

LINE FOLLOWER ROBOT

MINI PROJECT REPORT

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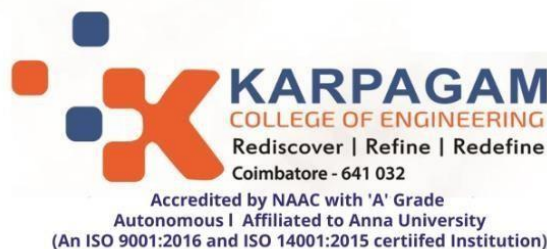
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in

ELECTRICAL AND ELECTRONICS ENGINEERING



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BONAFIDE RECORD OF WORK DONE BY

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ABSTRACT

Robotics is an interesting subject to discuss about and in this advanced world. Robots are becoming a part of our life. As strange as it might seem there is no standard definition for a robot. However there are some essential characteristics that a robot must have and this might help one to decide what is and what not a robot is. It will also help us to decide what features are required to build into a machine before it can behave like a robot. A robot has the essential characteristics sensing the robot should able to sense its surroundings.

Since the beginning of the developments of modern-day robots, people are very much fascinated by them. There is innumerable number of robots in almost all the sectors in the present-day. A lot of new techniques on robotics is developed since its inception. This has resulted in the utilization of electronic concepts in the development to state-of-the-art modern-day robots which can nearly mimic the humans and can nearly do all the sophisticated jobs without failure. In this article, a line-following robot has been studied and developed without using any kind of microcontrollers. Pure analog components have been used for this application. It is a cheaper and reliable way to develop small DIY robots. Its small, easy to learn, fun application that targets new to get a glimpse of hard- ware implementation in the fields of engineering.

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LIST OF ABBREVIATIONS

IR	Infra-Red
LED	Light Emitting Diode
IC	Integrated Circuits
DC	Direct Current

CHAPTER 1

INTRODUCTION

Robotics has greatly advanced in the developed countries. High performance, high accuracy, lower labour cost and the ability to work in hazardous places have put robotics in an advantages positions over many other such technologies but as for developing countries like India it still quite out of reach.

But it is one of the most fascinating and interesting aspects to the new generations and lot of development in robotics has been done in last couple of years. This creates awareness to make a relatively cheap line follower. In this project a vehicle or a robot is guided by two sensors which are used to detect the desired path of the robot. L293D driver with Mechanical model and two line tracking sensors are the main blocks in this project.

Line follower is an autonomous robot which follows either black line in white area or white line in black area. Robot must be able to detect particular line and keep following it .For special situations such as cross over's where robot can have more than one path which can be followed, predefined path must be followed by the robot.Line following is a task in which robot has to follow the line.

PROJECT DESCRIPTION

Building a basic Line Follower Robot involves the following steps.

- Designing the mechanical part or the body of the robot
- Defining the kinematics of the robots
- Designing the control of the robot

A basic Line follower robot can consist of a base at the two ends of which the wheels are mounted. A breadboard can be used as the base. Further a rigid body like a cylinder can be added along with other shaped bodies interconnected with each other by joints, and each with its defined motion in particular direction. The Line follower robot can be a wheeled mobile robot with a fixed base, a legged mobile robot with multiple rigid bodies interconnected by joints. The next step involves defining the Kinematics of the robot. Kinematic analysis of the robot involves the description of its motion with respect to a fixed coordinate system.

CHAPTER 3

AUTOMATION

The automation defines as the technique of making an apparatus, a process, or a system operate automatically. Automation is the technology by which a process or procedure is performed with minimal human assistance. Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heattreating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal or reduced human intervention.

It defines automation as "the creation and application of technology to monitor and control the production and delivery of products and services. Using our definition, the automation profession includes “everyone involved in the creation and application of technology to monitor and control the production and delivery of products and services”; and the automation professional is “any individual involved in the creation and application of technology to monitor and control the production and delivery of products and services.”

