# Chapter 1
# INTRODUCTION

## 1.1 OVERVIEW

Robots are smart machines that can be programmed and used in many areas such as manufacturing, industry, production lines, or health, etc. These robots performs hard, dangerous, and accurate work to facilitate our life and to increase the production because they can work 24 hours without rest, and performs like human but more precisely and with less amount of time. Assistive mobile robots that perform different kinds of work over everyday activities in many areas such as industry, product lines, manufacturing, or health etc. are very commonly used to improve our life. The idea behind this research is to exploit robotics usage in household work. A Smartphone is a mobile phone built on a mobile computing platform, which has more advanced connectivity and computing ability than what a feature phone has. Smartphone's are a more efficient and affordable hand held devices which can be used to support collaborative activities in a community. It is a result of a huge and remarkable advancement in the field of mobile phones technology. Human beings are anxiously working on finding new ways of interacting with machines. Floor cleaner is designed to make cleaning process become easier for human task. This project is a combination of hardware and software which has microcontroller, motor shield, sensor, an android application and finally a Bluetooth module via which the hardware connects the software. Smartphone, a small yet powerful device is rapidly changing its traditional ways of human-machine interaction. Android plat- form brought a big revolution in the field of application development for cell phones opening for technical exploration. The Android Smartphone can be freely rotated in space, temporarily varying 3D signal data is obtained from the phone's 3-axis acceleration sensor. This data is transmitted via Bluetooth module of Smartphone using an android app to the robot. Further, this data is processed by a microcontroller embedded on the robot to perform desirable motions. In this context, a robot is similar to any machine that is controlled by man varying from a simple toy to heavy machinery. Robots have replaced humans in performing various tasks that human are unable to perform due to physical disability, extreme environments or size.

## 1.2 MOTIVATION

In any educational field main goal is to improve the quality of student. Beforehand question papers are generated manually, teachers require more time and power to create examination paper because creating examination paper done by writer's knowledge, experience, and style and therefore we introduce new advanced technology that is the automatic question paper generation system. This requires less manpower, using this system to process different uncommon sets of papers automatically. The system takes over the entire difficult task and paperwork swiftly and efficiently.

## 1.3 NEED OF PROJECT

During the manual cleaning/brooming operation some dust and dirt particle may remain on the floor and due to the action of air the dirt and dust particle transfer from one area to another area which causes the problems during cleaning which tends to increase man effort. Due to which desire cleaning of the surface not possible and because ofthat it takes more time. During the rainy season the muddy water are dump on the corner of the wall with the help of manual cleaning it cannot possible to remove all the water from the surface of the floor which creates slippery surface and which may increase the chances of accidents also the water which remains on the corridor enter into the rooms.

## 1.4 OBJECTIVES

1. To develop a machine that helps in easy and quick cleaning.
2. To provide the another option for cleaning.
3. To reduce human efforts.
4. To save the time.
5. To remove stains dirt.

## 1.5 PROBLEM DEFINATION

The main objective of this project is to design and implement a Floor Cleaning robot prototype by using Node MCU, Motor Driver L293D, Ultrasonic Sensor and DC Motor to achieve the goal of cleaning controlled by android phone.

## 1.6 ORGANIZATION OF REPORT

Report consists of six chapters which goes through the implementation of system "Floor Cleaning Robot Using Android App".

- Chapter 1: The chapter cover introduction, Need of Project, Objective about the system.
- Chapter 2: This chapter explain literature survey. It includes literature review of our project that is from where we studied about this project.
- Chapter 3: This chapter contains the existing method used for irrigation and proposed method through our application.
- Chapter 4: This chapter contains Hardware tools and software platforms utilized for the application to develop.
- Chapter 5: This chapter introduces design and implementation of system.
- Chapter 6: This chapter contains Conclusion and Future scope.Some future improvements that can be made in our project are explained in this chapter.

# Chapter 2
# LITERATURE REVIEW

## 2.1 INTRODUCTION

This chapter will provide a research of different paper, including author requirements, research perspective, and overview of project idea, general constraints. In addition, it will also provide the information of algorithm and functionality needed for this system such as algorithm, techniques, functional requirements and performance requirements. With the event of Information and Communication Technology, various varieties of information security threats may be seen. These threats are important within the prevention of damage to person or institution to guard data on computer systems. In these studies, it is observed that ML is challenging techniques may be used.

## 2.2 REVIEW OF TECHNICAL REPORT PREFERED

1. Vidyashree, T.S., Bindushree, V., Rao, S. and Gowra, P.S., 2021.“ Smart Vacuum Cleaner”.Global Transitions Proceedings. RC car which is embedded with a vacuum cleaner is used. This system has an ultrasonic sensor attached to it, that helps in avoiding large obstacles such as tables, chairs, walls etc.[1]
2. Roshan, D., Bhosle, O., Bhosale, G., Borse, A. and Bandsode, T., 2020. “Blue- tooth Operated Vacuum and Floor Cleaner using Android Mobile”. The aim of this project work is to design and develop process for cleaning the floor having wet and dry surfaces. It is very useful for cleaning the wet as well as dry floors.[2]
3. Murdan, A.P. and Ramkissoon, P.K., 2020, November. A smart autonomous floor cleaner with an Android-based controller. The user has complete control over the robot either in the autonomous or remotecontrolled mode. The implemented cleaning system consists of five main blocks namely the power block (rechargeable dc battery), the motor system (driving wheels, rotating brush, vacuum fan, water pump), communica- tion block (Bluetooth control, HC 06 Bluetooth module) and software block (Android remote

controlled). Upon the implementation and testing of this prototype, it was observed that the robot works as programmed, and is equipped with most of the functionalities of a household commercial state of art cleaning robot.[3]

4. Das, N.R., Daga, R., Avte, S. and Mhatre, K., 2019. Robotic automated floor cleaner. Automated machine cleaners are pivotal in the modern era for modern living due to its elective lowering of the labor cost of a human being, saving both time and money. Most of these cleaners are designed purposely to satisfy the special need of the consumers. The project is a collaboration of Mechanical, Electrical and Electronic streams and employs devices and systems of these fields. It is an assembly of various rigid components like chassis, some motors and various electromechanical devices. Our motive is to present a working model of a cleaning machine which will be used in a household with minimum utilization of the resources available with us.[4]

5. Iwan Ulrich, Francesco Mondada, J D Nicoud "Autonomous Vacuum Cleaner" Robotics and Autonomous systems, In "Autonomous Vacuum Cleaner" (Robotics And Autonomous Systems) by Iwan Ulrich the Authors talk about broad topics which include Selection of shape of robot, selection of Cleaning mechanisms, Sensor systems and map- ping of obstacles using these Sensors. In this paper their Robot relies on the 54 tactile sensors placed on the robot and the area they are trying to clean have uncertain extent and obstacles. So they have assumed only four kinds of obstacles (wall, legs, concave and convex corners) for programming purposes. They have also considered the type of vacuum cleaner that needs to be used based upon the power supply available. Navigation is explained in terms of obstacle identification, hypothesis and map creation.[5]

6. T.B. Asafa, T.M. Afonja, E.A. Olaniyan, H.O. Alade "Development of a Vacuum Cleaner Robot".The paper "Development of a Vacuum Cleaner Robot" (Alexandria Engineering Journal) by T.B. Asafa gives us information about the characteristics that need to be considered while developing the robot. It gives us an idea about the considerations taken in order to design the aspects like Geometry, sweeper position, Dustbin size, cooling provisions, Electrical equipment, Controllers, Chassis and sensors.

7. Raj Vishal, Raghavan P., Rajesh R., Sachin Micheal, Mohan Rajesh Elara "Design of Dual Purpose Cleaning Robot". The paper "Design of Dual Purpose Cleaning Robot" (International Conference on Robotics and Smart Manufacturing) by Raj Vishaal gives information about the design of a dual purpose cleaning Robot which can be used for cleaning walls as well as the floor. The author also gives information about Electric Ducted Fan and how it is used in Adhering the robot to the glass walls. The floor cleaning system is manually controlled using Bluetooth signals from a Smartphone while the wall cleaning is carried out automatically. The robot has been designed in two parts namely the base module and the cleaning module. These two are attached by the supporting ropes.

8. Vatsal Shah"Floor Cleaning Robot with Mobile-App or Autonomous".The paper "Floor Cleaning Robot with Mobile-App or Autonomous" by Vatsal Shah deals with the research and development of Manual Phone application controlled as well as fully autonomous Robot. It highlights the key parameters that need to be taken into consideration while designing the robot like Obstacle avoidance, Floor detection, Collision detection, Fan motor monitoring, Light Sensing, Real time Clock, etc. The paper also gives a detail description of methodology followed as well as the components used in the development of the robot.

## 2.3 SUMMARY

It includes literature review of our project that is from where we studied about this project.

# Chapter 3

# METHODOLOGY

## 3.1 INTRODUCTION

The RC car is designed. The motor is fitted, motors are attached with wheels. Motors are soldered with wires–positive and negative. RC car is built by using 2 DC motors they run with the speed provided in Arduino IDE code, it uses motor shield to work in desired speed and direction. Ultrasonic sensor attached to RC car detects the distance at which obstacle is present in front of it. So, whenever it encounters any obstacles such as walls, tables, chair or any big things that cannot be considered as garbage or dust, RC car which carries vacuum cleaner changes its direction so that it won't crash and destroy itself. The code fed to the Node MCU runs continuously and the cycle repeats in regular intervals whenever the obstacle is detected.

