MINI PROJECT REPORT
(2019-20)

LINE FOLLOWING ROBOT

Institute of Engineering & Technology

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ACKNOWLEDGEMENT

We thank the almighty for giving me the courage and perseverance in completing the project.

This project itself is an acknowledgement for all those people who have given me their heartfelt co-operation in making this project a grand success. We extend our sincere thanks to **Mr. Pankaj Sharma,** our mini project trainer, for providing valuable guidance at every stage of this project work. We are profoundly grateful towards the unmatched services rendered by him.

Last but not least we would like to express our deep sense of gratitude and earnest thanksgiving to our dear parents for their moral support and heartfelt co-operation in completing the project.

ABSTRACT

Line Following Robot is one of the most important aspect of robotics. A line Following Robot is an autonomous robot which is able to follow either a black line that is drawn on the surface consisting of a contrasting color. It is designed to move automatically and follow the line.

The robot uses array of IR sensor to identify the line. Thus, assisting the robot to stay on the track. The array of four sensor makes its movement precise and flexible. The robot is driven by DC gear motor to control the movement of the wheel. The Arduino Uno interface is used to perform and implement algorithm to control the speed of the motor, steering the robot to travel along the line smoothly.

This project aims to implement the algorithm and control the movement of the robot by proper tuning of the control parameters and thus achieve better performance. It can be used for industrial automated equipment carriers, small household application, tour guide in museum and other applications etc.

DECLARATION

we hereby declare that the work which is being presented as mini project**, LINE FOLLOWING ROBOT** using **INTERNET OF THINGS(IOT)**, in partial fulfillment of the requirements for mini projects viva voice, is an authentic record of our own word carried under the supervision of "**Mr. Pankaj Sharma(Assistant Prof.)**".

Signature of Candidates:

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Course: B.Tech (Computer Science)
Year: 3rd
Semester: 6th

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CHAPTER 1

INTRODUCTION

Line follower is a machine that can follow a path. The path can be visible like a black line on a white surface. Sensing a line and maneuvering the robot to stay on course, while constantly correcting wrong moves using feedback from the sensor forms a simple yet effective system. It can be used in automobile, industrial automations, guidance, etc.

1.1 BACKGROUND

As technology becomes increasingly important in today's world, it is invaluable to not only learn how to use technology, but also to understand how to create it. Since being the engineer one should have sound knowledge of the other discipline. Most of the projects have limited scope to only specific discipline. This would limit one’s innovation and creativity. This project inspires to make connections across several disciplines rather than learning topics in isolation as it combines mechanical, electronic, electrical and programming skills.

1.2 MOTIVATION

How ants always travel in a line, following any invisible route in search of food, or back home. How on roads the lanes are followed to avoid accidents and traffic jams. Ever thought about a robot which follows line? A perfect or near perfect mimic of nature? After all the purpose of robotics is to recreate in terms of machines what one sees around to solve a problem or fulfill a requirement.

The area will be benefitted from the project:

- Industrial automated equipment carriers.
- Entertainment and small household applications.
- Tour guides in museums and other similar applications.

1.3 PROBLEM DESCRIPTION

In the industry carriers are required to carry products from one manufacturing plant to another which are usually in different buildings or separate blocks. Conventionally, carts or trucks were used with human drivers. Unreliability and inefficiency in this part of the assembly line formed the weakest link. The project is to automate this sector, using carts to follow a line instead of laying railway tracks which are both costly and an inconvenience.

1.4 OBJECTIVE

The objectives of the project is basically that the robot must be capable of following a line. and it should be capable of taking various degrees of turns. It can help can in automating medical centers by carrying the medicines from doctors to patients in particular time laps. It can also help in automating the industrial machinery goods to transport from one place to other. The minimum number of motors allows the robot to minimize the power consumption while constructing a program that can produce coordination of multi-degree of freedom for the movement of the robot. The main objective is to reduce the human workload and help them to complete the huge amount of work on time.

