A

PROJRCT REPORT

On

IOT BASED AUTONOMOUS FLOOR CLEANING ROBOT

Submitted in the partial fulfilment of the requirements for degree of

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in

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by

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CHAPTER-1

ITRODUCTION

1.1 Background

Cleaning is Important work approximate every place. Sometimes this is easy and sometimes difficult. Sometimes we assigned people for purpose of cleaning and pay money and sometimes cleaning is required in areas where presence of living being dangerous so we cannot assigned living being in every place. Some places are so that have a large floor areas in that place for cleaning purpose we need more than one person so we required some technique to compensate these problems. In advancement of science a robot come in light but it operate by a personnel. To avoid this limitation of personnel we require more technologies.

Automation is a great solution of this problem. So we make an autonomous floor cleaning robot that operated by internet of things and Arduino Nano programming. Ultrasonic sensor is the most important component for autonomous floor cleaning robot because ultrasonic sensor works as eyes of robot. Ultrasonic sensor useful for turning of robot by sense the obstacle or wall. Sensing distance range of robot set by Arduino Nano programming. In this range robot sense the obstacle and turn back.

Households of today are becoming smarter and also 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 adoption of domestic robots is evolving. Several robotic vacuum cleaners are available on market but only few ones implement wet cleaning of floors.

Purpose of this project is design and implement a Vacuum Robot Autonomous and Manual via Phone Application named as blynk. Vacuum Cleaner Robot is designed to make cleaning process become easier rather than by using manual vacuum.

The main objective of this project is to design and implement a vacuum robot prototype by using Arduino Nano, motor driver Ultrasonic Sensor and to achieve the goal of this project. Vacuum Robot will have several criteria that are user-friendly.

1.2 Objective

Objective of this project is to design the automatic floor cleaning robot in order to work human hazards place and to skip need of personnel. To develop an autonomous robotics system using internet of things and to design a floor cleaning robot without human to the driving. Mainly it is used when obstacle are less and large area is required to be clean. Mostly problem occurs during large floor that the human capability. Its means that in large floor areas the human can get tired. In areas like nuclear plants or chemical industries the dangerous radiations, chemicals, air, pollutions can make a man sick or death.

So this robot has applicable in that places. There are many features are added in this project like vacuum cleaner in front side and a wiper motor and water pump in middle for tightly wet cleaning of floor. Vacuum cleaner suck solid particle and clean floor after that wiper make tightly cleaning.

1.3 Scope Of Project

The scope of this project is to develop an automatic device that can derived from control room by internet of thing that work of sweeping floor without need of personnel and we need to just click a start button of the robot in smartphone application. This project has a scope in the areas like a large floor area, human hazards area in industries like nuclear plant chemical plant and the areas where threat of dangerous gasses presence.

1.4 IOT- Overview

IOT (Internet of Things) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system.

IOT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IOT utilizes existing and emerging technology for sensing, networking, and robotics.

IOT exploits recent advances in software, falling hardware prices, and modern attitudes toward technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services and the social, economic, and political impact of those changes.

IOT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more 0through smart devices and powerful enabling technology.

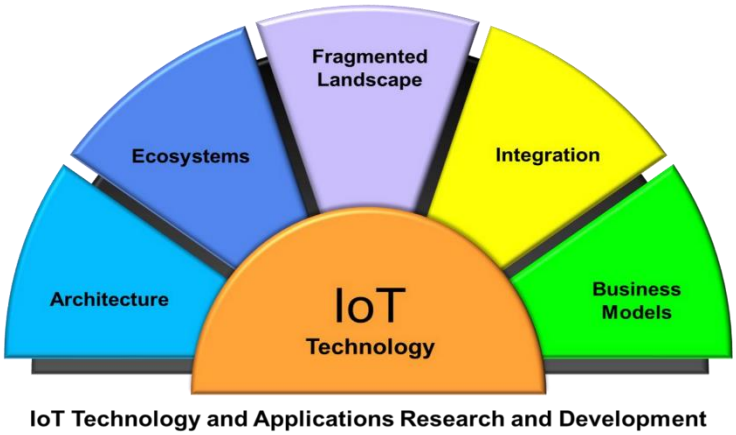

Figure 1.1 IOT Future Challenges

1.5 IOT- Features Key

The most important features of IOT include artificial intelligence, connectivity, sensors, active engagement, and small device use. A brief review of these features is given below:

- **AI –** IOT essentially makes virtually anything "smart", meaning it enhances every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. This can mean something as simple as enhancing your refrigerator and cabinets to detect when milk and your favorite cereal run low and to then place an order with your preferred grocer.
- **Connectivity –** New enabling technologies for networking, and specifically IOT networking, mean networks are no longer exclusively tied to major providers. Networks can exist on a much smaller and cheaper scale while still being practical. IOT creates these small networks between its system devices.
- **Sensors –** IOT loses its distinction without sensors. They act as defining instruments which transform IOT from a standard passive network of devices into an active system capable of real-world integration.

- **Active Engagement –** Much of today's interaction with connected technology happens through passive engagement. IOT introduces a new paradigm for active content, product, or service engagement.
- **Small Devices –** Devices, as predicted, have become smaller, cheaper, and more powerful over time. IOT exploits purpose-built small devices to deliver its precision, scalability, and versatility.

1.6 IOT − Advantages

The advantages of IOT span across every area of life style and business. Here is a list of some of the advantages that IOT has to offer:

- **Improved Customer Engagement –** Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IOT completely transforms this to achieve richer and more effective engagement with audience.

- **Technology Optimization –** The same technologies and data which improve the customer experience also improve device use and aid in more potent improvements to technology. IOT unlocks a world of critical functional and field data.
- **Reduced Waste –** IOT makes areas of improvement clear. Current analytics give us superficial insight, but IOT provides real-world information leading to more effective management of resources.
- **Enhanced Data Collection –** Modern data collection suffers from its limitations and its design for passive use. IOT breaks it out of those spaces and places it exactly where humans really want to go to analysis our world. It allows an accurate picture of everything.

1.7 IOT − Disadvantages

Though IOT delivers an impressive set of benefits, it also presents a significant set of challenges. Here is a list of some its major issues:

- **Security –** IOT creates an ecosystem of constantly connected devices communicating over networks. The system offers little control despite any security measures. This leaves users exposed to various kinds of attackers.
- **Privacy –** The sophistication of IOT provides substantial personal data in extreme detail without the user's active participation.
- **Complexity –** Some find IOT systems complicated in terms of design, deployment, and maintenance given their use of multiple technologies and a large set of new enabling technologies.
- **Flexibility –** Many are concerned about the flexibility of an IOT system to integrate easily with another. They worry about finding themselves with several conflicting or locked systems.
- **Compliance –** IOT, like any other technology in the realm of business, must comply with regulations. Its complexity makes the issue of compliance seem incredibly challenging when many consider standard software compliance a battle.

1.8 Technology and Protocols

Process extension within the IOT network. They exploit integration with critical business systems (e.g., ordering systems, robotics, scheduling, and more) in the execution of related tasks.