## 3.2 BLOCK DIAGRAM EXPLANATION

3.2.1. **Node MCU:** The microcontroller used in proposed model is Node MCU. It is a open Source Platform for developing electronics projects. It uses ESP8266-12E as a main controller, which is a high integration wireless SOC(System on Chip).

3.2.2. **Bluetooth:** Bluetooth is a wireless communication protocol running at the speed of 2.4 GHz with the architecture of client-server and which is suitable for forming personal area networks. Bluetooth gives the connectivity between two devices using their MAC address.

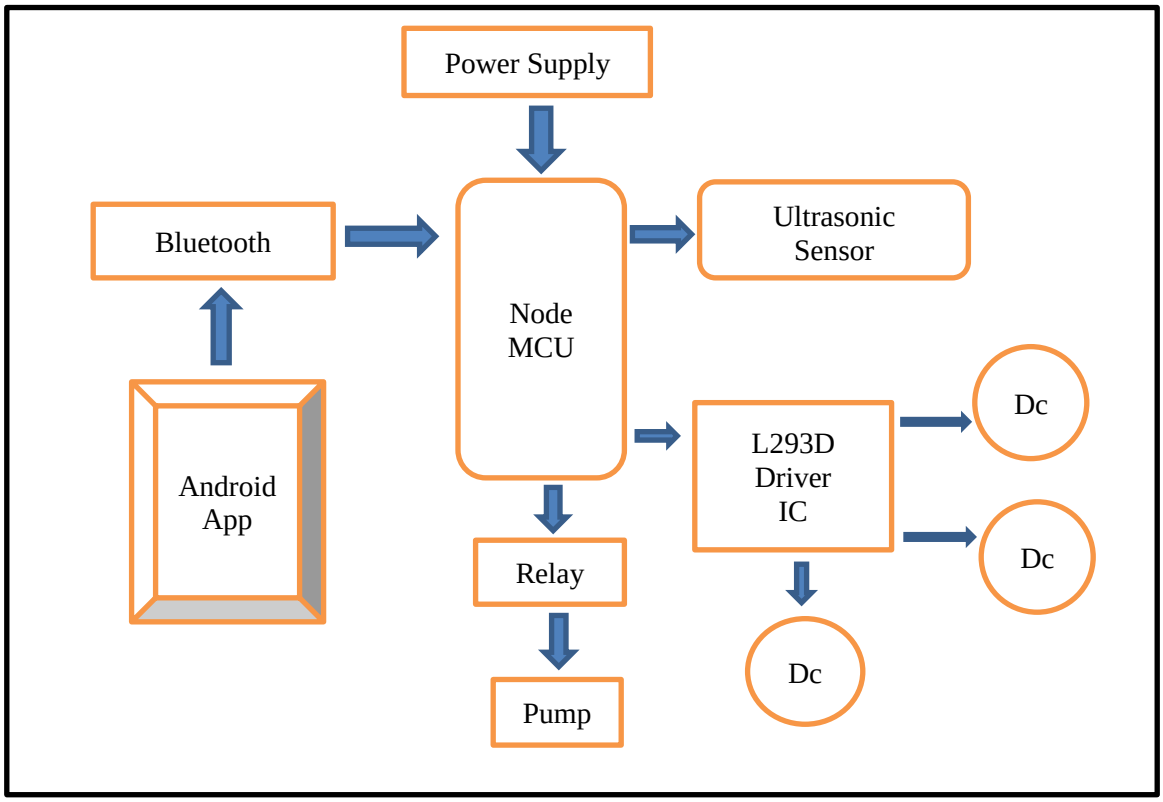
3.2.3. **L239D :** A very easy and safe is to use popular L293D chip. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

3.2.4. **DC Motor :** A DC Motor is a motor where by direct current electrical power is converted into mechanical power. Most often, this type of motor relies on forces that magnetic field produce. Proposed robot is designed with two DC motors to operate in forward and backward direction.

3.2.5. **Ultrasonic Sensor :** The HC-SR04 is a type of ultrasonic sensors which uses to find out the distance of object from the sensor. This sensors includes four pins.(VCC, Trigger, Echo, GND).

3.2.6. **Relay :** Relay module contains two relays that are electrically isolated from the controlling input. The relays can be used to switch higher voltage and current loads than a microcontroller can traditionally accomplish.

## 3.3 BLOCK DIGRAM




**3.1 Block Diagram**

# Chapter 4

# SYSTEM DEVELOPEMENT

## 4.1HARDWARE DESCRIPTION

4.1.1 **Node MCU:** Node MCU is a low-cost open source IOT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SOC from Espressif System and Hardware which was based on the ESP-12 module. Later, Support for the ESP32 32-bit MCU was added.


Figure 4.1: Node MCU

| **Microcontroller** | Node MCU |
|---|---|
| Analog Pin | A0 |
| GPIO Pins | GPIO 1 to GPIO 16 |
| SPI Pins | SD1, CMD, SD0, CLK |
| UART Pins | TXDO, RXDO |
| Power Pins | Micro-USB, 3.3V, GND, Vin |

Table 4.1: Node MCU

4.1.2 **Dc motor :** It is an electro-mechanical device that rotates when connected to a power source. DC motor is a rotatory electrical machine that converts electrical energy into mechanical energy. A normal DC motor has two terminals. Since these terminals must be connected through a coil. But they do not have any polarity. However, reversing the connection will only reverse the direction of the motor. Two terminals of the DC motor.

Terminal 1-Positive & Terminal 2- Negative/Ground: Axis rotates in a clockwise direction. Terminal 2-Positive & Terminal 1- Negative/Ground: Axis rotates in the anti-clockwise direction.

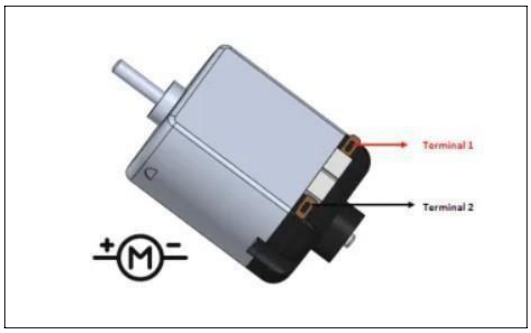



Figure 4.2: DC Motor

4.1.3 **Motor Driver (L293D):** It utilizes a maximum peak motor current of 1.2A. A maximum continuous motor current of 600mA is required. The range of supply voltage is 4.5V to 7V.The L293D is a 16-pin Motor Driver IC which can control a set of two DC motors simultaneously in any direction. The L293D is designed to provide bidirectional drive currents of up to 600 mA (per channel) at voltages from 4.5 V to 36 V (at pin 8!).

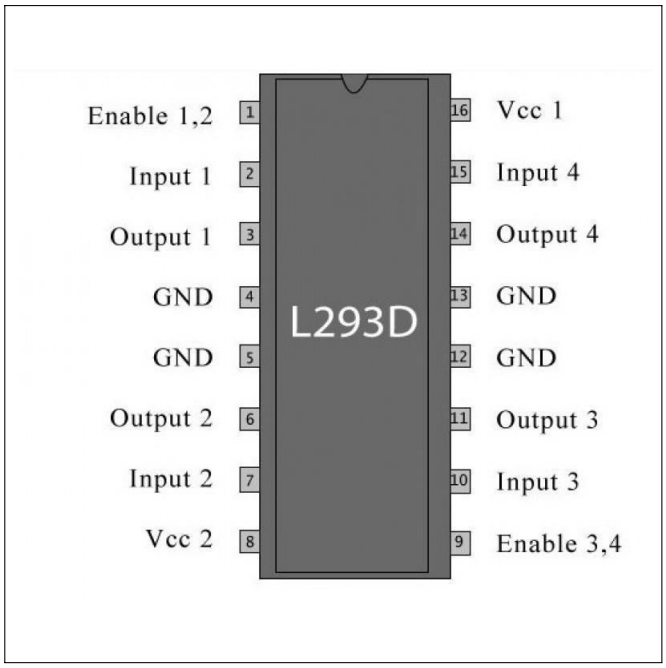



Figure 4.3: Motor Driver L293D

4.1.4 **Android Phone**: Remote operation is achieved by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touch screen operation. The android application device transmitter acts as a remote control that has the advantage of ad equate range, while the receiver have Bluetooth device fed to the microcontroller to drive DC motors via motor driver IC for necessary work.


Figure 4.4: Android phone

4.1.5 **Bluetooth device (HC05):** Used in wireless communication for a range of about 100m. Modulation used is GFSK and uses FHSS technology to send data serially.
It uses a power supply of 3.3V to 5V. It is used in a master slave configuration. Pin Description

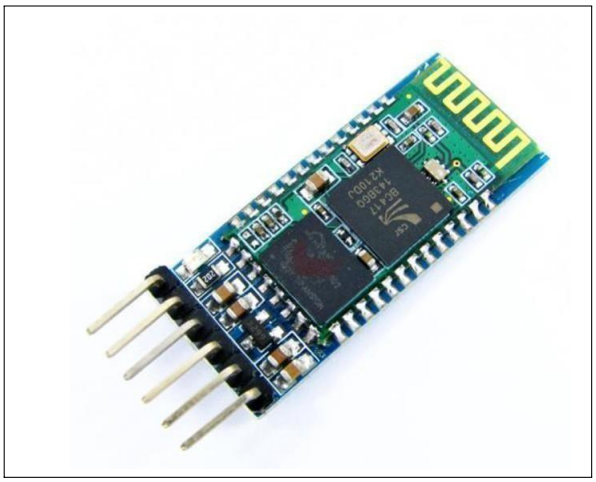


Figure 4.5: Bluetooth

It has 6 pins:

1. Key/EN: It is used to bring Bluetooth module in AT commands mode.
   If Key/EN pin is set to high, then this module will work in command Mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400mbps and 9600 in data mode.
2. VCC: Connect 5V or 3.3V to this Pin.
3. GND: Ground Pin of module.
4. TXD: Transmit Serial Data(wirelessly received data by Bluetooth module Transmitted out serially on TXD pin).
5. RXD: Receive Data Serially(received data will be transmitted wirelessly By Bluetooth module).
6. State: It tells whether module is connected or not.

