# CHAPTER 1
# INTRODUCTION

## 1.1 INTRODUCTION

Robot is a machine that is usually designed to reduce the amount of human work where it is applicable. It is usually developed for reducing risk factor for human work and increase comfort of any worker. High performance, high accuracy, lower labour cost and the ability to work in hazardous places have put robotics in an advantageous position over many other such technologies. In this paper a line tracer or follower has been presented which will trace a black line on a white surface or vice-versa . The idea proposed in this paper is by using machine vision to guide the robot We have made a robot that has several works to perform besides following a line. This robot follows a line without going to other direction. The construction of the robot circuit is easy and small. This can also be used in many applications such as automatic valet parking in efficient way. The rapid increase in urban car ownership not only increases the burden of urban traffic but also exacerbates the problem of insufficient parking spaces. The increased driving distance in the parking process increases energy consumption and exacerbates parking difficulties, which increasing the number of minor accidents, such as scuffing and collisions.

## 1.2 OBJECTIVES

The objective of this project is to implement a low cost , reliable, and The primary objective of a line follower robot is to follow a predetermined path or line using sensors to detect the location of the line and control the robot's movements. This type of robot is commonly used in industrial automation and in educational settings to teach the basics of robotics and control systems. The robot can be designed to follow a simple straight line, a more complex multi-line path, or a combination of both. Additionally, line follower robots can be used to navigate through mazes or other obstacle-laden environments.

# CHAPTER 2
# PROJECT DESCRIPTION

## 2.1 BLOCK DIAGRAM OF THE PROJECT

As shown in the above schematic diagram it mainly consists of an arduino, two IR sensors and a Bluetooth module and a Motor Driver L298N and motors . Here firstly, we chose a configuration to develop a line follower only using two infrared sensors with connection of Arduino Uno through motor driver IC. We followed a block diagram on the regard. The block diagram illustrates the connection for the development of the line follower which follows a black line on white surface. The block diagram of the project is shown in fig. 2.1.

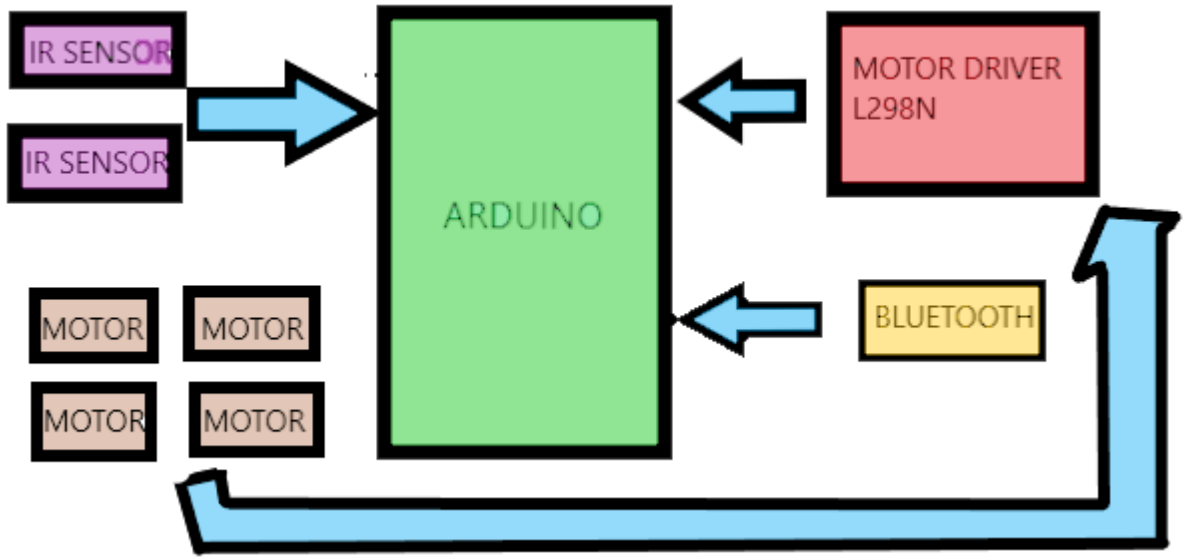


Fig.2.1 Block Diagram

## 2.2 HARDWARE DESCRIPTION

### 2.2.1 Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver

chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features:  1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes. Stronger RESET circuit. Atmega 16U2 replace the 8U2. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

| | |
|---|---|
| Microcontroller | ATmega328 |
| Operating Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limits) | 6-20V |
| Digital I/O Pins | 14 (of which 6 provide PWM output) |
| Analog Input Pins | 6 |
| DC Current per I/O Pin | 40 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 32 KB of which 0.5 KB used by bootloader |
| SRAM | 2 KB (ATmega328) |
| EEPROM | 1 KB (ATmega328) |