1.5 METHODOLOGY

After the detail literature survey through the books, journal, magazine, websites. The idea of the project is well defined. The logic is derived for the intelligence of the robot. It is programmed and burn it to the Arduino UNO by using the software Arduino IDE. The accuracy and viability of the program and electronic components is tested in the simulation software Proteus. After the successful simulation result it is implemented in the hardware. After finishing the programming, electrical and electronics part, the stable, reliable, flexible, mechanical design and fabrication is completed. Finally, system is tested and encountered error is omitted.

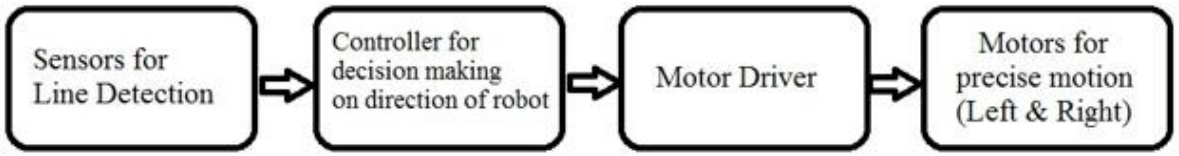
CHAPTER 2

LITERATURE SURVEY

The line follower is a self-operating robot that detects and follows a line that is drawn on the floor. The line follower robot using Arduino is a self-operating system that detects and follows track drawn on the floor. The track consists of a black path drawn on white surface.

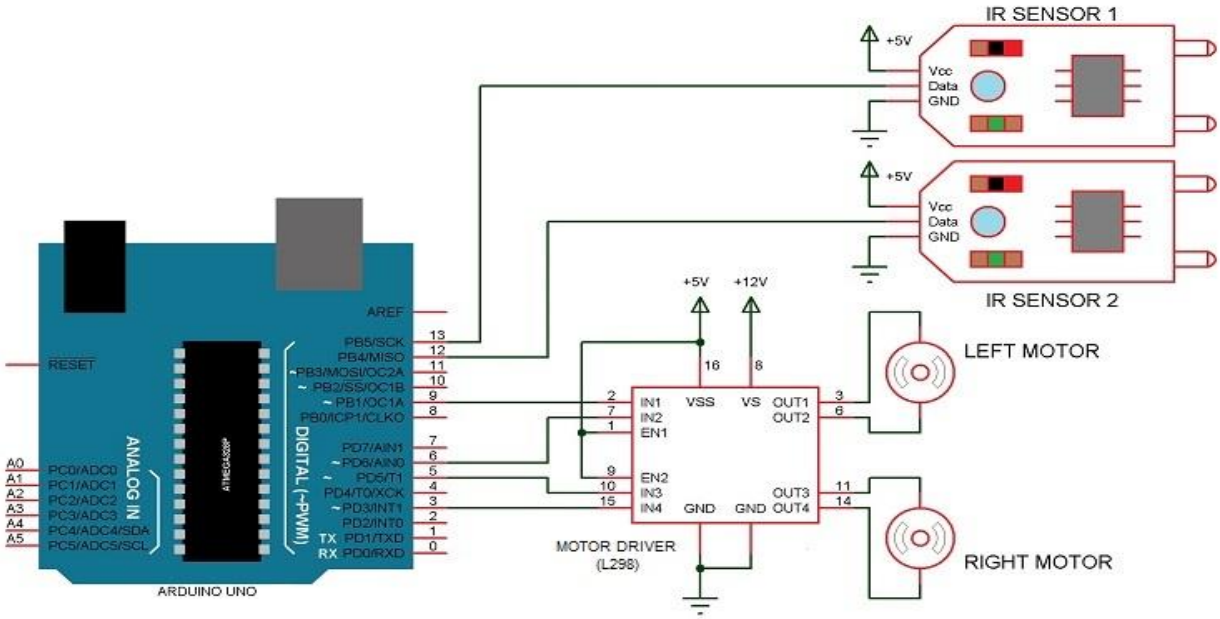
2.1 BLOCK DIAGRAM

The line follower robot built in this project is divided in to 4 blocks. The following image shows the block diagram for line following robot:



BLOCK DIAGRAM OF THE LINE FOLLOWING PROJECT

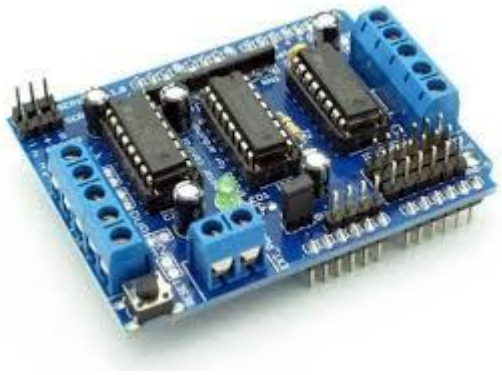
2.2 SCHEMATIC DIAGRAM



2.3 HARDWARE REQUIRED

- **IR Sensor:** We have used IR Sensor Module as the line detecting sensor for the project. It consists of an IR LED and a Photo diode and some other components like comparator, LED etc.

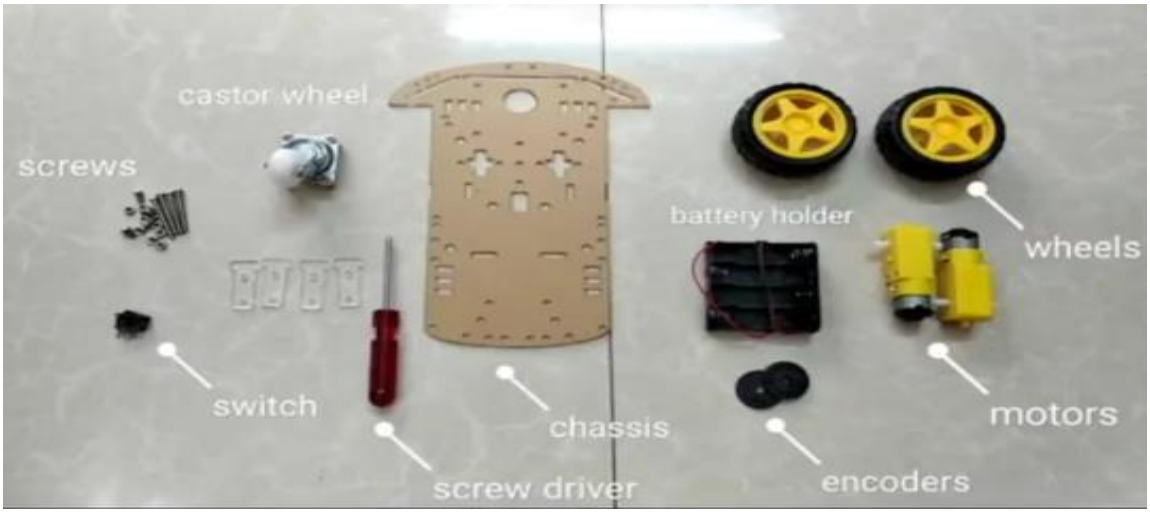
- **Motor Driver (L293D)**: L293D Motor Driver is used in this project to drive the motors of the robot. It receives signals from Arduino based on the information from the IR Sensors.

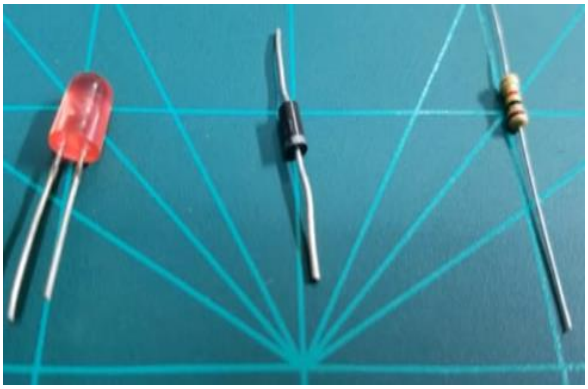


- **Arduino UNO**: Arduino UNO is the main controller in the project. The data from the sensors (IR Sensors) will be given to Arduino and it gives corresponding signals to the Motor Driver IC.

- **Geared Motors and Wheels**: We have used two geared motors at the rear of the line follower robot. These motors provide more torque than normal motors and can be used for carrying some load as well.

- And some other components are Chassis, Jumper Wire, LED, Diode, Register(1k),Battery.