It can be performed in many ways in various industries. For example, in the information technology domain, a software script can test a software product and produce a report. There are also various software tools available in the market which can generate code for an application. The users only need to configure the tool and define the process. In other industries, automation is greatly improving productivity, saving time and cutting costs. It is evolving quickly and business intelligence in applications is a new form of high-quality automation. In the technology domain, the impact of automation is increasing rapidly, both in the software/hardware and machine layer. However, despite advances in automation, some manual intervention is always advised.

MODULES AND COMPONENTS

4.1 Battery

A Lithium-ion battery is a type of rechargeable battery which uses the reversible reduction of lithium ions to store energy. Compared to other rechargeable battery technologies, Li-ion batteries have high energy densities, low self-discharge, and no memory effect.

4.2 IR Sensor

This is sensor was sensed black line. And the black line is cut the position at the time the sensor was stopped the robot kit.

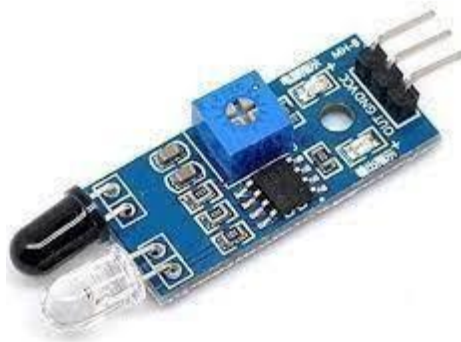


Fig 4.2 IR Sensor

4.2.1 IR Sensor circuit

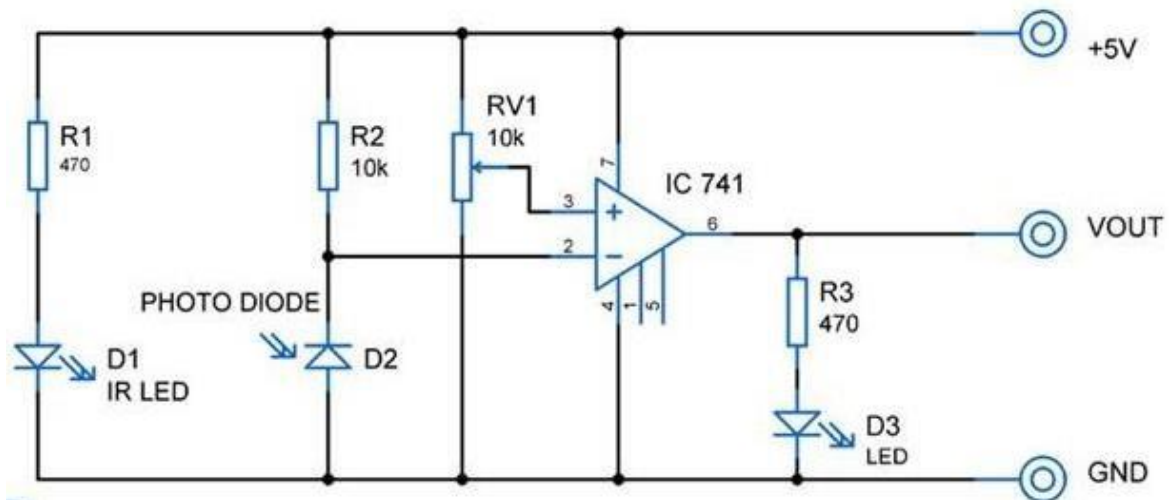


Fig 4.2.1 IR Sensor Circuit

IR transmitter and receiver sensor is used to identify the person standing in the foot step.

In transmitter side consist of IR LED. Here the electrical signal is converted into light energy.

In receiver side consist of IR receiver. It is used to sense the interrupt.

4.2.2 IR Sensor description

Consists of an IR-LED and Photodiode arrangement for each motor which is controlled by the switching on and off of the transistor. The IR LED on getting proper biasing emits Infra red light. This IR light is reflected in case of a white surface and the reflected IR light is incident on the photodiode.