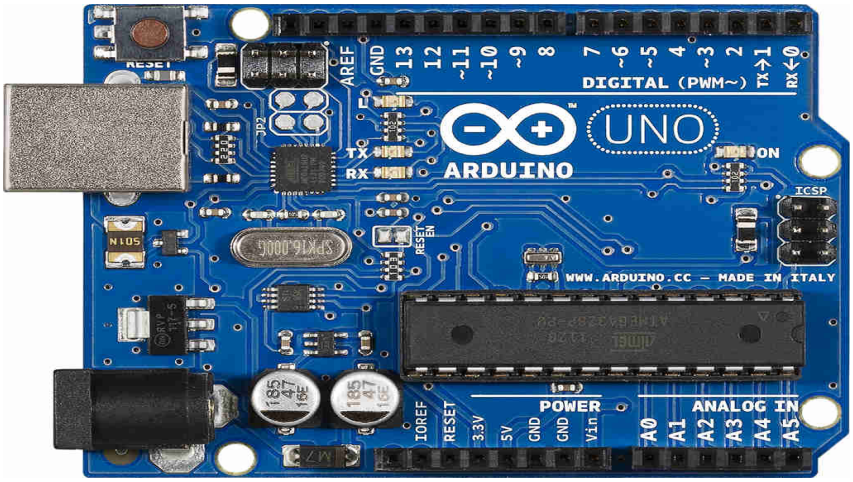


Fig. 2.2 Arduino Uno

**Applications:**

- Xoscillo, an open-source oscilloscope
- Arduinome, a MIDI controller device that mimics the Monome
- OBDuino, a trip computer that uses the on-board diagnostics interface found in most modern cars
- Gameduino, an Arduino shield to create retro 2D video games
- ArduinoPhone, a do-it-yourself cellphone
- Water quality testing platform
- Automatic titration system based on Arduino and stepper motor
- Low cost data glove for virtual reality applications
- Impedance sensor system to detect bovine milk adulteration
- Homemade CNC using Arduino and DC motors with close loop control by Homofaciens
- DC motor control using Arduino and H-Bridge.

### 2.2.2 IR Sensor

Line sensors are nothing but an active IR sensor. It consists of a transmitter and a receiver. The transmitter is nothing but an IR source, which emits IR rays continuously and when these rays collide with an object, these rays return from there to the module. An IR detector mounted on the sensor captures those reflected rays and these signals are then delivered to the microcontroller which detects the presence of the object based on the instruction the programmer has stored in the program memory. Fig. 2.3 is IR sensor.

For the line follower sensor, we are using black tape and we have patched it onto the reflective surface. When the IR light falls on the black tape, the IR rays will be absorbed from the surface and if those rays fall on the reflective surface then it will reflect back to the sensor and in this way, by calculating the reflected signals we will decide whether the robot is on the track or not. Infrared Ray Sensors are used to find out the position of a line follower with respect to the robot position. For line sensing operation, IR sensors are the one which are widely used for the development of a line follower robot. There are some basic things to follow where white surface of the black line reflects light and the black line receives it after the transmission. Two resistors R1 and R2 are used which limits current. Other resistors (R3, R5, R6, R8) forms individual voltage divider networks which is in connection with the designed LDR's. When the sensor is properly classified, both LED/LDR pairs will run over the white surface. In this condition, sufficient amount of light gets reflected back to the LDRs. So, their resistance will be low.

Infrared Ray Sensors are used to find out the position of a line follower with respect to the robot position. For line sensing operation, IR sensors are the one which are widely used for the development of a line follower robot. There are some basic things to follow where white surface of the black line reflects light and the black line receives it after the transmission.

Fig. 2.3 IR sensor

### 2.2.3 L298N Motor Driver

L298N is one of the easiest and chipset way to control DC motors. It is the two-channel motor driver that can control the speed and spinning direction of DC motors.

