

A SMART AUTONOMOUS AND BLUETOOTH CONTROLLED FLOOR CLEANER WITH AURDINO BASED MICROCONTROLLER

**Submitted in partial fulfillment of the requirements for the award of Bachelor
of Engineering degree in ELECTRONICS AND COMMUNICATION
ENGINEERING**

By

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHOOL OF ELECTRONICS & COMMUNICATION

ENGINEERING



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this project is the bonafide work of Kajjam venkata ramana kumar(38130093) & Tongali sunil varma(38130225) carried out the project entitled as "A SMART AUTONOMOUS AND BLUETOOTH CONTROLLED FLOOR CLEANER WITH ANDROID BASED MICROCONTROLLER." under our supervision from 09/12/2021 to 01/03/2022.

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DECLARATION

We Kajjam venkata ramana kumar & Tongali sunil varma hereby declare that the project report entitled “A SMART AUTONOMOUS AND BLUETOOTH CONTROLLED FLOOR CLEANER WITH ANDROID BASED MICROCONTROLLER ”done by us under the guidance of Dr.T.Vino at SATHYABAMA UNIVERSITY is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering in ELECTRONICS AND COMMUNICATION ENGINEERING.

Date:- 21/04/2022

Place:- KROSURU

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I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of E.C.E who were helpful in many ways for the completion of the project.

ABSTRACT

The project revolves around the creation of Bluetooth-enabled floor cleaning devices. The goal of this project is to create and test a model for cleaning wet and dry floor surfaces. It comes in handy for scrubbing damp flooring. Cleaning floors is important for our health, and this floor cleaning equipment decreases the amount of labour necessary. As a result, this project is quite valuable in our daily lives. It's straightforward to put together and operate. This equipment is simple to operate. This floor cleaning equipment has a sponge mop, swiping brushes, and a fan that helps to speed up the cleaning process. This machine's overall cost is similarly low. These machines are commonly employed for this purpose, although they operate on different principles and are quite expensive. Floor cleaning machines have grown more popular in recent years for cleaning huge floor surfaces in a short amount of time. However, in India, a growing country, large-scale cleaning equipment are necessary to meet the country's cleaning requirements.

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CHAPTER 1

INTRODUCTION

In today's world, Cleanliness having a great importance. Cleanliness means that there is no dirt, no dust, no stains, no bad smells. The goals of cleanliness are health, beauty, absence of offensive odor and to avoid the spreading of dirt and contaminants to oneself and others. With the help of cleanliness, we can keep our physical and mental health clean, which will make us feel good. Cleanliness gives rise to a good character by keeping body, mind, and soul clean and peaceful. Maintaining cleanliness is the essential part of healthy living because it is the cleanliness only which helps to improve our personality by keeping clean externally and internally. It is everybody's responsibility and one should keep themselves and their surroundings clean and hygienic. It also brings good and positive thoughts in the mind which slows down the occurrence of diseases. There are lots of options are available for floor cleaning. Available options include manual & semi-automatic cleaning. Manual cleaning requires human interference & it also took large time for cleaning. Other than this Many types of machines are widely used for this purpose. But they are working under different principles and the cost is also very high. This project deals with the designing and fabrication of Floor cleaning Machine by using Bluetooth. The aim of this work is to develop and modernized process for cleaning the wet & dry surface floors. The machine is very simple in construction and easy to operate. It consists of moisture cotton brush, the brush cleans the floor and dried with Fan. Hence it is very useful in houses, colleges, hospitals, auditoriums, malls and workshops. The time taken for cleaning is very less and the cost is also very less. Maintenance cost is less. In this project a very simple drive mechanism is used. The size of the machine is also compact and it is portable, so we can transfer from one place to another place very easily. The floor cleaning machine is simple & modern house holding device, as even children can also operate it easily with safety.

CHAPTER 2

LITERATURE SURVEY

1. SURVEY ON BLUETOOTH CONTROL TECHNOLOGY USING ARDUINO

Dr. Akash Rathee, Ishant Jalan, Lakshita Nandwani, Tanya Sharma
Automatic Smart Floor Cleaning Robot Using Arduino – UNO
2020 International Journal for Research in Engineering Application & Management (IJREAM).

In this paper we propose a smart floor cleaning robot that can clean the floor according to the instructions given by user. This robot makes the cleaning process fast and efficient as it receives the commands from smart phone wirelessly through Bluetooth module embedded on it. On getting the commands the robot perform functions like moving in different directions and mopping the floor. This system proves to be cost effective, low maintenance and reduced human effort which makes it a very reliable product.

2. SURVEY ON AUTOMATIC WORKING OF MACHINE

Uman Khalid, Muhammad Faizan Baloch, Haseeb Haider, Muhammad Usman Sardar, Muhammad Faisal Khan, Abdul Basit Zia and Tahseen Amin Khan Qasuria.
Smart floor cleaning robot-2018-Researchgate- 327837948

With the advancement of technology, robots are getting more attention of researchers to make life of mankind comfortable. This paper

presents the design, development and fabrication of prototype Smart Floor Cleaning Robot (CLEAR) using IEEE Standard 1621 (IEEE Standard for User Interface Elements in Power Control of Electronic Devices employed in Office/Consumer Environments). Subject robot operates in autonomous mode as well as in manual mode along with additional features like scheduling for specific time and bagless dirt container with auto-dirt disposal mechanism. This work can be very useful in improving life style of mankind.

3. SURVEY ON MATERIAL REQUIRED FOR MACHINE

S Monika, K Aruna Manjusha, S V S Prasad, B.Naresh
Design and Implementation of Smart Floor Cleaning Robot using
Android App. 2019-International Journal of Innovative Technology and
Exploring Engineering (IJITEE)

The advancements made in technology of robotics have made life of mankind very much easier and comfortable. This paper describes a smart floor cleaning robot that allows cleaning the floor by giving instructions to the robot. This robot makes floor cleaning process easy and fast utilizing a wireless robotic cleaning system. This wireless system consists of a transmitter application that runs on an android mobile app which allows the robot to follow commands given by the user through the transmitter app. The proposed robot consists of Arduino UNO controller which has fourteen digital input/output pins, robotic arm with cleaning pad with a water sprayer for efficient cleaning. The Arduino UNO, on receiving the commands from android device through Bluetooth receiver, decodes the given commands and controls the motors to achieve the desired path and direction.

4. SURVEY ON TECHNOLOGICAL ADVANTAGES OF MACHINE

Bhumika T, Harshitha U, Meghana S, Dr. Ganashree T

TIDDY - An Artificial Intelligence Based Floor Cleaning Robot

2020-august International Journal of Trend in Scientific Research and Development (IJTSRD).

ABSTRACT “Maid in India” is more important than “Made in India” in modern society. Nonetheless, in the hustle and bustle of the present world, cleanliness has been ignored. To make life of humankind easier, with assistance of machines and innovations a floor cleaner is introduced. TIDDY, the floor cleaning robot is both a self-sufficient and manual controlled cleaning machine used to accomplish the act of cleaning by methods of its wet and dry modes. Keeping the surrounding clean is just not an aspiration but an action. Hence, TIDDY helps to keep the surrounding neat and tidy. Cleanliness is most important for physical well-being and a healthy environment. It has bearing on public and personal hygiene. This is made budget friendly keeping in mind the different economical classes in society. With the additional features of artificial intelligence and voice recognition, it is made cost-effective.

5. REMOTE CONTROLLED AUTONOMOUS FLOOR CLEANING ROBOT

Raveena Ishalavath M, Sandhyashree N, Rakshitha R, Arpitha Shankar

Design and Development of an Automated Floor Cleaning Robot for Domestic Application

2020 International Journal of Engineering Research & Technology (IJERT).

With the advancement of technology, robots have gotten more attention of researchers to create lifetime of mankind easy. The actual project presents the look and development of Floor Cleaning Robot using IEEE Standards. Developing Bluetooth controlled mobile robot. Scan the obstacles ahead of the robot and to avoid collision when the robot is in motion. Raspberry Pi3 is that the main component won't to control the cleaning robot. An ultrasonic sensor which transmits the ultrasonic waves from its sensor head and again receives the echo waves and sends its output to the Raspberry Pi3. The ultrasonic sensor is connected with the servomotor, which helps within the rotation of ultrasonic sensor. The ultrasonic sensor measures the space between the robot and therefore the obstacle ahead of it. The Pi3 model will stop the robot immediately and also the buzzer are actuated. The moping operation will be started or stopped at any point of your time as per the need. The moping brush is actuated by the DC motor fixed thereto. Signal to the present motor is fed by the controller. An LCD displays each and each operation applied by the robot. Buzzer is an audio signalling device that provides the indication of operating status of the robot.