The resistance of the photodiode decreases, which leads to an increase in current through it and thus the voltage drop across it. The photodiode is connected to the base of the transistor and as a result of increased voltage across the photodiode, the transistor starts conducting and thus the motor connected to the collector of the transistor gets enough supply to start rotating.

In case of a black color on the path encountered by one of the sensor arrangement, the IR light is not reflected and the photodiode offers more resistance, causing the transistor to stop conduction and eventually the motor stops rotating.

4.2.3 Working of IR sensor

An Infra-Red sensor (IR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view. Apparent motion is detected when an infrared source with one temperature, such as human, passes in front of an infrared source with another temperature, such as a wall.

All object emit what is known as black body radiation. It is usually infrared radiation that is invisible to the human eye but can be detected by electronic devices designed for such a purpose. “Infra” meaning below our ability to detect it visually, and “Red” because this color represents the lowest energy level that our eyes can sense before it becomes invisible.

Thus, infrared means below the energy level of the color red, and applies to many sources of invisible energy. Infrared transmitted is one type of LED which emits infrared rays generally called as IR Transmitter.

One3 important points is both IR transmitter and receiver should be placed straight line to each other. The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver.

4.3 Motor driver

L293D is a typical Motor driver or Motor driver IC which allows DC motors to drive on either direction. L293D is 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.

Dual H-bridge Motor Driver IC receives signals 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 motors. Motors drives acts as an interface between the motors and the control circuits. Motor require high amount of current where as the controller circuit works on low current signals.

So the function of motor drives is to take a low-current signal that can drive a motor L293D IC generally comes as a standard 16-pin DIP(dual-in-line package). This motor driver IC can simentensoly control two small motors in either direction; forward and reverse with just 4 microcontroller pins.

4.3.1 Pin Details of L293 IC

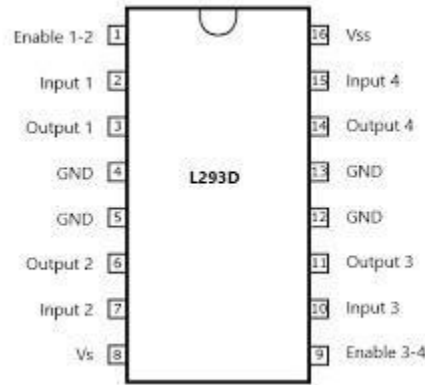


Fig 4.3.1 Pin diagram of L293D

The L293D is a 16 pin IC, with eight pins, on each side, to controlling of two DC motor simultaneously. There are 4 INPUT pins, 4 OUTPUT pins and 2 ENABLE pin for each motor.

Pin 1: When Enable1/2 is HIGH, Left part of IC will work, i.e motor connected with pin 3 and pin 6 will rotate

Pin 2: Input 1, when this pin is HIGH the current will flow though output

Pin 3: Output 1, this pin is connected with one terminal of motor.

Pin 4/5: GND pins

Pin 6: Output 2, this pin is connected with one terminal of motor.

Pin 7: Input 2, when this pin is HIGH the current will flow though output

Pin 8: VSS, this pin is used to give power supply to connected motors from 5V to 36V maximum depends on Motor connected.

Pin 9: When Enable 3/4 is HIGH, Right part of IC will work, i.e motor connected with pin 11 and pin 14 will rotate.

Pin 10: Input 4, when this pin is HIGH the current will flow through output

Pin 11: Output 4, this pin is connected with one terminal of motor.

Pin 12/13: GND pins

Pin 14: Output 3, this pin is connected with one terminal of motor.

Pin 15: Input 3, when this pin is HIGH the current will flow through output

Pin 16: VCC, for supply power to IC i.e 5V.

In order to have a complete control over DC motor, we have to control its speed and rotation direction. This can be achieved by combining these two techniques.

4.4 L293D Motor driver



Fig 4.4 L293D Motor driver

The L293D is a dual-channel H-Bridge motor driver capable of driving a pair of DC motors or one stepper motor.

