Marathwada Mitra Mandal's Polytechnic
Thergaon, Pune - 411033

INSTITUTE

Vision: To nurture proficient technicians with sound ethical and social values contributing towards the welfare of masses

Mission: We take ardent efforts to inculcate technical skills, social, and ethical values among students along with Theoretical, Analytical and Practical Knowledge through an excellent harmony among academic, professional and extra-curricular activities.

COMPUTER ENGINEERING DEPARTMENT

Vision:

To develop technically proficient and competent professional's with latest technology and ethical values to serve society.

Mission:

- To impact latest and sound technical education.
- To provide strong theoretical and practical knowledge of computer engineering branch with an emphasis o maintain software and hardware systems.
- Groom students with necessary skills and ethical values.

Program Specific Objectives (PSO's)

- **PSO1**: Foundation of Computer System: Ability to interpret the fundament principles, concepts and methodology of computer system.
- **PSO2**: Ability to develop, maintain and test computer systems on the basic of programming languages, computer network and hardware.
- **PSO3**: Professional Skills: Ability to communicate effectively, recognize ethical values and responsibility towards society.

MARATHWADA MITRA MANDAL’S POLYTECHNIC
THERGAON, PUNE 411033

A
PROJECT REPORT
On

Clean Sweeper

Submitted by

RITESH PHADTARE
JIGAR PATHAK

in partial fulfillment for the award

of

DIPLOMA

In

COMPUTER ENGINEERING

UNDER THE GUIDANCE OF
Prof. Trupti Kherde
FOR THE ACADEMIC YEAR
2021- 2022.

MAHARASHTRA STATE
BOARD OF TECHNICAL EDUCATION

CERTIFICATE

This is to certify that,

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of

Sixth Semester

of

Diploma in Computer Engineering

have completed

the Project entitled **CLEAN SWEEPER** satisfactorily

for the academic year 2021 to 2022 as prescribed in the curriculum of MSBTE at Marathwada Mitra Mandal’s Polytechnic, Thergaon, Pune 411033.

Place: PUNE Enrollment No.: 1909890166, 1909890168

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Project Guide **Head of the Department**

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(Ritesh Ranjeet Phadtare)
(Jigar Hitesh Pathak)

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Abstract

Cleaning is an essential part of our day-to-day lives. Cleaning effectively should be an important part of a larger plan to create healthier indoor environments by removing contaminants that can cause illness. Lack of hygiene and cleanness is an open invitation to infection. A clean environment allows for a safe work environment. People like to work in clean surroundings. Employees will not make additional effort to dress up to impress knowing that the workplace is dirty and smelly. This may indicate that owners and managers do not care about the environment in which they work. Robotic cleaners have received significant attention in robotics research in recent years due to their effectiveness in assisting humans in floor cleaning applications in homes, hotels, restaurants, offices, hospitals, workshops, warehousing, and universities, among other places. This document describes the design, development and production of the Clean Sweeper prototype. The subject robot works autonomously as well as in manual mode. The Clean Sweeper prototype lets the user operate the system from being within the prototype's Bluetooth range.

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Chapter 01
Introduction

1.1 Background

Clean Sweeper is autonomous and smartphone-controlled robot that cleans the floor of your home! The rotating mops on the front of the robot can do the job perfectly. There is also a water pump and reservoir that can be activated to throw water on the floor and moisten the mops for a thorough clean.

The project sends commands to the most commonly used microcontroller, the Arduino UNO, using Bluetooth communication via an HC-06 Bluetooth module. The robot is powered by a 12V lead acid battery, which is the optimal voltage for all of the motors used here. The driver motor pair is 100rpm, while the mops are 75rpm plastic ones. The best part is that the mops were made from old CDs and rags, and they work perfectly.

In this project, the Arduino Uno is the microcontroller. All the commands are stored in the Arduino Uno in the form of Program. The programming language used for this project is C++.Arduino Uno is the most popular microcontroller used for IoT Projects. The Arduino Uno is a microcontroller board that was designed by Arduino.cc and is based on the Microchip ATmega328P microprocessor.

The board has a number of digital and analogue input/output (I/O) pins that can be used to connect to various expansion boards (shields) and other circuits. The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable via a type B USB cable using the Arduino IDE (Integrated Development Environment).

1.2 Objective

The objective of this project is to design the manual and automatic floor cleaning robot to reduce the human workload. Because of this project, the cleaning time will be reduced and the cleaning robot is at an affordable price. This project can be developed according as per the users requirement. If the user need automatic robot then the user can get fully automatic robot and if the user need manual robot so that the user doesn't need to clean the floor physically but user can only command with a smart phone and the floor.

This project includes numerous features such as it has 2 rotating mops on the front side of the cleaning robot so it can clean the floor properly. It has an Ultrasonic Sensor attached to the front side of the cleaning robot to detect obstacles and to avoid accidents while cleaning. The cleaning robot has a pump and water container installed. Using the pump, the water will be sprayed in the front of the mops to make the mops wet.

1.3 Scope of Project

The project's goal is to create a manual and automatic device that can be controlled by a person or the internet of things to clean the floor without the need for personnel, and we only need to click a start button of the robot in a smartphone application. This project's scope includes a large floor area, human hazards areas in industries such as nuclear plants, chemical plants, and areas where dangerous gases are present.

1.4 IoT- Overview

The Internet of Things (IOT) is a sophisticated automation and analytics system that uses networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. When applied to any industry or system, these systems provide greater transparency, control, and performance.

IoT systems enable users to achieve greater automation, analysis, and system integration. They increase the reach and accuracy of these areas. For sensing, networking, and robotics, IOT makes use of both existing and emerging technology. IoT capitalises on recent software advances, falling hardware prices, and modern attitudes toward technology. Its new and advanced elements result in significant changes in the delivery of products, goods, and services, as well as the social, economic, and political consequences of those changes.

Because of their unique flexibility and adaptability to any environment, IoT systems have applications across industries. Through smart devices and powerful enabling technology, they improve data collection, automation, operations, and much more.

1.5 IoT- Features Key

The most important characteristics of IOT are artificial intelligence, connectivity, sensors, active engagement, and the use of small devices. Features:

AI: IoT basically makes anything "smart," which means it improves every aspect of life by leveraging the power of data collection, artificial intelligence algorithms, and networks. This can be as simple as upgrading your refrigerator and cabinets to detect when milk and your favourite cereal are running low and automatically placing an order with your preferred grocer.

- **Connectivity –** Because of new networking enabling technologies, particularly IoT networking, networks are no longer solely dependent on major providers. Networks can exist on a much smaller and less expensive scale while remaining functional. These small networks are created by IOT between its system devices.
- **Sensors –** Without sensors, IOT loses its uniqueness. They serve as defining instruments, transforming IOT from a passive network of devices to an active system capable of real-world integration.
- **Active Engagement –**Much of today's interaction with connected technology is done passively. The Internet of Things ushers in a new paradigm for active content, product, or service engagement.
- **Small Devices –** Devices have become smaller, cheaper, and more powerful over time, as predicted. To achieve its precision, scalability, and versatility, IOT relies on purpose-built small devices.

1.6 IoT- Advantages

The benefits of IOT extend across all aspects of life and business. Here is a list of some of the benefits that IOT provides:

- **Improved Customer Engagement** – Current analytics have blind spots and significant accuracy flaws, and, as previously stated, engagement remains passive. IoT completely transforms this to achieve richer and more effective audience engagement.
- **Technology Optimization –** The same technologies and data that improve customer experience also improve device use and aid in more powerful technological advancements. The Internet of Things unlocks a world of critical functional and field data.
- **Reduced Waste –** IOT identifies areas for improvement. Current analytics provide only a surface level of insight, whereas IOT provides real-world data that leads to more effective resource management.
- **Enhanced Data Collection –** Modern data collection is hampered by its limitations and passive design. IoT removes it from those spaces and places it precisely where humans want to go to analyse our world. It provides a complete picture of everything.

1.7 IoT- Disadvantages

Though IOT provides numerous advantages, it also presents a number of challenges. Here are some of its major issues:

- **Security –** The Internet of Things (IoT) creates an ecosystem of constantly connected devices that communicate over networks. Despite any security measures, the system provides little control. This exposes users to various types of attackers.
- **Privacy –** Without the user's active participation, the sophistication of IOT provides substantial personal data in extreme detail.
- **Complexity –** Given the use of multiple technologies and a large set of new enabling technologies, some people believe that IOT systems are difficult to design, deploy, and maintain.
- **Flexibility –** Many people are concerned about an IOT system's ability to easily integrate with another. They are concerned about encountering multiple conflicting or locked systems.
- **Compliance –** IoT, like any other business technology, must comply with regulations. Because of its complexity, the issue of compliance appears to be extremely difficult, when many consider standard software compliance to be a battle.

1.8 Technology and Protocols

Process enlargement within the IOT network They take advantage of integration with critical business systems (such as ordering systems, robotics, and scheduling) in the execution of related tasks.

- **Data Collection**

  This software is in charge of sensing, measurements, light data filtering, light data security, and data aggregation. It employs specific protocols to assist sensors in communicating with real-time, machine-to-machine networks. The data is then collected from multiple devices and distributed in accordance with the settings. It also works backwards by distributing data across devices. Eventually, the system sends all collected data to a central server.

- **Device Integration**

  The software that supports integration connects (creates dependent relationships) all system devices to form the body of the IOT system. It ensures the necessary device cooperation and stable networking. These applications are the defining software technology of the IOT network because it would not be an IOT system without them. They manage each device's various applications, protocols, and limitations to allow communication.

- **Real-Time Analytics**

  These applications convert data or input from various devices into viable actions or distinct patterns for human analysis. They analyse data based on various settings and designs in order to perform automation-related tasks or provide industry with data.

1.9 Process and Application Expansion

These applications broaden the reach of existing systems and software, allowing for a more comprehensive and effective system. They incorporate predefined devices for specific purposes, such as granting access to specific mobile devices or engineering instruments. It promotes increased productivity and more precise data collection. IoT relies heavily on standard protocols and networking technologies.

RFID, NFC, low-energy Bluetooth, low-energy wireless, low-energy radio protocols, LTE-A, and Wi Fi-Direct are the major enabling technologies and protocols of IOT. In contrast to a standard uniform network of common systems, these technologies support the specific networking functionality required in an IOT system.

1.9.1 Uses

- RFID technology makes use of two-way radio transmitter-receivers to identify and track tags attached to objects.
- NFC is made up of communication protocols for electronic devices, most notably a mobile device and a standard device.
- **Low-Energy Bluetooth**

This technology addresses the low-power, long-use requirement of IOT functions while leveraging a standard technology with native support across systems.

- **Low-Energy Wireless**

This technology replaces the most energy-intensive component of an IOT system. Though sensors and other elements can be turned off for extended periods of time, communication links (e.g., wireless) must remain in listening mode. Low-energy wireless not only reduces consumption but also increases device life through less use.

- **Radio Protocols**

Radio protocols for creating low-rate private area networks include Zig Bee, Z-Wave, and Thread. Unlike many similar options, these technologies are low-power but high-throughput. This boosts the power of small local device networks without incurring the usual costs.

- **Wi Fi – Direct**

  Wi Fi-Direct does away with the need for an access point. It enables P2P (peer-to-peer) connections at Wi-Fi speeds but with lower latency. Wi Fi-Direct eliminates a network component that frequently slows it down while not sacrificing speed or throughput.

  The Internet of Things has applications in all industries and markets. It caters to users ranging from those looking to reduce their home's energy consumption to large corporations looking to streamline their operations. It proves to be not only useful, but nearly critical in many industries as technology advances and we move closer to the advanced automation imagined in the distant future.

1.9.2 Engineering, Industry and Infrastructure

In these areas, IOT applications include improving production, marketing, service delivery, and safety. IoT provides a strong means of monitoring various processes, and true transparency creates greater visibility for opportunities for improvement. The deep level of control provided by IOT enables faster and more action on those opportunities, which include events such as obvious customer needs, nonconforming product, equipment malfunctions, distribution network problems, and more. IoT is also used in robotics, such as floor cleaning robots and wall-building robots.

- **Example**

  Ritesh owns a factory that produces shields for industrial machinery. When regulations for the composition and function of the shields change, the new appropriate requirements are automatically programmed in production robotics, and engineers are notified that the changes have been approved.

