

MEDICAL ASSISTANCE ROBOT FOR FLOOR SANITIZING

Submitted in fulfillment of the requirements for the award of
Bachelor of Engineering degree in Mechatronics

by

Buvaneswaran.S (39090006)

Navin.I (39090031)



**DEPARTMENT OF MECHATRONICS
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**

MAY - 2023

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **Buvaneswaran.S (39090006)** and **Navin.I (39090031)** who have done the project work entitled "**Medical Assistance Robot For Floor Sanitizing**" under our supervision from June 2022 to May 2023.

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DECLARATION

We **Buveneswaran.S (39090006)** and **Navin.I (39090031)** hereby declare that the Project Report entitled “**Medical Assistance Robot For Floor Sanitizing**” done by us under the guidance of **Dr.S.Sivasaravanan M.B.A., M.E., Ph.D.** is submitted in fulfillment of the requirements for the award of Bachelor of Engineering degree in Mechatronics.

1. 

2. 

DATE: ____ May 2023

PLACE: Chennai, Tamil Nadu

SIGNATURE OF THE CANDIDATES

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to the Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to Dr.S.Prakash, M.E., Ph.D., Dean, School of Mechanical engineering and Head of the Department, Department of Mechatronics for providing me necessary support and details at the right time during the progressive reviews.

I Would like to express my sincere and deep sense of gratitude to my Project Guide Dr.S.Sivasaravanan M.B.A., M.E., Ph.D for his valuable guidance, suggestions and constant encouragement paved the way for the successful completion of my project work.

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

ABSTRACT

In recent years, there has been a growing demand for automated cleaning technologies that can effectively sanitize surfaces in public spaces, especially in the wake of the COVID-19 pandemic. The floor sanitizing robot is one such technology that has gained popularity due to its ability to clean and disinfect floors without human intervention. This robot is designed to be user-friendly and efficient, with a compact and lightweight design that allows it to easily move around and clean even in hard-to-reach areas. It is equipped with powerful cleaning tools, such as brushes and nozzles, that can effectively remove dirt and grime from various types of floors, including tiles, hardwood, and carpets. The robot uses advanced sensors to detect obstacles and adjust its cleaning path accordingly, making it a safe and reliable cleaning solution for public spaces. It can be programmed to operate during off-hours, ensuring that it does not interfere with normal activities in the area being cleaned. Overall, the floor sanitizing robot is an important technology that can help maintain hygiene and cleanliness in public spaces, especially during times of heightened concern for public health and safety. Its efficient cleaning capabilities, combined with its ease of use and advanced features, make it a valuable tool for facility managers and cleaning professionals. To address the need of the World Wellbeing Association and the guaranteed disinfecting framework is an answer for faculty and surface sterilization. To conquer the issue created programmed convenient disinfecting hardware for showering sterilization arrangements. The convenient sanitizer unit is connected to the top of the versatile robot.

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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
V	VOLTAGE
PWM	Pulse Width Modulation
AC	ALTERNATING CURRENT
DC	DIRECT CURRENT
ICSP	In-Circuit Serial Programming
VIN	Voltage In
SPP	Serial Port Protocol
EDR	Enhanced Data Rate
LED	LIGHT EMITTING DIODE

CHAPTER 1

INTRODUCTION

Recently, people figured out the meaning of sanitization and the upsides of disinfection. The pandemic truly influenced the demeanor of people and their view on sanitization. Cleansing accepts a basic part in holding us back from being introduced to various dangerous contaminations and illnesses . Clinical facilities are one among the spots which are expected to have been stayed aware of cleanness and freed from pollution. Cleansing in those areas are expected to have been significantly checked and stayed aware of no naughtiness.

With the risks of microorganisms and microbial contamination increasing in public spaces like schools, universities, public restrooms, and clinics, the need for a reliable cleaning component is becoming an absolute necessity. This can save the lives of cleaning staff who are involved in the sanitization and tidying process and are more likely to become harmed by these harmful microorganisms which can affect their body functioning and occasionally cause death. Many janitors lose their lives every year throughout the world as a result of being harmed by these bacteria. Numerous automated cleaning and sanitising devices that are currently available are designed to operate independently but are either unable to continuously clean the most severely polluted areas or can only do so in a simple manner. The Independent Sanitization System proposed is designed to operate in both programmed and manual modes depending on the manner in which it is expected to cover and disinfect with the capacity to include as much surrounding floor surface and wall as is physically possible, without involving people in the cleaning process right away. The robot can play a crucial role in the situation of a continuous epidemic. It reduces human participation in every area, from patient assessment to the system for tranquillizer delivery. Also, health associations received training on how to steer clear of prominently crown-positive individuals. It is the finest test for clinical benefits support staff and subject-matter specialists. The public authority and medical professionals are constantly working to protect people from defilement and polluted persons. There are many crisis centres set up during this pandemic. The main problem is a labour shortage, and for a number of

