

# Autonomous Line following robot and Obstacle Avoiding Robot.



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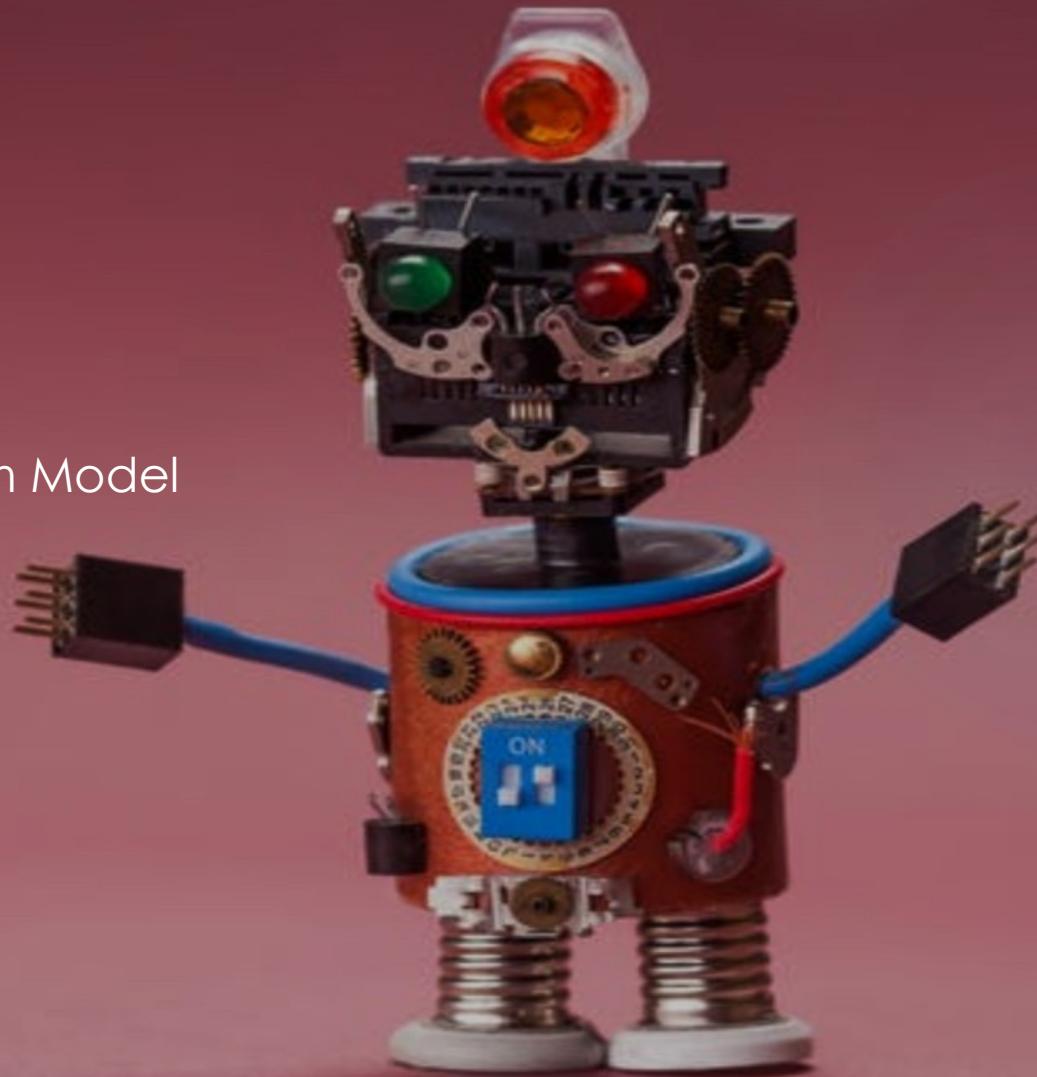
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# Outline

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## Objective

- The main objective of our project is to design a autonomous line following robot using Microcontroller.
  - The robot must be capable of following a line with the help of IR - sensors
  - It should be capable of taking various degrees of turns.
  - The robot must be able to detect any obstacle present in the path with the help of Ultrasonic sensors.
  - The robot must be able to carry weight of 150 -200 g in the carrier cart.
  - The robot must be insensitive to environmental factors such as lighting and noise.
  - It must allow calibration of the line's darkness threshold.
  - Scalability must be a primary concern in the design.



# Introduction

## ➤ What is Line following Robot ?

- Line follower is a machine which follows a line (black or white line).
- 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 .
- In our proposed project, we design a line following robot with the help of microcontroller.
- We use Atmega 32 microcontroller to control the operation of the line follower.