1.9.3 Government and Safety

IoT in government and safety allows for better law enforcement, defence, city planning, and economic management. The technology closes existing gaps, corrects many flaws, and broadens the scope of these efforts. For example, IOT can assist city planners in better understanding the impact of their design, and governments in better understanding the local economy.

- **Example**

  Ritesh resides in a small town. She's heard about a recent increase in crime in her neighbourhood and is concerned about returning home late at night. Local law enforcement has been notified of the new "hot" zone via system flags, and their presence has been increased. Area monitoring devices detected suspicious behaviour, and law enforcement followed up on these leads to help prevent crimes.

1.9.4 Home and Offices

IoT provides a personalized experience in our daily lives, from the home to the office to the organizations we frequently do business with. This improves our overall satisfaction, productivity, and our health and safety. For example, IoT can assist us in optimizing our office space.

1.9.5 Environmental Monitoring

Environmental monitoring applications of IOT include environmental protection, extreme weather monitoring, water safety, the protection of endangered species, commercial farming, and more. Sensors detect and measure any type of environmental change in these applications.

- **Air and Water Pollution**

  Current air and water safety monitoring technology relies heavily on manual labour, as well as advanced instruments and lab processing. IOT improves on this technology by reducing the need for human labour, allowing for frequent sampling, broadening the scope of sampling and monitoring, allowing for sophisticated on-site testing, and tying response efforts to detection systems. This enables us to avoid significant contamination and related disasters.

- **Extreme Weather**

  Although powerful, advanced systems are currently in use, they suffer from the use of broad instruments, such as radar and satellites, rather than more granular solutions. Their instruments for finer details lack the precision of stronger technology.

  New IoT advancements promise finer-grained data, greater accuracy, and greater flexibility. Effective forecasting necessitates a high level of detail as well as flexibility in terms of range, instrument type, and deployment. This enables early detection and response, preventing loss of life and property.

- **Commercial Farming**

For a long time, sophisticated commercial farms have used advanced technology and biotechnology; however, IOT provides greater access to deeper automation and analysis.

Much of commercial farming, such as weather monitoring, suffers from a lack of precision and necessitates human labour in the monitoring area. Its automation is also limited.

The Internet of Things enables operations to eliminate much of the human intervention in system function, farming analysis, and monitoring. Changes in crops, soil, and the environment are detected by systems. They improve standard processes by analysing large, rich data sets. They also prevent health hazards and allow for better control.

1.9.6 Energy Applications

The IOT's optimization capabilities in manufacturing also apply to energy consumption. The Internet of Things enables a wide range of energy control and monitoring functions, with applications in devices, commercial and residential energy use, and the energy source. Optimization is the result of detailed analysis that was previously unavailable to the majority of organizations and individuals.

- **Residential Energy**

The advancement of technology has increased energy costs. Consumers are looking for ways to reduce or control their consumption. IoT provides a sophisticated method of analyzing and optimizing use not only at the device level, but throughout the entire home system. This can be as simple as turning off or dimming lights, or as complex as changing device settings and modifying multiple home settings to optimize energy consumption.

IoT can also detect problems with consumption caused by issues such as older appliances, damaged appliances, or faulty system components. Traditionally, such problems necessitated the collaboration of multiple professionals.

- **Commercial Energy**

  Given the enormous energy needs of even small organizations, energy waste can easily and quietly have a significant impact on business. Smaller businesses struggle with balancing business costs while delivering a product with typically lower margins and working with limited funding and technology. Larger organizations must monitor a massive, complex energy ecosystem with few simple, effective solutions for energy management.

  A smart-meter still necessitates a site visit by a reader. This automated meter reader eliminates the need for visits and allows energy companies to bill based on real-time data rather than estimates over time.

  The Internet of Things simplifies energy monitoring and management while maintaining a low cost and high level of precision. It addresses all points of consumption for an organization across devices. Its depth of analysis and control gives organizations a powerful tool for managing their consumption for cost reduction and output optimization. IoT systems detect and resolve energy issues in the same way that they do functional issues in a complex business network.

- **Reliability**

  The analytics and actions provided by IOT also contribute to system reliability. In addition to consumption, IOT prevents system overloads and throttling. It also detects threats to system performance and stability, preventing downtime, damaged equipment, and injuries.

1.9.7 Consumer Applications

Consumers benefit personally and professionally from IOT optimization and data analysis. IoT technology functions as a team of personal assistants, advisors, and security. It improves the way we live, work, and play.

- **Home --** IOT replaces a full-time staff:
    - **Butler --** IOT anticipates your return and ensures that your home is fully prepared. It keeps track of your supplies, family, and the condition of your home. It takes action to address any issues that arise.
    - **Chef --** An IOT kitchen either prepares meals for you or assists you in doing so.
    - **Nanny --** In an emergency, IOT can act as a guardian by controlling access, providing supplies, and alerting the appropriate individuals.
    - **Gardner --** The same IOT systems used on farms can easily be used for home landscaping.
    - **Repairman --** Smart systems both perform and request critical maintenance and repairs.
    - **Security Guard --** IoT keeps an eye on you around the clock. It can spot suspicious people from a long distance away and predict minor equipment problems before they become disasters.
- **Work**

  A smart office or other workspace combines work environment customization with smart tools. IOT learns about you, your job, and how you work in order to provide an optimized environment. This results in practical accommodations such as adjusting the room temperature, as well as more advanced benefits such as changing your schedule and the tools you use to increase output while decreasing work time. IOT serves as a manager and consultant who can see what you cannot.
- **Play**

  IOT learns about you personally as well as professionally. This enables technology to help with leisure:

    - **Culture and Night Life** – IOT can analyse your real-world activities and responses to help you find more of what you enjoy, such as recommending restaurants and events based on your preferences and experiences.

- **Vacations –** Some people find it difficult to plan and save for vacations, and many rely on agencies, which can be replaced by IOT.
- **Products and Services –** Because of its greater access, IOT provides better analysis of the products you want and need than current analytics. It combines key information such as your finances to recommend excellent solutions.

1.10 Bluetooth

Bluetooth was invented in 1994 by Ericsson to enable wireless headsets. Bluetooth has since grown to include a wide range of applications such as Bluetooth headsets, speakers, printers, video game controllers, and many more. Bluetooth is also critical for the rapidly expanding Internet of Things, which includes smart homes and industrial applications. It provides low power, low range, and high bandwidth connectivity. When Bluetooth devices connect to one another (for example, your phone and a wireless speaker), the parent-child model is used, which means that one device is the parent and the other devices are the children. The parent communicates with the child, and the child listens for information from the parent.

Because a Bluetooth parent can have up to 7 children, your computer can be connected to multiple devices via Bluetooth at the same time. A "piconet" is formed when Bluetooth devices are linked together. A device can not only be a parent in one piconet and a child in another, but the parent-child relationship can also switch. When you put your Bluetooth device into pairing mode to connect it, it temporarily becomes the parent to establish a connection before connecting as the child.

The communication between the Clean Sweeper and Android Application is through Bluetooth. Bluetooth Module HC-05 Module is been used. It is used in a variety of consumer applications such as wireless headsets, game controllers, wireless mice, wireless keyboards, and many more. It has a range of up to 100m, depending on the transmitter and receiver, atmosphere, geographical and urban conditions.

CHAPTER-2

HARDWARE DESCRIPTION

2.1. Principal Components of Project

1. Arduino UNO
2. 100rpm DC Geared motors
3. HC-05/06 Bluetooth module
4. L293D motor driver board
5. Servo motor
6. 12V Sealed lead acid rechargeable battery
7. 12V Water pump
8. TIP31C NPN power transistors
9. 75rpm Plastic geared motors
10. Ultrasonic Sensor

2.1.1. Arduino UNO

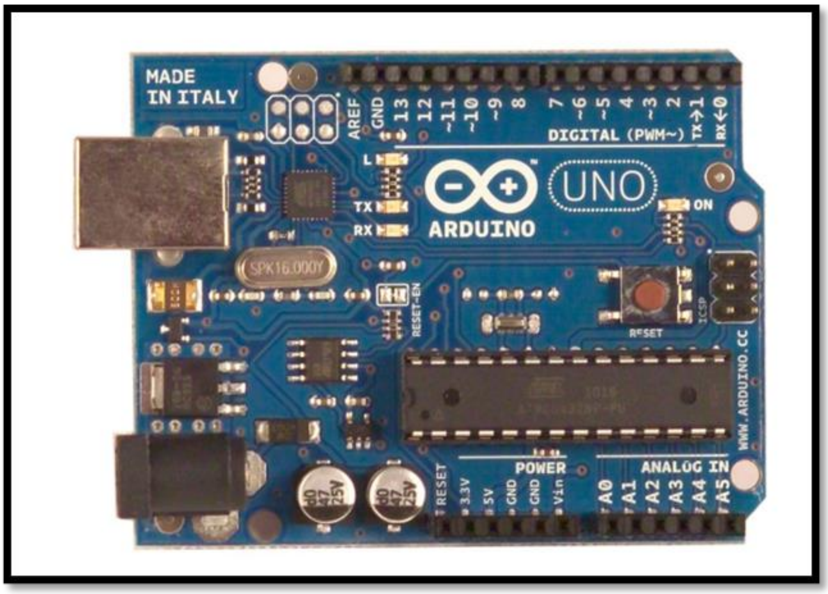

Fig 1: Arduino

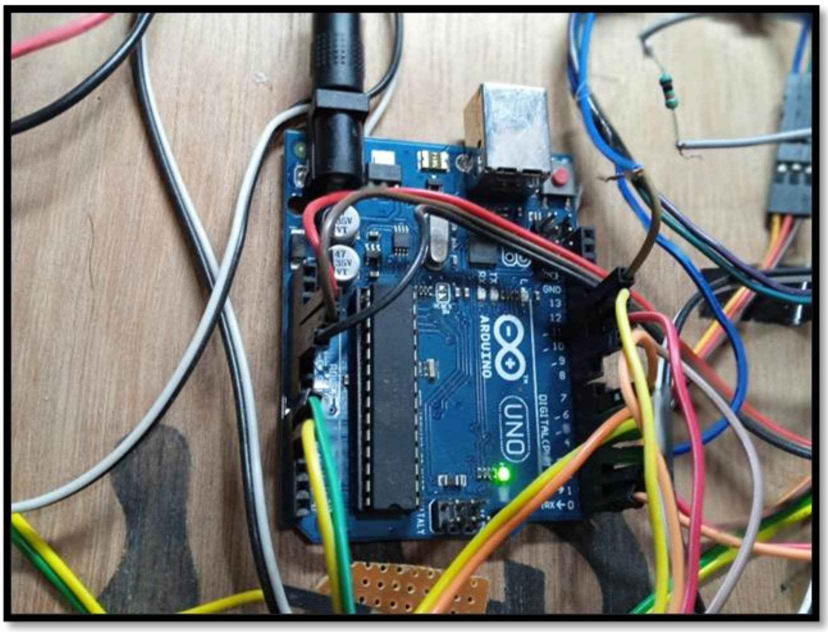

Fig 2: Arduino from model

The ATmega328-based Arduino Uno is a microcontroller board. It has 14 digital I/O pins (six of which are PWM outputs), 6 analogue inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It comes with everything you need to support the microcontroller; simply connect it to a computer via USB or power it via an AC-to-DC adapter or battery to get started. The FTDI USB-to-serial driver chip is absent from the Uno, as is the case with all previous boards. Instead, it uses an Atmega8U2 that has been programmed as a USB-to-serial converter.

- **Technical Specification**

1. **Summary**

Table 1: Summary Table of Arduino

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

2. **The Board**

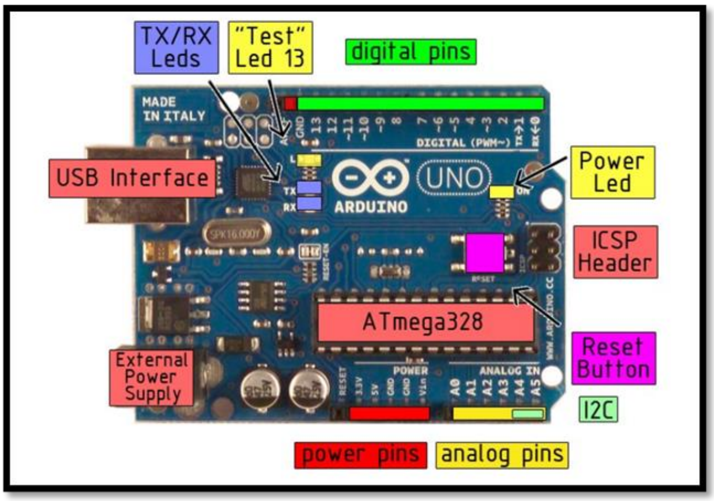

Fig 3: Arduino pin diagram

3. Power

The Arduino Uno can be powered via USB or by an external power supply. The power source is automatically selected.
External (non-USB) power can be supplied by either an AC-to-DC adapter (wall-wart) or a battery. Connect the adapter by inserting a 2.1mm center-positive plug into the board's power jack. Battery leads can be inserted into the POWER connector's Gnd and Vin pin headers.