6. **Meghana K , Harshitha V , Mahima Padmanabha B, Nagesh N Dikshit , B R Santosh Kumar.**

**A SURVEY ON AUTOMATIC AND MANUAL FLOOR CLEANING ROBOT
2019 JETIR April 2019, Volume 6, Issue 4**

Households of today are becoming smarter and more automated. Home automation 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 immature 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. Vacuum Robot will have several criteria that are user-friendly. With the advancement of technology, robots are getting more attention of researches to make life of mankind comfortable. This projects presents the design, development and fabrication of prototype automatic

floor cleaner. This robot operates autonomous mode with additional features like dirt container with air vacuum mechanism and pick and place mechanism. This work is very useful in improving life style of mankind.

7. **Puneet Kaushik , Mohit Jain , Gayatri Patidar ,Paradayil Rhea Eapen , Chandra Prabha Sharma.**

Smart Floor Cleaning Robot Using Android

International Journal of Electronics Engineering (ISSN: 0973-7383)

Volume 10 • Issue 2 pp. 502-506 June 2018-Dec 2018

This paper presents a cost-efficient robot that could be used even by people who won't be able to enjoy luxury to use roomba, scooba etc. There is variety of autonomous robots available in the market and they all do their work perfectly according to their specifications but none of them are cost-efficient. For a developing country like India, where the majority of the population is economic, keeping this in mind the robot is designed.

8. **Yuda Irawan, Muhardi Muhardi, Rian Ordila, Roni Diandra**
Automatic Floor Cleaning Robot Using Arduino and Ultrasonic Sensor
2021- Journal of robotics and control(JRC) Vol2 no-4

The entire floor cleaning robot is divided into several parts, namely consisting of an Ultrasonic Sensor, Motor Shield L298, Arduino Uno microcontroller, Servo, and Dc Motor. This tool works when the Arduino Uno microcontroller processes the ultrasonic sensor as a distance detector

and a DC motor as a robot driver, then the DC motor is driven by the Motor Shield L298. When an ultrasonic sensor detects a barrier in front of it, the robot will automatically look for a direction that is not a barrier to the floor cleaning robot. The distance value on the sensor has been determined, that is, when the distance read by the ultrasonic sensor is below 15 cm. The results of testing the value of the ultrasonic sensor distance found different conditions that occur. In a distance of > 15 cm, the condition of the prototype cleaning robot for the road floor cleaning is obtained, while the distance < 15 cm, the condition for the prototype of the street floor cleaning robot has stopped.

CHAPTER 3

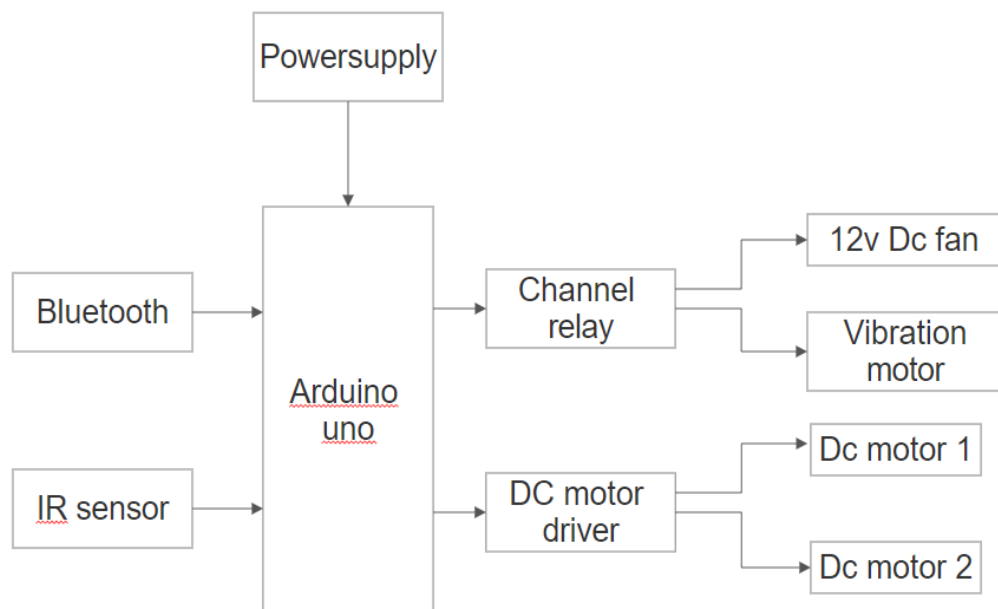
3.1 EXISTING SYSTEM

Some dust and dirt particles may stay on the floor during manual cleaning, and owing to the movement of air, the dirt and dust particles travel from one surface to another, causing issues while cleaning and increasing physical labour. Because of the urge to clean the surface rather than acquire, it takes longer. Manual cleaning necessitates human intervention and takes a long time. Aside from that, there are a variety of devices on the market that may be used for this purpose. However, they operate on distinct principles, and the cost is quite high.

3.2 PROPOSED SYSTEM

The Bluetooth application was used to design and control the floor cleaning equipment with a charging unit. The chassis frame, plywood, two plastic boxes, Arduino Uno, DC motors, wheels, battery, charging unit, Bluetooth unit, brush, fan, and cleaning sponge are among the different components utilised in the floor cleaning machine. It will assist in floor cleaning with less human effort and in less time. The floor cleaning machine has a relatively tiny size compared to other cleaning machines on the market, yet it has a beautiful appearance and is highly durable. The machine is made up of numerous components, including a DC motor, wiper, mope, and brushes. These components are mounted on a welded chassis composed of one-inch mild steel square bars and linked to the electrical system. The power for DC motors is provided by an SMPS, which converts the AC supply to a 12v DC supply.

3.3 BLOCK DIAGRAM



3.4 HARDWARE REQUIREMENTS

1. ARDUNIO UNO
2. IR SENSOR
3. HC-05 BLUETOOTH MODULE
4. CHANNEL REALY
5. L293 DC MOTOR DRIVER
6. DC MOTORS
7. POWER DISTRIBUTION MODULE
8. VIBRATION MOTOR
9. DRIYER FAN

3.5 SOFTWARE REQUIREMENTS

1. ARDUNIO IDE
2. ARDUNIO BLUETOOTH APP(FROM PLAYSTORE)

CHAPTER 4

4.1 HARDWARE

4.1.1 ARDUNIO UNO:-

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

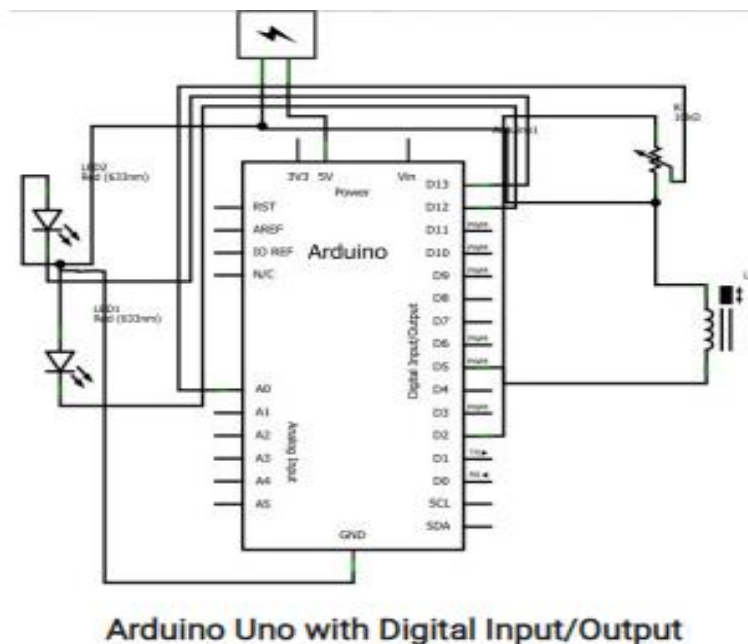
Arduino Uno is a microcontroller board based on the ATmega328P ([datasheet](#)). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

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.



There are many versions of Arduino boards introduced in the market like Arduino Uno, Arduino Due, Arduino Leonardo, Arduino Mega, however, most common versions are Arduino Uno and Arduino Mega. If you are planning to create a project relating to digital electronics, embedded system, robotics, or IoT, then using Arduino Uno would be the best, easy and most economical option.