- **Data Collection**

  This software manages sensing, measurements, light data filtering, light data security, and aggregation of data. It uses certain protocols to aid sensors in connecting with real-time, machine-to-machine networks. Then it collects data from multiple devices and distributes it in accordance with settings. It also works in reverse by distributing data over devices. The system eventually transmits all collected data to a central server.

- **Device Integration**

  Software supporting integration binds (dependent relationships) all system devices to create the body of the IOT system. It ensures the necessary cooperation and stable networking between devices. These applications are the defining software technology of the IOT network because without them, it is not an IOT system. They manage the various applications, protocols, and limitations of each device to allow communication.

- **Real-Time Analytics**

  These applications take data or input from various devices and convert it into viable actions or clear patterns for human analysis. They analyse information based on various settings and designs in order to perform automation-related tasks or provide the data required by industry.

1.9 Application and Process Extension

These applications extend the reach of existing systems and software to allow a wider, more effective system. They integrate predefined devices for specific purposes such as allowing certain mobile devices or engineering instruments access. It supports improved productivity and more accurate data collection. IOT primarily exploits standard protocols and networking technologies.

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

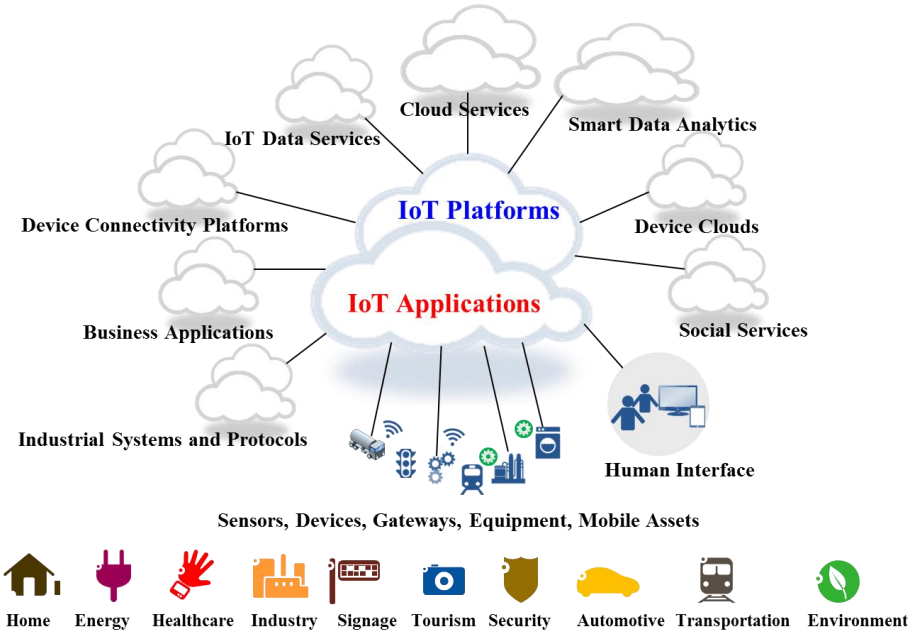

Figure 1.2 Internet of Things Integration of Platforms and Applications

1.9.1 Common Uses

- RFID technology employs 2-way radio transmitter-receivers to identify and track tags associated with objects.
- NFC consists of communication protocols for electronic devices, typically a mobile device and a standard device.
- **Low-Energy Bluetooth**

  This technology supports the low-power, long-use need of IOT function while exploiting a standard technology with native support across systems.

- **Low-Energy Wireless**

  This technology replaces the most power hungry aspect of an IOT system. Though sensors and other elements can power down over long periods, communication links (i.e., wireless) must remain in listening mode. Low-energy wireless not only reduces consumption, but also extends the life of the device through less use.

- **Radio Protocols**

  Zig Bee, Z-Wave, and Thread are radio protocols for creating low-rate private area networks. These technologies are low-power, but offer high throughput unlike many similar options. This increases the power of small local device networks without the typical costs.

- **Wi Fi - Direct**

  Wi Fi-Direct eliminates the need for an access point. It allows P2P (peer-to-peer) connections with the speed of Wi Fi but with lower latency. Wi Fi-Direct eliminates an element of a network that often bogs it down, and it does not compromise on speed or throughput.

IOT has applications across all industries and markets. It spans user groups from those who want to reduce energy use in their home to large organizations who want to streamline their operations. It proves not just useful, but nearly critical in many industries as technology advances and we move towards th0e advanced automation imagined in the distant future.

1.9.2 Engineering, Industry and Infrastructure

Applications of IOT in these areas include improving production, marketing, service delivery, and safety. IOT provides a strong means of monitoring various processes; and real transparency creates greater visibility for improvement opportunities. The deep level of control afforded by IOT allows rapid and more action on those opportunities, which include events like obvious customer needs, nonconforming product, malfunctions in equipment, problems in the distribution network, and more. IOT also used in robotics such as floor cleaning robot, wall making robot etc.

- **Example**

  Joan runs a manufacturing facility that makes shields for manufacturing equipment. When regulations change for the composition and function of the shields, the new appropriate requirements are automatically programmed in production robotics, and engineers are alerted about their approval of the changes.

1.9.3 Government And Safety

IOT applied to government and safety allows improved law enforcement, defence, city planning, and economic management. The technology fills in the current gaps, corrects many current flaws, and expands the reach of these efforts. For example, IOT can help city planners have a clearer view of the impact of their design, and governments have a better idea of the local economy.

- **Example**

  Joan lives in a small city. She's heard about a recent spike in crime in her area, and worries about coming home late at night. Local law enforcement has been alerted about the new "hot" zone through system flags, and they've increases their presence. Area monitoring devices have detected suspicious behaviour and law enforcement has investigated these leads to prevent crimes.

1.9.4 Home and Office

In our daily lives, IOT provides a personalized experience from the home to the office to the organizations we frequently do business with. This improves our overall satisfaction, enhances productivity, and improves our health and safety. For example, IOT can help us customize our office space to optimize our work.

1.9.5 Environmental Monitoring

The applications of IOT in environmental monitoring are broad: environmental protection, extreme weather monitoring, water safety, endangered species protection, commercial farming, and more. In these applications, sensors detect and measure every type of environmental change.

- **Air and Water Pollution**

  Current monitoring technology for air and water safety primarily uses manual labour along with advanced instruments, and lab processing. IOT improves on this technology by reducing the need for human labour, allowing frequent sampling, increasing the range of sampling and monitoring, allowing sophisticated testing on-site, and binding response efforts to detection systems. This allows us to prevent substantial contamination and related disasters.

- **Extreme Weather**

  Though powerful, advanced systems currently in use allow deep monitoring, they suffer from using broad instruments, such as radar and satellites, rather than more granular solutions. Their instruments for smaller details lack the same accurate targeting of stronger technology.

  New IOT advances promise more fine-grained data, better accuracy, and flexibility. Effective forecasting requires high detail and flexibility in range, instrument type, and deployment. This allows early detection and early responses to prevent loss of life and property.

- **Commercial Farming**

  Today's sophisticated commercial farms have exploited advanced technology and biotechnology for quite some time, however, IOT introduces more access to deeper automation and analysis.