clinical reasons, people are hesitant to enter the patient room. Sadly, traditional clinical facilities must keep their floors clean to maintain tidiness and to combat illness. We considered building a robot to clean the floors and make the task of a human being less and even more simple to undertake in response to the problems encountered in these locations.

There are different types of medical assistance robots for floor sanitizing, each with its own unique features and capabilities. Some robots use ultraviolet (UV) light to disinfect floors, while others use chemical sprays or high-powered suction to remove dirt and debris. Some robots are equipped with sensors that allow them to detect obstacles and adjust their cleaning patterns accordingly, while others have the ability to map out a hospital floor and navigate autonomously.

However, implementing medical assistance robots for floor sanitizing in healthcare facilities can come with its own set of challenges. For example, hospitals may need to reconfigure their floor plans or make changes to their cleaning protocols to accommodate the robots. There may also be concerns around privacy and security, as robots may need access to sensitive areas of the hospital.

Despite these challenges, medical assistance robots for floor sanitizing are a promising technology that has the potential to improve healthcare outcomes and reduce healthcare costs. This report will provide a comprehensive overview of these robots and their potential impact on the healthcare industry.

1.1 ADVANTAGES OF SANITIZING ROBOT

- **Efficiency:** Sanitizing robots are highly efficient in cleaning and disinfecting spaces. They are designed to cover large areas quickly and can work continuously without the need for breaks or rest.
- **Consistency:** Unlike humans, sanitizing robots can maintain a consistent level of cleaning and disinfecting. They can follow a pre-programmed route, ensuring that every inch of a space is thoroughly cleaned.

- **Safety:** Sanitizing robots are designed to work in hazardous environments, such as areas contaminated by pathogens or chemicals. They can be used to disinfect high-risk areas without exposing humans to potential harm.
- **Cost-effective:** In the long run, sanitizing robots can be cost-effective. They require minimal maintenance and can reduce the need for human labor. They can also help businesses avoid the costs associated with closures due to outbreaks or contamination.
- **Accuracy:** Sanitizing robots can detect and target specific areas that require cleaning and disinfecting, ensuring that no spot is missed. They can also adjust their cleaning methods based on the type of surface they are cleaning, using the appropriate amount of disinfectant for each surface.

1.2 DISADVANTAGES OF SANITIZING ROBOT

- **Limited effectiveness:** While sanitizing robots can help reduce the spread of germs and viruses, they may not be as effective as manual cleaning in certain situations, such as in hard-to-reach areas or on heavily soiled surfaces.
- **Dependence on technology:** Sanitizing robots rely heavily on technology, which means they may malfunction or require frequent repairs, leading to downtime and additional expenses.
- **Safety concerns:** Sanitizing robots can be dangerous if they malfunction or come into contact with people or objects, which may lead to injuries.
- **Lack of human touch:** While sanitizing robots can save time and effort, they lack the human touch that is often necessary for certain cleaning tasks, such as identifying and addressing specific problem areas.
- **Environmental impact:** The production and disposal of sanitizing robots may have an environmental impact, which can be a concern for those who prioritize sustainability.
- **Cost:** Sanitizing robots can be expensive to purchase and maintain, which may not be feasible for smaller businesses or individuals.

Overall, while sanitizing robots have their advantages, it's important to consider their disadvantages before deciding if they are the right solution for your cleaning needs.

1.3 TYPES OF CLEANING ROBOTS

1.3.1 Floor cleaning robots

Robotic floor cleaners are now widely used. They have the independence to Hoover, mop, and polish floors. The population is now considerably more aware of cleanliness thanks to the pandemic. It has increasingly been the determining factor for many individuals when picking where to eat or stay the night. However, the advantages of cleaning robots for restaurants, hotels, and conference centres go beyond just their ability to keep spaces clean and lighten the workload of workers. Robotic floor cleaners are efficient labour savers, but they cannot function totally on their own. On mopping robots, an operator is still required to change cleaning agents and empty the dirty water container. A worker is required to empty the robots' dustbins. The bot needs to be taught the layout of the building.