This L298N Motor Driver is a high-power motor driver module. It is used for driving DC and Stepper Motors. This motor driver consists of an L298N motor driver IC and a 78M05 5V voltage regulator, resistors, capacitor, power LED, 5V jumper in an integrated circuit.

When the jumper is placed, it enables the 78M05 Voltage regulator. When the power supply is less than or equal to 12V, the voltage regulator will power on the internal circuitry. When the power supply is more than 12v, then the jumper should not place and should give a separate 5v to power the internal circuitry.Here, ENA & ENB pins are speed control pins for Motor A, and Motor B. IN1& IN2 and IN3 & IN4 are direction control pins for Motor A and Motor B.Fig.2.4 is L298N Motor Driver.

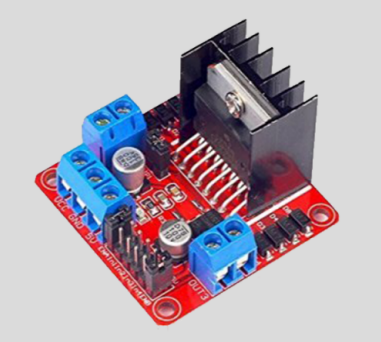

Fig.2.4 L298N Motor Driver

### 2.2.4 BO MOTORS

BO Motor is known as Battery Operated motor. These motors are commonly used in hobby-grade projects where the user requires a small DC motor as a simple actuator. BO series linear motor provides good torque and rpm at lower operating voltages. The BO motors are available in single Shaft, Dual Shaft, and DC Plastic Gear BO. These motors consume low current. In this project, we have used four single shaft BO motors.

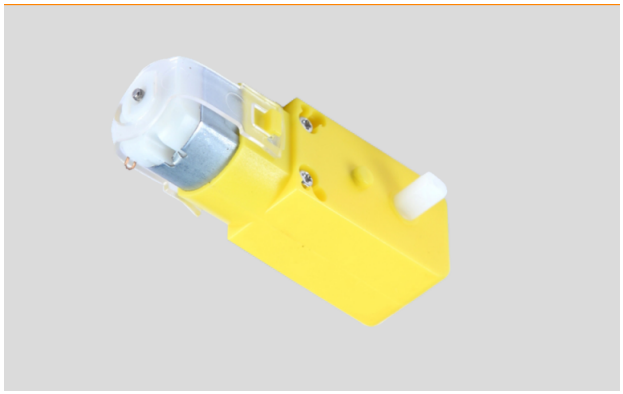

Fig. 2.5 BO MOTORS

### 2.2.5 HC-05 BLUETOOTH

The Bluetooth module will act as an interface between Bluetooth phone and moicrocontroller. We will be using HC-05 Bluetooth module for the line following robo. Which can be used as either receiver or transmitter .Generally our transmitter will be Bluetooth phone and receiver will be Bluetooth module HC-05.In this line following robot the Bluetooth used for alternate to move the robo . Because without Bluetooth module also we can run the robo. Fig.2.6 is the HC-05 Bluetooth module.

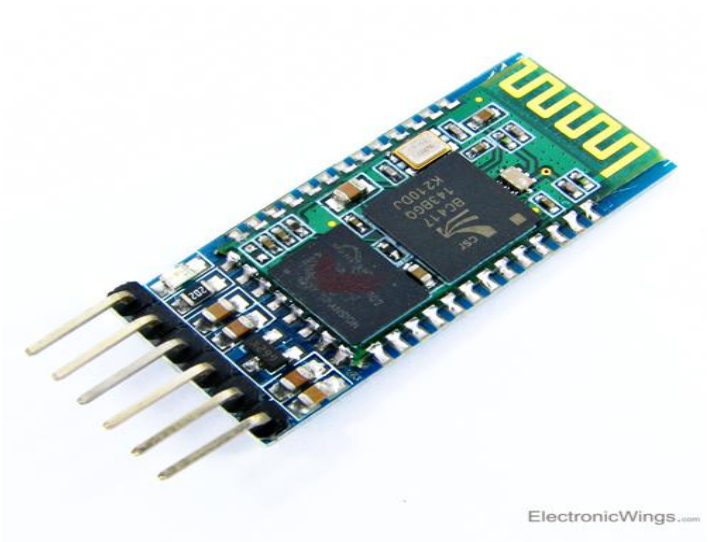


Fig. 2.6 HC-05 Bluetooth Module.