  Much of commercial farming, like weather monitoring, suffers from a lack of precision and requires human labour in the area of monitoring. Its automation also remains limited.

  IOT allows operations to remove much of the human intervention in system function, farming analysis, and monitoring. Systems detect changes to crops, soil, environment, and more. They optimize standard processes through analysis of large, rich data collections. They also prevent health hazards from happening and allow better control.

1.9.6 Energy Applications

The optimization qualities of IOT in manufacturing also apply to energy consumption. IOT allows a wide variety of energy control and monitoring functions, with applications in devices, commercial and residential energy use, and the energy source. Optimization results from the detailed analysis previously unavailable to most organizations and individuals.

- **Residential Energy**

  The rise of technology has driven energy costs up. Consumers search for ways to reduce or control consumption. IOT offers a sophisticated way to analyse and optimize use not only at device level, but throughout the entire system of the home. This can mean simple switching off or dimming of lights, or changing device settings and modifying multiple home settings to optimize energy use.

  IOT can also discover problematic consumption from issues like older appliances, damaged appliances, or faulty system components. Traditionally, finding such problems required the use of often multiple professionals.

- **Commercial Energy**

  Energy waste can easily and quietly impact business in a major way, given the tremendous energy needs of even small organizations. Smaller organizations wrestle with balancing costs of business while delivering a product with typically smaller margins, and working with limited funding and technology. Larger organizations must monitor a massive, complex ecosystem of energy use that offers few simple, effective solutions for energy use management.

A smart-meter still requires a reader to visit the site. This automated meter reader makes visits unnecessary, and also allows energy companies to bill based on real-time data instead of estimates over time.

Fig. 1.3 Smart Meter

IOT simplifies the process of energy monitoring and management while maintaining a low cost and high level of precision. It addresses all points of an organization's consumption across devices. Its depth of analysis and control provides organizations with a strong means of managing their consumption for cost shaving and output optimization. IOT systems discover energy issues in the same way as functional issues in a complex business network, and provide solutions.

- **Reliability**

  The analytics and action delivered by IOT also help to ensure system reliability. Beyond consumption, IOT prevents system overloads or throttling. It also detects threats to system performance and stability, which protects against losses such as downtime, damaged equipment, and injuries.

1.9.7 Consumer Applications

Consumers benefit personally and professionally from the optimization and data analysis of IOT. IOT technology behaves like a team of personal assistants, advisors, and security. It enhances the way we live, work, and play.

- **Home –** IOT takes the place of a full staff:

- **Butler –** IOT waits for you to return home, and ensures your home remains fully prepared. It monitors your supplies, family, and the state of your home. It takes actions to resolve any issues that appear.
- **Chef –** An IOT kitchen prepares meals or simply aids you in preparing them.
- **Nanny –** IOT can somewhat act as a guardian by controlling access, providing supplies, and alerting the proper individuals in an emergency.
- **Gardner –** The same IOT systems of a farm easily work for home landscaping.
- **Repairman –** Smart systems perform key maintenance and repairs, and also request them.
- **Security Guard –** IOT watches over you 24/7. It can observe suspicious individuals miles away, and recognize the potential of minor equipment problems to become disasters well before they do.

Fig. 1.4 Electric Stove

- **Work**

  A smart office or other workspace combines customization of the work environment with smart tools. IOT learns about you, your job, and the way you work to deliver an optimized environment. This results in practical accommodations like adjusting the room temperature, but also more advanced benefits like modifying your schedule and the tools you use to increase your output and reduce your work time. IOT acts as a manager and consultant capable of seeing what you cannot

- **Play**

  IOT learns as much about you personally as it does professionally. This enables the technology to support leisure:

- **Culture and Night Life –** IOT can analyse your real-world activities and response to guide you in finding more of the things and places you enjoy such as recommending restaurants and events based on your preferences and experiences.

- **Vacations –** Planning and saving for vacations proves difficult for some, and many utilize agencies, which can be replaced by IOT.

- **Products and Services –** IOT offers better analysis of the products you like and need than current analytics based on its deeper access. It integrates with key information like your finances to recommend great solutions.

1.10 Equipment and Cost

Following equipments are used in this project and their cost is also shown in the table.

S.N	Name of Equipments	Quantity	Cost
1	Arduino Nano	2	650
2	Battery 8V	1	300
3	Battery 12V	1	450
4	Ultrasonic sensor	1	99
5	Node MCU	1	340
6	DC shunt motor	2	500
7	Relay module	3	250
8	Water pump	1	300
9	Water tank	1	50
10	L293d	1	150
11	Ply board	1	200
12	Wheels and wheel connector	4	320
13	Vacuum cleaner	2	150
14	12V to 5V converter	2	150
15	Wiping motor	1	700
16	Connecting leads and glue	-	200
17	Other	-	1000
18	Total	-	5809

CHAPTER-2

HARDWARE DESCRIPTION

2.1 Principal Componants Of Project

1. Arduino Nano

2. Ultrasonic sensor

3. Motor driver L293d

4. Node MCU

5. DC shunt motor

6. Wiper motor

7. Vacuum cleaner

2.1.1 Arduino Nano

The Arduino Nano is a surface mount breadboard compatible version of the ever-popular Arduino micro controller. It's small with integrated on-board USB and is breadboard friendly. As the function It has almost all the analog and digital pins that the UNO or Duemilanove and the same function as Duemilanove or UNO. With the smaller and portable package Arduino Nano would be more friendly and convenient for users to enter the Arduino world and make use of Arduino to make their dream into reality.

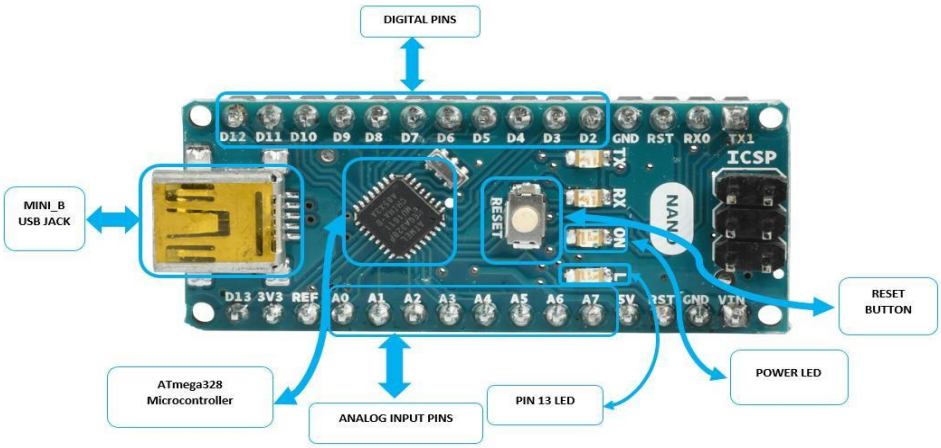

Fig. 2.1 Arduino nano

As a upgrade version of Arduino Nano is 100% compatible to Arduino Nano and its shield and IDEs. On the hardware part remarkable changes are taken to improve the flexibility and user experience. Memory of arduino nano is ATmega328 has 32 KB, (also with 2 KB used for the boot loader) and has 2 KB of SRAM and 1 KB of EEPROM.