4.1.6 **Robot Chassis:** The Chassis is the structural component for the robot which contains the drive train and allows the robot to be mobile by using wheels,tank or another method. A chassis is sometime referred to as the robot's frame.

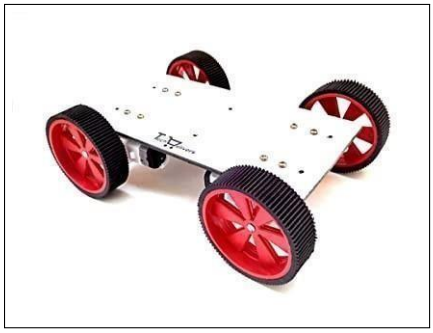


Figure 4.6: Robot Chassis

4.1.7 **Jumper Cables:** Jumper wires are used for making connections between Items on your breadboard and your Node MCU pins.Use them to wire up all your circuits.

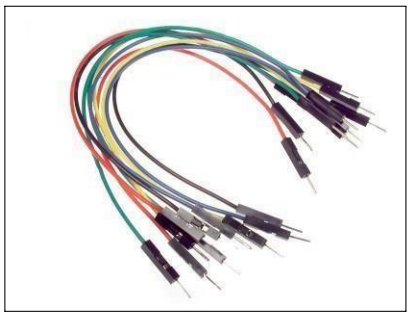


Figure 4.7: Jumper Cables

4.1.8 **Power Supply:** The power supply is the first and most important part of our project. For our project, we require a +5v regulated power supply with a maximum current rating of 500mA. The 1000µF capacitor serves as a "reservoir" Which maintains a reasonable input voltage to the 7805 throughtout the entire Cycle of the AC line voltage. The 10µF and .01µF serve to keep the power supply voltage constant when load condition changes. However, at high frequencies, this capacitor is not very efficient therefore the 0.1 µF is included to bypass high-frequency changes such as digital IC switching effects, to ground.

The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes.

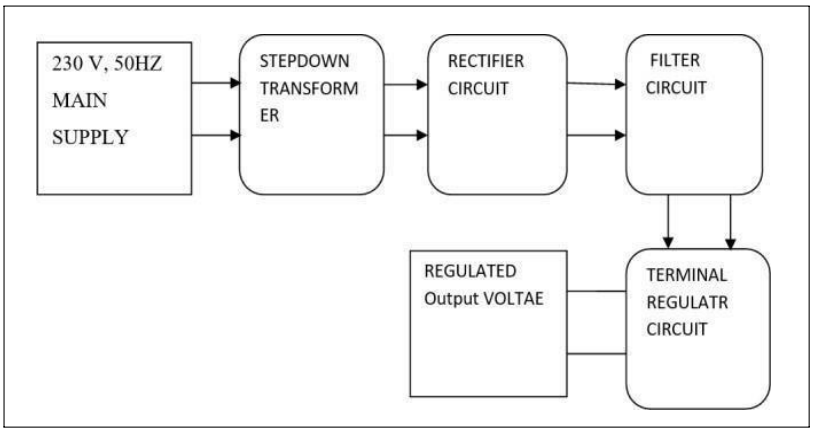



Figure 4.8: Power Supply

## 4.2 SOFTWARE DEVELOPMENT

### 4.2.1 OPERATING SYSTEM: MICROSOFT WINDOWS

Microsoft Windows, also called Windows and Windows OS, computer operating system (OS) developed by Microsoft Corporation to run personal computers (PCs). Featuring the first graphical user interface (GUI) for IBM-compatible PCs, the Win- dows OS soon dominated the PC market. Approximately 90 percent of PCs run some version of Windows

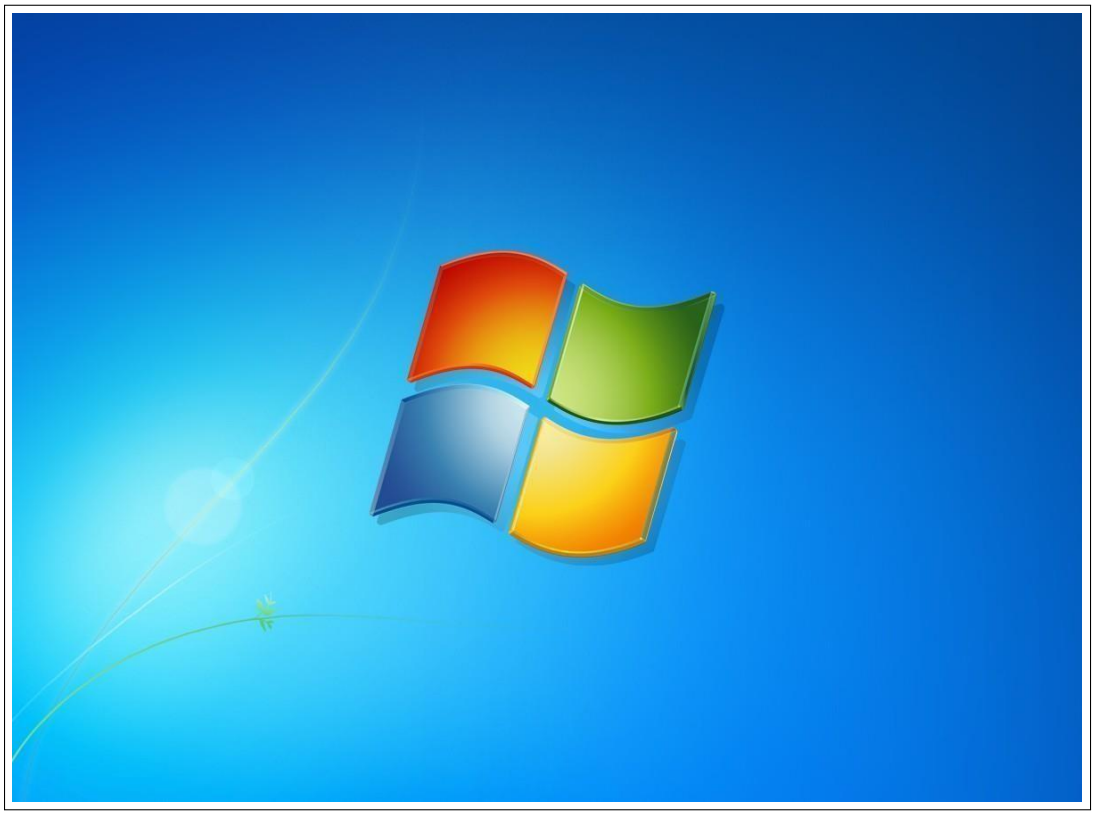


Figure 4.9: MICROSOFT WINDOWS

### 4.2.2 PROGRAMMING LANGUAGE: JAVA

Java is the most popular, widely used object-oriented programming language. The security features of Java makes it popular and widely used. It used by many enthusiasts for different purposes. By using Java. we can develop a variety of applications as enterprise applications, network applications, desktop applications, android app and many more.

Applications of Java Programming Language:

1.Mobile App Devlopement

2.Desktop GUI Applications

3.Web-Based Applications

4.Gaming Applications

5.IOT Applications

**Mobile App Development :**

The Java Programming Language can be considered as the official language for Mobile Application Development. Most of the android applications build using Java. The Most popular Android App Development IDE Android Studio also uses Java for developing Android Applications. So, if you are already familiar with Java, it will become much easier to develop android Applications. The most Popular android applictaions Spotify and Twitter are developed using Java.