CHAPTER 3

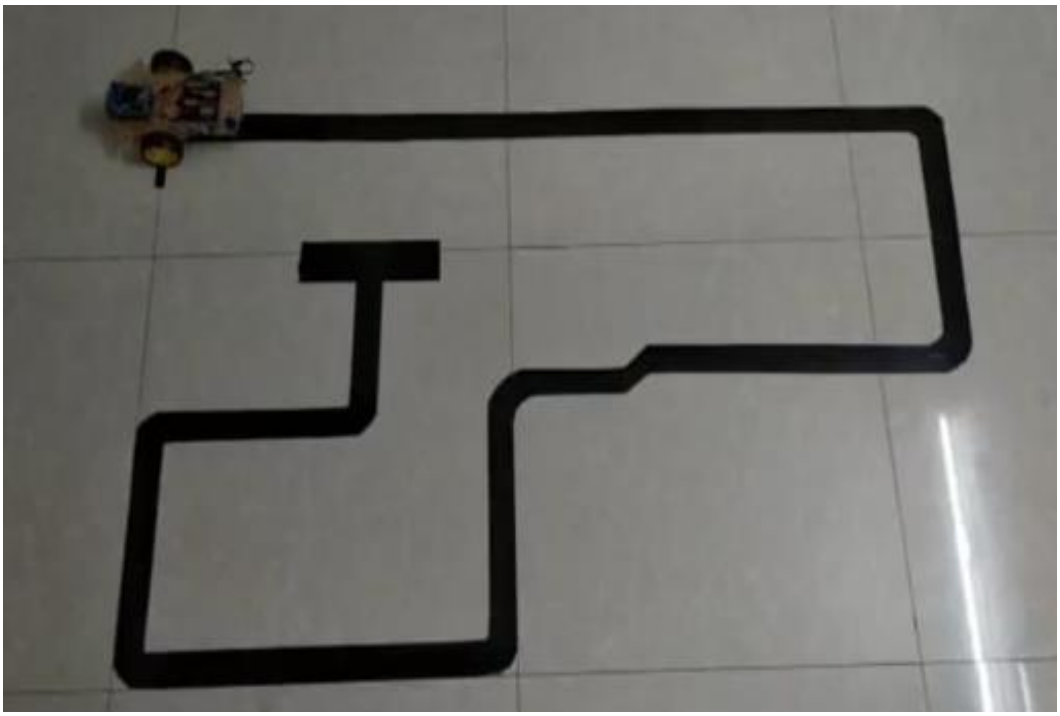
IMPLEMENTATION

In this project, we have designed an Arduino based Line Follower Robot. The working of the project is pretty simple: detect the black line on the surface and move along that line. The detailed working is explained here.

The chassis of the robot is made up of the acrylic glass since it can carry more load and have lighter in weight.

3.1 DESIGN OF THE PATH

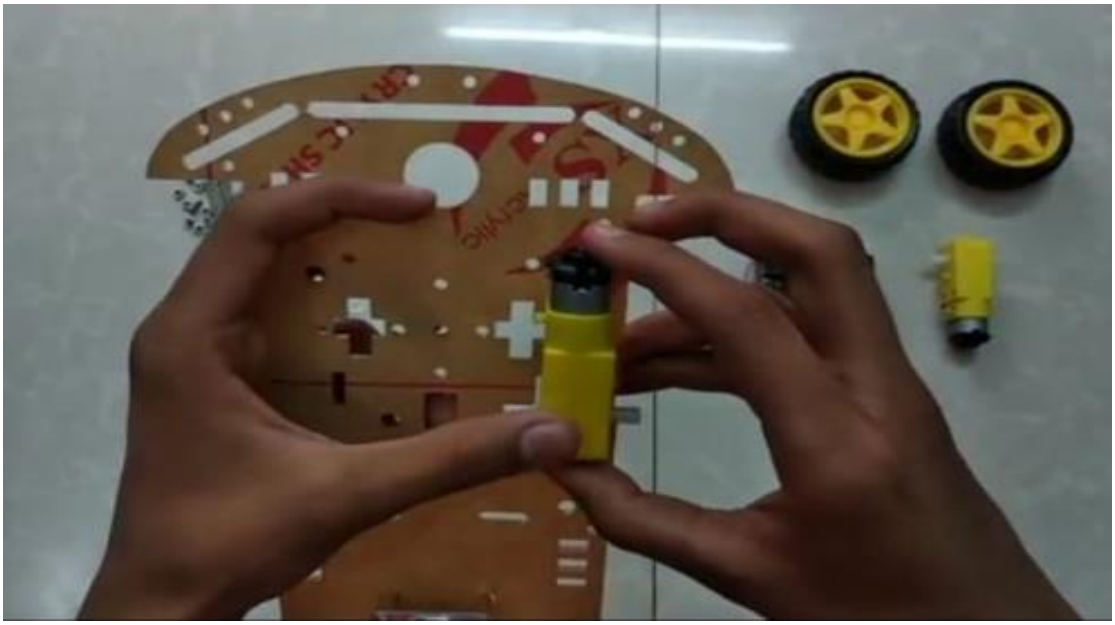
The path consists of many turns of different angles. Among these turns, our robot swiftly follows the whole path. The robot will not move out of track till the end.
The path is also called as **ARENA,** which is made up of black color paint. IR Sensor detects the black line path and reach the destination.