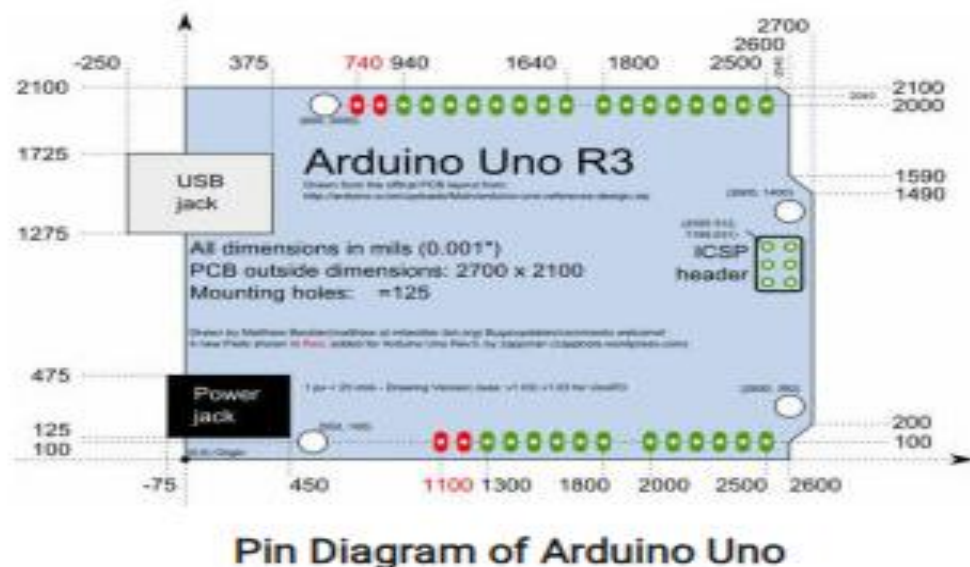
ARDUNIO BOARD



There are various types of Arduino boards in which many of them were third-party compatible versions. The most official versions available are the Arduino Uno R3 and the Arduino Nano V3. Both of these run a 16MHz Atmel ATmega328P 8-bit microcontroller with 32KB of flash RAM 14 digital I/O and six analogue I/O and the 32KB will not sound like as if running Windows. Arduino projects can be stand-alone or they can communicate with software on running on a computer. For e.g. Flash, Processing, Max/MSP). The board is clocked by a 16 MHz ceramic resonator and has a USB connection for power and communication. You can easily add micro SD/SD card storage for bigger tasks.

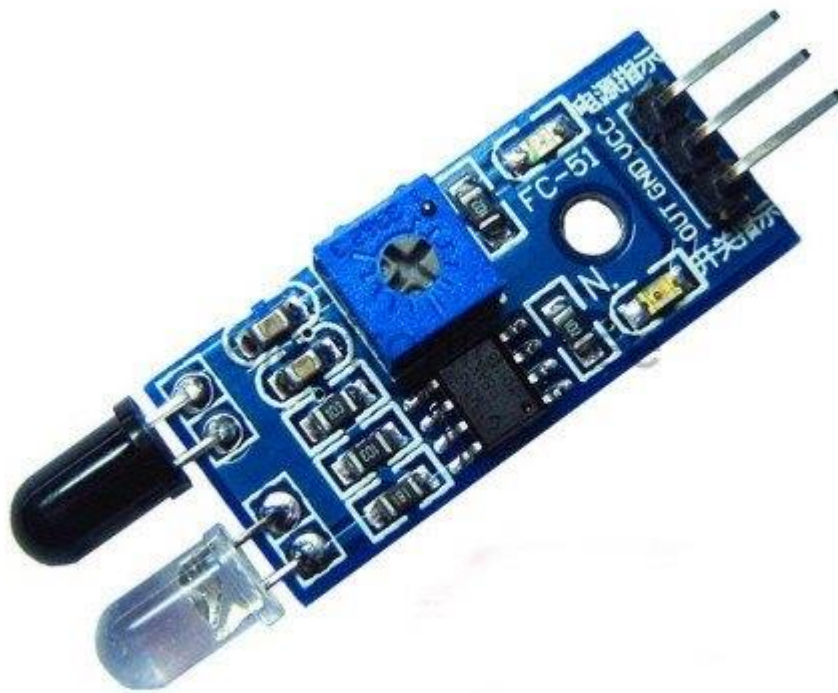
FEATURES OF ARDUINO:

- It is an easy USB interface. This allows interface with USB as this is like a serial device.
- The chip on the board plugs straight into your USB port and supports on your computer as a virtual serial port. The benefit of this setup is that serial communication is an extremely easy protocol which is time-tested and USB makes connection with modern computers and makes it comfortable.
- It is easy-to-find the microcontroller brain which is the ATmega328 chip. It has more number of hardware features like timers, external and internal interrupts, PWM pins and multiple sleep modes.



4.1.2 IR SENSOR:

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED.



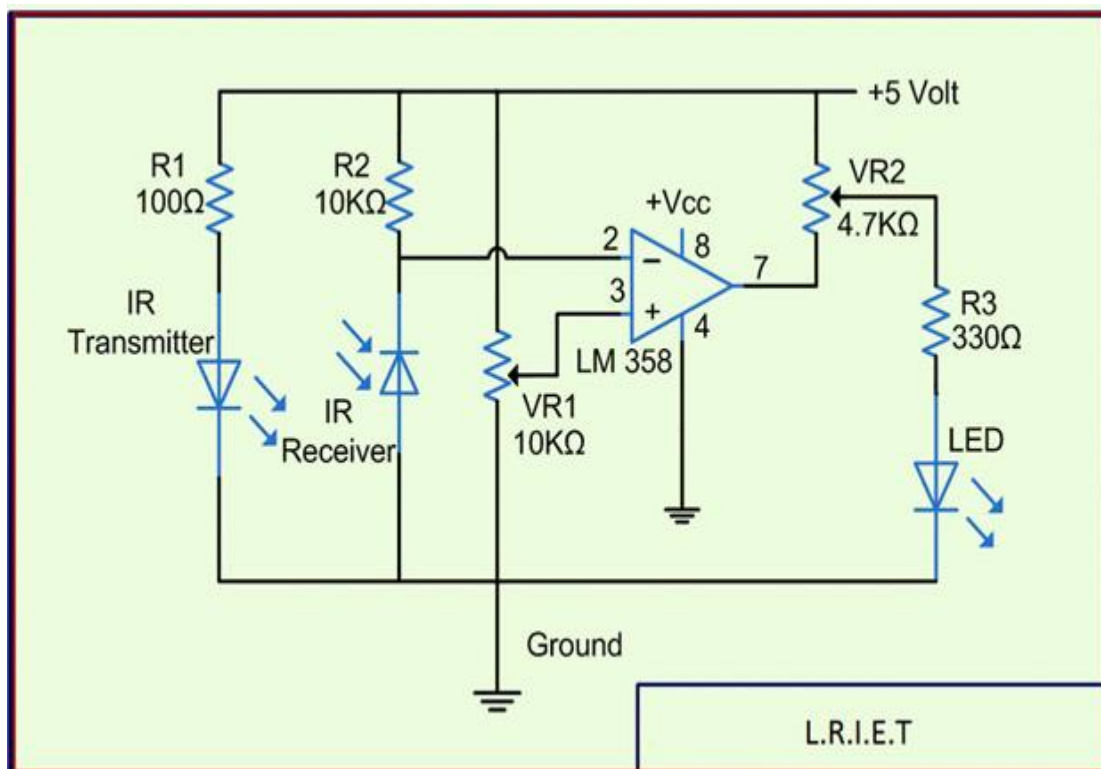
IR SENSOR

IR SENSOR CIRCUIT DIAGRAM AND WORKING PRINCIPLE:

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time. This circuit comprises of the following components

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo ohms.
- LED (Light Emitting Diode).

CIRCUIT DIAGRAM:



In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since

this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit.

When the IR receiver module receives signal to the potential at the inverting input goes low. Thus, the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals.

::

DIFFERENT TYPES OF IR SENSORS AND THEIR APPLICATIONS:

IR sensors are classified into different types depending on the applications.

Some of the typical applications of different types of sensors are

The speed sensor is used for synchronizing the speed of multiple motors. The temperature sensor is used for industrial temperature control. PIR sensor is used for automatic door opening system and Ultrasonic sensor are used for distance measurement.

Flame Monitors:

These types of devices are used for detecting the light emitted from the flames and to monitor how the flames are burning. The Light emitted from flames extend from UV to IR region types. PbS, PbSe, Two-color detector, pyro electric detector are some of the commonly employed detector used in flame monitors.

Moisture Analyzers:

Moisture analyzers use wavelengths which are absorbed by the moisture in the IR region. Objects are irradiated with light having these wavelengths (1.1 μm , 1.4 μm , 1.9 μm , and 2.7 μm) and also with reference wavelengths. The Lights reflected from the objects depend upon the moisture content and is detected by analyzer to measure moisture (ratio of reflected light at these wavelengths to the reflected light at reference wavelength). In GaAs PIN

photodiodes, Pbs photoconductive detectors are employed in moisture analyzer circuits.

Gas Analyzers:

IR sensors are used in gas analyzers which use absorption characteristics of gases in the IR region. Two types of methods are used to measure the density of gas such as dispersive and non-dispersive.

IR SENSOR APPLICATIONS:

IR sensors are used in various Sensor based projects and also in various electronic devices which measures the temperature that are discussed in the below.

Radiation Thermometers

IR sensors are used in radiation thermometers to measure the temperature depend upon the temperature and the material of the object and these thermometers have some of the following features

- Measurement without direct contact with the object
- Faster response
- Easy pattern measurements

IR IMAGING DEVICES:

IR image device is one of the major applications of IR waves, primarily by virtue of its property that is not visible. It is used for thermal imagers, night vision devices, etc.