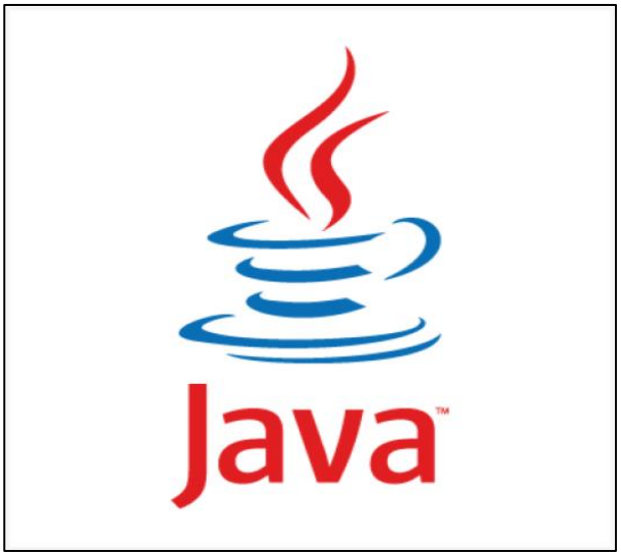



Figure 4.10: Java Language

### 4.2.3 IDE: ARDUINO

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

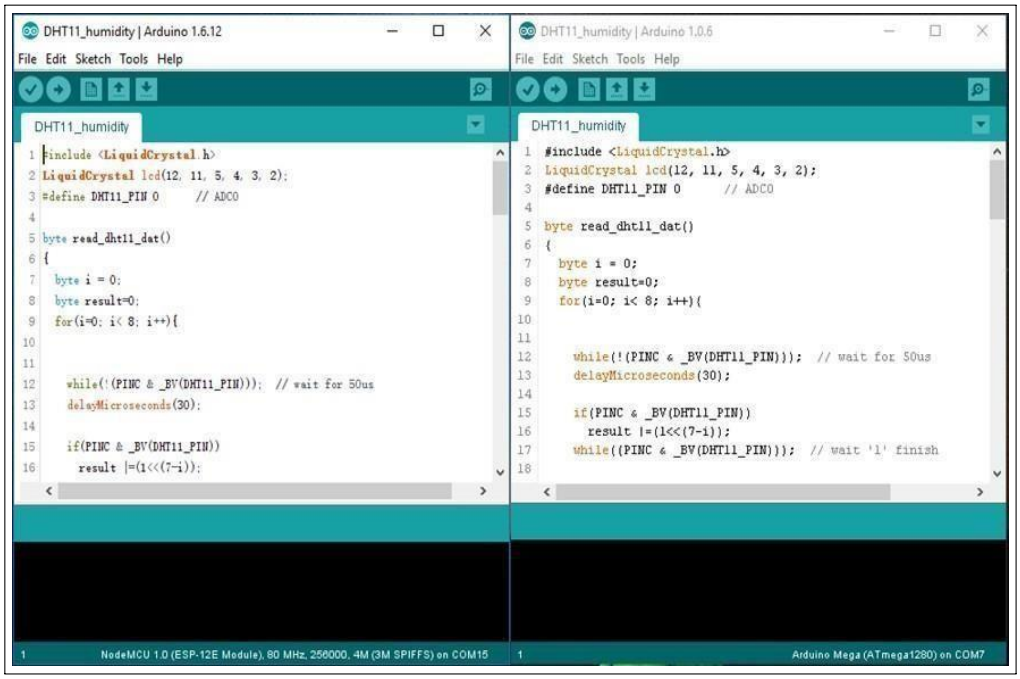



Figure 4.11: Arduino IDE

### 4.2.4 ANDROID APP

Android App is a software designed to run on an Android device or emulator. The term also refers to an APK file which stands for Android package. This file is a Zip archive containing app code, resources, and meta information. Android apps can be written in Kotlin, Java, and C++ and are run inside Virtual Machine.

Figure 4.12: Android App

## 4.3 OPERATIONAL DETAILS

### 4.3.1 Algorithm

1. Start
2. Measure the Distance
3. Display in Android App
4. Click Start Motor
5. Pump Motor and Sweeper Motor Started
6. Pass Command Move Forward
7. If obstacle NO go to step 6
8. If obstacle Yes go to step 9
9. Direction change by user either LEFT or RIGHT
10. End

### 4.3.2 Flowchart

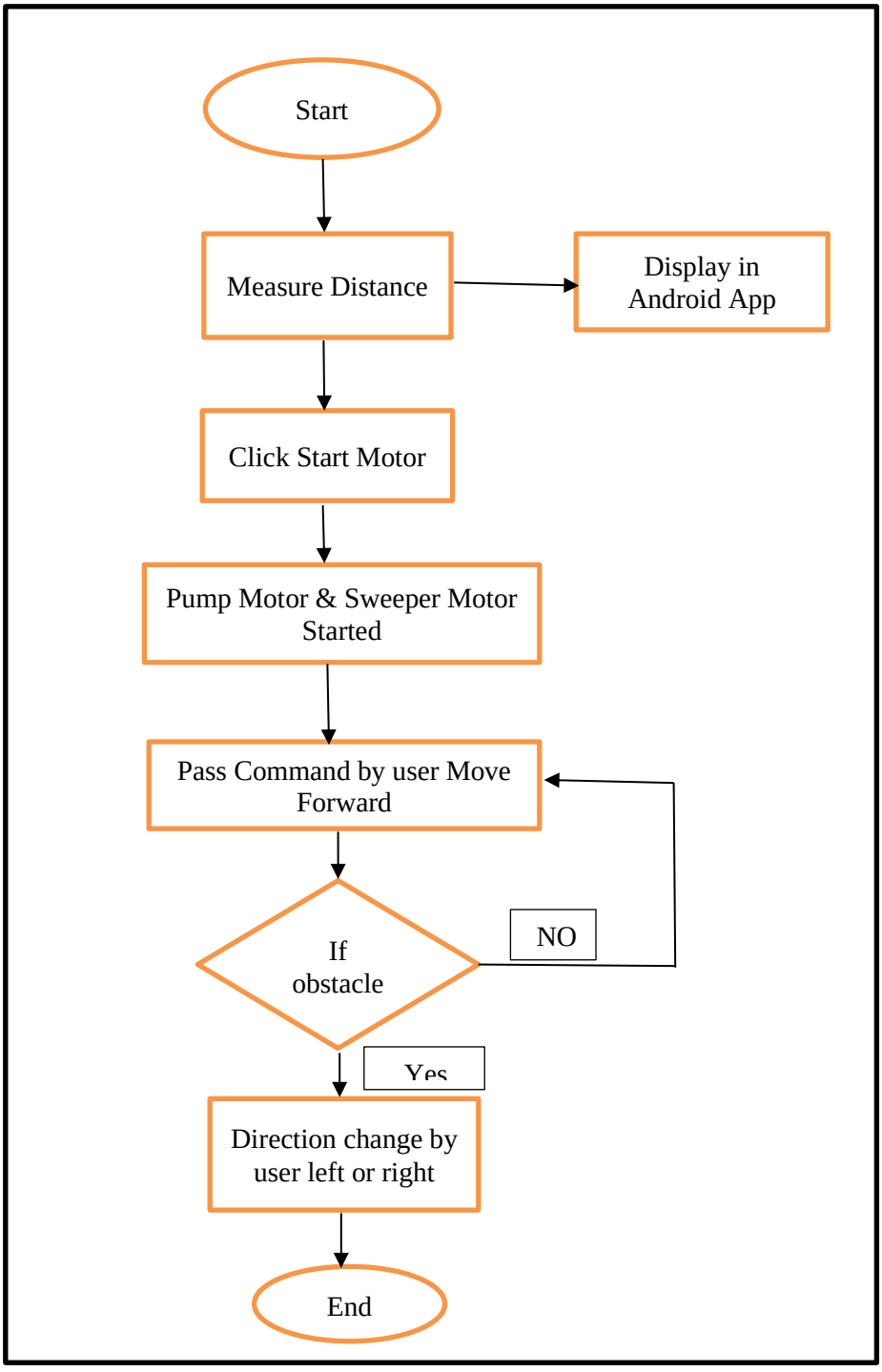



Figure 4.13: Robot Path

### 4.3.3 Circuit Diagram

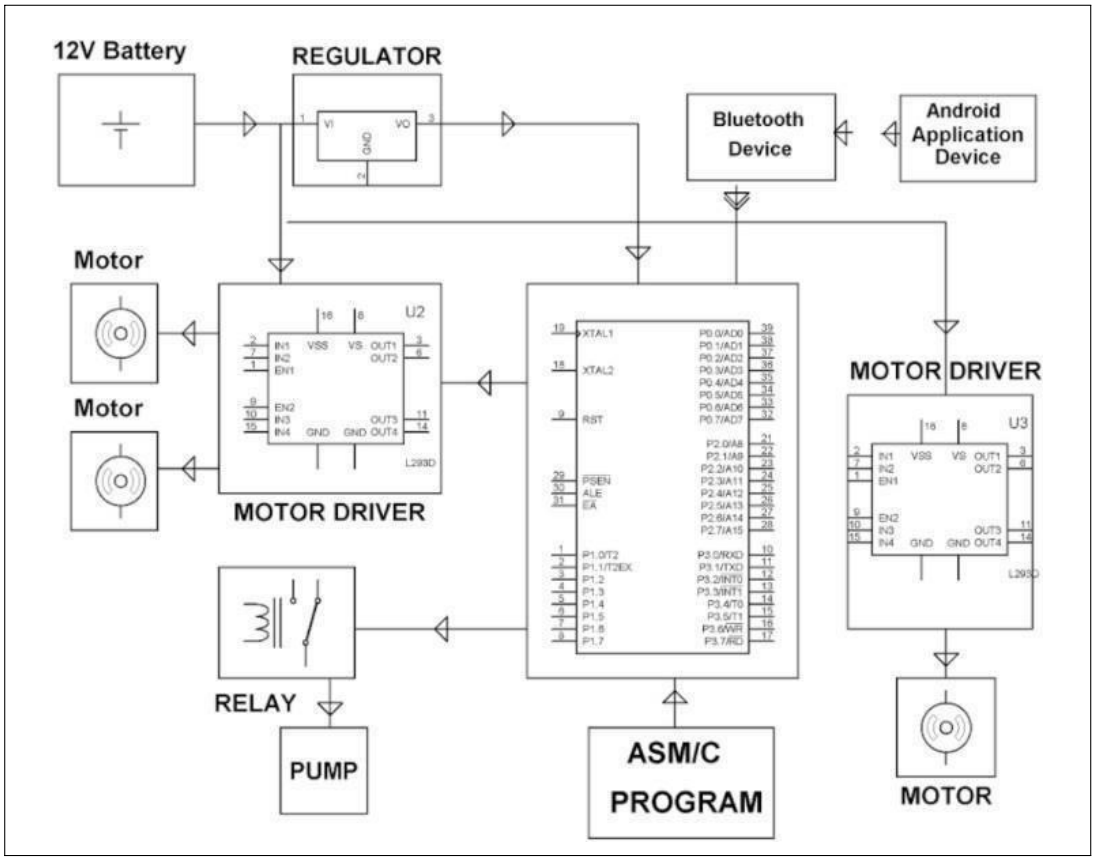



Figure 4.14: Circuit Diagram

**Summary :** This chapter discusses about Hardware tools and Software platforms utilized for the application to develop. The Algorithm And Flowchart are also charted in last of the chapter.