The board can be powered by an external supply ranging from 6 to 20 volts. However, if less than 7V is supplied, the 5V pin may supply less than five volts and the board may become unstable. When more than 12V is applied, the voltage regulator may overheat and damage the board. The suggested voltage range is 7 to 12 volts.
The power pins are as follows:

- **VIN -** The input voltage to the Arduino board when it is powered by an external source (rather than 5 volts from a USB connection or other regulated power source). This pin can be used to supply voltage or to access voltage if it is supplied via the power jack.
- **5V -** The regulated power supply that powers the microcontroller and other board components. This can be supplied by VIN via an on-board regulator, or by USB or another regulated 5V supply.
- **3V3 -** The on-board regulator generates a 3.3volt supply. The maximum current draw is 50 milliamperes.
- **GND -** Ground pins.

4. Memory

The Atmega328 has 32 KB of flash memory for code storage (0.5 KB of which is reserved for the bootloader); it also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

5. Input and Output

Each of the Uno's 14 digital pins can be used as an input or output by using the pinMode(), digitalWrite(), and digitalRead() functions. They are powered by 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. Furthermore, some pins serve specific purposes:

- **Serial: 0 (RX) and 1 (TX)**

Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

- **External Interrupts: 2 and 3**

These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

- **PWM: 3, 5, 6, 9, 10, and 11**

Provide 8-bit PWM output with the analogWrite() function.

- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK)**

These pins support SPI communication, which,
although provided by the underlying hardware, is not currently included in the Arduino language.

- **LED: 13**

There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is
on, when the pin is LOW, it's off.

The Uno has six analogue inputs, each with a resolution of ten bits (i.e., 1024 different values). They measure from ground to 5 volts by default, but the upper end of their range can be changed using the AREF pin and the analogReference() function. Furthermore, some pins have specialized functions:

- **I 2C: 4 (SDA) and 5 (SCL)**

Support I2C (TWI) communication using the Wire library.

There are a few more pins on the board:

- **AREF**

Reference voltage for the analog inputs. Used with analogReference().

- **Reset**

Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

6. Communication

The Arduino Uno includes a number of communication ports for connecting to a computer, another Arduino, or other microcontrollers. The ATmega328 supports UART TTL (5V) serial communication via digital pins 0 (RX) and 1. (TX). An ATmega8U2 on the board channels serial communication over USB and appears to software on the computer as a virtual com port. The '8U2 firmware makes use of standard USB COM drivers, so no additional drivers are required. On Windows, however, a *.inf file is required.

The Arduino software includes a serial monitor for sending and receiving simple textual data to and from the Arduino board. When data is transmitted via the USB-toserial chip and USB connection to the computer, the RX and TX LEDs on the board will flash (but not for serial communication on pins 0 and 1).
Serial communication on any of the Uno's digital pins is possible with a SoftwareSerial library.
I2C (TWI) and SPI communication are also supported by the ATmega328. The Arduino software includes a Wire library that simplifies I2C bus use; see the

documentation for more information. Please refer to the ATmega328 datasheet for more information on how to use SPI communication.

7. Programming

The Arduino software can be used to programmed the Arduino Uno (download). From the Tools > Board menu, select "Arduino Uno w/ ATmega328" (according to the microcontroller on your board). See the reference and tutorials for more information.

The ATmega328 on the Arduino Uno is pre-programmed with a bootloader, allowing you to upload new code without the use of an external hardware programmer. It uses the original STK500 protocol to communicate (reference, C header files). You can also bypass the bootloader and programmed the microcontroller using the ICSP (In-Circuit Serial Programming) header; for more information, see these instructions.

The source code for the ATmega8U2 firmware is available. The ATmega8U2 has a DFU bootloader that can be activated by connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. The FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) can then be used to load new firmware. You can also use an external programmer with the ISP header (overwriting the DFU bootloader).

2.1.2. 100rpm DC Geared motors

1. DC Motor:

A direct current (DC) motor is a rotating electrical device that converts direct current, which is electrical energy, into mechanical energy. When a DC voltage is applied to an inductor (coil) inside a DC motor, it generates a magnetic field that causes rotary motion. A coil of wire is wrapped around an iron shaft inside the motor. This shaft has two fixed, North and South, magnets on both sides that produce a repulsive and attractive force, resulting in torque. ISL Products designs and manufactures both brushed and brushless direct current motors. We customise the size and performance of our DC motors to your specifications.

2. DC Gear Motor:

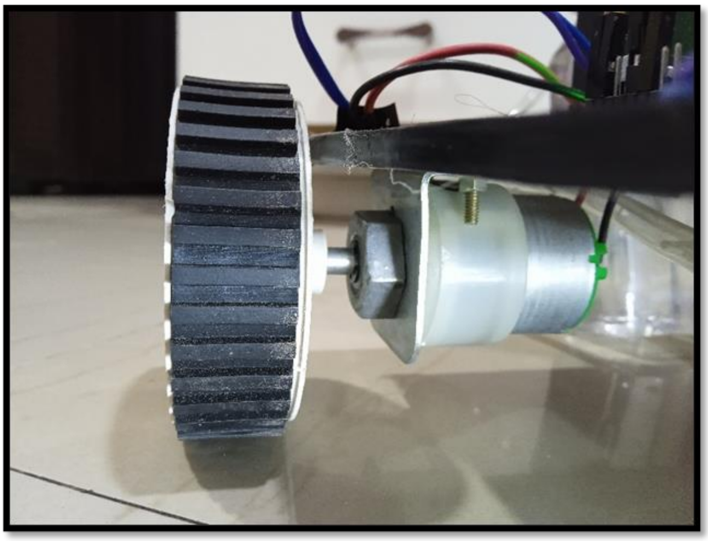

Fig 4: DC gear motor

A gear motor combines a motor and a gearbox into one unit. A gear head on a motor reduces its speed while increasing its torque output. Speed (rpm), torque (lb-in), and efficiency are the three most important parameters for gear motors (percent). To choose the best gear motor for your application, you must first calculate the load, speed, and torque requirements. ISL Products provides a wide range of Spur Gear Motors, Planetary Gear Motors, and Worm Gear Motors to meet a wide range of application needs. Most of our DC motors can be combined with one of our one-of-a-kind gearheads to create a highly efficient gear motor solution.

3. Gear Motor Performance Curves

The performance of a motor and the performance of a gearbox are combined into one graph by displaying three specific parameters. Speed, torque, and efficiency are the three parameters. When choosing a gear motor for your application, these performance curves are critical.

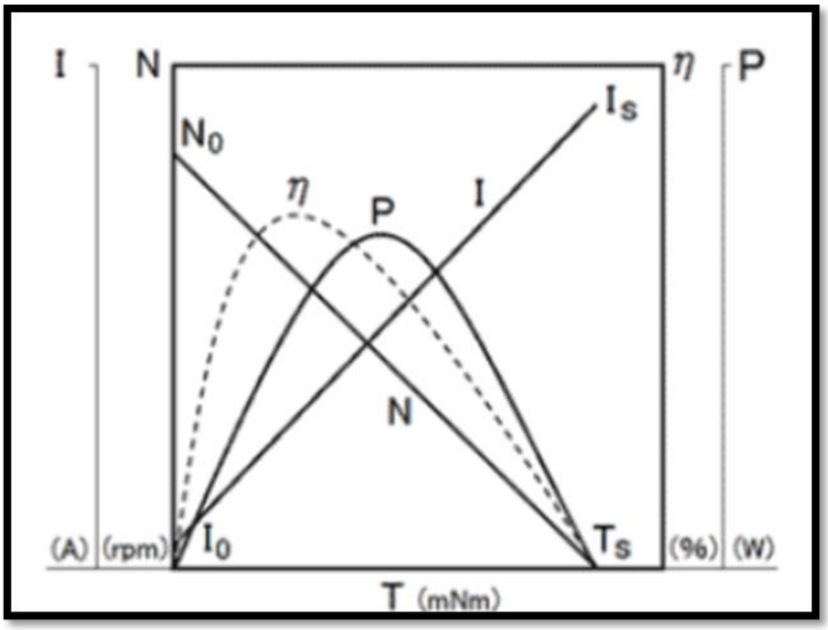

Fig 5: Graph of DC gear motor

Speed/Revolutions (N):

(unit: rpm) The relationship between the torque and speed of the gear motor is shown as a straight line. Depending on the voltage increase or decrease, this line will shift laterally.

- Efficiency (η):

(unit: %) The input and output values, represented by the dashed line, are used to calculate To maximize the potential of the gear motor, it should be used near its maximum efficiency.

- Torque (T):

This is the load carried by the motor shaft, represented on the X-axis (unit: gf-cm).

- Current (I):

A straight line from no load to full motor lock (unit: A). This diagram depicts the relationship between amperage and torque.

- Output (P):

(W) is the amount of mechanical energy produced by the gear motor.

2.1.3. HC-06 Bluetooth module

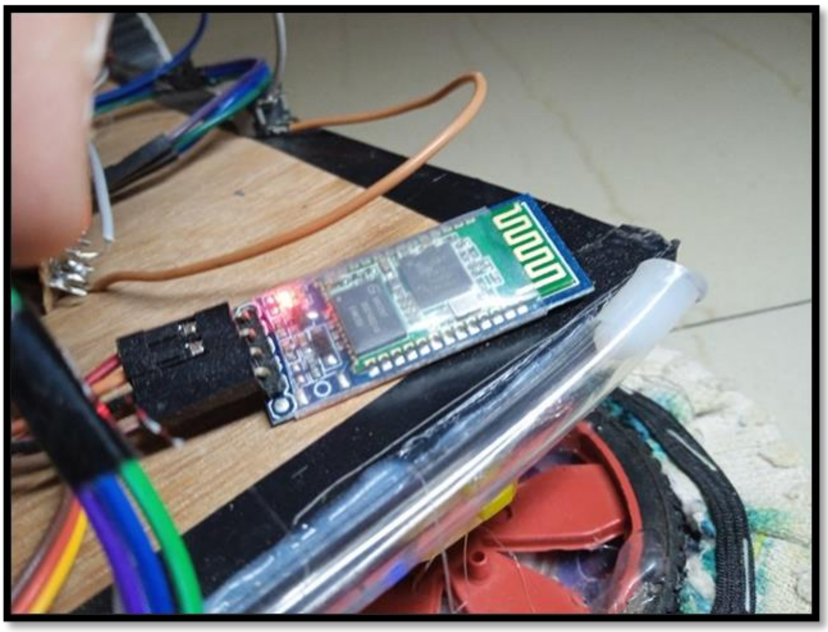

Fig 6: HC-06 Bluetooth module

It is used in a variety of consumer applications such as wireless headsets, game controllers, wireless mice, wireless keyboards, and many more. It has a range of up to 100m, depending on the transmitter and receiver, atmosphere, geographical and urban conditions. It is an IEEE 802.15.1 standardised protocol that can be used to create a wireless Personal Area Network (PAN). It transmits data over the air using frequency-hopping spread spectrum (FHSS) radio technology. It communicates with devices via serial communication. It communicates with the microcontroller through the serial port (USART).

Pin Description:

Bluetooth serial modules enable all serial-enabled devices to communicate wirelessly with one another.

It has 6 pins,

1. Key/EN:

It is used to activate the Bluetooth module's AT commands mode. If the Key/EN pin is set to high, the module will operate in command mode. Otherwise, it is in data mode by default. The HC-05's default baud rate in command mode is 38400bps and 9600bps in data mode.

The HC-05 module has two modes: 1. Data mode: data exchange between devices.

2. Command mode: It employs AT commands to modify the HC-05's settings. These commands are sent to the module serial (USART) port.

2. VCC:

Connect 5 V or 3.3 V to this Pin.

3. GND:

Ground Pin of module.

4. TXD:

Serial data transmission (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)

5. RXD:

Serially receive data (received data will be transmitted wirelessly by Bluetooth module).