1.2.1.1 Arduino Nano Physical Components

- **Microcontroller**

  In Arduino Nano 2.x version, still used ATmega168 microcontroller while the Arduino Nano 3.x version already used ATmega328 microcontroller.

- **ATmega168**

  ATmega168 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. And its features as follow:

- High Performance, Low Power Atmel AVR 8-Bit Microcontroller Family
- **Advanced RISC Architecture**

  131 Powerful Instructions o Most Single Clock Cycle Execution o 32 x 8 General Purpose Working Registers Fully Static Operation Up to 20 MIPS Throughput at 20MHz on chip- cycle multiplier.8V
- **Peripheral Features**

  Two 8-bit Timer/Counters with Separate Pre scalar and Compare Mode o One 16-bit Timer/Counter with Separate Pre scalar Compare Mode, and Capture Mode o Real Time Counter with Separate Oscillator Six PWM Channels 8-channel 10-bit ADC in TQFP and QFN/MLF package.
- **Operated Voltage**- 2.7-5.5 for ATmega 48/88/169V
- **Temperature Range**= -40 Centigrate to 85 Centigrate
- **Speed Grade**- 0-10 MHZ at 2.7V-5.5V, 0-20 MHZ at 4.5V-5.5V
- **Power Consumption at 1 MHZ, 1.8V, 25C**

  Active Mode- 0.3 A

  Power Down Mode- 0.1 micro A

  Power Save Mode- 0.8 micro A

2.1.2 Ultrasonic Sensor

Ultrasonic ranging and detecting devices use high frequency sound waves called ultrasonic waves to detect presence of an object and its range. Normal frequency range of human ear is roughly 20Hz to 20,000Hz. Ultrasonic sound waves are sound waves that are above the range of human ear, and thus have frequency above 20,000Hz. An ultrasonic sensor necessarily consists of a transducer for conversion of one form of energy to another, a housing enclosing the ultrasonic transducer and an electrical connection. These sensors are of two types:

- **Ultrasonic Transmitter –** Before transmitting the ultrasonic wave, there is a part which is ultrasonic wave generator that functions to generate ultrasonic wave. In that part, there is timing instruction means for generating an instruction signal for intermittently providing ultrasonic waves. This signal will send to an ultrasonic wave generator for generating ultrasonic waves based on the instruction signal from said timing instruction means (transform electrical energy into sound wave). After ultrasonic wave was produced, ultrasonic transmitter transmits the ultrasonic waves toward a road surface to find out the obstacle. The range that obstacle detected is depends on the range of ultrasonic sensors that used.

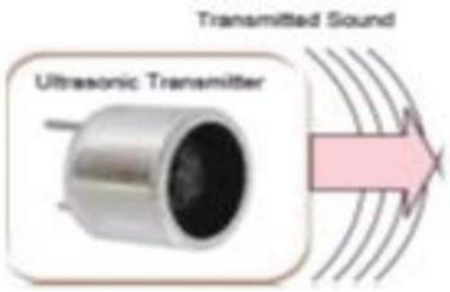

Fig 2.2 Ultrasonic Transmitter

- **Ultrasonic Receiver –** If the ultrasonic wave detects the obstacle, it will produce a reflected wave. An ultrasonic receiver is used for receiving the ultrasonic waves reflected from the road surface to generate a reception signal. There is ultrasonic transducer that will transform back the sound wave to electrical energy. This signal amplified by an amplifier. The amplified signal is compared with reference signal to detect components in the amplified signal due to obstacles on the road surface. The

magnitude of the reference signal or the amplification factor of the amplifier is controlled to maintain a constant ratio between the average of the reference signal and the average of the amplified signal.

Fig 2.3 Ultrasonic Receiver

2.1.3 Motor Driver L293d

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.

Fig. 2.4 Motor driver L293D

- **Pin Diagram**

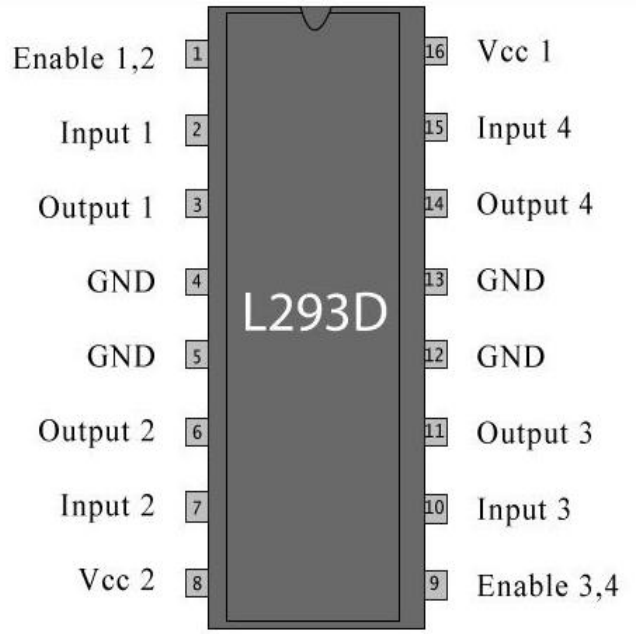

Fig. 2.5 Pin diagram

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. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled.

As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

- **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 $_1$

2.1.4 Node Mcu

Node MCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SOC from Espressif Systems and hardware which is based on the ESP-12 module. The term "Node MCU" by default refers to the firmware rather than the development kits. The firmware uses the LUA scripting language.

It is based on the ELUA project and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as LUA-CJSON and SPIFFS.

Fig.2.6 Node MCU

2.1.5 DC Shunt motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

Fig. 2.7 DC shunt motor

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. Speed of DC motor can be controlled over a wide range using either a variable supply voltage or by changing the strength of current in field windings. Small DC motors are used in tools, toys, and appliances.

The universal motor can operate on direct current but is a light weigh brushed motor used for portable power tools and appliances.

Larger DC motors are currently used in propulsion of electric vehicles elevator and hoists and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

Mathematical expression of dc shunt motor described as…

A DC shunt motor (also known as a shunt wound DC motor) is a type of self-excited DC motor where the field windings are shunted to or are connected in parallel to the armature winding of the motor. Since they are connected in parallel the armature and field windings are exposed to the same supply voltage. Though there are separate branches for the flow of armature Current and field current as shown in the figure of below.

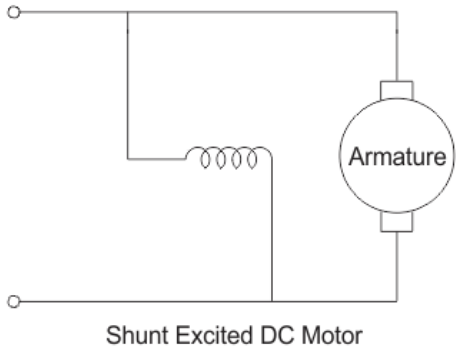

Fig. 2.8 DC Shunt Motor Circuit Diagram

DC Shunt Motor Equations

Let us now consider the voltage and current being supplied from the electrical terminal to the motor be given by E and I_{total} respectively.