# Chapter 5
# RESULT AND DISCUSSION

## 5.1 RESULT
### Experimental Setup

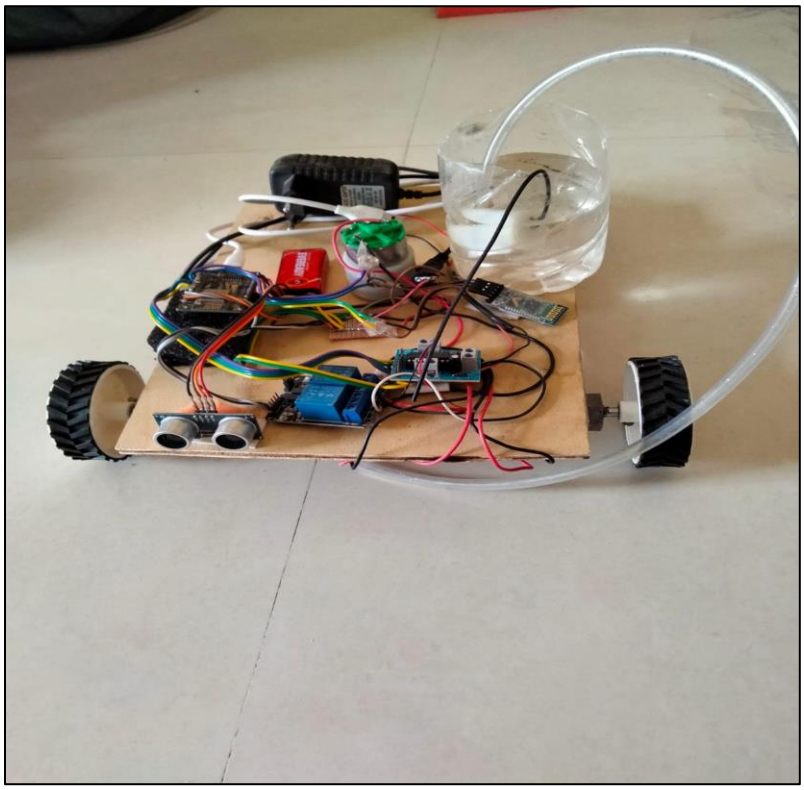


Figure 5.1: Robot

The Model of Floor cleaner is created by using chassis ,jumper cable and it is fitted with micro controller and battery and other parts of cleaning. It form basic robot frame for system which can be operated through Android app.

## App Screenshot

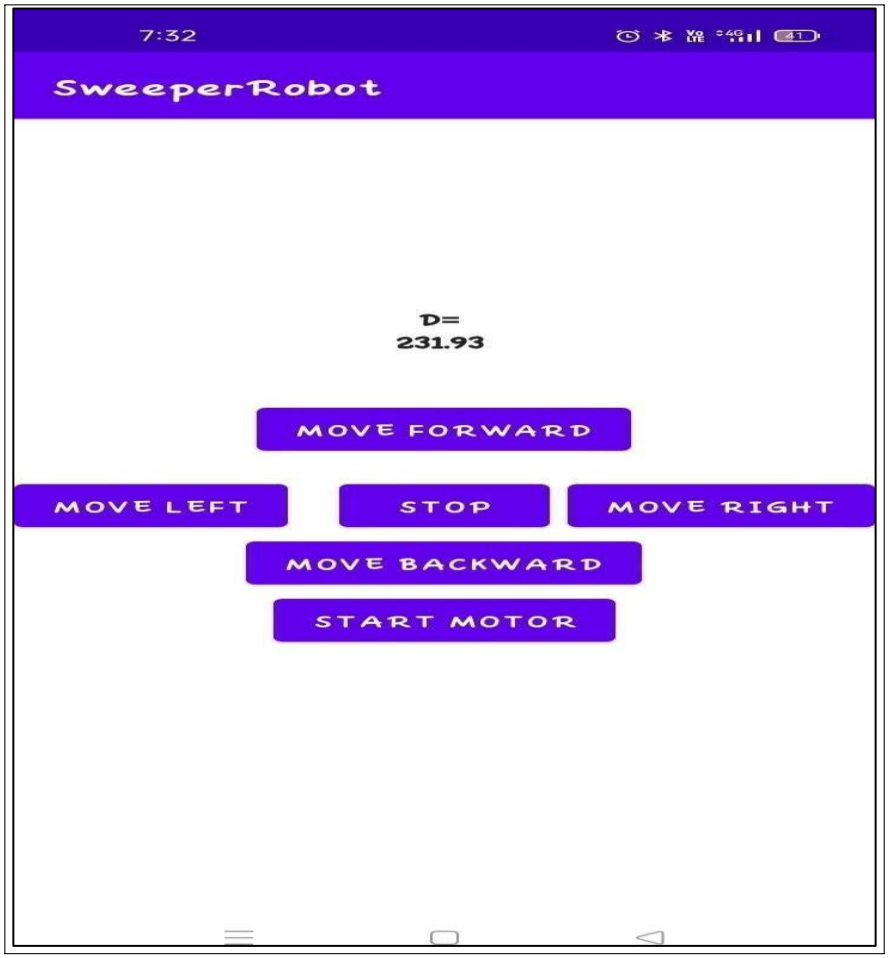



Figure 5.2: Android App

The app is created through studio. It covers basic interface to communicate with model. Connection to model and disconnecting the model can be done through app. The robot can be moved in direction such as right left.

## 5.2 Applications

1. Corporate Company
2. Homes
3. Industry

## 5.3 Advantages

1. Clean Floor
2. Less Human Power
3. Save Time
4. Sanitization

## 5.4 Summary

This chapter discusses about results obtained for Robot Cleaner . The result shows Experimental setup of robot and app for the application.

# Chapter 6
# RESULT AND DISCUSSION

## 6.1 Experimental Code

```
char state;
int flag=0;
void stp();
void fwd();
void left();
void right();
void back();



int triggerPort = 5;
int echoPort =4;
const int sani = 2;
void setup()
{
pinMode(14,OUTPUT);
pinMode(12,OUTPUT);
pinMode(13,OUTPUT);
pinMode(15,OUTPUT);


pinMode(sani, OUTPUT);
digitalWrite(sani,HIGH);
Serial.begin(9600);
delay(1000);
digitalWrite(sani,LOW);
//Initialize LCD I2C

//Initialize MLX90614
pinMode( triggerPort, OUTPUT );
pinMode( echoPort, INPUT );
}
```

```
void loop()
{
digitalWrite(triggerPort, LOW);      // set to LOW trigger's output
digitalWrite(triggerPort, HIGH);    // send a 10us pulse to the trigger
delayMicroseconds( 10 );
digitalWrite(triggerPort, LOW);
long duration = pulseIn(echoPort, HIGH);

long r = 3.4 * duration / 2;      // here we calculate the distance

float distance = r / 100.00;


Serial.println("D=");
Serial.println(distance );

if (distance<10 || distance>700)
{
if(Serial.available() > 0)      // Ckeck for command Recieved
{
state = Serial.read();
Serial.println(state);
flag=0;
}


if (state == 'E')     // Checking Command from User
{
 stp();
 delay(1000);
 }
 else if (state == 'A')
 {
 fwd();
 delay(1000);
 }
 else if (state == 'B')
{
 back();delay(1000);
 }
 else if (state == 'C')
{
 left();delay(1000);
 }
else if (state == 'D')
```

```
 {
 right();delay(1000);
 }

 else if (state == 'G')
 {
 digitalWrite(sani,LOW);
 delay(1000);
 }
 else if (state == 'F')
{
digitalWrite(sani,HIGH);

delay(1000);
 }

 }

 delay(1000);
 }



  void fwd()          // Forward
  {
  digitalWrite(14,HIGH);
  digitalWrite(13,HIGH);
  digitalWrite(12,LOW);
  digitalWrite(15,LOW);
  }
  void back()          // Backward
 {
 digitalWrite(12,HIGH);
 digitalWrite(15,HIGH);
 digitalWrite(14,LOW);
 digitalWrite(13,LOW);
 }
 void left()          //LEFT
{
 digitalWrite(14,HIGH);
 digitalWrite(12,LOW);
 digitalWrite(15,HIGH);
digitalWrite(13,LOW);
 }
```

```
void right()          // Right
{
digitalWrite(13,HIGH);
digitalWrite(15,LOW);
digitalWrite(12,HIGH);
digitalWrite(14,LOW);
}
 void stp()           // Robot Stops
{
digitalWrite(14,LOW);
digitalWrite(12,LOW);
digitalWrite(13,LOW);
digitalWrite(15,LOW);
}
```

# Chapter 7
# CONCLUSION AND FUTURE WORK

## 7.1 Conclusion

In this project Floor Cleaning Robot has been implemented. It was works on A pre-defined code inserted in Node MCU. Whenever RC car encounters obstacle, it turns to the side where the distance between obstacle and car is more.