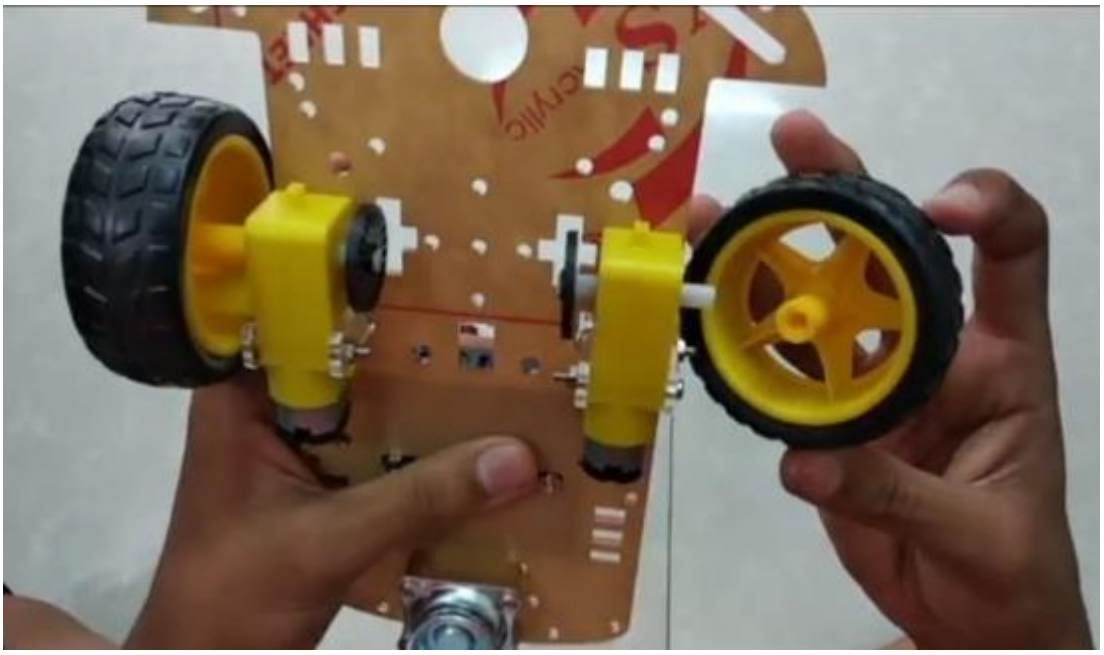
3.2 WORKING

The working starts by assembling all the major components of the robot on the chassis plate. Here we are connecting the front wheel of the robot to the chassis plate.

Now we will connect the geared motor through the chassis plate. The motor will basically help to rotate the rear wheels of the robot so that the robot can move along the path depending on the incoming signals from IR Sensor.