## 2.3 SOFTWARE DESCRIPTION

The software used here is ARDUINO SOFTWARE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

**Writing Sketches:**

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

**NB:**

Versions of the Arduino Software (IDE) prior to 1.0 saved sketches with the extension pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the ino extension on save.

***Verify***

Checks your code for errors compiling it.

***Upload***

Compiles your code and uploads it to the configured board. See uploading below for details.

**Note:** If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

***New***

Creates a new sketch.

***Open***

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

**Note:** due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File | Sketchbook menu instead.

***Save***

Saves your sketch.

***Serial Monitor***

Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools,and help.

## Programming on arduinouno

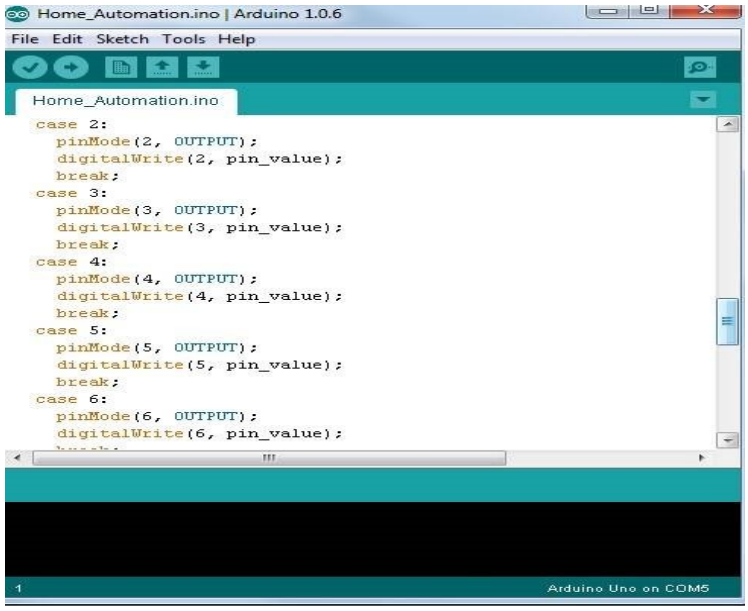


Fig.2.6 Software IDE

In order for the Arduino-Uno board to be able to interact with the application used in this project certain program (code) needs to be uploaded to the Arduino-Uno.

Arduino Company provides user friendly software which allows writing any code for any function wanted to be performed by the Arduino-Uno and upload it to the board.Refer to appendix A for the full source code of the Arduino-Uno board.

# CHAPTER 3
# CIRCUIT DIAGRAM AND DESCRIPTION

## 3.1 Working

We have used the IR sensors which will detect the line. Then gives the signal to the L298N driver module then the module send the information to Arduino.Then the arduino receives it and automatically switch on the motors. The IR sensor detects the line and moves along the line.If we missed the line we can also use the Bluetooth to follow the line. The line fallowing robot is one of the self-operating robots. That detects and fallows a line drawn on the area. The line is indicated by white line on a block surface or block line on a white surface. This system must be sense by the line. This application is depends upon the sensors. Here we are using two sensors for path detection purpose. That is proximity sensor and IR sensor. The proximity sensor used for path detection and IR sensor used for obstacle detection. These sensors mounted at front end of the robot. The microcontroller is an intelligent device the whole circuit is controlled by the microcontroller. The schematic is as shown in fig.3.1.