## 7.2 Future Work

The system can be enhanced with use of more machine learning models for cleaning and covering distance on floor. And When obstacles detect System Automatically Take decision either Left or Right.

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6. Raj Vishaal, Raghavan P., Rajesh R., Sachin Micheal, Mohan Rajesh Elara "Design of Dual Purpose Cleaning Robot" Procedia Computer Science (In- ternational Conference on Robotics and Smart Manufacturing), Vol 133, pp 518- 525, 2018

7. Vatsal Shah"Floor Cleaning Robot with Mobile-App or Autonomous" Unpublished

# APPENDIX A

## Costing of Project

| Sr. No | Components | Quantity | Individual Cost | Total Cost |
|---|---|---|---|---|
| 1 | Node MCU | 1 | Rs.390 | Rs.390 |
| 2 | Relay | 1 | Rs.115 | Rs.115 |
| 3 | Pump Motor | 1 | Rs.199 | Rs.199 |
| 4 | DC Motor | 3 | Rs.82 | Rs.246 |
| 5 | Wheels | 2 | Rs.50 | Rs.150 |
| 6 | Male to Female jumper wires | 1 | Rs.147 | Rs.147 |
| 7 | Adapter | 1 | Rs.197 | Rs.197 |
| 8 | Battery and battery clip connector | 1 | Rs.120 | Rs.120 |
| 9 | Robot Platform | 1 | Rs.310 | Rs.310 |
| 10 | Bluetooth | 1 | Rs.207 | Rs.207 |
| 11 | Ultrasonic Sensor | 1 | Rs.185 | Rs.185 |
| | **Total Cost** | | | **Rs.2271** |

Table 7.1: Costing of Project

# APPENDIX B

## DATASHEET

### 1. Node MCU

#### ➢ Specification Features

- Microcontroller : Tensilica32-bitRISCCPUXtensaLX106
- OperatingVoltage:3.3V
- InputVoltage:7-12V
- FlashMemory:4MB
- SRAM:64KB
- ClockSpeed:80MHz
- USB-TTLbasedonCP2102is included on board, Enabling Plug Play
- PCB Antenna
- Digital I/O Pins(DIO):16
- Small Sized module to fit smartly inside your IoT projects

#### ➢ Pinout Configuration

| Pin Category | Name | Description |
|---|---|---|
| Power | Micro-USB, 3.3V, GND, Vin | Micro-USB: Node MCU can be powered through the USB port 3.3V: Regulated 3.3V can be supplied this pin to power the board GND: Ground pins Vin: External Power Supply |
| Control Pins | EN,RST | The pin and the button resets the microcontroller |
| Analog Pin | A0 | Used to measure analog voltage In the range of 0- 3.3V |
| GPIO Pins | GPIO1 to GPIO16 | Node MCU has16 general Purpose input-output pins on its board |
| SPI Pins | SD1,CMD, SD0,CLK | Node MCU has four pins available For SPI communication. |
| UART Pins | TXD0, RXD0, TXD2,RXD2 | Node MCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1).UART1 is use to upload. The firmware/program. |

Figure 7.2: Pinout Configuration

## 2. Relay Module

### ➢ Connections

| Pin | Function |
|---|---|
| IN1 | TTL digital input |
| IN2 | TTL digital input |
| GND | Ground |
| +5V | Power(+5V) |
| NO1 | Normally open contact |
| COM1 | Common contact |
| NC1 | Normally closed contact |
| NO2 | Normally open contact |
| COM2 | Common contact |
| NC2 | Normally closed contact |

Table 7.3: Connections

### ➢ Characteristics

| Name | Voltage |
|---|---|
| Supply voltage VCC1(seeNote1) | 36V |
| Output supply voltage, VCC2 | 36V |
| Input voltage, VI | 7V |
| Output voltage range | 3Vto3V |
| Peak output current, IO (non-repetitive, t 5 ms): L293 | ±2A |
| Peak output current, IO(non-repetitive ,t 100 µs): L293D | ±1.2A |

Table 7.4: Pin out Configuration

## 3. DC Motor

### ➢ Motor Specification

- Standard130TypeDCmotor
- OperatingVoltage:4.5Vto9V
- Recommended/RatedVoltage:6V
- CurrentatNoload:70mA(max)
- No-loadSpeed:9000rpm

- Loadedcurrent:250mA(approx)
- RatedLoad:10g*cm
- MotorSize:27.5mmx20mmx15mm
- Weight:17grams

### ➢ Pinout Configuration

| Pin Name | Description |
|---|---|
| Terminal1 | A normal DC motor would have only two terminals. Since these terminals are connected together only through a coil they have not polarity. Revering the connection will only reverse the direction no the motor |
| Terminal2 | A normal DC motor would have only two terminals. Since these terminals are connected together only through a coil they have not polarity. Revering the connection will only reverse the direction no the motor |

Table 7.5: Pinout Configuration

# 4. Bluetooth

## ➢ Specification Features

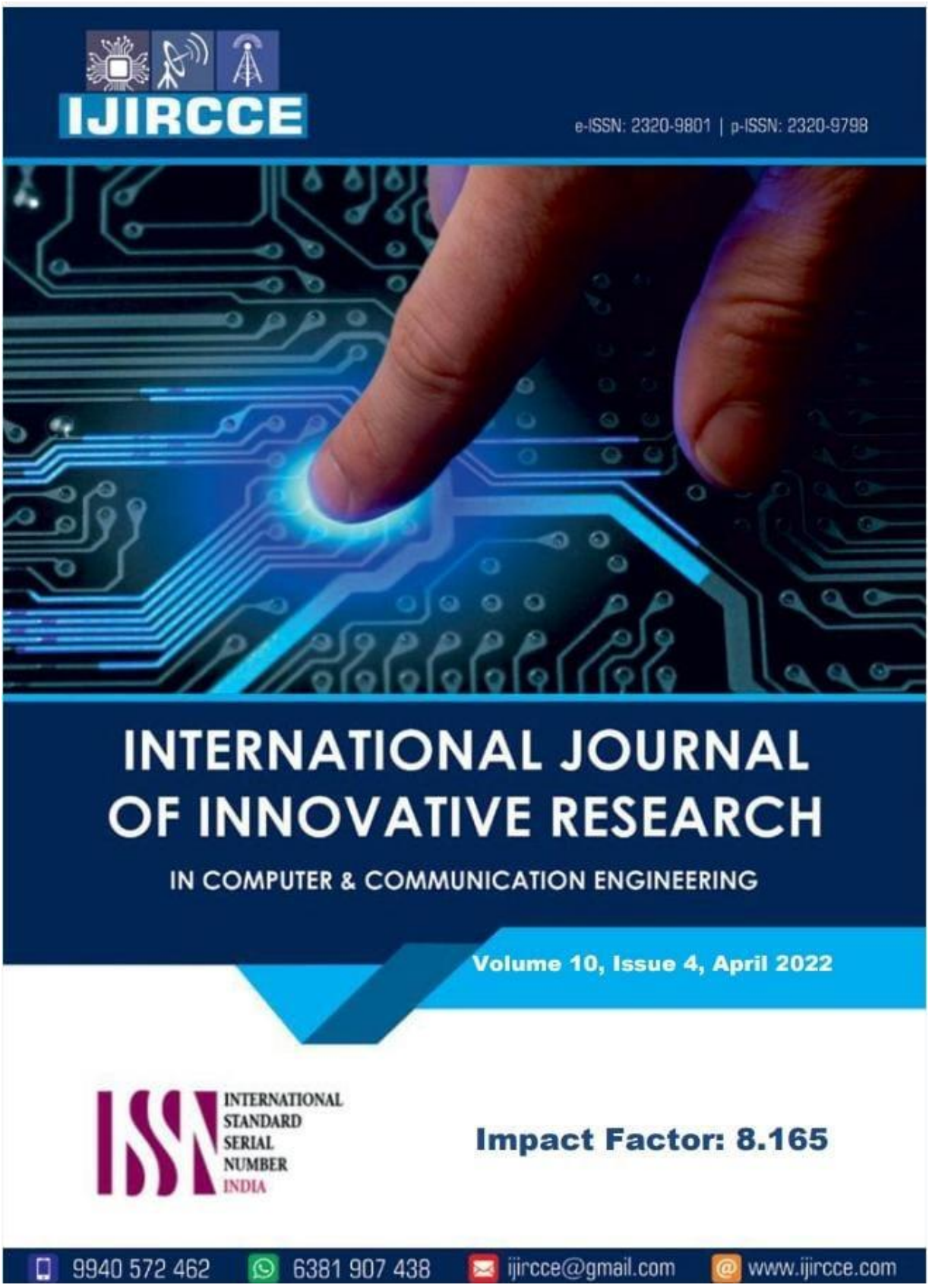
- Bluetooth protocol: Bluetooth Specification **v2.0+EDR** (Enhanced Data Rate)
- Frequency: **2.4GHz ISM band**
- Modulation: **GFSK** (Gaussian Frequency Shift Keying)
- Emission power: ≤4dBm, Class 2
- Sensitivity: ≤-84dBm at 0.1% BER
- Speed: Asynchronous communication: **2.1Mbps (Max) / 160 kbps**, Synchronous communication: **1Mbps/1Mbps**
- Security: Authentication and encryption
- Profiles: Bluetooth serial port
- Supply Voltage: **+3.3V to 6.0 V**
- Supply Current: **30mA**
- Working temperature: -20 ~ +75Centigrade
-

| **Pin** | **Function** |
|---|---|
| Key-En | This pin is used to bring the Bluetooth module in AT commands mode. By default, this pin operates in data mode. The Key/EN pin should be high to operate Bluetooth in command mode. In HC-05, the default baud speed in command mode is 38400bps and 9600 in data mode. |
| VCC | Used to power the Bluetooth module. Give 5V / 3.3 V to this Pin. |
| GND | The ground pin of the module |
| TXD | Connect this pin with the RXD pin of the Microcontroller. This pin transmits Serial data (wireless signals received by the Bluetooth module are converted by module and transmitted out serially on this pin) |
| RXD | Connect this pin to the TXD pin of the Microcontroller. The HC-05 Bluetooth module receives the data from this pin and then transmits it wirelessly. |
| STATE | It is used to check if the module is connected or not. It acts as a status indicator. |