6. State:

It tells whether module is connected or not.

2.1.4. L293D motor driver board

The L293D integrated circuit is a dual H-bridge motor driver (IC). Because they take a low-current control signal and provide a higher-current signal, motor drivers function as current amplifiers. The motors are driven by this higher current signal. The L293D includes two Hbridge driver circuits. Two DC motors can be driven simultaneously in both forward and reverse directions in its common mode of operation.

1. **Pin Diagram:**

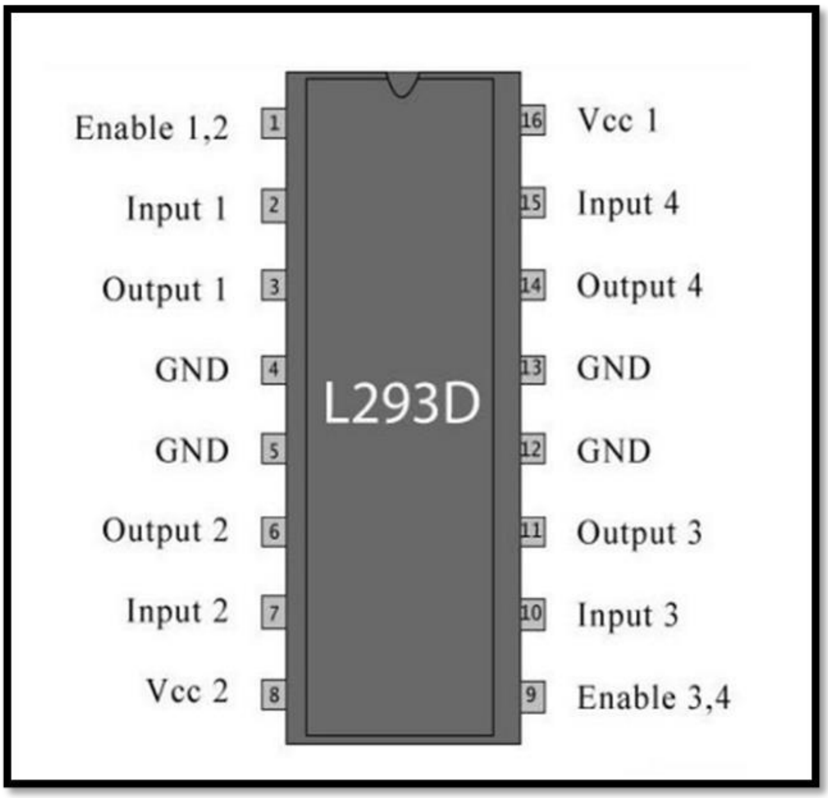

Fig 7: Pin diagram of L293D

Input logic at pins 2 and 7 and 10 and 15 can control the motor operations of two motors. Input logic 00 or 11 will cause the corresponding motor to stop. Logic 01 and 10 will rotate it clockwise and counterclockwise, respectively. To start the motors, enable pins 1 and 9 (corresponding to the two motors) must be high. When an enable input is set to true, the associated driver is activated.

As a result, the outputs become active and operate in phase with their respective inputs. When the enable input is low, the driver is disabled, and their outputs are turned off and in the high impedance state.

2. Pin Description:

Table 2: Pin description

Pin No	Function	Name
1	Enable pin for Motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 1
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors; 9-12V (up to 36V)	Vcc_2
9	Enable pin for Motor 2; active high	Enable 3,4
10	Input 1 for Motor 1	Input 3
11	Output 1 for Motor 1	Output 3
12	Ground (0V)	Ground
13	Ground (0V)	Ground
14	Output 2 for Motor 1	Output 4
15	Input2 for Motor 1	Input 4
16	Supply voltage; 5V (up to 36V)	Vcc_1

2.1.5. Servo motor

A servo motor is a type of motor that can rotate with pinpoint accuracy. This type of motor typically includes a control circuit that provides feedback on the current position of the motor shaft; this feedback allows servo motors to rotate with great precision. A servo motor is used when you want to rotate an object at a specific angle or distance. It is simply a motor that is controlled by a servo mechanism. If the motor is powered by a DC power supply, it is referred to as a DC servo motor; if it is powered by an AC power supply, it is referred to as an AC servo motor. This tutorial will only cover the operation of a DC servo motor.

Aside from these major categories, there are numerous other types of servo motors based on gear arrangement and operating characteristics. A servo motor is typically equipped with a gear arrangement that enables us to obtain a very high torque servo motor in small and lightweight packages. Because of these characteristics, they are used in a variety of applications such as toy cars, RC helicopters and planes, robotics, and so on.

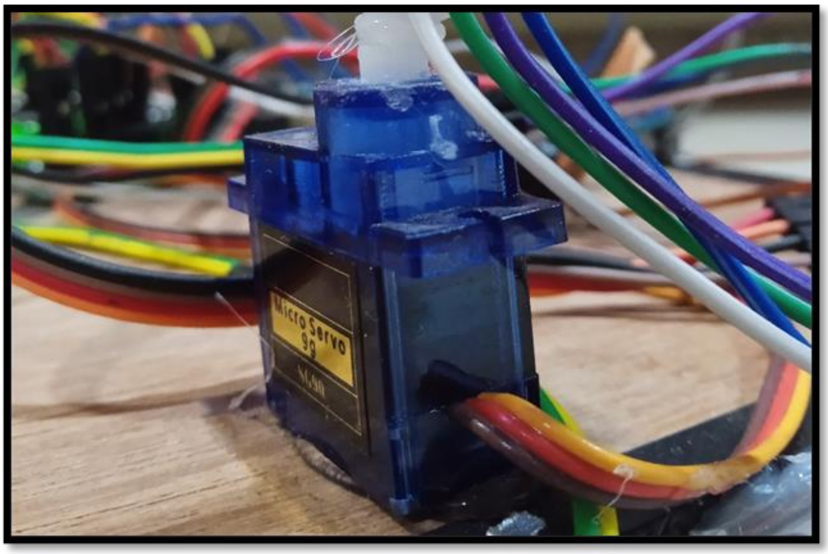

Fig 8: Servo motor

Most hobby servo motors are rated in kg/cm (kilogram per centimeter), with most being 3kg/cm, 6kg/cm, or 12kg/cm. This kg/cm value indicates how much weight your servo motor can lift at a given distance. As an example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the shaft of the motor; the greater the distance, the less weight carrying capacity. A servo motor's position is determined by an electrical pulse, and its circuitry is located beside the motor.

2.1.6. 12V Sealed lead acid rechargeable battery

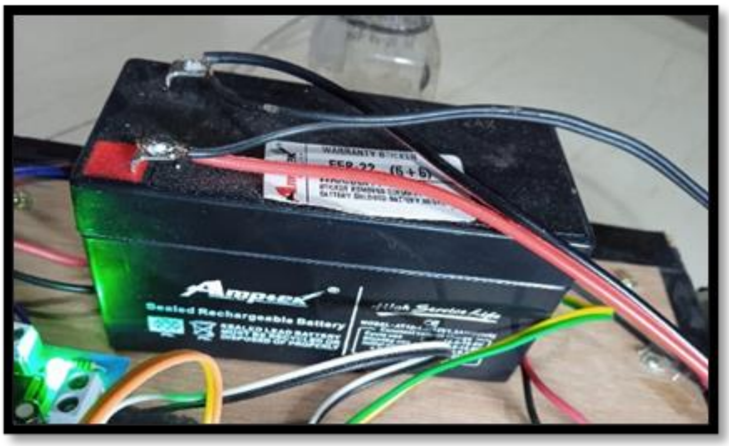

Fig 9: 12V Sealed lead acid battery

A valve regulated lead–acid (VRLA) battery, also known as a sealed lead–acid (SLA) battery, is a type of lead–acid battery distinguished by a limited amount of electrolyte ("starved" electrolyte) absorbed in a plate separator or formed into a gel; proportioning of the negative and positive plates so that oxygen recombination within the cell is facilitated; and the presence of a relief valve that retains the battery contents

VRLA batteries are classified into two types: absorbent glass mat (AGM) and gel cell (gel battery). Gel cells dissolve silica dust in the electrolyte, resulting in a thick putty-like gel. AGM (absorbent glass mat) batteries have fibreglass mesh between the battery plates to keep the electrolyte contained and the plates separated. When compared to flooded vented lead–acid (VLA) batteries or each other, both types of VRLA batteries have advantages and disadvantages.

The gel cell and AGM types of VRLA can be mounted in any orientation and do not require constant maintenance due to their construction. The term "maintenance free" is misleading because VRLA batteries still require cleaning and functional testing on a regular basis. They are widely used in large portable electrical devices, off-grid power systems, and other applications where large amounts of storage are required at a lower cost than other low-maintenance technologies such as lithium ion.

2.1.7. 12V Water pump

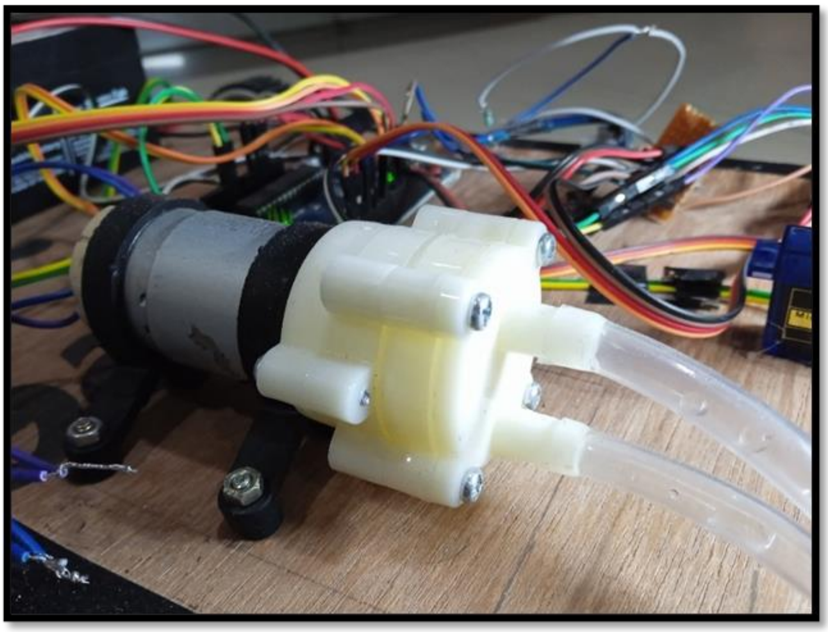

Fig 10: 12V Water pump

The R385 6-12V DC Diaphragm Based Mini Aquarium Water Pump is an excellent non-submersible pump for a wide range of liquid movement applications. It has enough pressure to be used in conjunction with a nozzle to create a spray system. The pump can handle heated liquids up to 80°C and can suck water through the tube from up to 2m and pump water vertically for up to 3m when properly powered.

A small aquarium pump, automatic plant watering system, making a water feature, or music activated dancing water features are just a few examples of possible uses/projects. The pump runs very quietly when pumping a liquid. The pump can also pump air, though when doing so, the pump is quite noisy.

The R385 requires 6 – 12V DC and 0.5 – 0.7A and will operate at maximum efficiency when power is at the upper end of these ranges.

This immersible pump can be used to water plants, create a fountain or waterfall, and even change the water in your fish tank. It operates quietly, with a sound level of less than 30dB. The pump contains a filter as well as a suction cup that allows it to adhere tightly to smooth surfaces.

2.1.8. TIP31C NPN power transistors

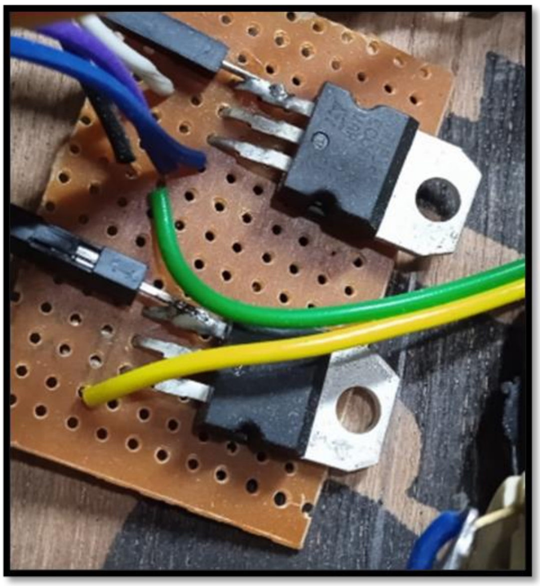

Fig 11: TIP31C NPN power transistors

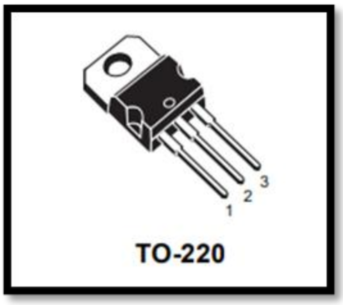

Fig 12: TIP31C NPN transistors pin diagram

TIP stands for Texas Instruments Power, and it is a series of bipolar junction transistors manufactured by Texas Instruments. The series was introduced in the 1960s and is still in use today due to its simplicity, durability, and ease of use. TIP04 and TIP14 part numbers are listed in a 1966 Texas Instruments catalogue.