This supply current in case of the shunt wound DC motor is split up into 2 parts. I_a flowing through the armature winding of resistance R_a and I_{sh} flowing through the field winding of resistance R_{sh}. The voltage across both windings remains the same. From there we can write..

$$I_{total} = I_a + I_{sh}$$

$$Where\ I_{sh} = \frac{E}{R_{sh}}$$

$$or,\ I_a = I_{total} - I_{sh} = \frac{E}{R_a}$$

Thus we put this value of armature current I_a to get general voltage equation of a DC shunt motor**.**

$$E = E_b + I_a R_a$$

$$Or \; E = E_b + (I_{total} - I_{sh}) R_a$$

Now in general practice when the motor is in its running condition and the supply voltage is constant and the shunt field current given by-

$$I_{sh} = \frac{E}{R_{sh}}, \; remains \; constant$$

But we know $I_{sh} \propto \Phi$

i.e. field flux Φ is proportional to filed current $I_{sh.}$ Thus the field flux remains more or less constant, and for this reason, a shunt wound DC motor is called a constant flux motor.

2.1.6 Wiper Motor

Windscreen wiper motor brushes have played very important role in the construction of wiper motors. The motors used in windscreen wipers are also known as Ferrite magnet type motors as permanent magnets are used in them. These motors contain gears to control the speed of the wiper and three brushes to be used according to the speed of the wiper and the motor itself.

These three brushes include a high speed brush, a low speed brush and a common brush for the ground. The gear section of the wiper motor also contains a cam switch to stop the wiper every time at the same position.

Fig. 2.9 DC wiper motor

The armature coils in the wiper motor generate a counter-electromotive force when it is turned to control the speed of rotation of the motor.

When low-speed brush from the three Windscreen wiper motor brushes provides current into the armature coils then they generate a large counter electromotive force to slow down the speed of rotation of the wiper motor.

2.1.7 Vacuum Cleaner

The first vacuum-cleaning device to be portable and marketed at the domestic market was built in 1905 by **Walter Griffith** manufacturer in Birmingham, England. His Griffith's Improved Vacuum Apparatus for Removing Dust from Carpets resembled modern-day cleaners it was portable easy to store and powered by any one person (such as the ordinary domestic servant) who would have the task of compressing a bellows-like contraption to through a removable, flexible pipe to which a variety of shaped nozzles could be attached.

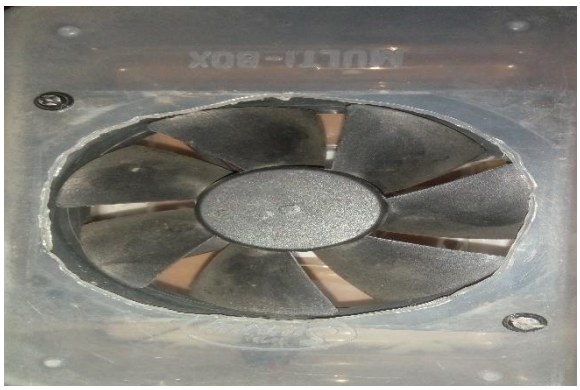

Fig. 2.10 Vacuum Cleaner

2.1.8 Relay

A relay is an electrical switch that uses an electromagnet to move the switch from the off to on position instead of a person moving the switch. It takes a relatively small amount of power to turn on a relay but the relay can control something that draws much more power.

Ex: A relay is used to control the air conditioner in your home. The AC unit probably runs off of 220VAC at around 30A. That's 6600 Watts! The coil that controls the relay may only need a few watts to pull the contacts together.

Fig.2.11 Relay

This is the schematic representation of a relay. The contacts at the top are normally open (i.e. not connected). When current is passed through the coil it creates a magnetic field that pulls the switch closed (i.e. connects the top contacts). Usually a spring will pull the switch open again once the power is removed from the coil.

- **WORKING PRINCIPLE OF RELAY**

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energies the electromagnetic field which produces the temporary magnetic field.

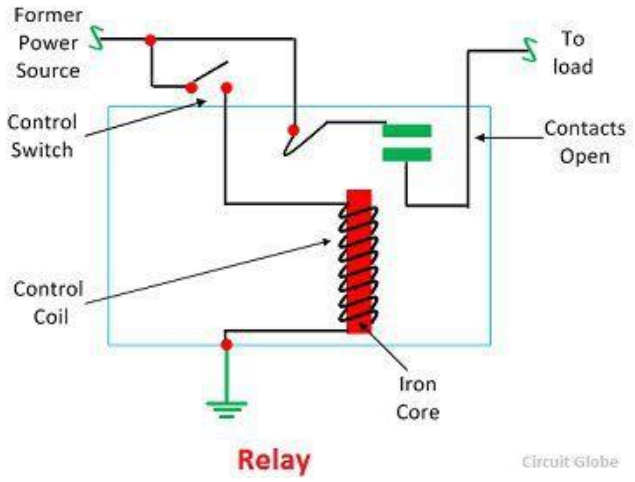

Fig. 2.12 Circuit Diagram of Relay

This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch. The inner section of the relay is shown in the figure below. It has an iron core which is wound by a control coil.

The power supply is given to the coil through the contacts of the load and the control switch. The current flows through the coil produces the magnetic field around it.Due to this magnetic field, the upper arm of the magnet attracts the lower arm.

Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence open the contacts.

2.2 Assembly of Project

Project is assemble on a ply board. Four wheels are connect with all four corners. Two wheels that's on front side of board and two wheels are connected with back side of ply board. Front side wheels are free to move while back side wheels are connected with motors. These motors are dc shunt motors.

Movement of motors is controlled by a motor driver. This motor driver is programed with Arduino software and power supply is received from the 12 volt battery.

Two batteries are used one battery is of 12 volt and other battery is of 8 volt and these Batteries also have a 12 to 5 volt convertor and a 8 to 5 volt convertor because some devices are used 12 volt supply and some used 5 volt supply. The classification of 12v and 5v supplies is given below-

- **5V operated devices**
  - Ardiuno
  - Node MCU
  - Ultrasonic sensor
  - Water pump

- **12v operated devices**
  - Motors
  - Wiper motor
  - Vacuum cleaner

First we connected all devices with their required supplies. Some devices require relay for operation so we connect with relay to the devices. There are three relays are used in this project these relays are connected with the devices. Relay receives three input wires these wires connected with supply, ground and one with Arduino 1.

- **Relays connection with device**

Relay 1	Water Pump (5v)
Relay 2	Wiper (12v)
Relay 3	Vacuum Cleaner (12v)

Two wheels operate with dc motors and these dc motors are operated with the motor driver L293D the motor driver use Arduino programming and pin connection.

In Arduino software digital write pin is used for providing input. For operation of motor driver we provide input to motor driver from the Arduino digital write pin. Different pins are assigned for the operation of Arduino. The pin used is given below –

Digital write pins of Arduino	**Pin of L293D**
D6	M1b
D5	M1a
D8	M2b
D7	M2a

There are two Arduino nano used and these are nominated with arduino 1 and arduino 2. Arduino 1 is used for the programming of three relays and is operate at a voltage of 5v. This is programmed with the Arduino software.