## Literature Review

- There are lot of resources available to learn about the working of microcontrollers and other circuit elements.
- We have followed [1] to understand the working of vision based robots.
- The circuit diagram for the line follower is available on various online platforms [2]-[9].
- To learn about various IC we followed the respective datasheets from [10].



## Motivation

- How ants always travel in a line, following an invisible route in search of food, or back home?
- How on roads the lanes is followed to avoid accidents and traffic jams?
- Ever thought about a robot which follows line?
- A perfect or near perfect mimic of nature?
- Based on technical developments, our need and dependency on automation is increasing rapidly.
- One of most important key behind the automation in a system is its brain that is Microcontroller.
- The basic motivation behind this project is to learn the working of Line follower robot with help of microcontroller.

- After all the purpose of robotics is to recreate in terms of machines what one see 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.

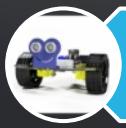


## Problem Formulation

- 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.
- The system has restricted to the following limitation :
  - Choice of line is made in the hardware abstraction and cannot be changed by software.
  - Calibration is difficult, and it is not easy to set a perfect value.
  - Few curves are not made efficiently, and must be avoided.



- The turning radius should be of minimum 100m to take smooth U-turning of robot.
- The width of the path must be of 45mm so that it can cover minimum 3 sensors.
- The path should be plane and obstacle free.
- The steering mechanism is not easily implemented in huge vehicles and impossible for non-electric vehicle

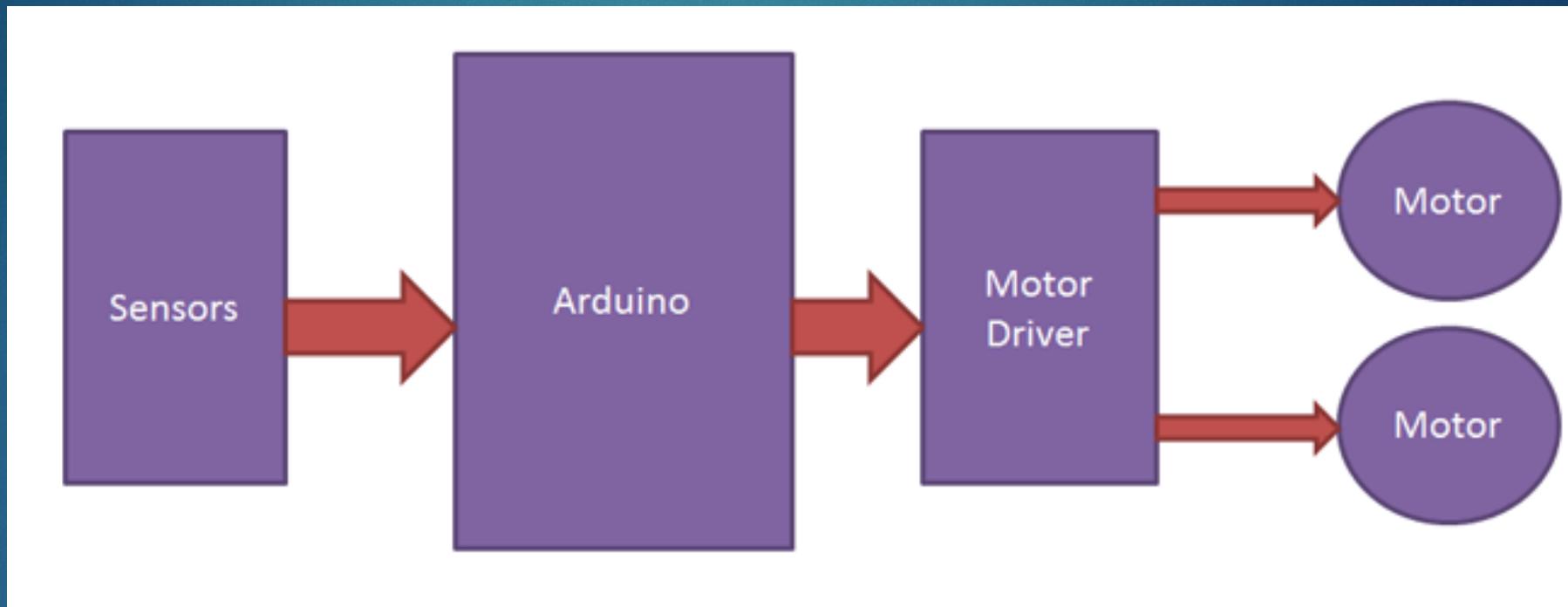


## Solution Methodology : System Model

- With the problems mentioned in the previous slides, we aim to design a line following robot which can automatically follow a predefined path.
- To control the operation of our model, we have used an Microcontroller.
- This robot can follow either white or black line as per our requirement.
- Line detection part is done by an IR sensor module.
- Based on the signal comes from the IR sensor module, rotation of the DC motors will be controlled by the Microcontroller.
- We have ultrasonic sensors for the detection of any obstacle in the path .