For examples Water, rocks, soil, vegetation, an atmosphere, and human tissue all features emit IR radiation. The Thermal infrared detectors measure these radiations in IR range and map the spatial temperature distributions of the object/area on an image. Thermal imagers usually composed of a Sb (indium antimonite), Gd Hg (mercury-doped germanium), Hg Cd Te (mercury-cadmium-telluride) sensors.



An electronic detector is cooled to low temperatures using liquid helium or liquid nitrogen. Then the Cooling the detectors ensures that the radiant energy (photons) recorded by the detectors comes from the terrain and not from the ambient temperature of objects within the scanner itself an IR imaging electronic device.

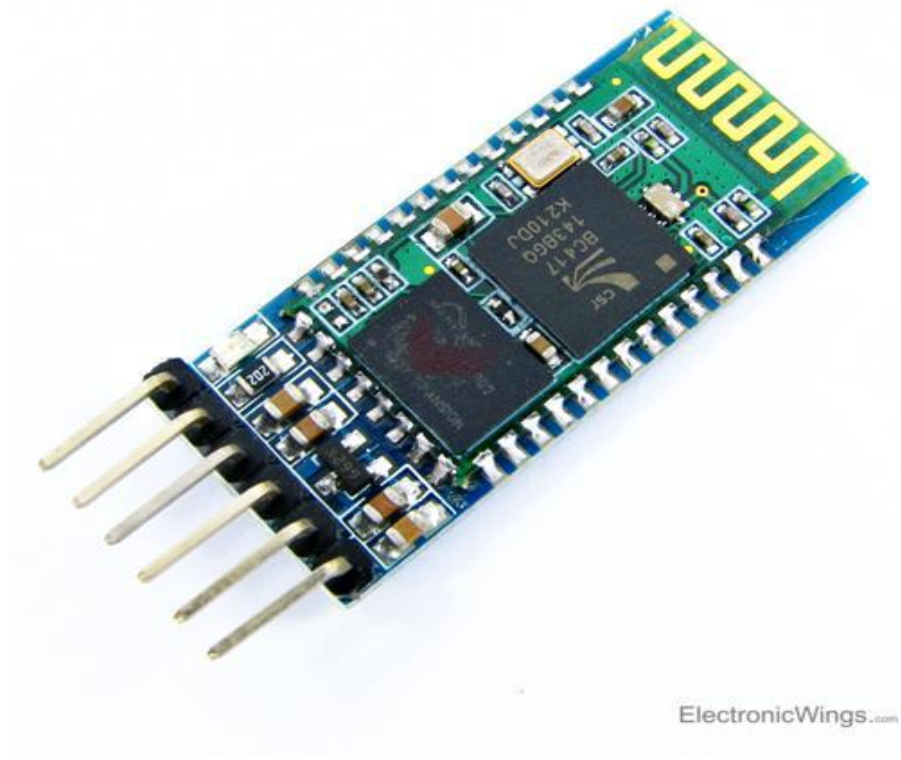
Thus, this is all about IR sensor circuit with working and applications. These sensors are used in many sensors based electronics projects.

4.1.3 HC-05 BLUETOOTH MODULE:

INTRODUCTION:-

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.
- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).



HARDWARE FEATURES:

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation, 1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate

SOFTWARE FEATURES:

- Default Baud rate: 38400, Data bits: 8, Stop bit: 1, Parity: No parity, Data control: has.
- Supported baud rate: 9600, 19200, 38400, 57600, 115200, 230400, 460800.

PIN DESCRIPTION:

Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

It has six pins.

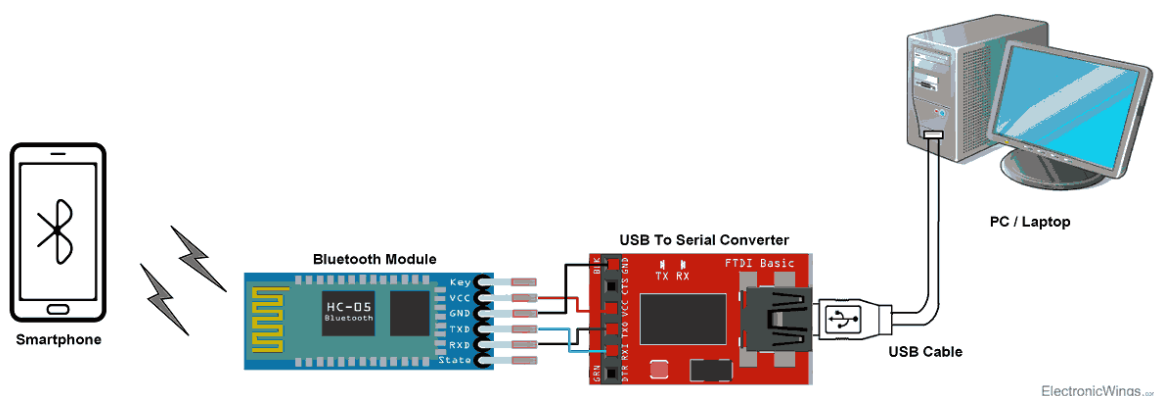
1. Key/EN: It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

1. Data mode: Exchange of data between devices.
2. Command mode: It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.
2. VCC: Connect 5 V or 3.3 V 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.

BLUETOOTH COMMUNICATION BETWEEN DEVICES:

To communicate smartphone with HC-05 Bluetooth module, smartphone requires Bluetooth terminal application for transmitting and receiving data. You can find Bluetooth terminal applications for android and windows in respective app. store.



So, when we want to communicate through smartphone with HC-05 Bluetooth module, connect this HC-05 module to the PC via serial to USB converter.

Before establishing communication between two Bluetooth devices, 1st we need to pair HC-05 module to smartphone for communication.

PAIR HC-05 AND SMARTPHONE:

1. Search for new Bluetooth device from your phone. You will find Bluetooth device with "HC-05" name.
2. Click on connect/pair device option; default pin for HC-05 is 1234 or 0000.

After pairing two Bluetooth devices, open terminal software (e.g. Teraterm, Realterm etc.) in PC, and select the port where we have connected USB to serial module. Also select default baud rate of 9600 bps.

In smart phone, open Bluetooth terminal application and connect to paired device HC-05.

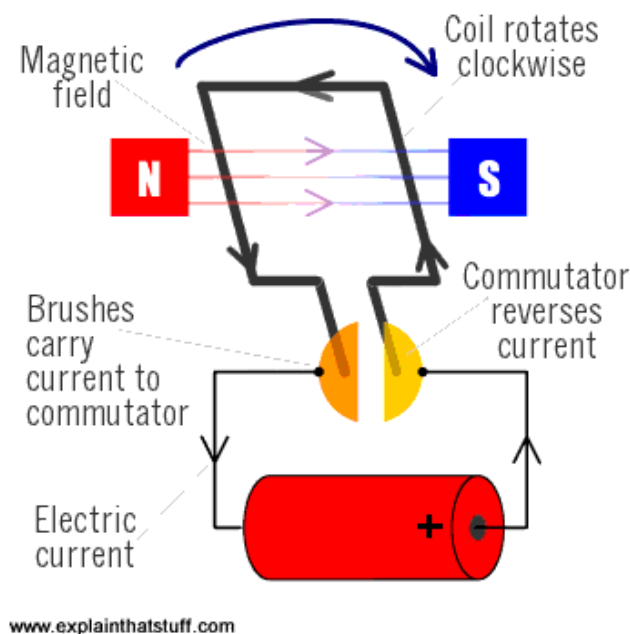
It is simple to communicate, we just have to type in the Bluetooth terminal application of smartphone. Characters will get sent wirelessly to Bluetooth module HC-05. HC-05 will automatically transmit it serially to the PC, which will appear on terminal. Same way we can send data from PC to smartphone.

APPLICATIONS:

1. Wireless communication between two microcontrollers
2. Communicate with Laptop, Desktops and mobile phones
3. Data Logging application
4. Consumer applications
5. Wireless Robots
6. Home Automation

4.1.4 DC MOTORS:

Motor is a device that produce mechanical output. The working of motor is given as follows: One is to use a kind of electric current that periodically reverses direction, which is known as an alternating current (AC). In the kind of small, battery-powered motors we use around the home, a better solution is to add a component called a commutator to the ends of the coil. (Don't worry about the meaningless technical name: this slightly old-fashioned word "commutation" is a bit like the word "commute". One end of the coil is attached to each half of the commutator. The electric current from the battery connects to the motor's electric terminals.



These feed electric power into the commutator through a pair of loose connectors called brushes, made either from pieces of graphite (soft carbon similar to pencil "lead") or thin lengths of springy metal, which (as the name suggests) "brush" against the commutator. With the commutator in place, when electricity flows through the circuit, the coil will rotate continually in the same direction.

COMPONENTS



ROTOR

In an electric motor, the moving part is the rotor, which turns the shaft to deliver the mechanical power. The rotor usually has conductors laid into it that carry currents, which interact with the magnetic field of the stator to generate the forces that turn the shaft. Alternatively, some rotors carry permanent magnets, and the stator holds the conductors.

