts)<=350 && !analogRead(rights)<=350){
  //turn left
  motor1.run(FORWARD);
  motor2.run(FORWARD);
  motor3.run(BACKWARD);
  motor4.run(BACKWARD);

 }
 //line detected by right sensor
 else if(!analogRead(lefts)<=350 && analogRead(rights)<=350){
  //turn right
  motor1.run(BACKWARD);
  motor2.run(BACKWARD);
  motor3.run(FORWARD);
  motor4.run(FORWARD);

 }
 //line detected by none
 else if(!analogRead(lefts)<=350 && !analogRead(rights)<=350){
  //stop
  motor1.run(RELEASE);
  motor2.run(RELEASE);
  motor3.run(RELEASE);
  motor4.run(RELEASE);

 }
```

ADVANTAGES :

- Robot movement is automatic
- It is used for long distance applications
- Simplicity of building
- Fit and forget system
- Used in home, industrial automations etc.

Applications:

- ✓ Industrial automated equipment carriers.
- ✓ Automated cars.
- ✓ Tours guides in museums and other similar applications.
- ✓ Deliver the mail within the office building.
- ✓ Deliver medication in a hospital.
- ✓ Used in place of crane.

Sample Figure

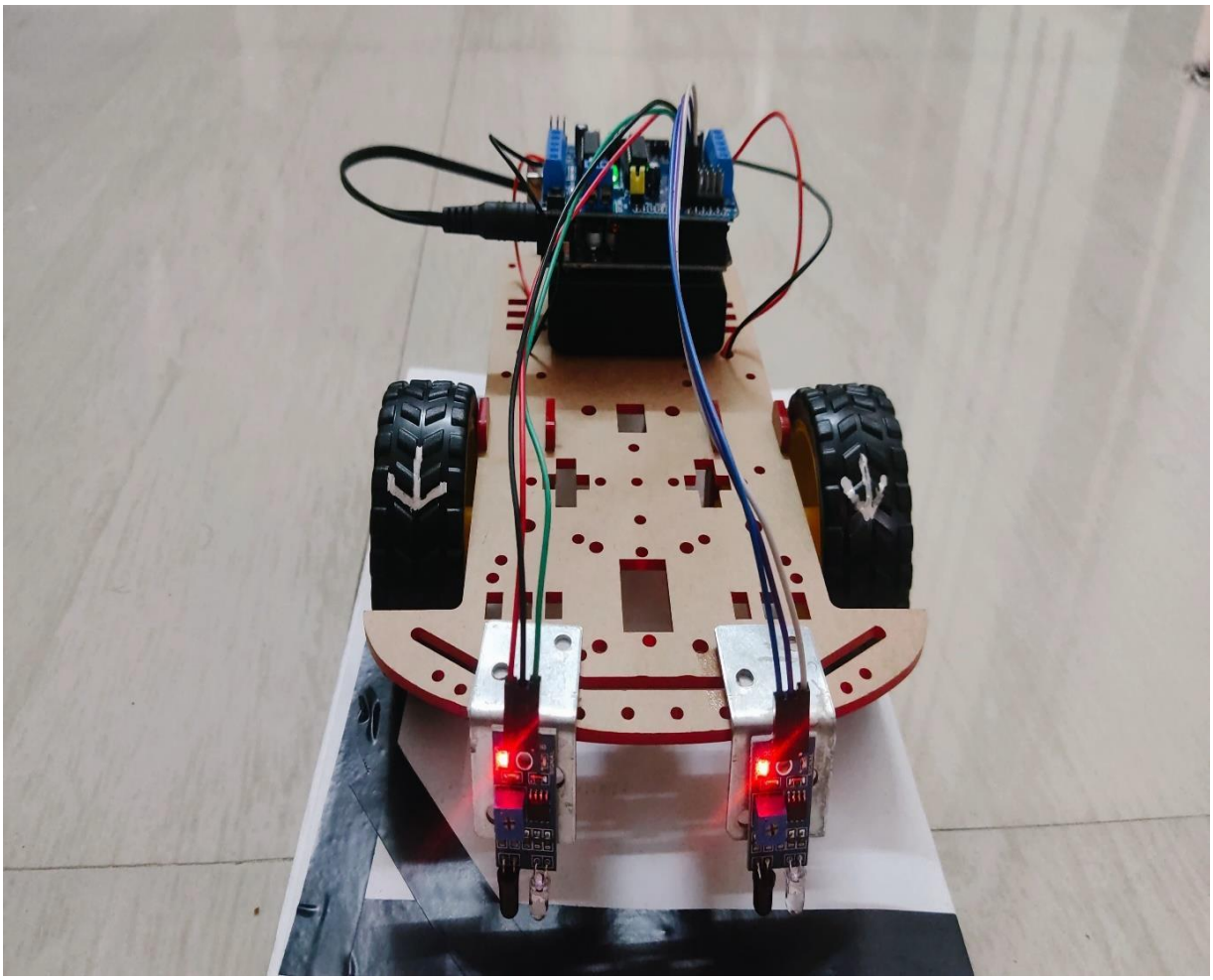

Fig 6

Result

In this report we conclude from our project that if we give input through sensor in analog form then it converted into output in digital form. We also conclude that we can make carto follow the certain path of our choice. In this project, the sensors sense the color of surface and according to the code the car will move left, right or straight.