# System Block Diagram





## Components

➤ Components:

- Arduino Uno .
- DC Geared motors or Battery Operation(BO) motor.
- Infrared Sensors.
- Microcontroller Atmega 328P.
- L 293D motor driver.
- Connecting wires or Jumper wires.
- Lithium –Ion Battery.
- Ultrasonic Sensor.
- Carrier Cart.
- Caster Wheel and Robot Wheels.
- Software Specification – Arduino IDE

## 1.Arduino Uno Board:

Arduino board consists of a microcontroller and the control circuit. It can be used for multiple operations at a time. It contains multiple input output pins to connect many input and output devices.

The microcontroller takes the signal from the IR sensor and take the decision and sends the signals to the motor drivers which control the DC motors to rotate the wheels of the Line follower . Atmega 328P is one the most popular microcontrollers.

## 2. L293D Motor Driver:

Motor drivers are used to drive the motors in clockwise or anticlockwise rotation based on the signal comes from the microcontroller. We have taken L293D motor driver.

The L293D IC receives signals from the microprocessor and transmits the relative signal to the motors. It has two voltage pins, one of which is used to draw current for the working of the L293D and the other is used to apply voltage to the motor.



### **3.DC Geared motor:**

To provide motion to the robot we have used DC geared motor which can be easily controlled by DC power supply.

DC motor (BO) Battery Operation.

Dc motor converts electrical energy into mechanical energy.

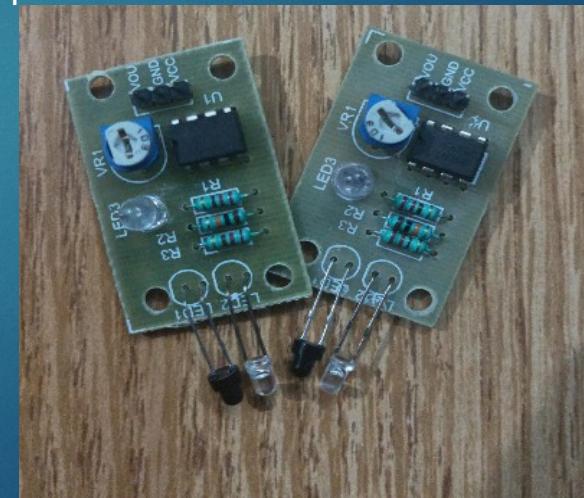
Why DC gear motor used in robot Motor control circuit .DC MOTOR concept is where gears reduce the speed of the vehicle but increase its torque is known as gear reduction.



### **4.Infrared Sensors:**

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm ... 50 μm.

IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.



## 5. Lithium –Ion Battery:

A lithium-ion battery is a family of rechargeable battery types in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. Chemistry, performance, cost and safety characteristics vary across lithium-ion battery types.



## 6.Ultrasonic Sensor HC-SR04:

This **HC-SR04**-Ultrasonic Range Finder is a very popular sensor that is found in many applications where it requires measuring distance and detecting objects.

The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver.

The **HC-SR04** ultrasonic sensor uses sonar to determine the distance to an object like bats or dolphins do.



This Ultrasonic Sensor module is a transmitter, a receiver, and a control circuit in one single pack!! It has very handy and compact construction.

## 7.Jumper Wires:

A jump wire is an electrical wire or group of them in a cable with a connector or pin at each end. Wires are used to connect components to each other on the breadboard or other prototypes, internally or with other equipment or components, without soldering.

Wire connectors could be male or female . A male connector is commonly referred to as a plug and has a solid pin for a center conductor . A female connector is commonly referred to as a jack and has a center conductor with a hole in it to accept the male pin.