BEARINGS

The rotor is supported by bearings, which allow the rotor to turn on its axis. The bearings are in turn supported by the motor housing. The motor shaft extends through the bearings to the outside of the motor, where the load is

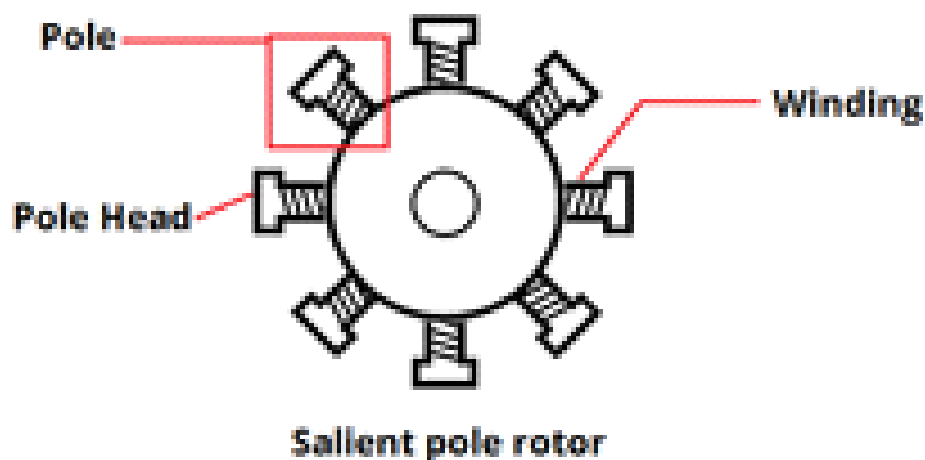
applied. Because the forces of the load are exerted beyond the outermost bearing, the load.

STATOR

The stator is the stationary part of the motor's electromagnetic circuit and usually consists of either windings or permanent magnets. The stator core is made up of many thin metal sheets, called laminations. Laminations are used to reduce energy losses that would result if a solid core were used.

AIR GAP

The distance between the rotor and stator is called the air gap. The air gap has important effects, and is generally as small as possible, as a large gap has a strong negative effect on performance. It is the main source of the low power factor at which motors operate. The magnetizing current increases with the air gap. For this reason, the air gap should be minimal. Very small gaps may pose mechanical problems in addition to noise and losses.



WINDINGS

Windings are wires that are laid in coils, usually wrapped around a laminated soft iron magnetic core so as to form magnetic poles when energized with current.

Electric machines come in two basic magnet field pole configurations: salient-pole and nonsalient-pole configurations. In the salient-pole machine the pole's magnetic field is produced by a winding wound around the pole below the pole face. In the nonsalient-pole, or distributed field, or round-rotor, machine, the winding is distributed in pole face slots.^[60] A shaded-pole motor has a winding around part of the pole that delays the phase of the magnetic field for that pole.

Some motors have conductors that consist of thicker metal, such as bars or sheets of metal, usually copper, alternatively aluminum. These are usually powered by electromagnetic induction.

COMMUTATOR



A commutator is a mechanism used to switch the input of most DC machines and certain AC machines. It consists of slip-ring segments insulated from each other and from the shaft. The motor's armature current is supplied through

stationary brushes in contact with the revolving commutator, which causes required current reversal, and applies power to the machine in an optimal manner as the rotor rotates from pole to pole.^{[61][62]} In absence of such current reversal, the motor would brake to a stop

MOTOR SUPPLY AND CONTROL:

A DC motor is usually supplied through slip ring commutator as described above. AC motors' commutation can be either slip ring commutator or externally commutated type, can be fixed-speed or variable-speed control type, and can be synchronous or asynchronous type. Universal motors can run on either AC or DC.

Fixed-speed controlled AC motors are provided with direct-on-line or soft-start starters.

Variable-speed controlled AC motors are provided with a range of different power inverter, variable-frequency drive or electronic commutator technologies.

The term electronic commutator is usually associated with self-commutated brushless DC motor and switched reluctance motor applications.

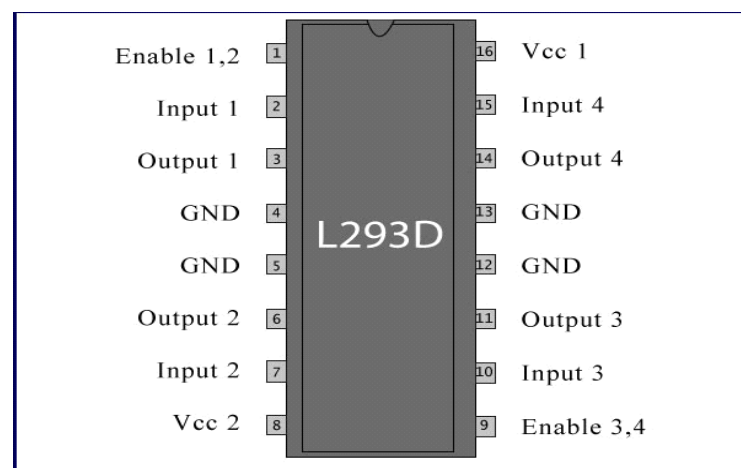
4.1.5 L293 DC MOTOR DRIVER:

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

PIN DIAGRAM:

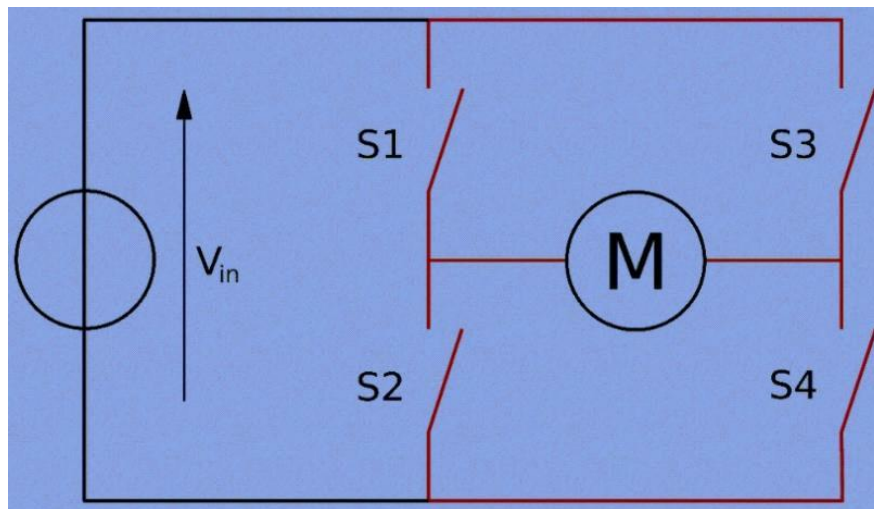
Common DC gear head motors need current above 250mA. There are many integrated circuits like ATmega16 Microcontroller, 555 timer IC. But, IC 74 series cannot supply this amount of current. When the motor is directly connected to the o/p of the above ICs then, they might damage. To overcome this problem, a motor control circuit is required, which can act as a bridge between the above motors and ICs (integrated circuits). There are various ways of making H-bridge motor control circuit such as using transistor, relays and using L293D/L298.



H-BRIDGE CIRCUIT

A H bridge is an electronic circuit that allows a voltage to be applied across a load in any direction. H-bridge circuits are frequently used in robotics and many other applications to allow DC motors to run forward & backward. These motor control circuits are mostly used in different converters like DC-DC, DC-AC, AC-AC converters and many other types of power electronic converters. In specific, a bipolar stepper motor is always driven by a motor controller having two H-bridges.

A H-bridge is fabricated with four switches like S1, S2, S3 and S4. When the S1 and S4 switches are closed, then a +ve voltage will be applied across the motor. By opening the switches S1 and S4 and closing the switches S2 and S3, this voltage is inverted, allowing invert operation of the motor.



Generally, the H-bridge motor driver circuit is used to reverse the direction of the motor and also to break the motor. When the motor comes to a sudden stop, as the terminals of the motor are shorted. Or let the motor run free to a stop, when the motor is detached from the circuit. The table below gives the different operations with the four switches corresponding to the above circuit.



L293D Motor Driver ic

L293D IC is a typical Motor Driver IC which allows the DC motor to drive on any direction. This IC consists of 16-pins which are used to control a set of two DC motors instantaneously in any direction. It means, by using a L293D IC we can control two DC motors. As well, this IC can drive small and quiet big motors.

This L293D IC works on the basic principle of H-bridge, this motor control circuit allows the voltage to be flowing in any direction. As we know that the voltage must be change the direction of being able to rotate the DC motor in both the directions. Hence, H-bridge circuit using L293D ICs are perfect for driving a motor.