That means it can individually drive up to two motors making it ideal for building two-wheel robot platforms.

4.4.1 Power supply

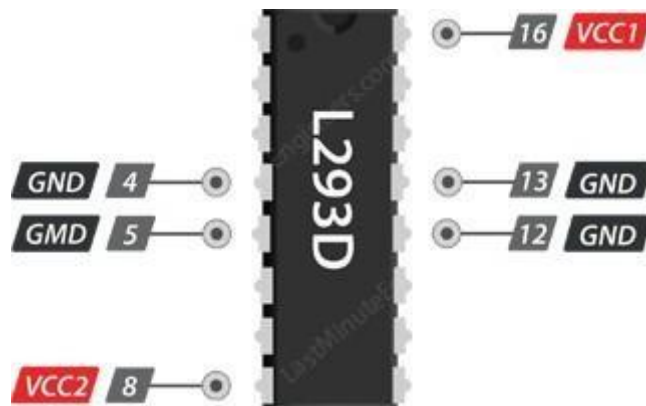


Fig 4.4.1 Power supply

- The L293D motor driver IC actually has two power input pins viz. 'Vcc1' and 'Vcc2'.
- **Vcc1** is used for driving the internal logic circuitry which should be 5V.
- From **Vcc2** pin the H-Bridge gets its power for driving the motors which can be 4.5V to 36V. And they both sink to a common ground named GND.

4.4.2 Output terminal



Fig 4.4.2 Output terminal

The L293D motor driver's output channels for the motor A and B are brought out to pins OUT1,OUT2 and OUT3,OUT4 respectively.

You can connect two DC motors having voltages between 4.5 to 36V to these terminals.

Each channel on the IC can deliver up to 600mA to the DC motor.

However, the amount of current supplied to the motor depends on system's power supply.

4.4.3 Direction control pins

For each of the L293D's channels, there are two types of control pins which allow us to control speed and spinning direction of the DC motors at the same time viz. Direction control pins & Speed control pins.

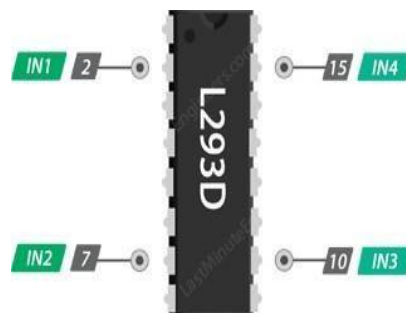


Fig 4.4.3 Direction control pins

Using the direction control pins, we can control whether the motor spins forward or backward. These pins actually control the switches of the H-Bridge circuit inside L293D IC.

The IC has two direction control pins for each channel. The **IN1,IN2** pins control the spinning direction of the motor A while **IN3,IN4** control motor B.

The spinning direction of a motor can be controlled by applying either a logic HIGH(5 Volts) or logic LOW(Ground) to these pins. The below chart illustrates how this is done.

4.5 DC Motor

A brushed DC motor from Portescap is ideal for portable and small devices. Brush DC motor technology offers the distinct advantages of low friction, low starting voltages, absence of iron losses, high efficiency, good thermal dissipation and linear torque-speed function.

These ultra-compact small DC motors are designed to deliver superb speed-to-torque performance with lower joule heating. We also offer a variety of gearheads and encoders. Portescap small DC motors can deliver a torque range from 0.36 mNm up to 160 mNm continuously and from 2.5 mNm up to 1,487 mNm in intermittent operation. In addition, Portescap proudly offers our special line of high power density DC motors, the Athlonix series! Our brushed DC motors are designed for quick and easy modification, so you can get exactly what you need with the pricing and delivery you expect from an off-the-shelf solution. We can customize standard brush motor features to meet specific application requests, including performance specifications, mounting configuration, thermal and ambient condition requirements, and other operational needs.