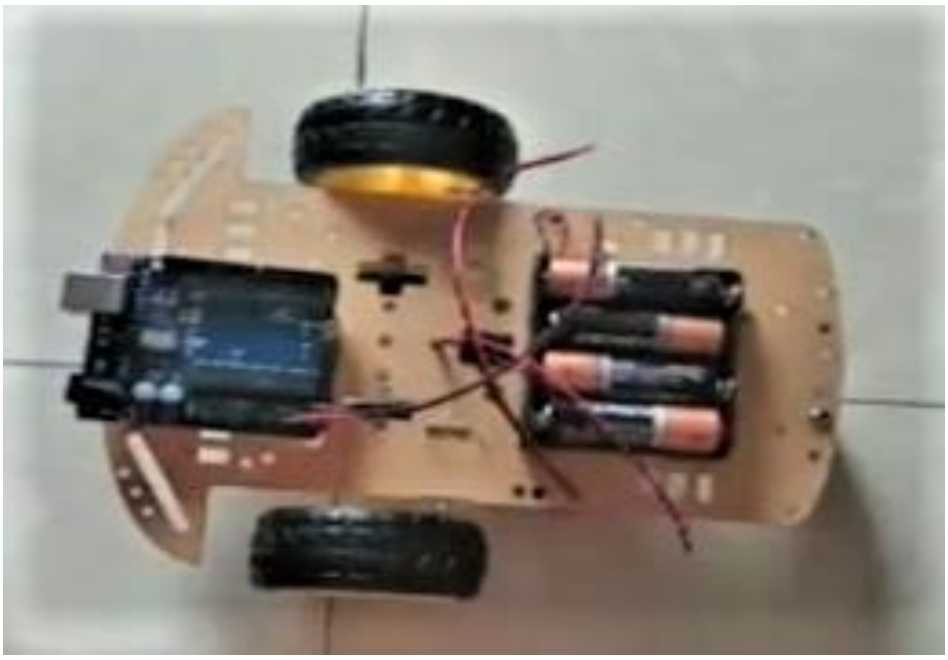


Now we are connecting rear wheels to the geared motor set.



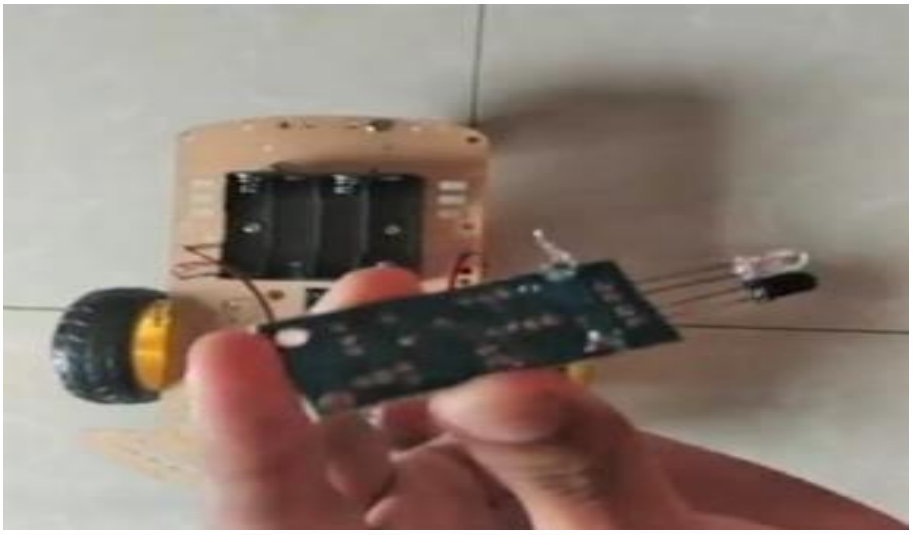
The battery holder and batteries are attached to the chassis plate to provide 5volt supply to the IR Sensor, Geared motor and Arduino board.

Arduino board is now attached to the LFR model. Arduino UNO is used to connect the hardware to the Arduino IDE software through the programming executable code.