2.1.9. 75rpm Plastic geared motors

Fig 13: 75rpm Plastic geared motos

This is a low-cost, low-voltage, long-lasting Dual Shaft Plastic Gear BO Motor with a speed of 75 RPM. It is best suited for light-weight robots that operate on low voltage. One of its two shafts can be connected to the wheel, while the other can be connected to the position encoder. The drive shaft has a clutch for non-continuous overload protection.

2.1.10. Ultrasonic Sensor

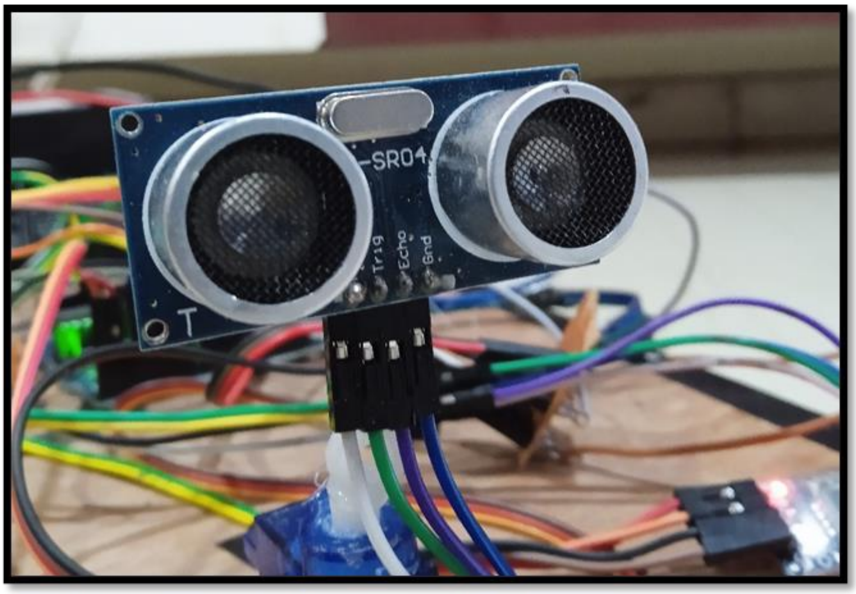

Fig 14: Ultrasonic Sensor

An ultrasonic sensor is a device that uses ultrasonic sound waves to determine the distance between two objects. An ultrasonic sensor employs a transducer to send and receive ultrasonic pulses that relay information about the proximity of an object. High-frequency sound waves reflect off boundaries, creating distinct echo patterns.

- **How Ultrasonic Sensor Works:**

Ultrasonic sensors operate by emitting a sound wave with a frequency higher than that of human hearing. The sensor's transducer functions as a microphone to receive and transmit ultrasonic sound. Like many others, our ultrasonic sensors use a single transducer to send a pulse and receive the echo. The sensor calculates the distance to a target by measuring the time between sending and receiving the ultrasonic pulse. This module's operation is straightforward. It emits a 40kHz ultrasonic pulse that travels through the air and, if it encounters an obstacle or object, bounces back to the sensor. The distance can be calculated by multiplying the travel time by the speed of sound.

Ultrasonic sensors are an excellent solution for detecting clear objects. Because of target translucence, applications that use infrared sensors, for example, struggle with this particular use case for liquid level measurement. Ultrasonic sensors detect objects regardless of colour, surface, or material for presence detection (unless the material is very soft like wool, as it would absorb sound.) Ultrasonic sensors are a reliable choice for detecting transparent and other items where optical technologies may fail.

2.2. Assembly of Project

The project is being built on a ply board. Two wheels are attached to the plywood's back side. In addition, there are two plastic geared motors on the front side. A small roller in the front middle part of the plywood is used to support the plastic geared motors. The weight of the plywood and the components in the front is transferred to the roller.

A motor driver controls the movement of motors. This motor driver is programmed with Arduino software and powered by a 12-volt battery.

12V Sealed lead acid rechargeable battery is for the power supply. The 12V Sealed lead acid rechargeable battery is connected to the Arduino UNO. And then Arduino UNO supplies the power supply to other components used.

- **5V operated devices**
- Servo Motor
- L293D
- Ultrasonic Sensor

- **12v operated devices**
- Plastic Geared Motors
- Pump
- 100rpm Geared Motors

First, we checked that all the components which are going to be used for the project are in working condition and we make sure that there is no fault in the components. After that we took two old CD's and a cleaning cloth. We cut the cloth in a circular shape a little bit bigger than CD size. We stitched elastic to the corner of the cloth so that it can fit onto CDs properly. Then those CDs are attached to the plastic wheels with the glue gun. And here our mop is ready. We attached those mops to the plastic gear motors which will be attached to the front of the plywood.

Two wheels are powered by dc motors, which are controlled by the motor driver L293D via Arduino programming and pin connections.
The digital write pin is used in Arduino software to provide input. We provide motor driver input from the Arduino digital write pin for operation. For Arduino to function, various pins are assigned.

Table 3: Arduino pin with L23D

Digital write pins of Arduino UNO	Pins of L293D
D10	In 4 (Right motor '+')
D11	In 3 (Right motor '-')
D6	In 1 (Left motor '+')
D9	In 2 (Left motor '-')

The Arduino is used to program motor drivers. The motor driver is programmed to control the motion of dc motors. When the ultrasonic sensor sends a signal to the Arduino, the motor driver operates the motors for a right or left turn, and then the motor moves forward.

The pins of HC-06 Bluetooth Module are connected to Arduino UNO. Following table displays which pin of HC-06 Bluetooth Module is connected to which pin of Arduino UNO.

Table 4: Arduino pin with HC-06 Bluetooth

Digital write pins of Arduino UNO	Pins of HC-06 Bluetooth Module
RXD	TXD
TXD	RXD

We soldered the circuit of "TIP31C NPN power transistors" onto the PCB board. We soldered the 5-volt pins together on one part of the PCB board so that the 5 volt power supply should go from one source. We soldered the ground pins together on the second part of the PCB board.

The pins of Ultrasonic Sensor are connected to the Arduino UNO so that Arduino can transmit and receive the data from the Ultrasonic Sensor. Following table shows that which pin of Ultrasonic Sensor are connected to which pin of Arduino UNO.

Table 5: Arduino pin with Ultrasonic sensor

Analog pins of Arduino UNO	Pins of Ultrasonic Sensor
A0	Echo
A2	Trig

- **Other Components connected to Arduino UNO:**

Table 6: Arduino pin with other components

Sr. no.	Component Name	Digital write pins of Arduino UNO	Pin of Component
1.	Pump	D4	Positive Point
2.	Plastic Gear Motors (Mops)	D5	Positive Point
3.	Servo Motor	D3	Pulse