Fig 4.5 DC Motor

4.5.1 DC Motor specifications

DC motors or robotics come in many variants. Two most common are geared and non-geared motor. In simple term, geared motors. In simple terms, geared motors have a gear mechanism that slow down the motors speed and increase the torque

4.5.2 DC Motor current

As with all circuitry, you must pay attention to current. Too little, and just won't work. Too much, and you have meltdown. When buying a motor, there are two current rating you should pay attention to. The first is operation current.

This is the average amount of current the motor is expected to draw under a typical torque. Multiply this power draw required to run the motor. The other current rating which you need to pay attention to is the stall.

This is when you power up the motor, but you put enough torque on it to force it to stop rotating. This the maximum amount of current the motor will ever draw, and hence the maximum amount of power too. So you must design all control circuitry capable of handling this stall current. Also, if you plan to constantly run your motor. Or run it higher than the rated voltage, it is wise to heat sink your motor to keep the coils from melting.

WORKING

5.1 Block diagram

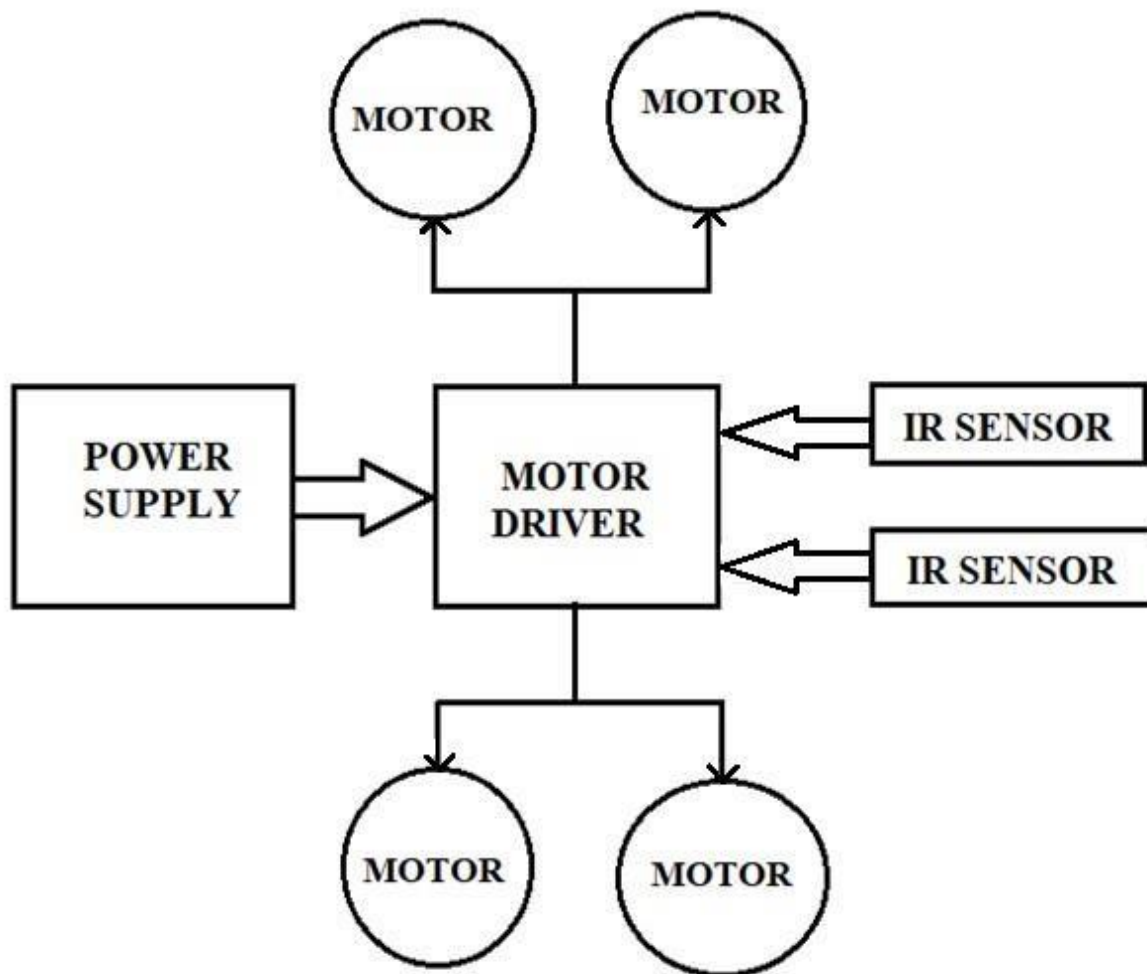


Fig 5.1 Block diagram

5.2 Circuit diagram

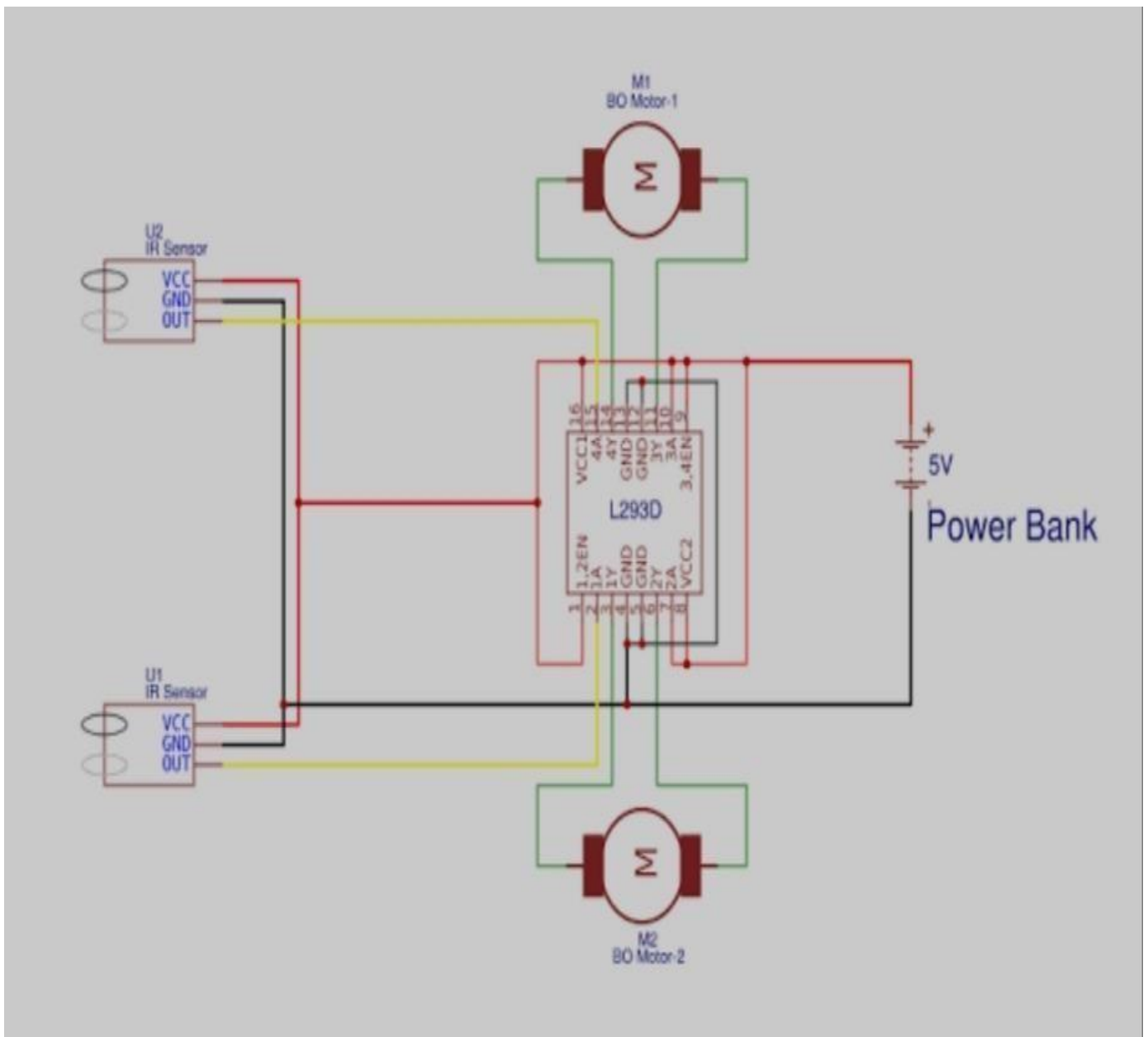


Fig 5.2 Circuit diagram

5.3 Working

In this project we have two line tracking sensors and those are connected like ground looking position. The robot's path should be in black line, because of the sensors can easily detect the black line. When the power is given to the L293 driver it runs the models of the robo, which is connect to the robots wheel.

So the robot will move in forward direction on the black line. Two sensors connected fixed in front of the model sensor the black line, when power is given to the L293 driver, the model in the way of black line. If it goes away from the black line means, model stops.