4.1.6 VIBRATORY MOTOR:

A vibratory motor is a three-phase motor that is intentionally unbalanced, and is also known as an eccentric rotating mass (ERM) or vibrating motor. Vibratory motors are used to vibrate sieves, troughs and tables, but also to separate products in a bunker or landfill pipe.



Its working principle is, there is an eccentric weight on the rotating shaft of the vibration motor, which generates centrifugal force when it rotates. This unbalanced force displaces it. Its high-Speed displacement causes it to swing, which is called “vibration”.

4.1.7 DRIYER DC FAN:

A DC fans are widely regarded as the most efficient type of fans. They consume significantly less power than AC fans. In fact, DC fans consume up to 70 percent less energy to produce the same output as traditional AC fan types. This means, that a 25-watt DC-driven yields the same results as 100-watt AC fan.



4.1.8 POWER DISTRIBUTION MODULE:

A power distribution module (PDM) is used to provide electrical power from a main power source to a variety of vehicle or equipment peripherals which may require the following:

- Compact form factors when reliability and safety are factors
- Cost reduction challenges
- High power electrical terminals
- Meeting government regulations
- Protection from dust, moisture, shock and vibration



A power distribution module is used to improve organization and connection quality and reliability. With GEP's power distribution units, individual circuits are isolated and can be protected with fuses, diodes or other power protection devices. Because of the environments that off-road vehicles operate in, a reliable system is vital for proper function and dependability.

4.1.9 CHANNEL RELAY:

A relay is an electrically operated device. It has a control system and (also called input circuit or input contactor) and controlled system (also called output circuit or output contactor). It is frequently used in automatic control circuit. To put it simply, it is an automatic switch to controlling a high-current circuit with a low-current signal.

ADVANTAGES

The advantages of a relay lie in its lower inertia of the moving, stability, long-term reliability and small volume. It is widely adopted in devices of power protection, automation technology, sport, remote control, reconnaissance and communication, as well as in devices of electromechanics and power electronics. Generally speaking, a relay contains an induction part which can reflect input variable like current, voltage, power, resistance, frequency, temperature, pressure, speed and light etc. It also contains an actuator module (output) which can energize or de-energize the connection of controlled circuit. There is an intermediary part between input part and output part that is used to coupling and isolate input current, as well as actuate the output. When the rated value of input (voltage, current and temperature etc.) is above the critical value, the controlled output circuit of relay will be energized or de-energized.

NB: input into a relay can be divided into two categories: electrical quantities (including current, voltage, frequency, power etc.) and non- electrical quantities(including temperature, pressure, speed, etc.)



FEATURES:

- The features of 1-Channel Relay module are as follow:
- Good in safety. In power system and high voltage system, the lower current can control the higher one.
- 1-channel high voltage system output, meeting the needs of single channel control
- Wide range of controllable voltage.
- Being able to control high load current, which can reach 240V, 10A
- With a normally-open (NO) contact and a normally-closed (NC) contacts.

4.2 SOFTWARES

4.2.1 ARDUINO IDE:

INTRODUCTION

The Arduino IDE is incredibly minimalistic, yet it provides a near-complete environment for most Arduino-based projects. The top menu bar has the standard options, including “File” (new, load save, etc.), “Edit” (font, copy, paste, etc.), “Sketch” (for compiling and programming), “Tools” (useful options for testing projects), and “Help”. The middle section of the IDE is a simple text editor that where you can enter the program code.



Projects made using the Arduino are called sketches, and such sketches are usually written in a cut-down version of C++ (a number of C++ features are not included). Because programming a microcontroller is somewhat different from programming a computer, there are a number of device-specific libraries (e.g., changing pin modes, output data on pins, reading analog values, and timers). This sometimes confuses users who think Arduino is programmed in an “Arduino language.” However, the Arduino is, in fact, programmed in C++. It just uses unique libraries for the device.

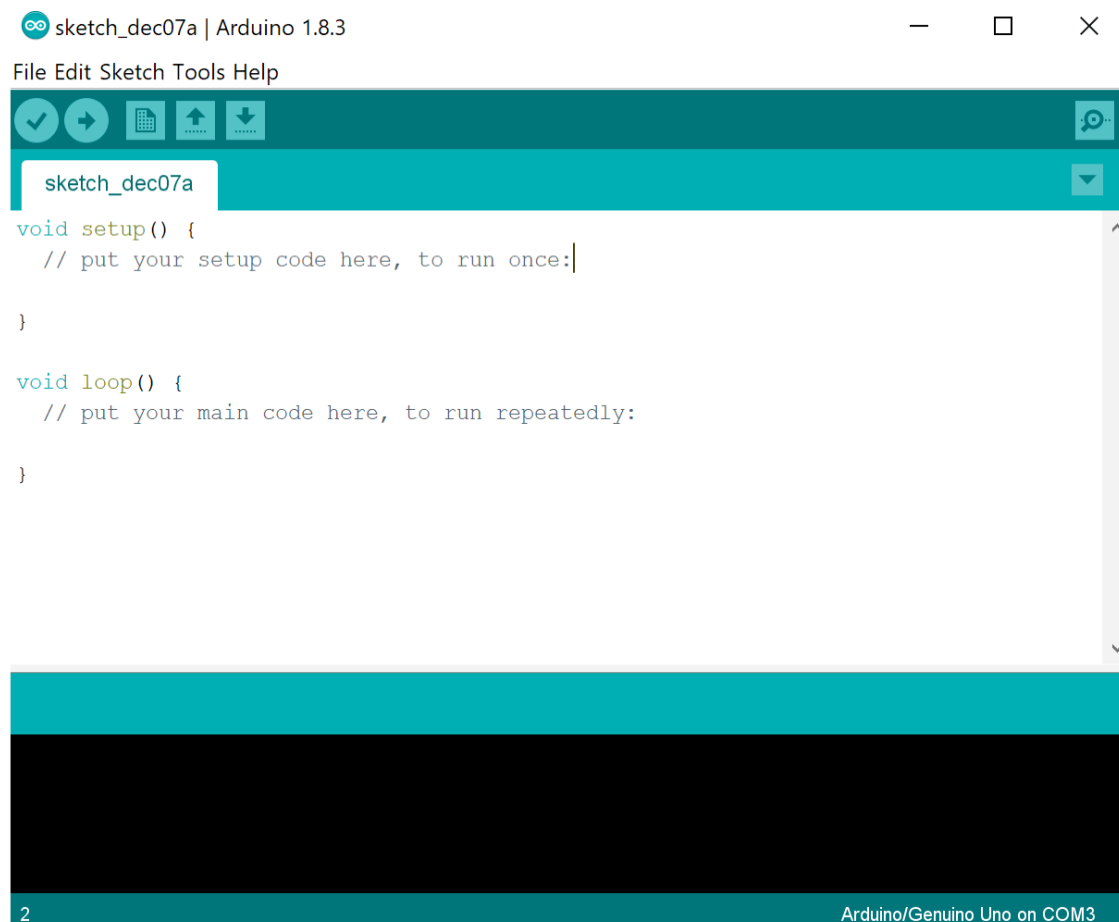
THE 6 BUTTONS

While more advanced projects will take advantage of the built-in tools in the IDE, most projects will rely on the six buttons found below the menu bar.



THE BUTTON BAR

- The check mark is used to verify your code. Click this once you have written your code.
- The arrow uploads your code to the Arduino to run.
- The dotted paper will create a new file.
- The upward arrow is used to open an existing Arduino project.
- The downward arrow is used to save the current file.
- The far-right button is a serial monitor, which is useful for sending data from the Arduino to the PC for debugging purposes.



The source code for the IDE is released under the [GNU General Public License](#), version 2. The Arduino IDE supports the languages [C](#) and [C++](#) using special rules of code structuring. The Arduino IDE supplies a [software library](#) from the [Wiring](#) project, which provides many common input and output procedures.

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.

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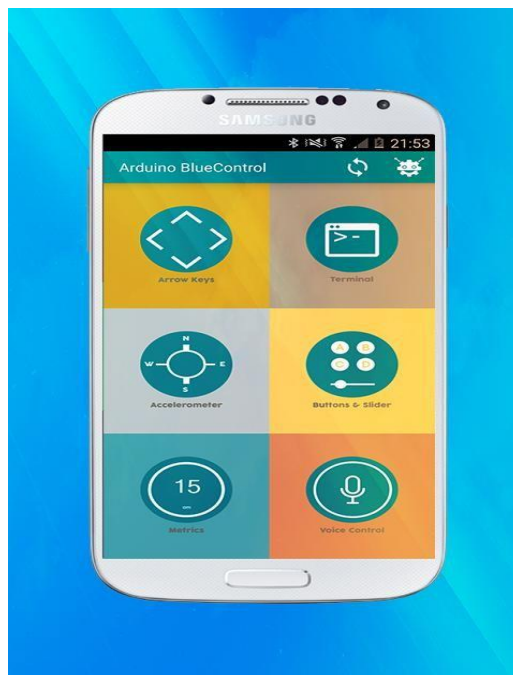
The Arduino IDE employs the program `avrdude` to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

4.2.2 ARDUINO BLUETOOTH CONTROL:

Arduino Bluetooth Control is an application that allows you to control your arduino board (and similar boards) via Bluetooth, and so to create awesome and fully customized projects, with the new features available within the app.