Fig: 1.1 : Floor cleaning robots.

1.3.2 Pool Cleaning Robots:

The technology of robotic pool cleaning is well-established, and there are several vendors to select from. The robots can cover the entire pool thanks to their sophisticated navigation. To remove dirt, trash, and algae, they have brushes on board. Many provide remote control. Commercial pool cleaners include an electrical cord to supply power for large pools. Models that run on batteries are available and have varying runtimes between charges. Human assistance is still required, though. An operator must clean the pool cleaning robots. They fill a container that needs to be emptied with debris and filth.



Fig: 1.2 : Pool Cleaning Robot

1.3.3 Bathroom Cleaning Robots:

Bathroom cleaning robots are still in their infancy on the market. Cleaning products are available with "touch-free" systems. It is a multipurpose device with a power spray as its first function. The unclean water is then removed using a Hoover as the next step. The apparatus employs a fan to dry everything off in the end. One portable machine contains all of this. Without a doubt, this reduces labour costs and spares workers from having to crouch down and clean. Yet a cleaning worker must still utilise the gadget. At the time of this writing, there seems to be just one seller with a genuinely autonomous solution. The three steps above are carried out by the robot. But it does so without a person being involved. Videos demonstrate the robot vacuuming and spraying a bathroom on its own. It has a tool-changing robot arm. Hence it may make use of a brush, a Hoover, and a power-sprayer. The robot arm doesn't seem to be able to reach under the toilet. The robot can only manage a certain variety of urinals and toilets. Instead of being sold as a product, it is presented as a monthly service.



Fig: 1.3 : Bathroom Cleaning Robot

1.3.4 Solar Panel Cleaning Robots :

The frequency of cleaning solar panels is a topic of discussion. Every six months appears to be the general agreement. Of course, where you are determines how this works. Solar panels lose efficiency when they get dirty, that much is known. It's critical to have a cheap method for cleaning the panels. Solar panels would be harmed if somebody walked on top of them. Also, the panels are frequently located on rooftops or in other difficult-to-access areas. There are many manufacturers selling robotic solar panel cleaning agents, which are in use all over the world. The robots employ a dry system with brushes or a microfiber cloth in arid environments. Robots that clean solar panels are available, each of which carries a tank of cleaning solution. Others feature a tube that runs from the cleaning agent to the appliance. Certain models can move over panels that are slanted. The majority of these options merely provide some autonomy. The unit requires supervision and is frequently operated remotely by an operator. The robot may occasionally need to be hoisted into place using a crane.



Fig:1.4 : Solar Panel Cleaning Robot

1.3.5 Street Cleaning and Garbage collecting Robot:

The majority of the ideas are still in their infancy for outdoor applications. Robotic garbage collectors are starting to show up to clean beaches and parks. Yet, the majority of the alternatives lack autonomy. Instead, an operator can control them remotely from up to 300 metres distant. Pilot trials have produced encouraging results, and autonomous street cleaning robots are currently being investigated. The safety certificates, however, are not currently in place. Rivers and other bodies of water are cleaned by floating robots that collect trash. Also, they are still in the beginning phases. The majority of these robots are human-operated cleaning devices.



FIGURE: 1.5 : Street cleaning and Garbage collecting robot

1.3.6 Window Cleaning Robot:

Window cleaning robots are innovative devices designed to clean windows automatically, without the need for human intervention. These robots work by attaching themselves to the window and moving up and down, while cleaning the surface using rotating brushes or microfiber pads.

Window cleaning robots are ideal for cleaning high-rise buildings, commercial establishments, and homes with large, hard-to-reach windows. They are equipped with advanced technology, including sensors and algorithms, that enable them to detect the edges of the window and avoid obstacles.

Popular window cleaning robots in the market include Winbot, Hobot, and Ecovacs. These robots typically come with a rechargeable battery, cleaning pads, and a cleaning solution that is sprayed onto the window as the robot cleans. In summary, window cleaning robots are a convenient, safe, and efficient way to keep your windows clean and sparkling. They are equipped with advanced technology that makes window cleaning easy and hassle-free.