- **Circuit Diagram:**

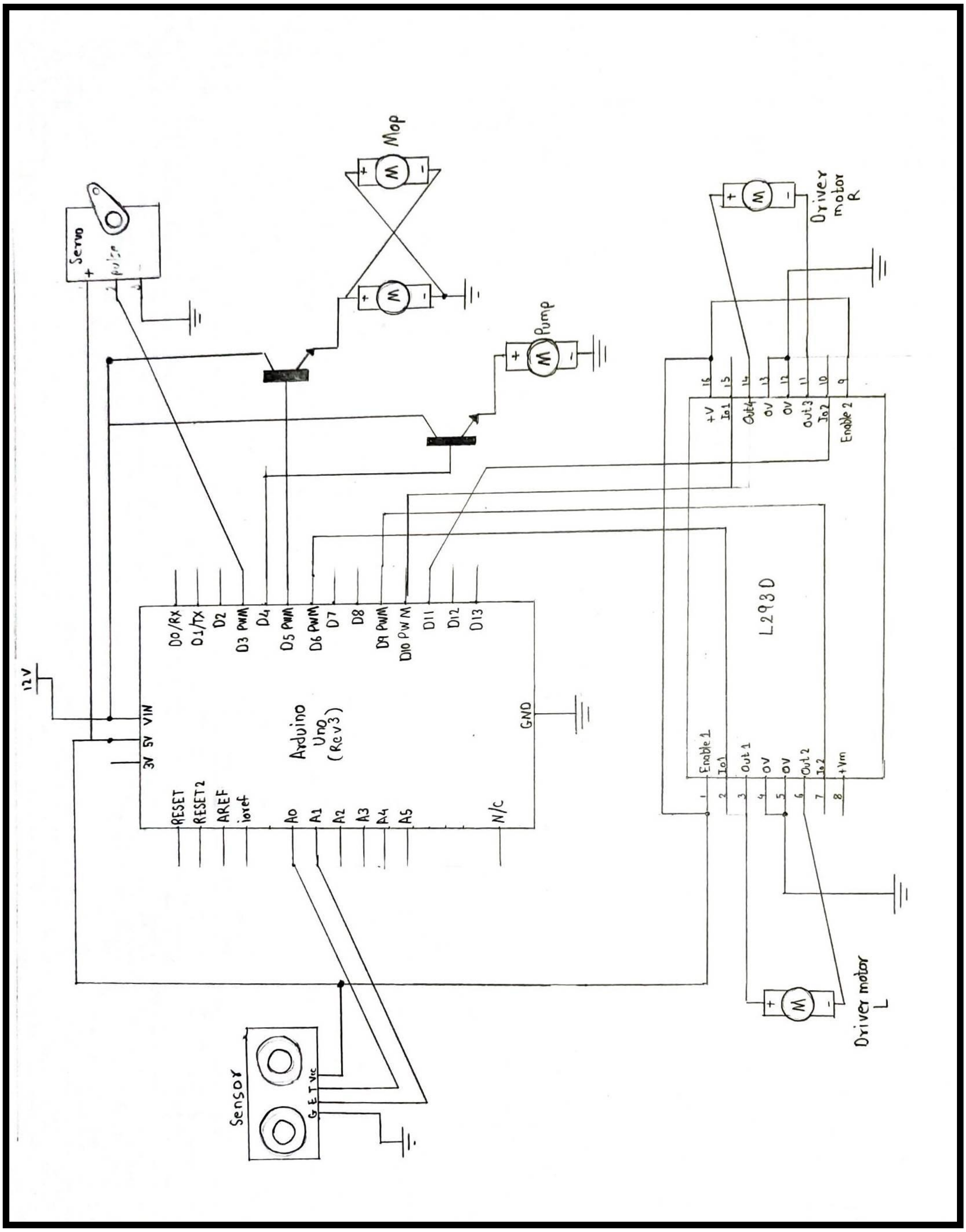

Fig 15: Circuit Diagram

- **Project Pictures:**

1. **Top View:**

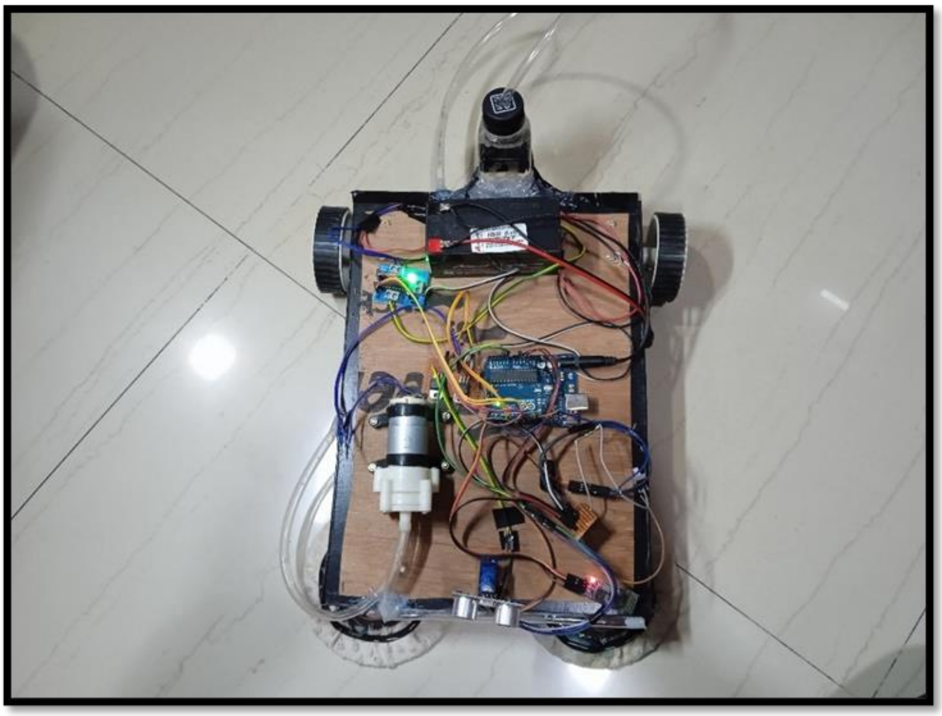

Fig 16: Model Top view

2. **Front View:**

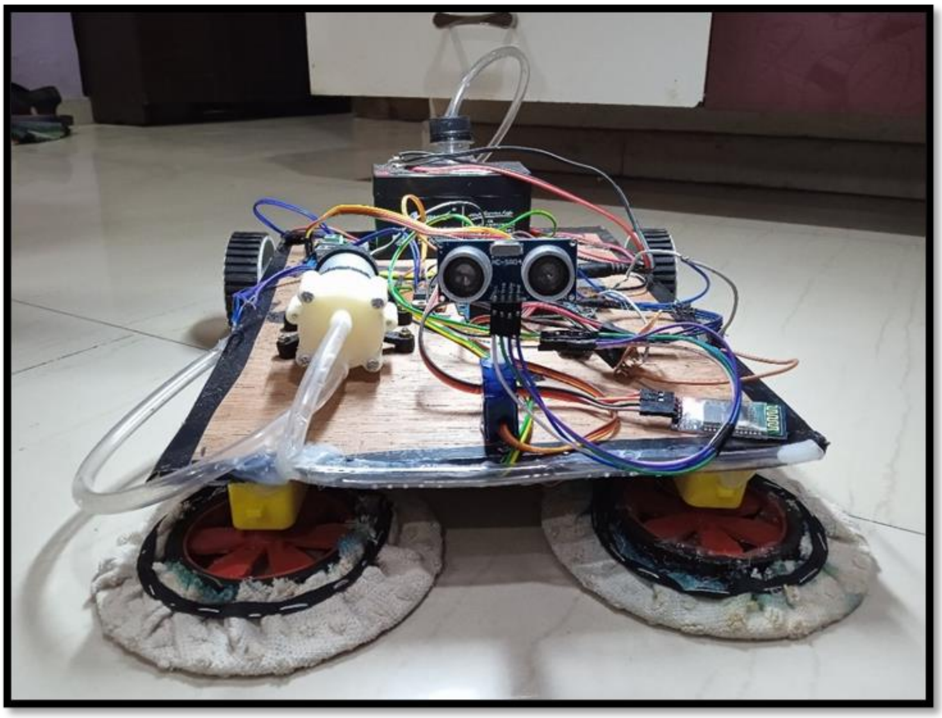

Fig 17: Model Front view

3. Left Side View:

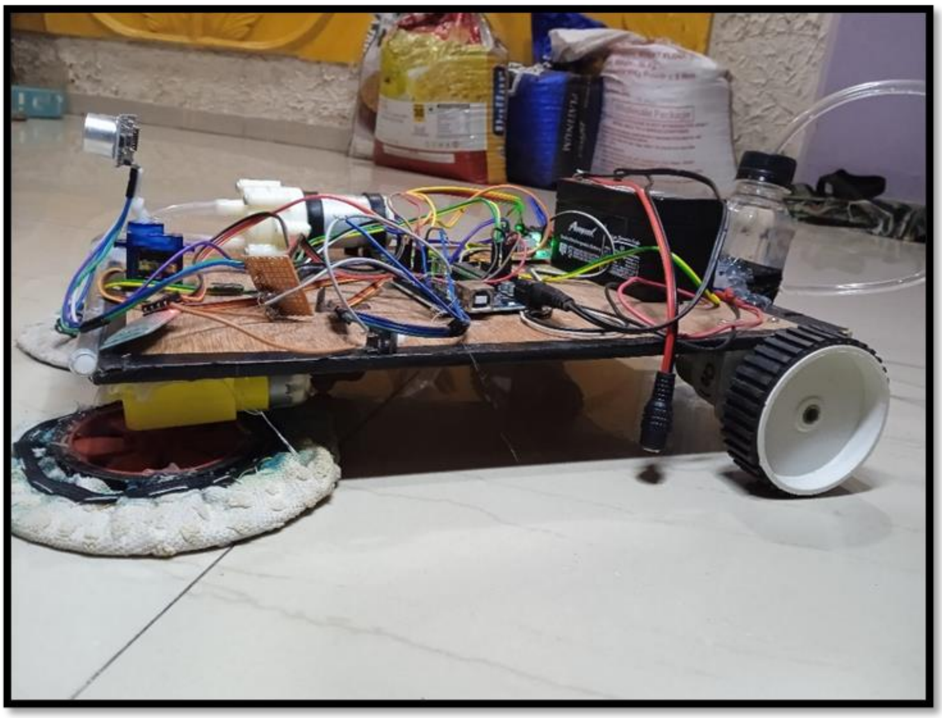

Fig 18: Model Left side view

4. Right Side View:

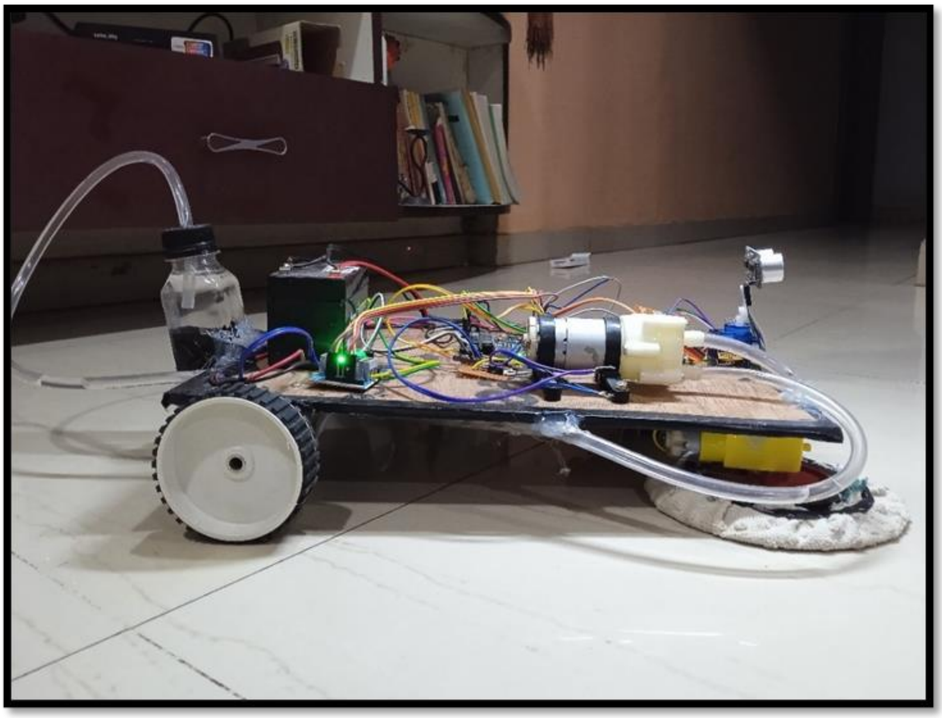

Fig 19: Model Right side view

CHAPTER-3
SOFTWARE DESCRIPTION

3.1. Program for Manual Mode

```
#include <Servo.h>
#include <AFMotor.h>
#include <NewPing.h>

#define TRIG_PIN A0
#define ECHO_PIN A1
#define MAX_DISTANCE 200
#define MAX_SPEED 255

  NewPing sonar(TRIG_PIN, ECHO_PIN, MAX_DISTANCE);

  int r_motor_n = 10;
  int r_motor_p = 11;
  int l_motor_p = 9;
  int l_motor_n = 6;

  int pump = 4;

  int mop = 5;

  int serv = 3;

  int speedv=255;
  int incomingByte =0;
  int distance = 100;

  Servo myservo;

 void setup() {
       myservo.attach(3);
       myservo.write(115);
       pinMode(r_motor_n, OUTPUT); //Set control pins to be outputs
       pinMode(r_motor_p, OUTPUT);
       pinMode(l_motor_p, OUTPUT);
       pinMode(l_motor_n, OUTPUT);
       pinMode(pump, OUTPUT);
```

```
    pinMode(mop, OUTPUT);
    digitalWrite(r_motor_n, LOW); //set both motors off for start-up
    digitalWrite(r_motor_p, LOW);
    digitalWrite(l_motor_p, LOW);
    digitalWrite(l_motor_n, LOW);
    digitalWrite(pump, LOW);
    digitalWrite(mop, LOW);
    pinMode(LED_BUILTIN, OUTPUT);
    Serial.begin(9600);
    delay(2000);
   }

void moveStop()
{
  digitalWrite(r_motor_n, LOW);
  digitalWrite(r_motor_p, LOW);
  digitalWrite(l_motor_p, LOW);
  digitalWrite(l_motor_n, LOW);
}

int lookRight()
{
   myservo.write(30);
   delay(500);
   distance = readPing();
   delay(1000);
   myservo.write(115);
   return distance;
}

int lookLeft()
{
   myservo.write(190);
   delay(500);
   distance = readPing();
   delay(1000);
   myservo.write(115);
   return distance;
   delay(100);
}

int readPing() {
  delay(70);
  int cm = sonar.ping_cm();
```

```
  if(cm==0)
  {
    cm = 250;
  }
  return cm;
}

void moveForward() {

analogWrite(r_motor_n, speedv);
digitalWrite(r_motor_p, LOW);
digitalWrite(l_motor_p, LOW);
analogWrite(l_motor_n, speedv);
}

void moveBackward() {
digitalWrite(r_motor_n, LOW);
analogWrite(r_motor_p, speedv);
analogWrite(l_motor_p, speedv);
digitalWrite(l_motor_n, LOW);
}

void turnRight() {
  analogWrite(r_motor_n, speedv);
digitalWrite(r_motor_p, LOW);
analogWrite(l_motor_p, speedv);
digitalWrite(l_motor_n, LOW);
}

void turnLeft() {
digitalWrite(r_motor_n, LOW);
analogWrite(r_motor_p, speedv);
digitalWrite(l_motor_p, LOW);
analogWrite(l_motor_n, speedv);
}



void loop() {
int distanceR = 0;
int distanceL =  0;
delay(40);

if (Serial.available() > 0)
```

```
    {
      incomingByte = Serial.read();
    }

switch(incomingByte)
    {

    case 'S':
    moveStop();
    Serial.println("Stop");
    incomingByte='*';
    break;

    case 'R':
    turnRight();
    Serial.println("right");
    incomingByte='*';
    break;

    case 'L':
    turnLeft();
    Serial.println("left");
    incomingByte='*';
    break;

    case 'F':
    moveForward();
    Serial.println("forward");
    incomingByte='*';
    break;


    case 'B':
    moveBackward();
    Serial.println("back");
    incomingByte='*';
    break;

    case 'H':
    lookLeft();
    incomingByte='*';
    break;

    case 'E':
```

```
        lookRight();
        incomingByte='*';
        break;

        case 'M':
        digitalWrite(mop, HIGH);
        Serial.println("mopper on");
        incomingByte='*';
        break;

        case 'm':
        digitalWrite(mop, LOW);
        Serial.println("mopper off");
        incomingByte='*';
        break;
         case 'P':
        digitalWrite(pump, HIGH);
        Serial.println("pump on");
        incomingByte='*';
        break;
        delay(5000);
  }
}
```