The settings section allows you to adapt the application to your needs, through a very simple and intuitive interface.

The application also smartly remembers your bluetooth module and tries to connect automatically to the latest one you have used, so you won't have to select it every time you use it.



You can also use the application on your wearable device if you have any.

1. Metrics tool

This tool was optimized to receive data via the `println()` function of arduino, which

allows special processing of the data received, like in the "Metrics" tool. It allows you to receive only numbers and fix alarms to get notified about the variations of the value received. Once the alarm triggered, a stop button shows up, allowing you to stop it. Besides you can activate the shaking mode, that will allow you to send data simply by shaking your phone.

2. Arrow keys

This tool provides direction buttons that can fully customized with the data to send, and the sensitivity, which allows to send continuously data to the board by maintaining long press on them.

3. Terminal

This tool is just a classic terminal that receives and sends data to the board, displayed with the timestamp corresponding to each action.

4. Buttons and slider

In portrait orientation, this tool provides 6 buttons fully customized, that will allow you to send specific data when pressed. When you rotate your device, a slider view shows up, to which you can set the range of the data to be sent.

5. Accelerometer

This tool permits you to interpret the gesture commands of your phone, and send the corresponding data to your board, and so, your phone can be the steering wheel of your robot. You can of course set the sensitivity of it through the settings interface.

6. Voice Control

Have you ever dreamed of talking to your robots? Well now your dream is becoming true! With Arduino Bluetooth Control, you can customize your own vocal commands and use them to control all your microcontroller-based boards.

CHAPTER 5

5.1 CODE DESCRIPTION:

```
#define ir1 8
const int fan =6;
const int cm =7;
String button;
const int M1=2;
const int M2=3;
const int M3=4;
const int M4=5;
String a;

void setup()
{
  Serial.begin(9600);
  pinMode(fan,OUTPUT);
  pinMode(cm,OUTPUT);
  pinMode(ir1,INPUT);
  pinMode(M1,OUTPUT);
  pinMode(M2,OUTPUT);
  pinMode(M3,OUTPUT);
  pinMode(M4,OUTPUT);
  digitalWrite(fan,LOW);
  digitalWrite(cm,LOW);
}
void forward()
{
  digitalWrite(M1,HIGH);
  digitalWrite(M2,LOW);
  digitalWrite(M3,LOW);
  digitalWrite(M4,HIGH);
```

```
digitalWrite(fan,HIGH);  
digitalWrite(cm,HIGH);  
Serial.println("go forward");  
}
```

```
void backward()  
{  
    digitalWrite(M1,LOW);  
    digitalWrite(M2,HIGH);  
    digitalWrite(M3,HIGH);  
    digitalWrite(M4,LOW);  
    digitalWrite(fan,HIGH);  
    digitalWrite(cm,HIGH);  
    Serial.println("GO backward");  
}
```

```
void right()  
{  
    digitalWrite(M1,HIGH);  
    digitalWrite(M2,LOW);  
    digitalWrite(M3,LOW);  
    digitalWrite(M4,LOW);  
    digitalWrite(fan,HIGH);  
    digitalWrite(cm,HIGH);  
    Serial.println("GO right");  
}
```

```
void left()  
{  
    digitalWrite(M1,LOW);  
    digitalWrite(M2,LOW);  
    digitalWrite(M3,LOW);  
    digitalWrite(M4,HIGH);  
    digitalWrite(fan,HIGH);  
}
```

```

    digitalWrite(cm,HIGH);
    Serial.println("GO left");
}

void Stop()
{
    digitalWrite(M1,LOW);
    digitalWrite(M2,LOW);
    digitalWrite(M3,LOW);
    digitalWrite(M4,LOW);
    digitalWrite(fan,LOW);
    digitalWrite(cm,LOW);
    Serial.println("stop");
}

void loop()
{
    int c = digitalRead(ir1);
    if(Serial.available()>0)
    {
        button = Serial.readString();
        Serial.println(button);
    }
    if(button=="front")
    {
        forward();
    }
    else if(button=="back")
    {
        backward();
    }
    else if(button=="right")
    {
        right();
    }
}

```

```

    }
else if(button=="left")
    {
        left();
    }
else if(button=="stop")
    {
        Stop();
    }
else if(button=="Auto")
    {
        if(c == 0)
        {
            Serial.println(c);
            Serial.println("obstacle detected");
            right();
            delay(100);
        }
        else
        {
            Serial.println("Entered Autonomous Mode");
            forward();
            delay(2000);
            right();
            delay(1300);
            forward();
            delay(2000);
            left();
            delay(1300);
        }
    }
else
    {
        Stop(); }}

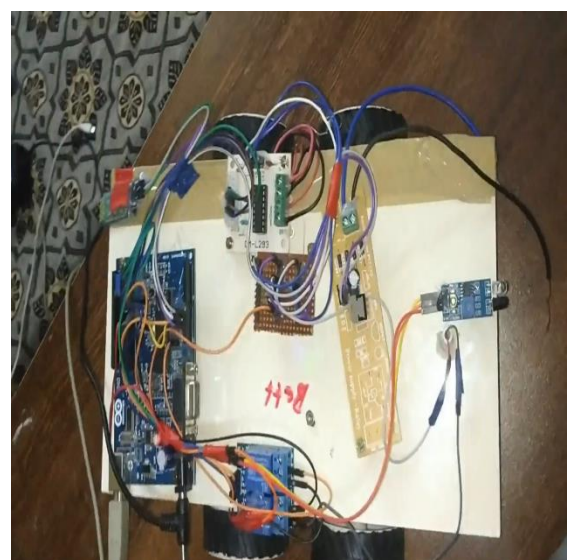
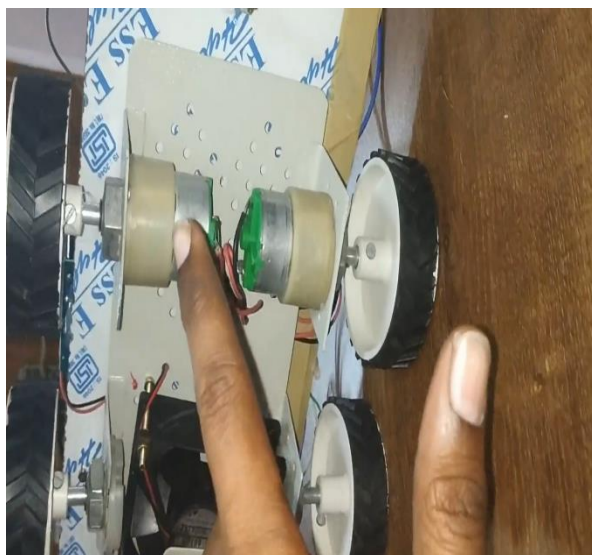
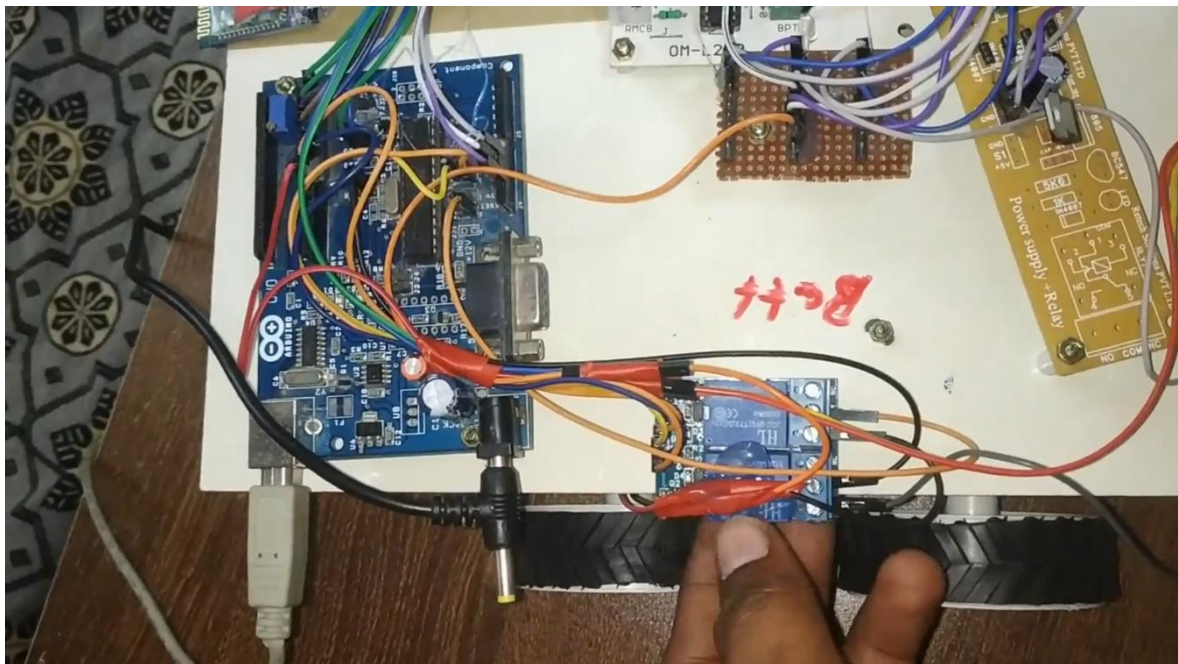
```