Table 7.6: Pinout Functions

# PUBLICATION

1. Sonali Babar, Asmita Yadav, Prof. Meenakshi Annamalai Mam, “Floor Cleaning Robot Using Android App ” IJIRCCE Journal , issue 4 April 2022, p-ISSN : 2320-9798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# Floor Cleaning Robot Using Android App

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**ABSTRACT:** Households of today are becoming smarter and more automated. Home automa- tion delivers convenience and creates more time for people. Domestic robots are entering the homes and people's daily lives, but it is yet a relatively new and im- mature market. However, a growth is predicted and the adoption of domestic robots is evolving. Several robotic vacuum cleaners are available on the market but only few ones implement wet cleaning of floors. The purpose of this project is to design and implement a Floor Cleaner Robot Autonomous and Manual via Phone Application. Floor Cleaning Robot is designed to make cleaning process become easier rather than by using manual vacuum. The main objective of this project is to design and implement a floor clean robot prototype by using, Node MCU, DC Motor, Relay, LDR Sensor, Real Time Clock, Motor Shield L293D, Ultrasonic Sensor, and IR Sensor and to achieve the goal of this project.

**KEYWORDS:** Calculate Obstacles distance, Node MCU, Bluetooth

## I. INTRODUCTION

Robots are smart machines that can be programmed and used in many areas such as manufacturing, industry, production lines, or health, etc. These robots per- forms hard, dangerous, and accurate work to facilitate our life and to increase the production because they can work 24 hours without rest, and performs like human but more precisely and with less amount of time. Assistive mobile robots that per- form different kinds of work over everyday activities in many areas such as industry, product lines, manufacturing, or health, etc are very commonly used to improve our life. The idea behind this research is to exploit robotics usage in household work. A Smartphone is a mobile phone built on a mobile computing platform, which has more advanced connectivity and computing ability than what a feature phone has. Smartphone's are a more efficient and affordable hand held devices which can be used to support collaborative activities in a community. It is a result of a huge and remarkable advancement in the field of mobile phones technology. Human beings are anxiously working on finding new ways of interacting with machines. Floor cleaner is designed to make cleaning process become easier for human task. This project is a combination of hardware and software which has microcontroller, mo- tor shield, sensor, an android application and finally a Bluetooth module via which the hardware connects the software. Smartphone, a small yet powerful device is rapidly changing its traditional ways of human-machine interaction. Android plat- form brought a big revolution in the field of application development for cell phones, opening for technical exploration. The Android Smartphone can be freely rotated in space, temporarily varying 3D signal data is obtained from the phone's 3-axis accel- eration sensor. This data is transmitted via Bluetooth module of Smartphone using an android app to the robot. Further, this data is processed by a microcontroller em- bedded on the robot to perform desirable motions. In this context, a robot is similar to any machine that is controlled by man varying from a simple toy to heavy ma- chinery. Robots have replaced humans in performing various tasks that human are unable to perform due to physical disability, extreme environments or size limita- tion. Smartphone's have proved to be of much more aid than being a device just for making calls.

## II. THE RESEARCH METHOD

Vidyashree, T.S., Bindushree, V., Rao, S. and Gowra, P.S., 2021." Smart Vacuum Cleaner".Global Transitions Proceedings, 2020.

Roshan, D., Bhosle, O., Bhosale, G., Borse, A. and Bandsode, T., 2020. "Blue- tooth Operated Vacuum and Floor Cleaner using Android Mobile."

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## III. THE REFLECTIVE PROCESS

The RC car is designed. The motor is fitted, motors are attached with wheels. Motors are soldered with wires–positive and negative. RC car is built by using 2 DC motors they run with the speed provided in Arduino IDE code, it uses motor shield to work in desired speed and direction. Ultrasonic sensor attached to RC car detects the distance at which obstacle is present in front of it. So, whenever it encounters any obstacles such as walls, tables, chair or any big things that cannot be consider

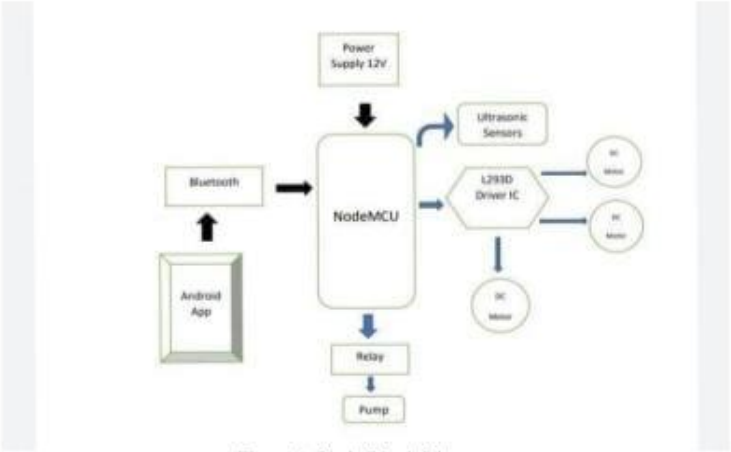


Figure 1. Basic Block Diagram

as garbage or dust, RC car which carries vacuum cleaner changes its direction so that it won't crash and destroy itself. The code fed to the Node MCU runs continuously and the cycle repeats in regular intervals whenever the obstacle is detected.

- **Node MCU**: The microcontroller used in proposed model is Node MCU. It is a open Source Platform for developing electronics projects. It uses ESP8266-12E as a main controller, which is a high integration wireless SOC(System on Chip).
- **Bluetooth:** Bluetooth is a wireless communication protocol running at the speed of 2.4 GHz with the architecture of client-server and which is suitable for forming personal area networks. Bluetooth gives the connectivity between two devices using their MAC address.
- **L239D :** A very easy and safe is to use popular L293D chip. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.
- **DC Motor :** A DC Motor is a motor where by direct current electrical power is converted into mechanical power. Most often, this type of motor relies on forces that magnetic field produce. Proposed robot is designed with two DC motors to operate in forward and backward direction.

## IV. SYSTEM DEVELOPEMENT

### HARDWARE DESCRIPTION

**1. Node MCU**

Node MCU is a low-cost open source IOT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SOC from Espressif System and Hardware which was based on the ESP-12 module. Later, Support for the ESP32 32-bit MCU was added.

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**Figure 2:Node MCU**

**2.Ultrasonic Sensor**

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound

**Figure 3: Ultrsonic Sensors**

**3.Motor Driver (L293D)**

It utilizes a maximum peak motor current of 1.2A. A maximum continuous motor current of 600mA is required. The range of supply voltage is 4.5V to 7V. The L293D is a 16-pin Motor Driver IC which can control a set of two DC motors simultaneously in any direction. The L293D is designed to provide bidirectional drive currents of up to 600 mA (per channel) at voltages from 4.5 V to 36 V (at pin 8!)

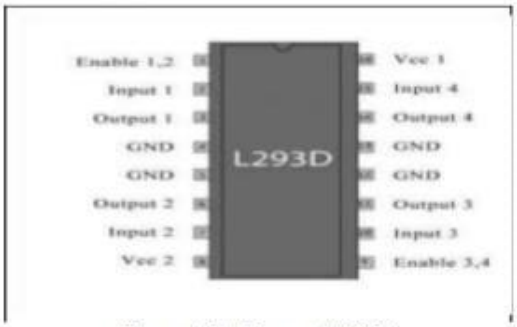


**Figure 4: Pin Diagram(L293D)**

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**4.Bluetooth device (HC05)**

Used in wireless communication for a range of about 100m. Modulation used is GFSK and uses FHSS technology to send data serially. It uses a power supply of 3.3V to 5V. It is used in a master slave configuration. Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

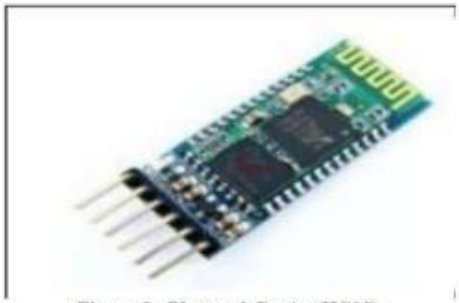

**Figure 5: Bluetooth Device(HC05)**

**5. Power Supply**

The power supply is the first and most important part of our project. For our project, we require a +5v regulated power supply with a maximum current rating of 500mA. The 1000µF capacitor serves as a "reservoir" which maintains a reasonable input voltage to the 7805 throughout the entire cycle of the AC line voltage. The 10µF and.01µF serve to keep the power supply voltage constant when load condition changes. However, at high frequencies, this capacitor is not very efficient therefore the .01µF is included to bypass high-frequency changes such as digital IC switching effects, to ground. The ac voltage,

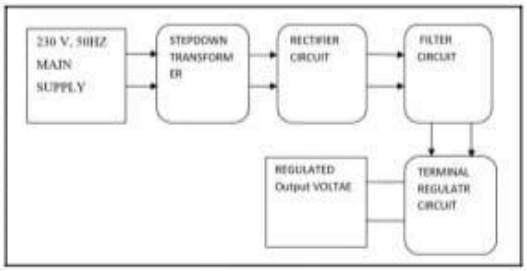


**Figure 6: Power Supply**

typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes.