Fig: 1.6: Window Cleaning Robot

1.3.7 Air Purifier Robots:

Air purifier robots are innovative devices designed to clean the air in your home or office using advanced filtration systems to remove pollutants like dust, pollen, smoke, and pet dander. These robots come with a range of features and benefits, including various types of filtration systems, sensors, air quality monitoring, smart controls, and portability. Some models can be controlled via mobile apps or voice commands and integrated with smart home systems. When choosing an air purifier robot, consider factors such as maintenance, noise level, coverage area, price, and energy efficiency. These robots typically come with rechargeable batteries, air filters, and a range of sensors and controls to help you monitor and adjust the air cleaning process. In summary, air purifier robots are a great solution for maintaining healthy indoor air quality. They come with various features and benefits to make your life easier, such as advanced filtration systems, sensors, air quality monitoring, smart controls, and portability. When choosing an air purifier robot, consider factors such as filtration systems, maintenance, noise level, coverage area, price, integration with smart home systems, and energy efficiency.



Fig: 1.7: Air Purifier Robot

CHAPTER 2

LITERATURE SURVEY

Abhishek Pandey et al (2014) The authors begin by defining autonomous home cleaning robots and their basic components, such as sensors, actuators, and control systems. They then discuss the different types of cleaning robots, including robotic vacuums, mops, and window cleaners, and provide an overview of their features, advantages, and limitations. The paper also covers the various technologies used in cleaning robots, such as vision-based systems, laser-based sensors, and mapping algorithms. The authors examine the challenges involved in designing these robots, such as obstacle avoidance, navigation, and battery life, and discuss the strategies used to address them. Finally, the authors conclude the paper by summarizing the key findings and highlighting the potential for future research in this area.

Acharya, U. R et al (2018) The paper starts with an introduction to CHF, its prevalence, and the importance of early diagnosis. The authors then explain the process of collecting ECG data and preprocessing it for use in their DCNN model. They also describe the architecture of the DCNN model and the training process used to optimize its parameters. The authors evaluate the performance of their model using a dataset of 2,827 ECG recordings, consisting of 1,295 CHF cases and 1,532 normal cases. The results show that their model achieved an accuracy of 98.98%, a sensitivity of 99.08%, and a specificity of 98.87% in correctly classifying the ECG signals. Finally, the authors conclude the paper by summarizing their findings and discussing the potential impact of their approach in the early diagnosis of CHF.

Alnasser. H. et al (2021) The paper proceeds with an introduction to the COVID-19 pandemic and its impact on healthcare facilities. The authors then describe the design and development of their autonomous floor cleaning robot, which utilizes sensors and mapping algorithms to navigate and clean floors without human intervention. The authors evaluate the performance of their robot in a simulated hospital environment, testing its ability to navigate, detect obstacles, and clean floors effectively. The results show that the robot is capable of cleaning floors

autonomously, with an average cleaning efficiency of 98%. Finally, the authors conclude the paper by summarizing their findings and discussing the potential applications of their autonomous cleaning robot in healthcare facilities during the COVID-19 pandemic and beyond.

Chen.X et al (2020) The paper starts with an introduction to the growing popularity of mobile health applications and the importance of accurate and efficient recognition of medical signs for diagnosis and treatment. The authors then describe the system architecture and the different components of the system, such as image preprocessing, feature extraction, and classification. The authors evaluate the performance of their system using a dataset of 6,600 images of Chinese medical signs. The results show that their system achieved an accuracy of 92.78% in recognizing and classifying the signs correctly. Finally, the authors conclude the paper by summarizing their findings and discussing the potential applications of their system in mobile health. They suggest that their approach can be used to improve the accuracy and efficiency of medical diagnosis and treatment, particularly in resource-limited settings where access to healthcare professionals and facilities may be limited.

Choudhury.B et al (2020) The paper starts with an introduction to the COVID-19 pandemic and the importance of surface disinfection in preventing the spread of the virus. The authors then describe the design and development of their robot, which utilizes a UV light source mounted on a mobile platform to disinfect floors in medical facilities. The authors evaluate the performance of their robot in a laboratory setting, testing its ability to sanitize surfaces effectively. The results show that the robot is capable of sanitizing surfaces using UV light, with a disinfection rate of up to 99.9%. The authors conclude the paper by summarizing their findings and discussing the potential applications of their UV disinfection robot in medical facilities during the COVID-19 pandemic and beyond. They suggest that such robots can help reduce the risk of infection for healthcare workers and patients while improving the overall cleanliness and sterility of medical facilities.