The IR sensor consists of IR LED and a photodiode. When given a proper biasing, the IR LED emits IR rays which is reflected by the white surface and detected by the photodiode. Photodiode produces an analog output proportional to the amount of IR rays reflected and detected. This analog output is then fed to a comparator configured by the use of operational amplifiers. The IR sensor module has LM393 IC, which consists of two comparators. But here, we require only one comparator to compare the output of the photodiode to a reference voltage to produce an output. The comparator is used to digitize the output of the photodiode. When the output voltage of the photodiode exceeds or becomes less than the small reference voltage given to the comparator, the output of the comparator switches between V_{cc} and ground that has been provided for the IC.

In this case, it is 5V. So, in this way, we get a digital signal of 5V and 0V.

But the IR sensor modules are built in such a way that the output goes high when the obstacle is not detected and the output goes low when the obstacle is detected by the module. The output of the module is connected to the base of the transistor and the motor is connected to the collector of the transistor so that the voltage at the output of the IR sensor module controls and drives the DC motor.

When the obstacle is detected, the output of the IR sensor module goes low.

CHAPTER 6

APPLICATIONS

- Used in various industrial and domestic applications.
- A robot should not harm the human being directly or indirectly
- A robot should protect its own existence by itself.
- It helps to Transportation and carry goods.

CHAPTER 7

ADVANTAGES

- No programming is required as there is no microcontroller.