## Software Specification :

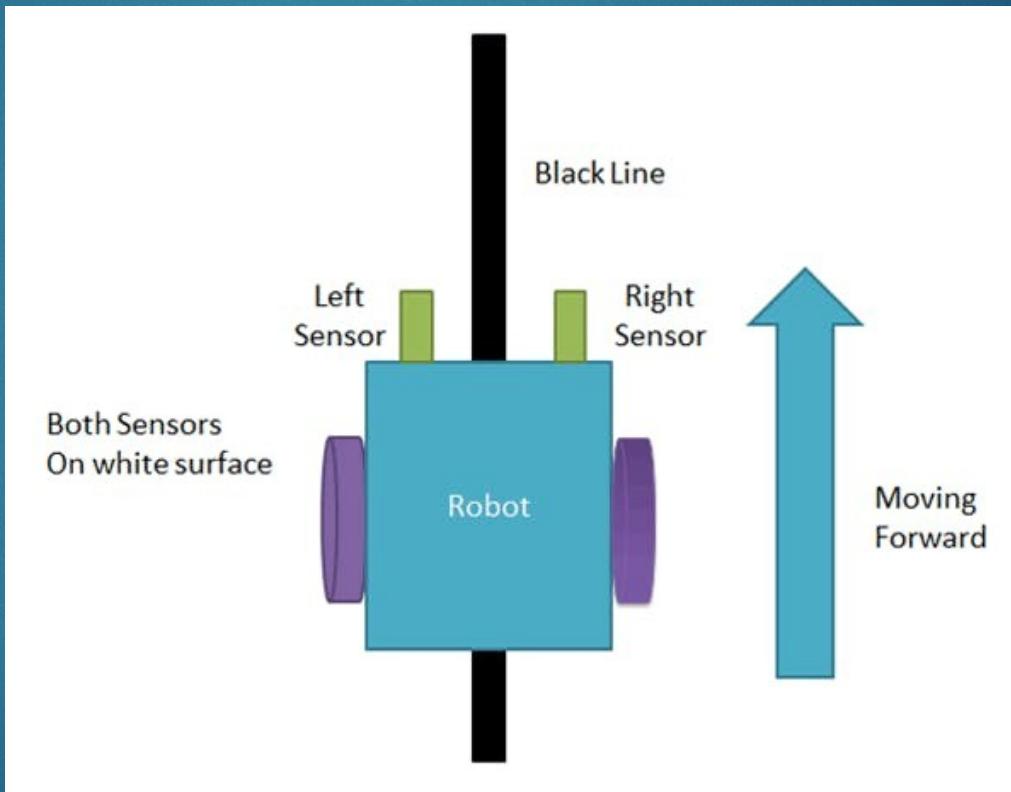
Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language, and the Arduino Software IDE based on processing.





## Working of the Line follower

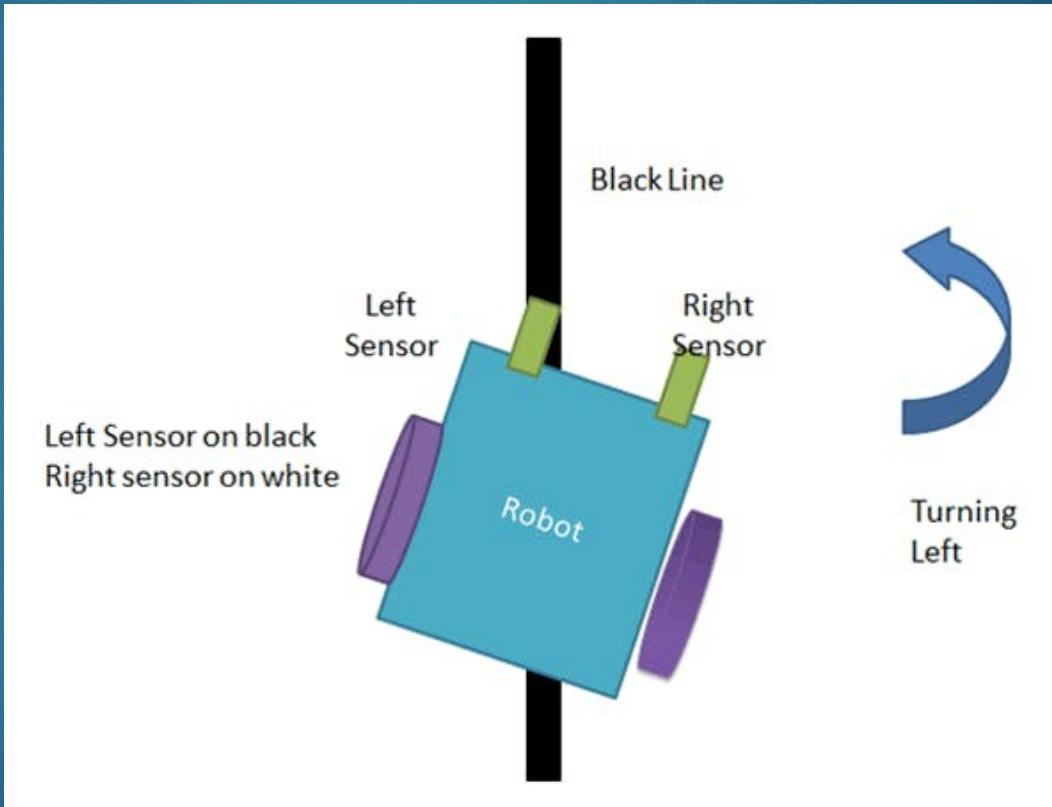
Here in this project we are using two IR sensor modules namely left sensor and right sensor. When both left and right sensor senses white then robot move forward.