This is also connected with the node MCU for IOT connection. Second Arduino is used for the programming of motor driver. Motor driver is programmed for the motion control of dc motors. When ultrasonic sensor send signal to the Arduino then as per the turn number motor driver operate motors for right turn or left turn and then motor move forward.

Node MCU is used for the IOT control of floor cleaner. This node mcu is programed with the Arduino software. Node MCU is connected with Blynk app. When internet is connected to node MCU and Blynk app is operate then we can control the four circuits.

Pin of node MCU	**Connection**
D0	vacuum cleaner
D1	water pump
D2	wiper motor
D3	motor driver

All devices are assemble and placed their most suitable place. Figure of project is given below-

- **Circuit Diagram**

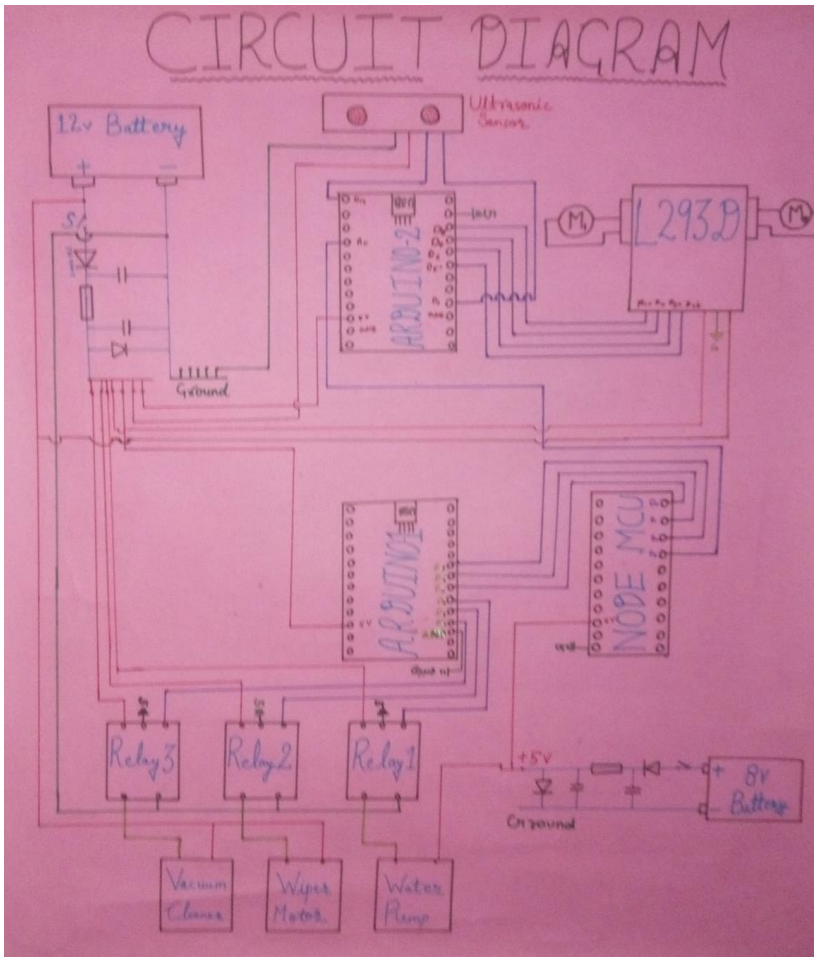

Fig. 2.2.1 Circuit Diagram

- **Project Picture**

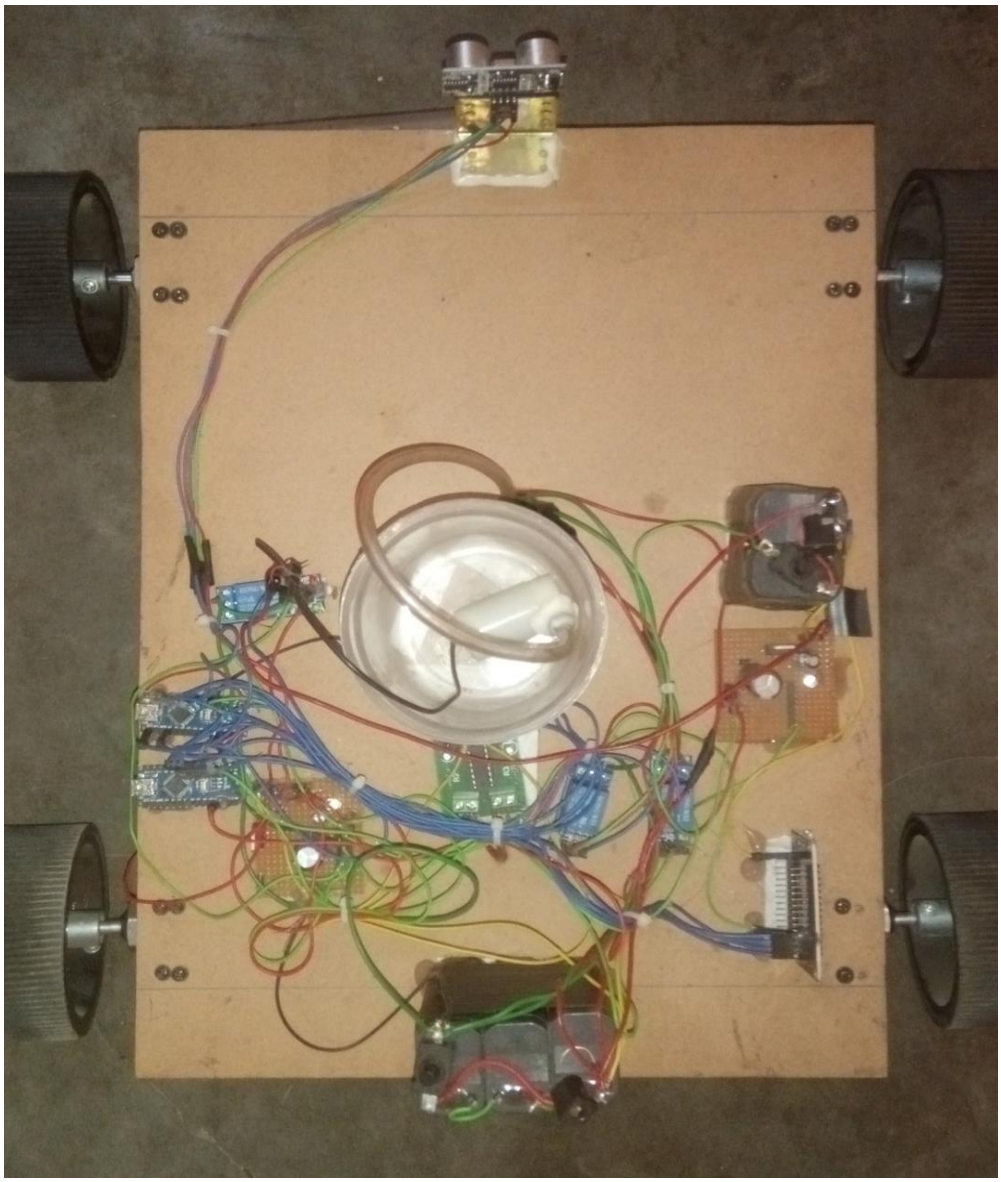

Fig 2.2.2 Floor Cleaning Robot

CHAPTER 3

SOFTWARE DESCRIPTION

3.1 Programming for Arduino Nano 1

We know that there are two Arduino Nano used in this project. Function of first Arduino Nano is to driven water pump, wiping motor and vacuum cleaner. The programming for this is mention below-

```
void setup()
{
 // initialize serial communication:
PinMode(5, OUTPUT);
pinMode(6, OUTPUT);
pinMode(7, OUTPUT);
pinMode(8, OUTPUT);
digitalWrite(5, HIGH);
digitalWrite(6, HIGH);
digitalWrite(7, HIGH);
 pinMode(2, INPUT);
 digitalWrite(2, HIGH);
 pinMode(3, INPUT);
digitalWrite(3, HIGH);
pinMode(4, INPUT);
digitalWrite(4, HIGH);
}
void loop()
```

```
{
 if(digitalRead(2)==1)
  {
digitalWrite(5, LOW);
}
if(digitalRead(2)==0)
{
digitalWrite(5, HIGH);
}
if(digitalRead(3)==1)
{
digitalWrite(6, LOW);
}
if(digitalRead(3)==0)
{
digitalWrite(6, HIGH);
}
if(digitalRead(4)==1)
{
digitalWrite(7, LOW);
}
if(digitalRead(4)==0)
digitalWrite(7, HIGH);
}
```

This program is make for the operation of relay module connected with the water pump, wiper motor and vacuum cleaner.

3.2 Programming for Arduino Nano 2

Arduino nano 2 is programmed for operate the motor driver. Motor driver receive input functioning from the Arduino Nano 2 and move the wheels. Programing for Arduino Nano 2 is given below.

```
const int trigPin = 2;

const int echoPin = 13;

int l=0, r=1;

int rounds=0;

int sem = 0;

void setup()

{

// initialize serial communication:

analogWrite(3, 180);

Serial.begin(9600);

pinMode(5, OUTPUT);

pinMode(6, OUTPUT);

pinMode(7, OUTPUT);

pinMode(8, OUTPUT);

digitalWrite(5, LOW);

digitalWrite(6, LOW); //left motor

digitalWrite(7, LOW);

digitalWrite(8, LOW); // right moto

 pinMode(A0, INPUT);
```

```
digitalWrite(A0, HIGH);
}
void loop()
{
// establish variables for duration of the ping,
// and the distance result in inches and centimeters:
long duration, inches, cm;
while(digitalRead(A0)==0)
{
// The sensor is triggered by a HIGH pulse of 10 or more microseconds.
// Give a short LOW pulse beforehand to ensure a clean HIGH pulse:
pinMode(trigPin, OUTPUT);
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
// Read the signal from the sensor: a HIGH pulse whose
// duration is the time (in microseconds) from the sending
// of the ping to the reception of its echo off of an object.
pinMode(echoPin, INPUT);
duration = pulseIn(echoPin, HIGH);
// convert the time into a distance
inches = microsecondsToInches(duration);
```

```
cm = microsecondsToCentimeters(duration);
Serial.print(inches);
Serial.print("in, ");
Serial.print(cm);
Serial.print("cm");
Serial.println();
delay(500);
if(cm>50 )
{
digitalWrite(5, LOW);
digitalWrite(6, HIGH); //left motor