3.2. Program for Automatic Mode

```
#include <Servo.h>
#include <AFMotor.h>
#include <NewPing.h>

#define TRIG_PIN A0
#define ECHO_PIN A1
#define MAX_DISTANCE 200

NewPing sonar(TRIG_PIN, ECHO_PIN, MAX_DISTANCE);

int r_motor_n = 10;
int r_motor_p = 11;
int l_motor_p = 9;
int l_motor_n = 6;

int pump = 4;

int mop = 5;

int serv = 3;

int speedy = 215;
int incomingByte = 0;
int distance = 100;
Servo myservo;


void setup() {
  myservo.attach(3);
  myservo.write(0);
  pinMode(r_motor_n, OUTPUT); //Set control pins to be outputs
  pinMode(r_motor_p, OUTPUT);
  pinMode(l_motor_p, OUTPUT);
  pinMode(l_motor_n, OUTPUT);
  pinMode(pump, OUTPUT);
  pinMode(mop, OUTPUT);
  digitalWrite(r_motor_n, LOW); //set both motors off for start-up
  digitalWrite(r_motor_p, LOW);
  digitalWrite(l_motor_p, LOW);
  digitalWrite(l_motor_n, LOW);
```

```
  digitalWrite(pump, LOW);
  digitalWrite(mop, LOW);
  Serial.begin(9600);

}

void moveStop()
{
  digitalWrite(r_motor_n, LOW);
  digitalWrite(r_motor_p, LOW);
  digitalWrite(l_motor_p, LOW);
  digitalWrite(l_motor_n, LOW);
}

int lookRight()
{
    myservo.write(50);
    delay(500);
    int distance = readPing();
    delay(500);
    myservo.write(115);
    return distance;
}

int lookLeft()
{
    myservo.write(170);
    delay(500);
    int distance = readPing();
    delay(100);
    myservo.write(115);
    return distance;
    delay(100);
}

int readPing() {
  delay(70);
  int cm = sonar.ping_cm();
  if(cm==0)
  {
    cm = 250;
  }
  return cm;
}
```

```
void moveForward() {
analogWrite(r_motor_n, speedy);
digitalWrite(r_motor_p, LOW);
digitalWrite(l_motor_p, LOW);
analogWrite(l_motor_n, speedy);
}

void moveBackward() {
digitalWrite(r_motor_n, LOW);
analogWrite(r_motor_p, speedy);
analogWrite(l_motor_p, speedy);
digitalWrite(l_motor_n, LOW);
}

void turnRight() {
  analogWrite(r_motor_n, speedy);
digitalWrite(r_motor_p, LOW);
analogWrite(l_motor_p, speedy);
digitalWrite(l_motor_n, LOW);
}

void turnLeft() {
digitalWrite(r_motor_n, LOW);
analogWrite(r_motor_p, speedy);
digitalWrite(l_motor_p, LOW);
analogWrite(l_motor_n, speedy);
}

void loop() {
  int distanceR = 0;
  int distanceL =  0;
  delay(40);

  if (Serial.available() > 0)
    {
        incomingByte = Serial.read();
    }
if(incomingByte=='A'){
    if(distance<=30)
      {
      digitalWrite(mop, LOW);
      moveStop();
      delay(500);
```

```
        moveBackward();
        delay(500);
        moveStop();
        delay(200);
        distanceR = lookRight();
        delay(200);
        distanceL = lookLeft();
        delay(200);
        if(distanceR>=distanceL)
        {
          digitalWrite(mop, LOW);
          turnRight();
          delay(1000);
          moveStop();
        }else
        {
          digitalWrite(mop, LOW);
          turnLeft();
          delay(1000);
          moveStop();
        }
        }else
        {
        digitalWrite(mop, HIGH);
        delay(20);
        digitalWrite(pump, HIGH);
        delay(1000);
        digitalWrite(pump, LOW);
        moveForward();
        distance = readPing();
    }
      }

delay(5000);
}
```

CHAPTER-4
WORKING OF PROJECT

4.1. Working

Clean Sweeper robot has a 12V Sealed lead-acid rechargeable battery. First step is to connect the 12V Sealed lead-acid rechargeable battery with Arduino Uno and connect Bluetooth with the HC-06 Bluetooth Module and make hole circuit controllable remotely with **Bluetooth Serial Controller Application**. When we send a motion signal from the Bluetooth Serial Controller Application, the program set by the Arduino Uno will launch a given command motion.

We can give 9 commands from Bluetooth Serial Controller Application.

Tab 7: Commands from Application

Sr. no.	Commands	Description
1.	**'F'**	Gives command to go Forward
2.	**'B'**	Gives command to go Backward
3.	**'R'**	Gives command to go Right
4.	**'L'**	Gives command to go Left
5.	**'S'**	Gives command to Stop
6.	**'M'**	Gives command to turn on Mop
7.	**'m'**	Gives command to turn off Mop
8.	**'P'**	Gives command to turn on Pump
9.	**'A'**	Gives command to turn on Automatic Mode

4.2. Methodology

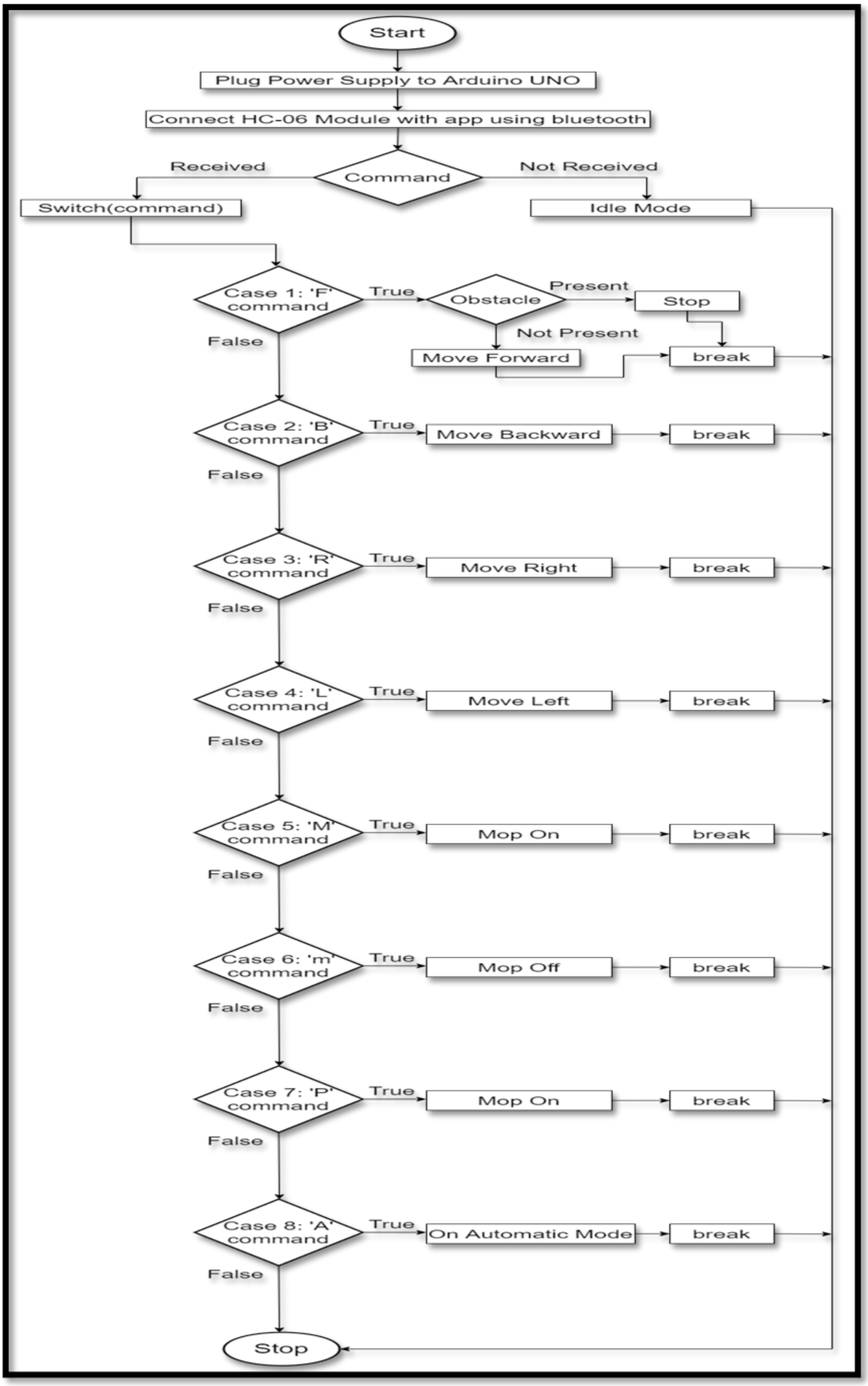

Fig 20: Methodology of Manual Mode

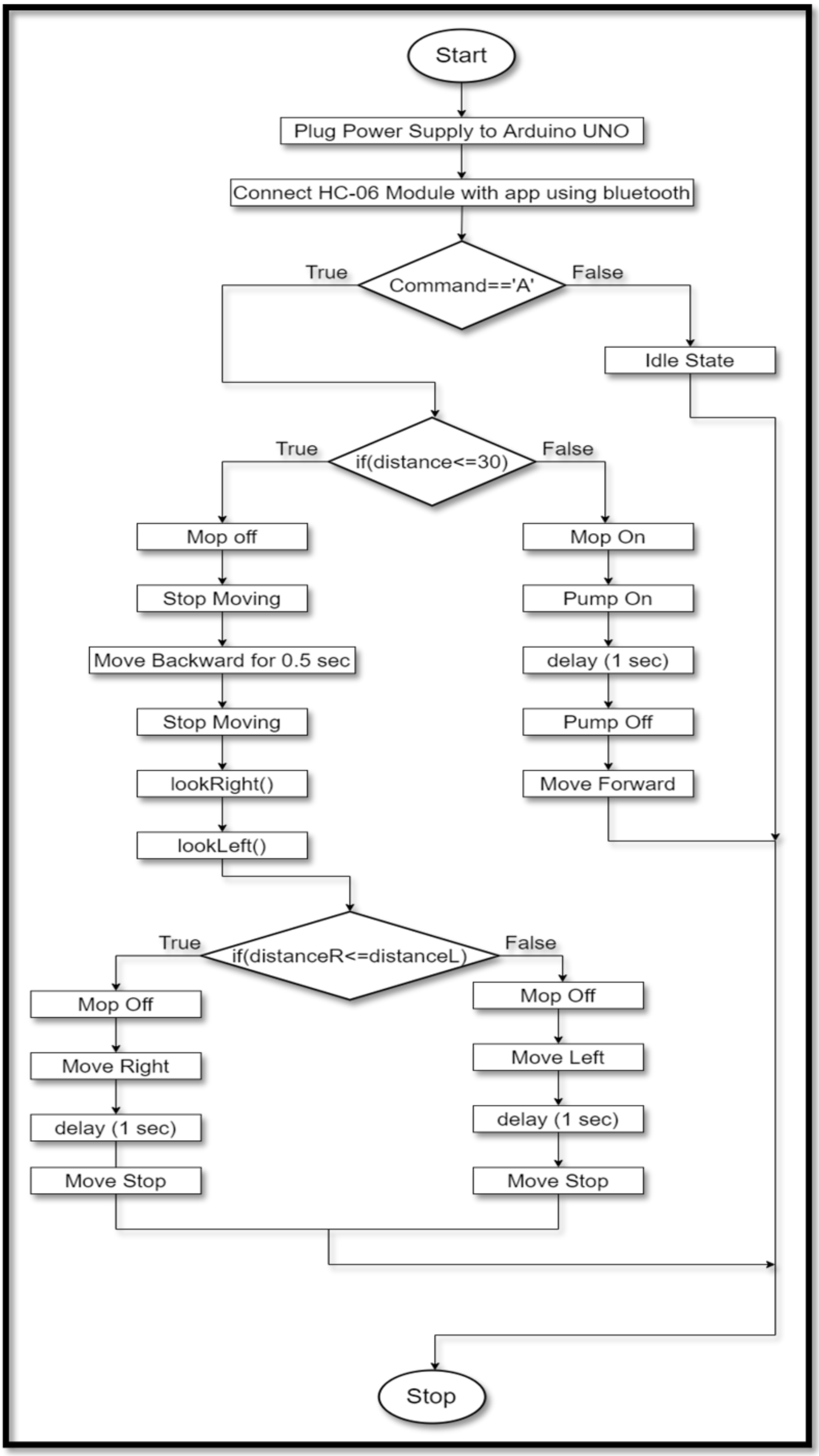

Fig 21: Methodology of Automatic Mode

CHAPTER-5
RESULT

5.1. RESULT

As a result of this manual and autonomous IOT-based Clean Sweaper, each component's function is working properly, and the entire system has been completed successfully. This performs well in terms of movement in a room-wide direction and room cleaning.
The ranging accuracy of the ultrasonic sensor in this prototype is approximately 20cm to 2m, and it operates effectively within the prescribed range of 30 cm.