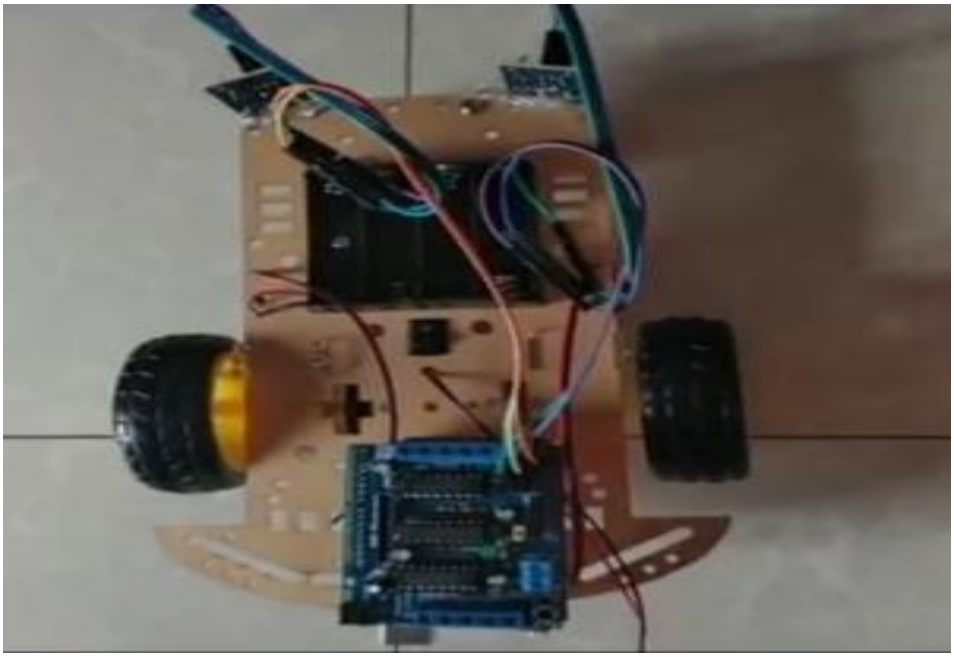
Now we will place motor driver L293D over Arduino UNO board. The main purpose of motor driver L293D is to coordinate between sensors and actuators.

As mentioned in the block diagram, we need sensors to detect the line. For line detection logic, we used two IR Sensors, which consists of IR LED and Photodiode. They are placed in a reflective way i.e. side – by – side so that whenever they come in to proximity of a reflective surface, the light emitted by IR LED will be detected by Photo diode.