digitalWrite(7, LOW);
digitalWrite(8, HIGH); // right motor
Serial.println("fwd");
while(rounds>3)
{
Serial.println("rounds complete press reset");
digitalWrite(5, LOW);
digitalWrite(6, LOW); //left motor
digitalWrite(7, LOW);
digitalWrite(8, LOW); // right motor
}
}
```

```
while(cm<=50 && rounds<5)
{
if(l == 0  && sem ==0)
{
Serial.println("go dir1 u turn and stop");
rounds++;
Serial.print("rounds: ");
Serial.println(rounds);
digitalWrite(5, LOW);
digitalWrite(6, HIGH); //left motor
 digitalWrite(7, HIGH);
 digitalWrite(8, LOW); // right motor
delay(5000);
 digitalWrite(5, LOW);
 digitalWrite(6, HIGH); //left motor
 digitalWrite(7, LOW);
 digitalWrite(8, HIGH); // right motor
 delay(1500);
 digitalWrite(5, LOW);
 digitalWrite(6, HIGH); //left motor
 digitalWrite(7, HIGH);
 digitalWrite(8, LOW); // right motor
delay(5000);
 digitalWrite(5, LOW);
```

```
 digitalWrite(6, LOW); //left motor
 digitalWrite(7, LOW);
digitalWrite(8, LOW); // right motor
l=1
break;
}
if(r == 1  && sem ==0)
{
Serial.println("go dir 2 u turn and stop");
r=1;
l=0;
sem=0;
rounds++;
digitalWrite(5, HIGH);
digitalWrite(6, LOW); //left motor
digitalWrite(7, LOW);
 digitalWrite(8, HIGH); // right motor
 delay(5000);
 digitalWrite(5, LOW);
 digitalWrite(6, HIGH); //left motor
 digitalWrite(7, LOW);
digitalWrite(8, HIGH); // right motor
delay(1500);
digitalWrite(5, HIGH);
```

```
digitalWrite(6, LOW); //left motor

digitalWrite(7, LOW);

digitalWrite(8, HIGH); // right motor

delay(5000);

digitalWrite(5, LOW);

digitalWrite(6, LOW); //left motor

gitalWrite(7, LOW);

digitalWrite(8, LOW); // right motor

break;


 }

 }

  }

 While (digitalRead(A0)==1)

 {

Serial.println("iot off");

digitalWrite(5, LOW);

digitalWrite(6, LOW); //left motor

digitalWrite(7, LOW);

digital Write(8, LOW); // right motor

}

}

long microseconds To Inches (long microseconds)
```

{

// According to Parallax's datasheet for the PING))), there are

// 73.746 microseconds per inch (i.e. sound travels at 1150 feet per

// second). This gives the distance travelled by the ping, outbound

// and return, so we divide by 2 to get the distance of the obstacle.

return microseconds / 74 / 2;

}

long microsecondsToCentimeters(long microseconds)

{

// The speed of sound is 340 m/s or 29 microseconds per centimeter.

// The ping travels out and back, so to find the distance of the

// object we take half of the distance travelled.

return microseconds / 29 / 2;

}

3.3 Programing for Node MCU

Node MCU is also programmed by Arduino Nano software. Node MCU is used to receive signal from Blynk App

0#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>

// Authorization token from the Blynk App.

char auth[] = "d01d138837df429eaa8269b0360fe2e6";

// Your Wi Fi credentials;

// Set password to "" for open networks.

```
char ssid[] = "Qadir";

char pass[] = "1234567890";

const int sensorPin= A0; //sensor pin connected to analog pin A0

float lock;

void setup()

{

Serial.begin(9600);

Blynk.begin(auth, ssid, pass);

pinMode(sensorPin, INPUT);

Blynk.virtualWrite(V0, lock);

Blynk.run();

}

void loop()

{

lock = analogRead(sensorPin);

Serial.println(lock);//This will print the liquid level in the monitor

Blynk.virtualWrite(V0, lock);

delay(100);

Blynk.run();

}
```

CHAPTER-4

WORKING OF PROJECT

4.1 Working

Floor cleaning robot has two switch that are connected with two batteries. First step is to on both switches and connected Wi Fi with node MCU and make whole circuit online with Blynk app. When we give signal from Blynk app to start motion than a Forword motion will start by the program set by the Arduino Nano.