## Working of the Line follower

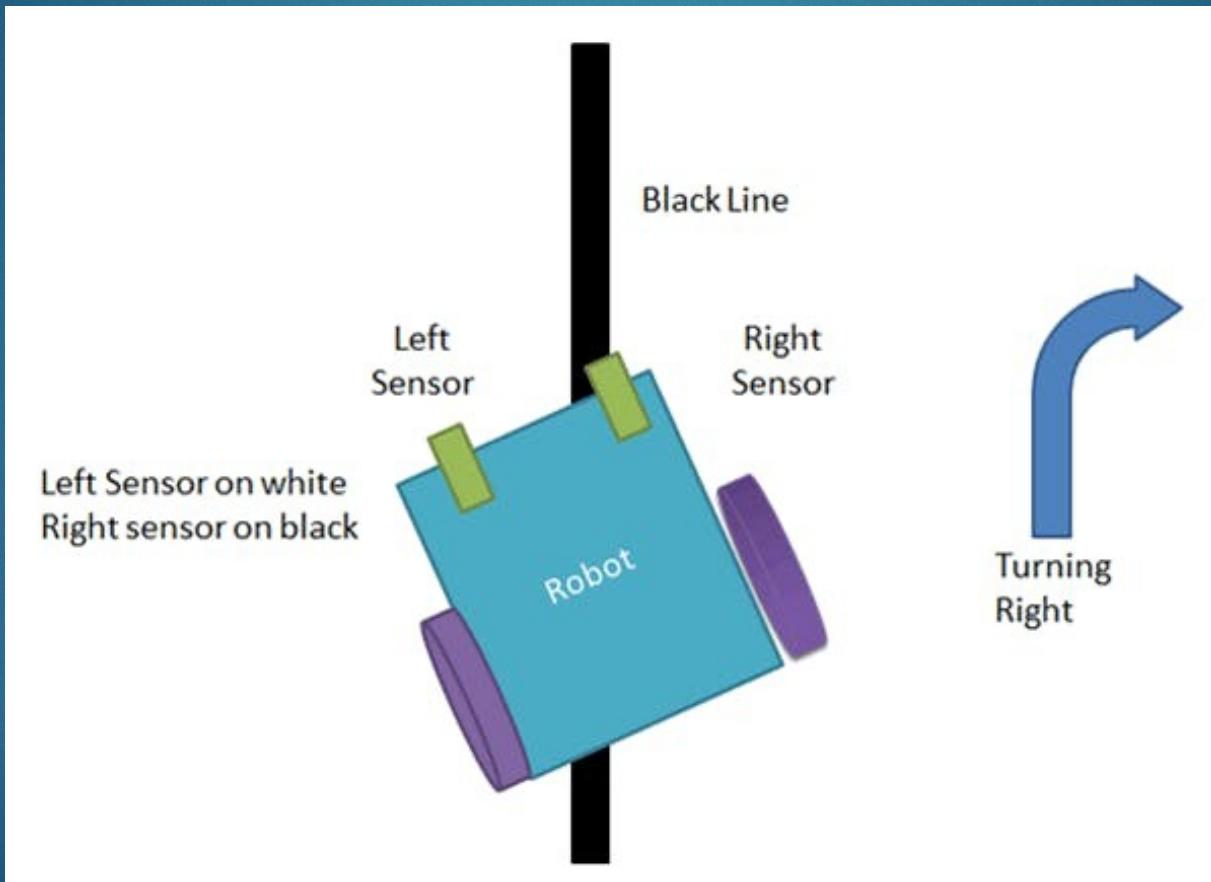
If left sensor comes on black line then robot turn left side.