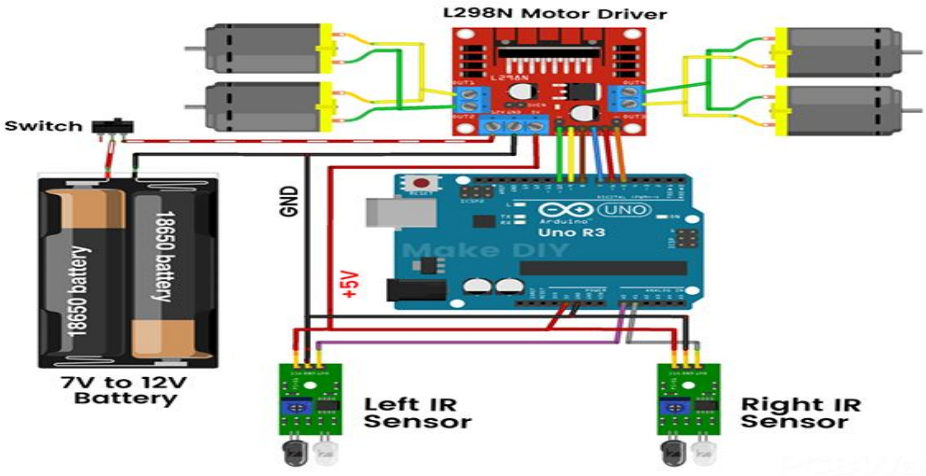


Fig.3.1 Schematic diagram

## 3.2 RESULTS

The experimental result is as shown in below fig. 3.2. The objective of the line following robot is to follow a line on its given path which is obtained for which it uses IR sensors which detects the line and sends the information to L298N comparator and then to H bridge which controls the working of the wheel‟s. Microcontroller controls the

other operations. And it is cost effective as in it will cost exactly as the project requires (optimum price). Fig.3.2 is Experimental result

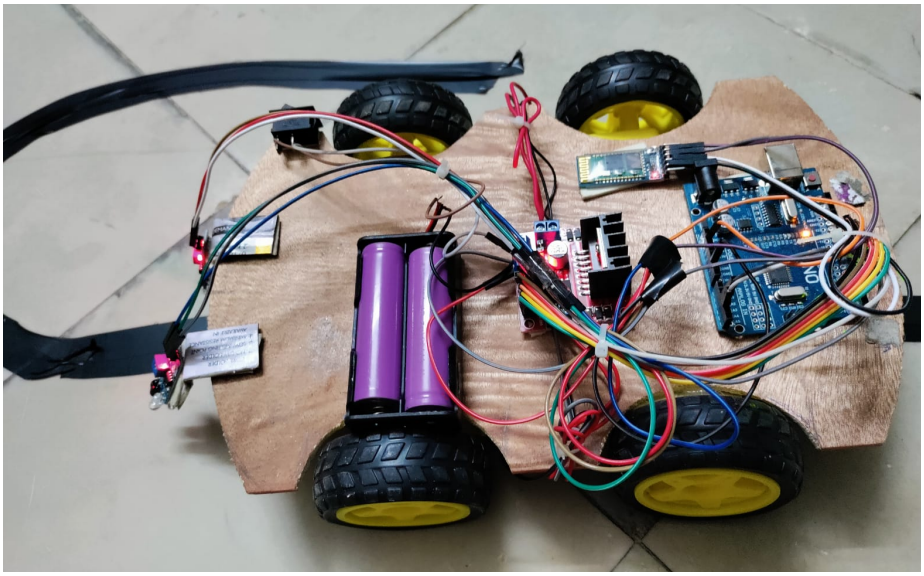

Fig.3.2 Experimental result

## 3.3 ADVANTAGES

- ➢ Robot movement is automatic.
- ➢ Fit and Forget system.
- ➢ Used for long distance applications.
- ➢ Defence applications.
- ➢ Simplicity of building.

## 3.4 DISADVANTAGES

- ➢ Line Follow robot follows a black line about 1 or 2 inches in width on a white surface.
- ➢ Line Follow robot are simple robots with an additional sensors placed on them.
- ➢ Needs a path to run either white or black since the IR rays should reflect from the particular path.

# CHAPTER 4

# CONCLUSION

### 4.1CONCLUSION

In this project we have studied and implemented a line following Robot using a IR sensor, Bluetooth which is usefull for blind people. Bring objects in a working place this is very useful and simple**.** Despite their usefulness, line following robots still face challenges such as detecting and following complex or changing paths, handling obstacles, and dealing with environmental variations. Overall, line following robots are a valuable tool for automating tasks and have the potential for significant impact in industries such as manufacturing, logistics, and transportation.

## 4.2 FUTURE SCOPE

- ➢ Smarter versions of the line following robots are used to deliver mails within office building and deliver medications in a hospital
- ➢ This technology has been suggested for rumming buses and other mass transit systems and may end up as apart of autonomous cars navigating the freeway.
- ➢ Integration with other technologies such as AI and IoT to enhance their capabilities.
- ➢ Development of more advanced sensors, such as LIDAR, to improve line detection and path following accuracy.
- ➢ Expansion of their use in industries such as agriculture, healthcare, and retail, for tasks such as crop monitoring, inventory management, and customer service.

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