- Without microcontroller, the cost of the overall project is reduced.
- The circuit is simple and helps strengthen basic electronics concepts.
- 4 Less power consumption.

FEATURE SCOPE

Nowadays, all industries and libraries are improved by robotic technologies to transmit the products or books from one section to another section. Every robot is designed with the help of microcontroller and hence the circuit is too big and difficult to understand. For the reason, this intelligent line follower robot is developed with simple logic gates. This is a mobilized robot which detects and follows the black line drawn on the floor path using IR Sensor and motor driver.

The path must be in a visible black line.

The robot need to be able to move around its environment. Whether rolling on wheels, walking on legs or propelling by thrusters a robot should be able to move. The robots need to power itself. A robot might be solar powered, battery powered

CONCLUSION OF OUR PROJECT

The Project on **LINE FOLLOWER ROBOT** is working fine, getting the parameter envisaged during the conceptual stage.

During the design, as well as during the construction, greater care has been put into avoid hiccups at the final stage. The breadboard layouts were prepared with utmost care to incorporate the circuits in a modular manner. The circuit is made as simple as to our knowledge. Also components were selected keeping in mind their availability and cost.

It was a very interesting process of developing the prototype, stage by stage and testing the same. We have to go through fairly large pages of data related to the components etc. It was a useful and fulfilling assignment to get the project completed in time. This gave us a sense of satisfaction and accomplishment

10.1 REFERENCES

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