## Working of the Line follower

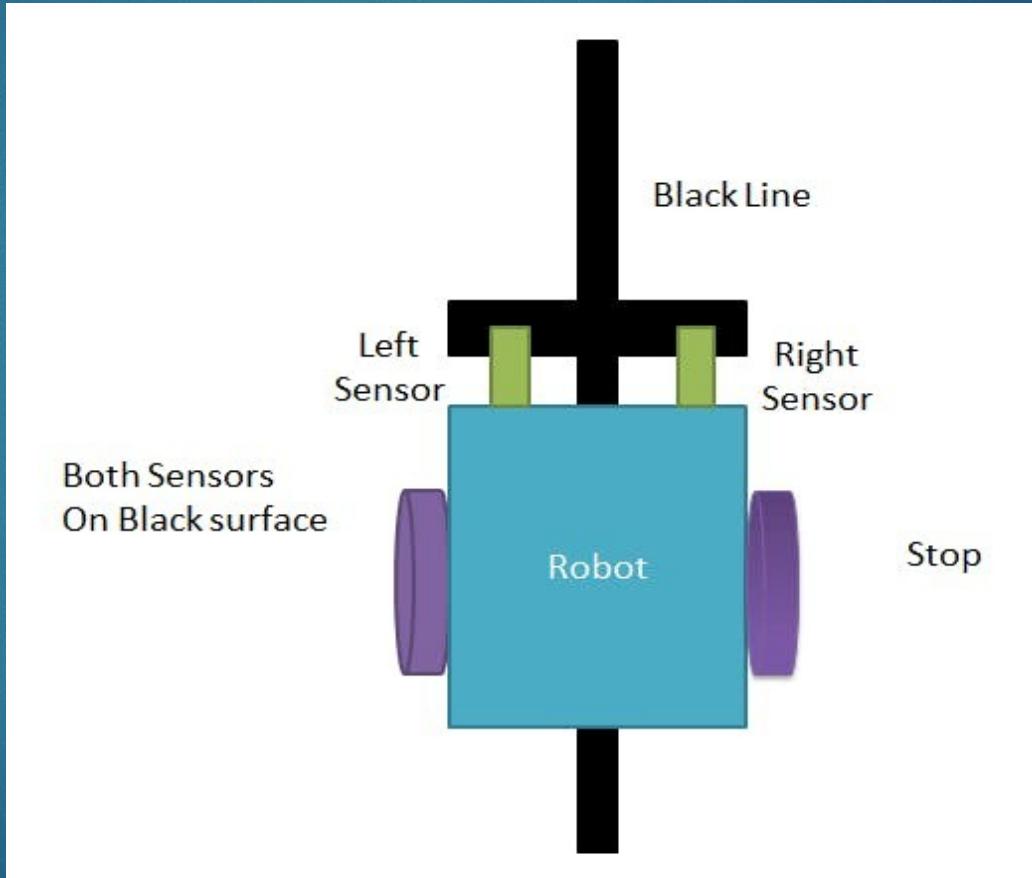
If right sensor sense black line then robot turn right side until both sensor comes at white surface. When white surface comes robot starts moving on forward again.