Project has three more switch from Blynk app. First switch is connected with water pump second one is connected with water pump and third one is connected with vacuum cleaner. we can control the all three switch from Blynk app as per the requirement of the cleaning.

When switch D3 turn ON from the Blynk app then the wheel start to move to forward direction. If any obstacle or wall come in front of robot than ultrasonic sensor receive the signal and send information to Arduino Nano than wheels start to turn. This turn is move towards left if round is even and move to left if round is odd than robot turn to right.

We have need to analyse the dimension of room and then set number of turn in Arduino software programming. For motion straight or turning to left or right we have to connection the motor driver to Arduino Nano software and setting low or high the pins D5, D6, D7, D8. These pin are set in program as given below-

- **For straight forward motion**

Pin name	**State**
D5	low
D6	high
D7	low
D8	high

- **For turn right motion**

D5	high
D6	low
D7	low
D8	high

- **For turn left motion**

D5	low
D6	high
D7	high
D8	low

4.2 Methodology

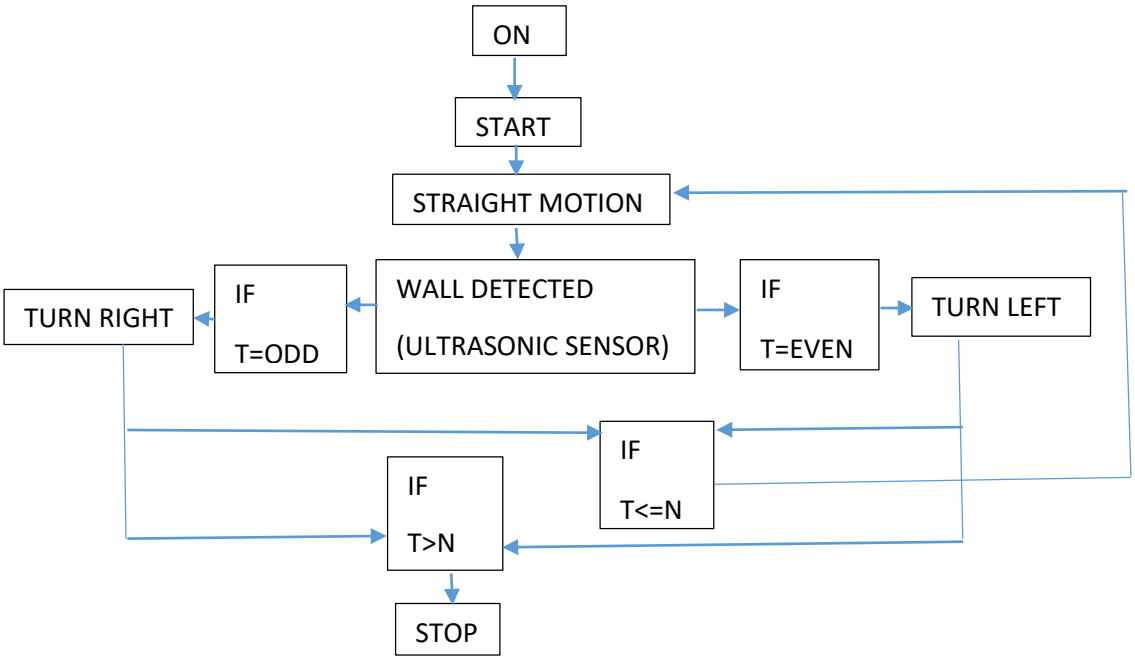

Fig. 4.1 Methodology

Where

T= turn number

N= total turn set in programing

CHEPTER – 5

RESULT

5.1 RESULT

As a result of this autonomous IOT based floor cleaning robot, the function of each part is working well and the whole system is successfully accomplished. This perform well the working of movement in a whole room direction and make cleaning of the room.

The ranging accuracy of ultrasonic sensor in this prototype is about 20cm to 2m and works effectively within the prescribed limit of 50 cm range.

5.2 FINAL OVERVIEW OF PROJECT

In this project, we have checked the working of our project, we connected it with a batteries and whose cleaning and moving system is controlled by a DC gear motor and pump. This technique is eco-friendly and this work is an attempt to reduce accidents while in critical driving conditions. We have tested the working of the system by placing various objects ahead as obstacles.

The system responded by reducing the speed of the vehicle when the obstacle is placed at various distances from it. Also system properly perform the cleaning via vacuum cleaner and wiper motor and this process is properly controlled by internet of things. Controlling of system via Blynk app is properly working.

APPLICATION

Floor cleaning robot is developed to make floor cleaning process easier. This can be used in power plant like nuclear power plants because in that places the harmful radiations is placed and cause serious health problems.

To avoiding this we can send a robot to perform the whole operation. In colleges and other places where large floor area is present we can use floor cleaning robot to clean that areas. In industries we required cleaning in large areas as well as small areas and both areas can be clean without need of personnel. By this we can save money and time.

The Android app is generally developed using JAVA language. The app controlling this vacuum robot can be built without having the knowledge in java language. It is called as "VBot211" developed by MIT App Inventor. Shown below is a diagram which shows the interface of the app.

In this way, some functional requirements that would improve the robot performance were not taking into account due either to their inherent complexity or to their mechanical implications. These robots operate semi- or fully autonomously to perform services useful to the well-being of humans and equipment. With the aim of keeping our robot as simple as possible, while able to perform the initial goals, i.e. an autonomous vacuum cleaner robot able to randomly navigate through a room or a house with the minimum human assistance, the following specifications were found:

FUTURE SCOPE

This robot can modified in future for a better effective work and multipurpose. Efficiency of cleaning can be improve. By using IR sensor and to add other features we can make a device that perfectly work for cleaning. If we add a timer than it can work for a special time with starting automatically.

This floor cleaning robot is limited to clean floor stairs cannot be cleaned by this so it can be modified for cleaning of stairs. This robot can be modified for cleaning of more than one room by one robot. This robot cannot clean circular room we can programmed for cleaning every shaped room. So these are the future scope of floor cleaning robot

CONCLUSION

We have successfully completed the autonomous IOT based floor cleaning robot model prototype and this project presents the implementation of an Automatic cleaning System controlled by Internet of Thing, but the speed of the vehicle can be reduced automatically due to the sensing of the obstacles.

It reduces the accident levels and tends to save the lives of so many people. By doing this project practically we gained the knowledge about working of automatic braking system and with this future study and research.

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

Hence we believe that the incorporation of all components in Automatic Braking System will maximize safety and also give such system a bigger market space and a competitive edge in the market.

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