Kelly.J et al (2019) The article provides an overview of socially assistive robotics for active aging. The authors note that the aging population is rapidly increasing, and there is a need for technology that can support and assist older adults in their daily lives. Socially assistive robots (SARs) have the potential to improve the quality of life for older adults by providing social companionship, cognitive and physical assistance, and healthcare monitoring. The authors categorize SARs into three main types: cognitive, physical, and social. Cognitive SARs provide assistance with cognitive tasks such as memory and decision-making. Physical SARs assist with activities of daily living (ADLs) such as bathing, dressing, and medication management. Social SARs provide companionship and emotional support. The article discusses various SARs that have been developed for older adults, including the Paro seal robot, the NAO humanoid robot, and the GiraffPlus system. The authors note that these SARs have shown promising results in improving social engagement, cognitive functioning, and physical activity in older adults. The article also discusses challenges and considerations for the development and deployment of SARs for older adults, including privacy and ethical concerns, design considerations for ease of use, and the importance of user-centered design.

Lee.D.D et al(2018)The authors note that maintaining a clean and sterile environment is crucial in hospitals to prevent the spread of infections and improve patient outcomes. They argue that a service robot can reduce the workload of cleaning staff and improve the overall cleanliness of hospital environments. The robot is designed to navigate autonomously and perform various tasks, including sterilization and cleaning. It is equipped with various sensors, including a laser range finder and depth camera, which enable it to detect obstacles and navigate around them. The robot is controlled using a computer, which allows for remote monitoring and control. The authors conducted experiments to evaluate the performance of the robot in terms of sterilization and cleaning effectiveness and navigation capabilities. The results showed that the robot was able to effectively sterilize surfaces using UV-C light and clean floors using a combination of brushes and suction while avoiding obstacles and navigating through complex environments. The robot's ability to navigate autonomously and perform various tasks, including sterilization and cleaning, makes it a promising solution for

improving the hygiene and cleanliness of hospital environments while reducing the workload of cleaning staff.

Pandey.R et al (2020) The paper starts with an introduction to the need for disinfection and the challenges faced by hospitals in maintaining a clean environment. The authors then describe the design and development of their autonomous floor sanitizing robot, which utilizes a combination of ultraviolet light and chemical disinfectant spray to sanitize floors. The authors evaluate the performance of their robot in a hospital setting, testing its ability to navigate and sanitize floors effectively. The results show that the robot is capable of sanitizing floors autonomously, with an average cleaning efficiency of 98.7%. Finally, the authors conclude the paper by summarizing their findings and discussing the potential applications of their autonomous floor sanitizing robot in hospitals. They suggest that such robots can help reduce the workload of cleaning tasks and minimize the risk of infection for healthcare workers and patients. The authors also highlight the need for further optimization and development of autonomous disinfection robots to improve their performance and functionality.

Park.J et al (2011) The authors note that maintaining a clean and hygienic environment is crucial in hospitals to prevent the spread of infections and improve patient outcomes. They argue that a service robot for floor cleaning can reduce the workload of cleaning staff and improve the overall cleanliness of hospital environments. The robot is designed to navigate autonomously and clean floors using a combination of brushes and suction. It is equipped with various sensors, including a laser range finder and ultrasonic sensors, which enable it to detect obstacles and navigate around them. The robot is controlled using a microcontroller and a computer, which allows for remote monitoring and control. The authors conducted experiments to evaluate the performance of the robot in terms of cleaning effectiveness and navigation capabilities. The results showed that the robot was able to effectively clean floors while avoiding obstacles and navigating through complex environments. Overall, the article provides valuable insights into the design of a service robot for floor cleaning in hospitals. The robot's ability to navigate autonomously and clean floors using a combination of brushes

and suction makes it a promising solution for improving the hygiene and cleanliness of hospital environments while reducing the workload of cleaning staff.