**SOFTWARE DEVELOPMENT**

**1. OPERATING SYSTEM : Microsoft Windows 7 and Above**

Microsoft Windows, also called Windows and Windows OS, computer operating system (OS) developed by Microsoft Corporation to run personal computers (PCs). Featuring the first graphical user interface (GUI) for IBM-compatible PCs, the Windows OS soon dominated the PC market. Approximately 90 percent of PCs run some version of Windows.

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**2 JDK**

(Java Development Kit) A Java software development environment from Oracle. It includes the JVM, compiler, debugger and other tools for developing Java applets and applications. Each new version of the JDK adds features and enhancements to the language.The JDK includes tools useful for developing and testing programs written in the Java programming language and running on the Java platform.


**Figure 7: JDK (Java Platform)**

**3 IDE : ARDUINO**

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

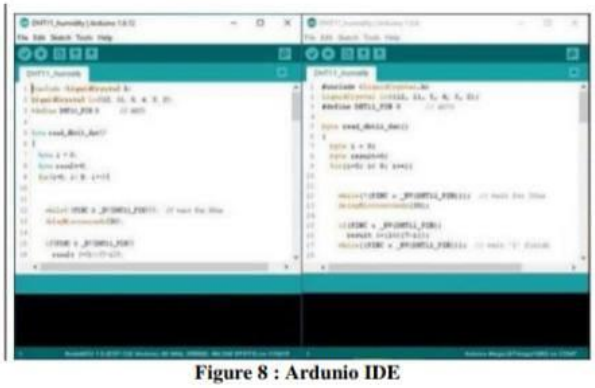

**Figure 8 : Ardunio IDE**

**OPERATIONAL DETAILS**

**Algorithm**

**KNN:** K nearest neighbors is a simple algorithm that stores all available cases and classifies new cases based on a similarity measure (e.g., distance functions). KNN has been used in statistical estimation and pattern recognition already in the begin- ning of 1970's as a non-parametric technique.

- Determine parameter K= number of neares t neighbor.

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- Calculate the distance between the query-instance and all training sample.
- Sort the distance and determine nearest neighbor based on the k-th minimum distance.
- Gather the category of the nearest neighbor.
- Use simple majority of the category of nearest neighbors as prediction value of the query instance.

**KNN Pseudo code**
kNN (dataset, sample)

1. Go through each item in my dataset, and calculate the "distance" from that data item to my specific sample.
2. Classify the sample as the majority class between K samples in the dataset having minimum distance to the sample.

Flowchart

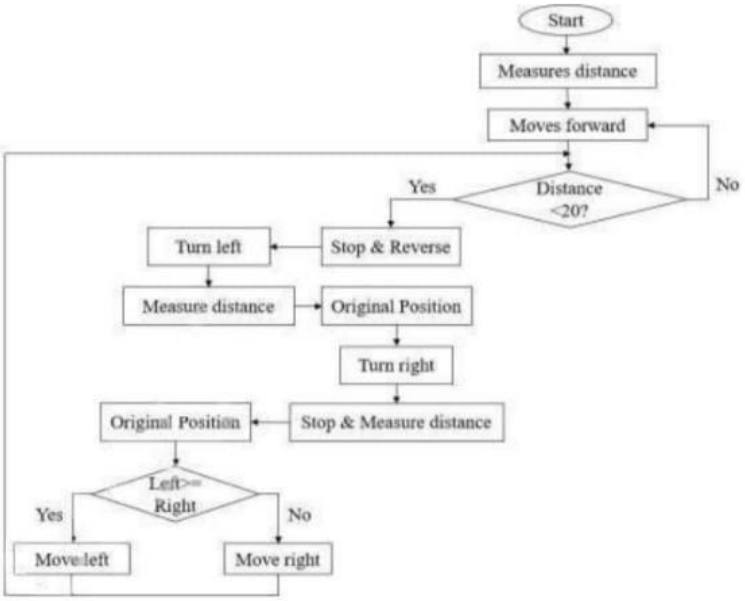


Figure: Robot Path

## V. CONCLUSIONS

In this project Floor Cleaning Robot has been implemented. It was works on a pre-defined code inserted in Node MCU. Whenever RC car encounters any obstacle, it turns to the side where the distance between obstacle and car is more. The System consists of transmitter App.

## REFERENCES

1.Vidyashree, T.S., Bindushree, V., Rao, S. and Gowra, P.S., 2021." Smart Vacuum Cleaner".Global Transitions Proceedings. RC car which is embedded with a vacuum cleaner is used. This system has an ultrasonic sensor attached to it, that helps in avoiding large obstacles such as tables, chairs, walls etc.[1]
2. Roshan, D., Bhosle, O., Bhosale, G., Borse, A. and Bandsode, T., 2020. "Blue- tooth Operated Vacuum and Floor Cleaner using Android Mobile."The aim of this project work is to design and develop process for cleaning the floor

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having wet and dry surfaces. It is very useful for cleaning the wet as well as dry floor having wet and dry surfaces. It is very useful for cleaning the wet as well as dry floors. [2]

3. Murdan, A.P. and Ramkissoon, P.K., 2020, November. A smart autonomous floor cleaner with an Android-based controller.The user has complete control over the robot either in the autonomous or remote-controlled mode. The implemented cleaning system consists of five main blocks namely the power block (rechargeable dc battery), the motor sys- tem (driving wheels, rotating brush, vacuum fan, water pump), communica- tion block (Bluetooth control, HC 06 Bluetooth module) and software block (Android remote controlled). Upon the implementation and testing of this pro- totype, it was observed that the robot works as programmed, and is equipped with most of the functionalities of a household commercial state-of-art clean- ing robot.[3]

4. Das, N.R., Daga, R., Avte, S. and Mhatre, K., 2019. Robotic automated floor cleaner.

Automated machine cleaners are pivotal in the modern era for modern living due to its elective lowering of the labor cost of a human being, saving both time and money. Most of these cleaners are designed purposely to satisfy the special need of the consumers. The project is a collaboration of Mechanical, Electrical and Electronic streams and employs devices and systems of these fields. It is an assembly of various rigid components like chassis, some motors and various electromechanical devices. Our motive is to present a working model of a cleaning machine which will be used in a household with minimum utilization of the resources available with us.[4]

5. Iwan Ulrich, Francesco Mondada, J D Nicoud "Autonomous Vacuum Cleaner" Robotics and Autonomous systems, In "Autonomous Vacuum Cleaner" (Robotics And Autonomous Systems) by Iwan Ulrich the Authors talk about broad topics which include Selection of shape of robot, selection of Cleaning mechanisms, Sensor systems and map- ping of obstacles using these Sensors. In this paper their Robot relies on the 54 tactile sensors placed on the robot and the area they are trying to clean have uncertain extent and obstacles. So they have assumed only four kinds of ob- stacles (wall, legs, concave and convex corners) for programming purposes. They have also considered the type of vacuum cleaner that needs to be used based upon the power supply available. Navigation is explained in terms of obstacle identification, hypothesis and map creation. [5]

6. T.B. Asafa, T.M. Afonja, E.A. Olaniyan, H.O. Alade "Development of a Vac- uum Cleaner Robot"

The paper "Development of a Vacuum Cleaner Robot" (Alexandria Engineer- ing Journal) by T.B. Asafa gives us information about the characteristics that need to be considered while developing the robot. It gives us an idea about the considerations taken in order to design the aspects like Geometry, sweeper position, Dustbin size, cooling provisions, Electrical equipment, Controllers, Chassis and sensors. [6]

7. Raj Vishaal, Raghavan P., Rajesh R., Sachin Micheal, Mohan Rajesh Elara "Design of Dual Purpose Cleaning Robot".The paper "Design of Dual Purpose Cleaning Robot" (International Confer- ence on Robotics and Smart Manufacturing) by Raj Vishaal gives information about the design of a dual purpose cleaning Robot which can be used for clean- ing walls as well as the floor. The author also gives information about Electric Ducted Fan and how it is used in Adhering the robot to the glass walls. The floor cleaning system is manually controlled using Bluetooth signals from a Smartphone while the wall cleaning is carried out automatically. The robot has been designed in two parts namely the base module and the cleaning mod- ule. These two are attached by the supporting ropes. [7]

8. Vatsal Shah"Floor Cleaning Robot with Mobile-App or Autonomous"

The paper "Floor Cleaning Robot with Mobile-App or Autonomous" by Vatsal Shah deals with the research and development of Manual Phone application controlled as well as fully autonomous Robot. It highlights the key parameters that need to be taken into consideration while designing the robot like Obstacle avoidance, Floor detection, Collision.


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