5.2 PERFORMANCE & RESULTS:

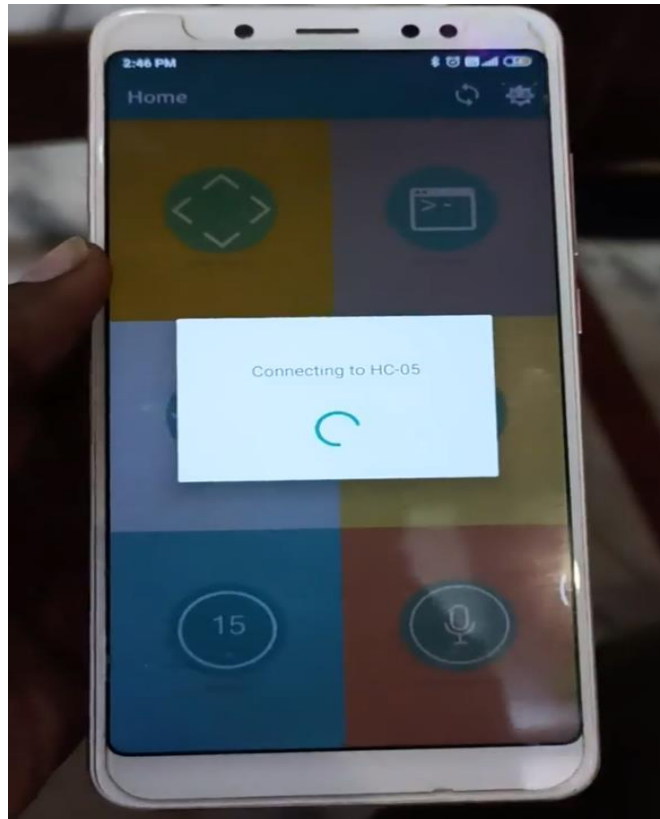
We have to setup the equipment i.e power the arduino uno and giving connections, and connect bluetooth module with mobile to operate

When we connect our mobile with bluetooth module with an application, we can operate it and give the commands to it.

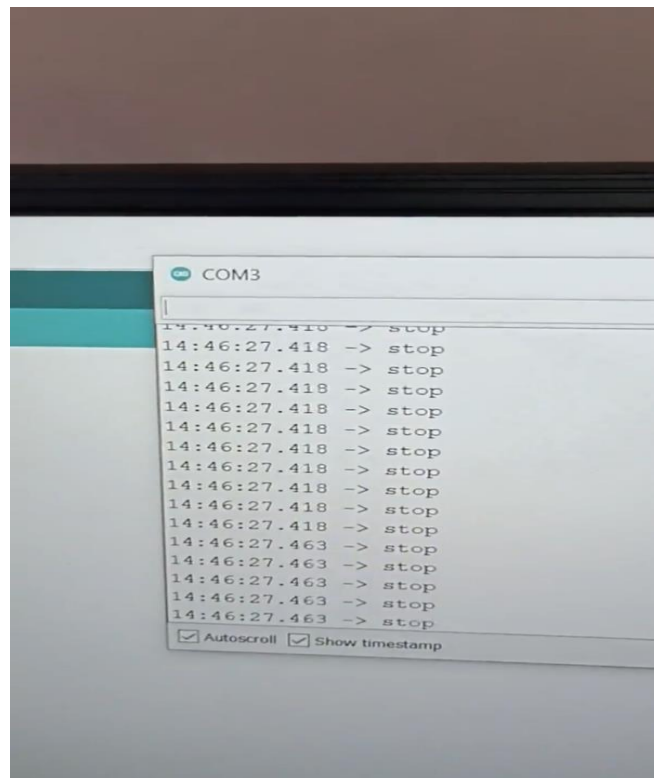
Below are the pics for performance of the robot.



Connecting hc-05 bluetooth module.....



Here we can see commands in the serial monitor, initially it is stop...



We can give the commands to arduino board or to robot using the terminal provided in the application, we can give the commands like Left – so that robot turns to left side, by stopping the rotation of left wheel so that it drifts left side

Right- same happens like in left, but it rotates to right.

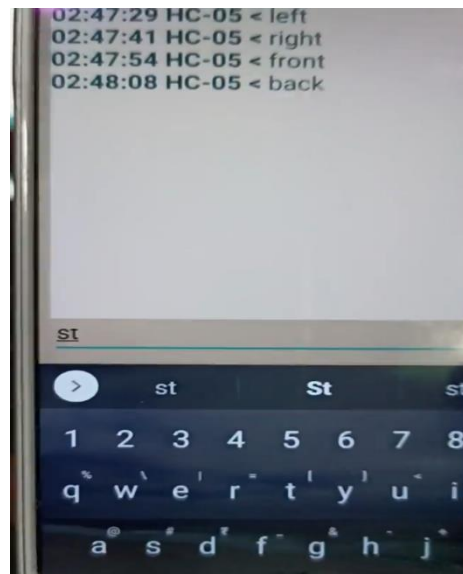
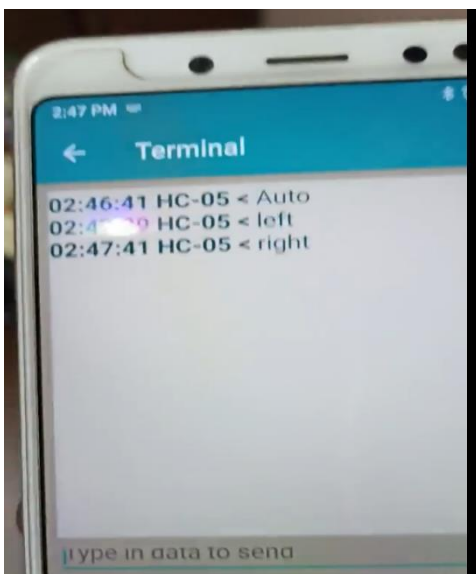
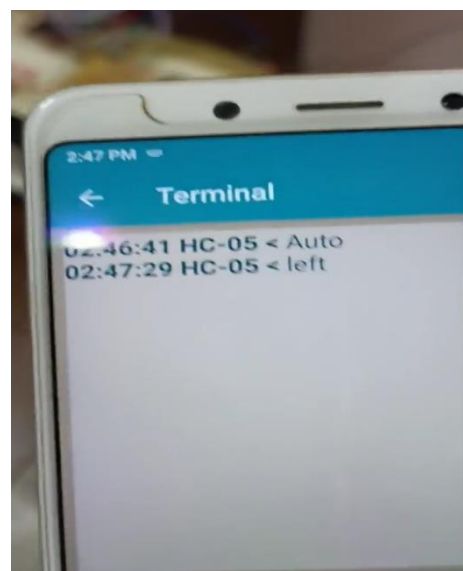
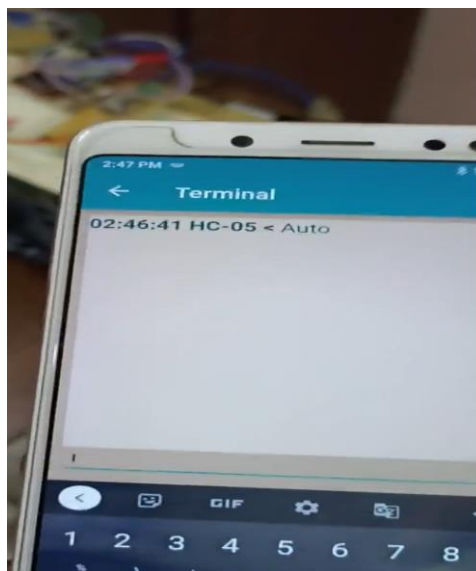
Front- moves forward

Back- moves backward

Stop- stops

Auto- it moves in the way we programmed, if the obstacle is detected

The serial monitor shows “obstacle is detected” and it turns right.



CHAPTER 6:

CONCLUSION:

The finished product is completely functional and performs as expected. It is being tested in a room, which normally yields a positive result.

During a power outage, a manually operated floor cleaning machine is a viable alternative to an automatic floor cleaning equipment. The design is basic and straightforward to make. Overall, the concept is highly useful, and the mechanical portions provide a lot of room for modification.

They'll keep optimising until they find the greatest one. Overall, the project achieves its goal and will undoubtedly alter the robotics and floor cleaning eras. The algorithm for automation is meant to achieve 90% efficiency, which is far too high in the current situation. In the subject of sensing, progress can be made.

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