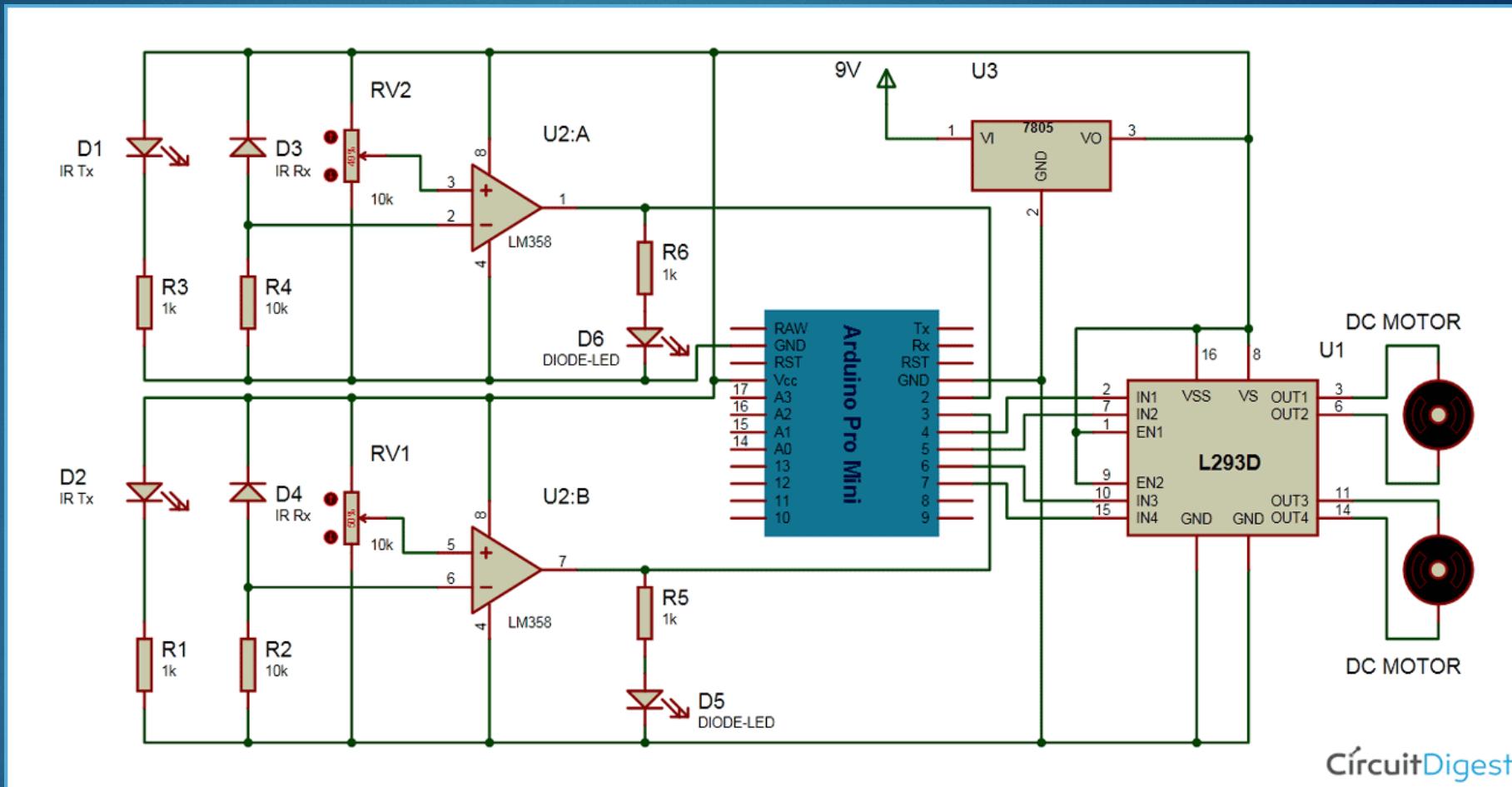
## Working of the Line follower

If both sensors comes on black line, robot stops.