5.2. FINAL OVERVIEW OF PROJECT

In this project, we tested the operation of our project by connecting it to batteries and controlling the cleaning and moving system with a DC gear motor and pump. This method is environmentally friendly. We put various objects ahead of us as obstacles to test the system's functionality.

When the obstacle is placed at various distances from the vehicle, the system responds by slowing it down. Also, the system cleans properly with a mop, and this process is properly controlled by the internet of things. The system can be controlled using the Bluetooth Serial Controller app.

CHAPTER-6
APPLICATION

The floor cleaning robot was created to make the cleaning process easier. This can be used in colleges and offices because the floor area is large enough to cover.

To avoid this, we can have a robot perform the entire operation. In colleges and other places where there is a large floor area, we can use a floor cleaning robot to clean that area. Cleaning in large and small areas is required in industries, and both areas can be cleaned without the use of personnel. We can save money and time by doing so.

The Android app is downloaded from the Playstore and after that I have selected how many buttons are required and how many buttons should be displayed on the screen. Then I named those buttons according to their working. After that I assigned commands to those buttons where they would be sent to the HC-06 Module. A screenshot of the app's interface is shown below.

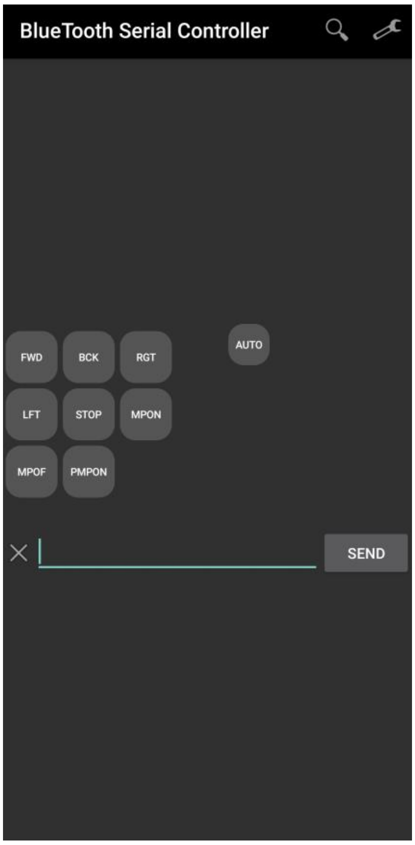

Fig 22: Application GUI

CHAPTER-7
FUTURE SCOPE

This robot can be modified in the future to be more effective and multipurpose. Cleaning efficiency can be improved. We can create a device that works perfectly for cleaning by using an infrared sensor and adding other features. If we add a timer, it will work for a specific time and will begin automatically.

This floor cleaning robot is only capable of cleaning floors; however, it can be modified to clean stairs. This robot can be modified to clean multiple rooms with a single robot. This robot cannot clean circular rooms, but it can be programed to clean any shape of room. So, these are the potential applications of floor cleaning robots in the future.

CONCLUSION

We have completed the manual and autonomous IOT-based floor cleaning robot model prototype, and this project presents implementing a Manual and Automatic cleaning System controlled by the Internet of Things. The vehicle's speed can be automatically reduced due to the detection of obstacles.

It reduces the work of many people to clean the wide range of floors. By doing this project practically, we gained knowledge about working of components like geared motor, pump. And we also gained knowledge about electric circuits.

We hope to develop the system into an even more advanced speed control system, while realizing that this certainly requires tons of work and learning, like the programming and operation of microcontrollers.

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[5] Paper Published Link: *http://ijariie.com/AdminUploadPdf/IoT_Cleaning_Robot_ijariie17044.pdf*

PUBLISHED PAPER

IoT Cleaning Robot

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ABSTRACT

Cleaning is an essential part of our day-to-day lives. Cleaning effectively should be an important part of a larger plan to create healthier indoor environments by removing contaminants that can cause illness. Lack of hygiene and cleanness is an open invitation to infection. A clean environment allows for a safe work environment. People like to work in clean surroundings. Employees will not make additional effort to dress up to impress knowing that the workplace is dirty and smelly. This may indicate that owners and managers do not care about the environment in which they work. Robotic cleaners have received significant attention in robotics research in recent years due to their effectiveness in assisting humans in floor cleaning applications in homes, hotels, restaurants, offices, hospitals, workshops, warehousing, and universities, among other places [1]. This document describes the design, development and production of the Clean Sweeper prototype. The subject robot works autonomously as well as in manual mode. The Clean Sweeper prototype lets the user operate the system from being within the prototype's Bluetooth range.

Keyword: - *IoT, Arduino UNO, HC-06 Bluetooth Module.*

1. INTRODUCTION

Clean Sweeper is autonomous and smartphone-controlled robot that cleans the floor of your home! The rotating mops on the front of the robot can do the job perfectly. There is also a water pump and reservoir that can be activated to throw water on the floor and moisten the mops for a thorough clean.

The project sends commands to the most commonly used microcontroller, the Arduino UNO, using Bluetooth communication via an HC-06 Bluetooth module. The robot is powered by a 12V lead acid battery, which is the optimal voltage for all of the motors used here. The driver motor pair is 100rpm, while the mops are 75rpm plastic ones. The best part is that the mops were made from old CDs and rags, and they work perfectly.

In this project, the Arduino Uno is the microcontroller. All the commands are stored in the Arduino Uno in the form of Program. The programming language used for this project is C++.Arduino Uno is the most popular microcontroller used for IoT Projects. The Arduino Uno is a microcontroller board that was designed by Arduino.cc and is based on the Microchip ATmega328P microprocessor.

The board has a number of digital and analogue input/output (I/O) pins that can be used to connect to various expansion boards (shields) and other circuits. The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable via a type B USB cable using the Arduino IDE (Integrated Development Environment).

2. OBJECTIVE

The objective of this project is to design the manual and automatic floor cleaning robot to reduce the human workload. Because of this project, the cleaning time will be reduced and the cleaning robot is at an affordable price. This project can be developed according as per the user's requirement. If the user needs automatic robot, then the user can get fully automatic robot and if the user needs manual robot so that the user doesn't need to clean the floor physically but user can only command with a smart phone and the floor.

This project includes numerous features such as it has 2 rotating mops on the front side of the cleaning robot so it can clean the floor properly. It has an Ultrasonic Sensor attached to the front side of the cleaning robot to detect obstacles and to avoid accidents while cleaning. The cleaning robot has a pump and water container installed. Using the pump, the water will be sprayed in the front of the mops to make the mops wet.

3. SCOPE OF PROJECT

The project's goal is to create a manual and automatic device that can be controlled by a person or the internet of things to clean the floor, and we only need to click a start button of the robot in a smartphone application. This project's scope includes a large floor area.

4. PRINCIPAL COMPONENTS OF PROJECT

1. Arduino UNO
2. HC-05/06 Bluetooth module
3. Ultrasonic Sensor
4. L293D motor driver board
5. Servo motor
6. 12V Sealed lead acid rechargeable battery
7. 12V Water pump
8. TIP31C NPN power transistors
9. 75rpm Plastic geared motors
10. 100rpm DC Geared motors

5. ASSEMBLY OF PROJECT

The project is being built on a ply board. Two wheels are attached to the plywood's back side. In addition, there are two plastic geared motors on the front side. A small roller in the front middle part of the plywood is used to support the plastic geared motors. The weight of the plywood and the components in the front is transferred to the roller. A motor driver controls the movement of motors. This motor driver is programmed with Arduino software and powered by a 12-volt battery.
12V Sealed lead acid rechargeable battery is for the power supply. The 12V Sealed lead acid rechargeable battery is connected to the Arduino UNO. And then Arduino UNO supplies the power supply to other components used.
First, we checked that all the components which are going to be used for the project are in working condition and we make sure that there is no fault in the components. After that we took two old CD's and a cleaning cloth. We cut the cloth in a circular shape a little bit bigger than CD size. We stitched elastic to the corner of the cloth so that it can fit onto CDs properly. Then those CDs are attached to the plastic wheels with the glue gun. And here our mop is ready. We attached those mops to the plastic gear motors which will be attached to the front of the plywood.
Two wheels are powered by dc motors, which are controlled by the motor driver L293D via Arduino programming and pin connections.
The digital write pin is used in Arduino software to provide input. We provide motor driver input from the Arduino digital write pin for operation. For Arduino to function, various pins are assigned.

Table -1: Arduino Uno pins assigned to L293D

SN.	Digital write pins of Arduino Uno	Pins of L293D
1	D10	In 4 (Right motor '+')
2	D11	In 3 (Right motor '-')
3	D6	In 1 (Left motor '+')
4	D9	In 2 (Left motor '-')

The Arduino is used to program motor drivers. The motor driver is programmed to control the motion of dc motors. When the ultrasonic sensor sends a signal to the Arduino, the motor driver operates the motors for a right or left turn, and then the motor moves forward.
The pins of HC-06 Bluetooth Module are connected to Arduino UNO. Following table displays which pin of HC-06 Bluetooth Module is connected to which pin of Arduino UNO.

Table -2: Arduino Uno pins assigned to HC-06 Bluetooth Module.

SN.	Digital write pins of Arduino Uno	Pins of HC-06 Bluetooth Module
1	RXD	TXD
2	TXD	RXD

We soldered the circuit of "TIP31C NPN power transistors" onto the PCB board. We soldered the 5-volt pins together on one part of the PCB board so that the 5-volt power supply should go from one source. We soldered the ground pins together on the second part of the PCB board.
The pins of Ultrasonic Sensor are connected to the Arduino UNO so that Arduino can transmit and receive the data from the Ultrasonic Sensor. Following table shows that which pin of Ultrasonic Sensor are connected to which pin of Arduino UNO.

Table -3: Arduino Uno pins assigned to Ultrasonic Sensor.

SN.	Digital write pins of Arduino Uno	Pins of Ultrasonic Sensor
1	A0	Echo
2	A2	Trig

Table -4: Arduino Uno pins assigned to Other Components.

SN.	Component Name	Digital write pins of Arduino UNO
1	Pump	D4
2	Plastic Gear Motors (Mops)	D5
3	Servo Motor	D3

6. WORKING

Clean Sweeper robot has a 12V Sealed lead-acid rechargeable battery. First step is to connect the 12V Sealed lead-acid rechargeable battery with Arduino Uno and connect Bluetooth with the HC-06 Bluetooth Module and make hole circuit controllable remotely with Bluetooth Serial Controller Application. When we send a motion signal from the Bluetooth Serial Controller Application, the program set by the Arduino Uno will launch a given command motion.
We can give 9 commands from Bluetooth Serial Controller Application.

Table -5: Commands given by application.

SN.	Commands	Description
1	'F'	Gives command to go Forward
2	'B'	Gives command to go Backward
3	'R'	Gives command to go Right
4	'L'	Gives command to go Left
5	'S'	Gives command to Stop
6	'M'	Gives command to turn on Mop
7	'm'	Gives command to turn off Mop
8	'P'	Gives command to turn on Pump
9	'A'	Automatic Mode

7. MODEL

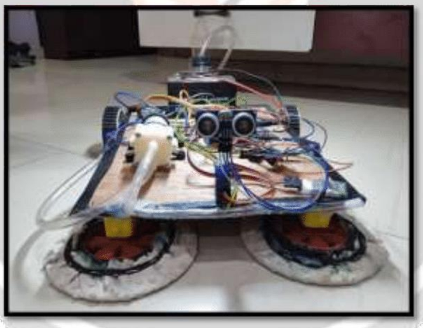

Fig -1: Front view of Model.

Fig -2: Side view of Model.

8. CONCLUSION

We have completed the manually controlled and autonomous IOT floor cleaning robot model prototype, and this project presents implementing an Internet of Things-controlled, manual and automatic cleaning system. In today's world, time is an important aspect for people. People aren't getting much time from work to do household work. So for those people, this product can be helpful. And If people have time but they are not physically able to clean the floor, then this product's manual mode will help them to clean. In the Manual mode of IoT Cleaning robot, if there is obstacle in between the way of robot and still if user gives command to go forward, then robot will not respond to that command because of obstacle.

9. REFERENCES

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