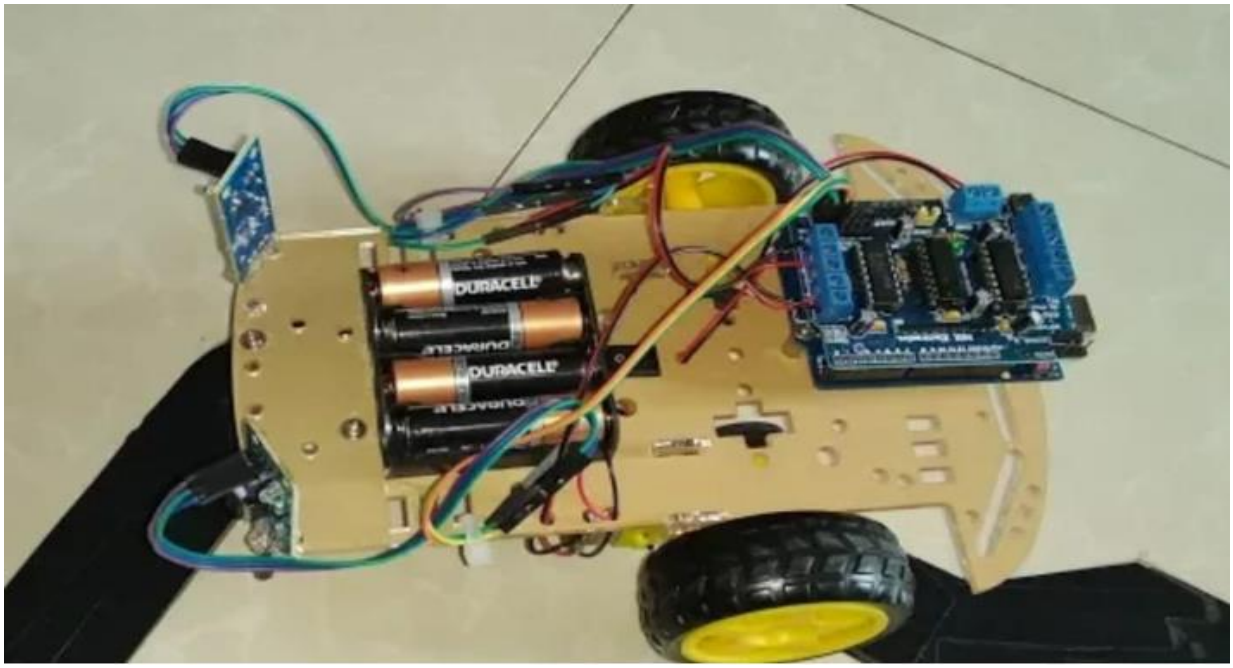


When the robot moves forward, both the sensors wait for the line to be detected. For example, if the IR Sensor 1 in the above image detects the black line, it means that there is a right curve (or turn) ahead.

Finally, we will connect all the components with the jumper wires as shown below:



The picture of the line following robot is captured by the still camera at some angle and shown below.



CHAPTER 4

TESTING

Testing in simple terms is checking your application for potential bugs before it's made live or before code is moved into the production environment. During this stage issues such as that of application bugs, security, the functioning of the site, its access to handicapped as well as regular users and its ability to handle traffic is checked.

4.1 Functionality Testing

This is used to check if your product is as per the specifications you intended for it as well as the functional requirements you charted out for it in your developmental documentation. It is a kind of black box testing that is performed to confirm that the functionality of an application or system is behaving as expected.

4.2 Performance testing

Performance testing is the process of determining the speed, responsiveness and stability of a computer, network, software program or device under a workload. Performance testing can involve quantitative tests done in a lab, or occur in the production environment in limited scenarios. It is a type of testing performed to check how application or software performs under workload in terms of responsiveness and stability.

CHAPTER 5

APPENDICES

5.1 PROGRAM CODE:

Here code is developed in the same view represented by the flowchart. Code accompany with algorithm side of it.

```
#include <AFMotor.h>

//defining pins and variables
#define lefts A4
#define rights A5

//defining motors
AF_DCMotor motor1(4, MOTOR12_8KHZ);
AF_DCMotor motor2(3, MOTOR12_8KHZ);
/*
AF_DCMotor motor1(3, MOTOR12_8KHZ);
AF_DCMotor motor2(4, MOTOR12_8KHZ);
 */

void setup() {
  //setting the speed of motors
  motor1.setSpeed(200);
  motor2.setSpeed(200);
  //declaring pin 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)<=400 && analogRead(rights)<=400){
    //stop
```

```
   motor1.run(RELEASE);
    motor2.run(RELEASE);
  }
  //line detected by left sensor
  else if(analogRead(lefts)<=400 && !analogRead(rights)<=400){
    //turn left
    motor1.run(BACKWARD);
    motor2.run(FORWARD);
    /*
    motor1.run(RELEASE);
    motor2.run(FORWARD);
     */
  }
  //line detected by right sensor
  else if(!analogRead(lefts)<=400 && analogRead(rights)<=400){
    //turn right
    motor1.run(FORWARD);
    motor2.run(BACKWARD);
    /*
    motor1.run(FORWARD);
    motor2.run(RELEASE);
     */
  }
  //line detected by none
  else if(!analogRead(lefts)<=400 && !analogRead(rights)<=400){
    //stop
    motor1.run(FORWARD);
    motor2.run(FORWARD);
    /*
    motor1.run(BACKWARD);
    motor2.run(BACKWARD);
     */
  }

}
```

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

The line following robot is automobile system that has ability to recognize its path, move and change the robot's position toward the line in the best way to remain in track. This project report presents a IR sensor based line follower robot design of 300gm weight which always directs along the black line on white surface. It is designed to move automatically and follow the plotted line. It enhances interdisciplinary approach to mechanical, electronic, electrical and programming skills. The application of the project is range from the individual domestic appliance to automation and control aspect of large industry. Human are intelligent natural machine but it has serious limitation of efficiency and reliability.

6.2 FUTURE SCOPE

In the process of development of the line follower, most of the useful feature is identified and many of them was implemented. But due to the time limitations and other factor some of these cannot be added. So the development features in brief:

- Use of color sensor.
- Use of camera for better recognition and precise tracking the path.

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