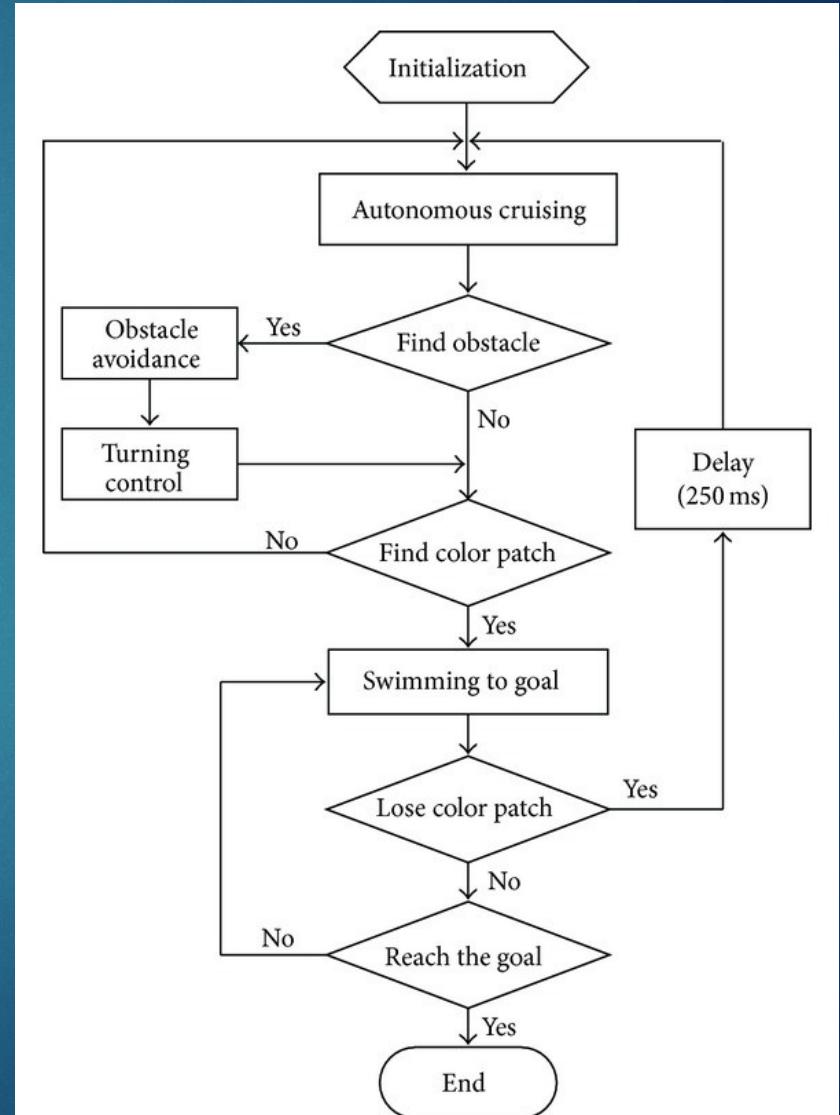
# Circuit Diagram





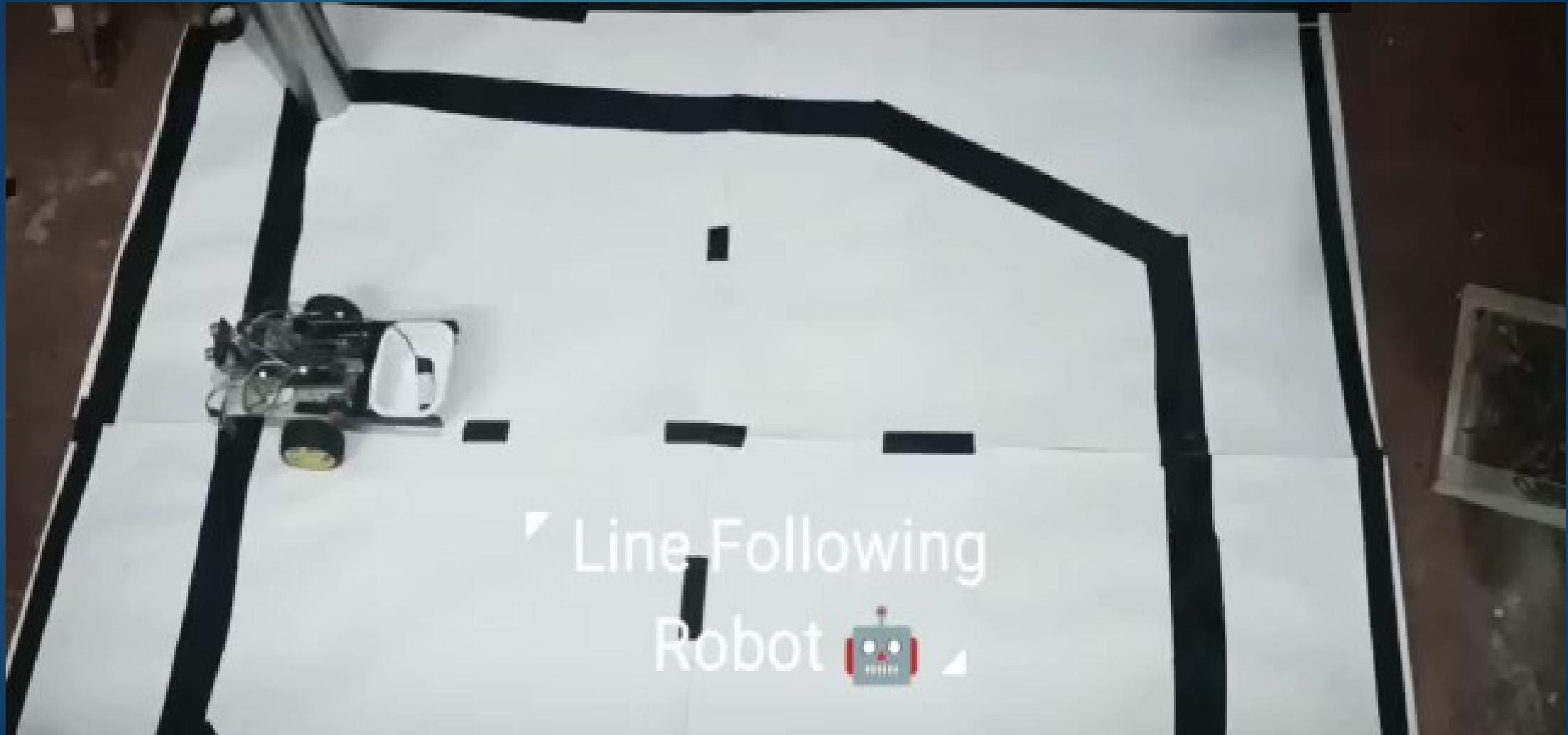
# Working of Obstacle Avoiding Robot

Obstacle Avoiding Robot is an intelligent device which can automatically sense the obstacle in front of it and avoid them by turning itself in another direction.





## Video Demonstration of Working Model.





## Conclusion

- The line following robot is automobile system that has ability to recognize it's path , move and change the robot's position toward the line in the best way to remain in track.
- This project report presents a photodiode sensor based line follower robot design which always directs along the black line on white surface
- The robot is able to detect it's path in case it is out of path.
- The line following robot project challenged the group to cooperate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming.



## 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 ccd camera for better recognition and precise tracking the path.
  - Use of voice command for the working of the line follower robot.



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