Raveena Ishalavath.M(2020) The article you mentioned discusses the design and development of an automated floor cleaning robot for domestic applications. The authors note that traditional floor cleaning methods are time-consuming and labor-intensive, and an automated robot can reduce the workload and make cleaning more efficient. The robot is designed to clean floors using a combination of brushes and suction, and it is equipped with sensors, including ultrasonic sensors and a color sensor, which enable it to detect obstacles and navigate around them. The robot is controlled using an Arduino board and an Android application, which allows the user to select the cleaning mode and monitor the robot's progress. The authors conducted experiments to evaluate the performance of the robot in terms of cleaning effectiveness and navigation capabilities. The results showed that the robot was able to effectively clean floors while avoiding obstacles and navigating through complex environments. Overall, the article provides valuable insights into the design and development of an automated floor cleaning robot for domestic applications. The robot's ability to navigate autonomously and clean floors using a combination of brushes and suction makes it a promising solution for improving the efficiency and effectiveness of domestic cleaning processes. The inclusion of an Android application also adds an extra layer of convenience and control for the use.

Shakhawat Hossen Prayash.H.A et al (2019) The paper starts with an introduction to the concept of autonomous cleaning robots, their benefits and challenges, and the need for optimizing their design to achieve better performance. The authors then describe the design and development of their autonomous vacuum floor cleaning robot, which utilizes sensors and mapping algorithms to navigate and clean floors without human intervention. The authors evaluate the performance of their robot in a laboratory setting, testing its ability to navigate, detect obstacles, and clean floors effectively. The results show that the robot is capable of cleaning floors autonomously, with an average cleaning efficiency of 92%. Finally, the authors conclude the paper by summarizing their findings and discussing the potential applications of their autonomous cleaning robot in daily life. They suggest

that such robots can help reduce the workload of cleaning tasks and maintain a clean and healthy environment. The authors also highlight the need for further optimization and development of autonomous cleaning robots to improve their performance and functionality.

Venkatesan, R et al (2021) The article you mentioned focuses on the design and development of an autonomous sanitizing robot to combat the COVID-19 pandemic in hospitals. The authors highlight the need for effective disinfection protocols in hospitals to prevent the spread of the virus and reduce the risk of infection for healthcare workers and patients. The robot is designed to navigate autonomously and sanitize surfaces using a combination of UV-C light and a disinfectant spray. It is equipped with various sensors, including a LIDAR sensor, a camera, and an infrared temperature sensor, which enable it to detect and avoid obstacles, navigate around the environment, and identify areas that require sanitization. The robot is controlled through a web-based interface, which allows users to monitor its progress and set cleaning parameters such as cleaning time and the amount of disinfectant spray to be used. The authors also discuss the algorithms used for obstacle avoidance and path planning, as well as the design of the robot's hardware and software components. Overall, the article provides valuable insights into the design and development of an autonomous sanitizing robot specifically for combating the COVID-19 pandemic in hospitals. The robot's ability to sanitize surfaces using UV-C light and disinfectant spray, as well as its autonomous navigation capabilities, make it a promising solution for reducing the risk of infection in healthcare settings.

Yunbo Hong et al (2014) The article you mentioned presents the design and experimental results of the mopping module of a multifunction floor cleaning robot. The robot is designed to clean floors using a combination of sweeping, vacuuming, and mopping. The mopping module consists of a water tank, a microfiber mop pad, and a motor that drives the mop pad. The robot is equipped with sensors, including a laser range finder and an inertial measurement unit, which enable it to navigate autonomously and avoid obstacles while mopping the floor. The authors conducted experiments to evaluate the performance of the mopping module in terms of cleaning effectiveness and water usage. The results showed that the

module was effective in removing dirt and stains from the floor, and that the amount of water used was minimal compared to traditional mopping methods. The article also discusses the challenges encountered during the development process, such as optimizing the water usage and preventing the robot from slipping on wet surfaces. The authors suggest that further research is needed to improve the robot's mopping performance and develop more efficient and effective cleaning strategies. Overall, the article provides valuable insights into the design and experimental results of the mopping module of a multifunction floor cleaning robot. The module's ability to effectively clean floors while minimizing water usage makes it a promising solution for improving the efficiency and sustainability of floor cleaning processes.

Zhao.W et al (2021) The article you mentioned focuses on the design and development of a floor cleaning robot for hospital environments. The authors highlight the importance of maintaining a clean and hygienic environment in hospitals to prevent the spread of infections and improve patient outcomes. The robot is designed to navigate autonomously and clean floors using a combination of brushes and suction. It is equipped with various sensors, including ultrasonic sensors and a LIDAR sensor, which enable it to detect obstacles and navigate around them. The robot also includes a water tank and a cleaning solution tank, which allow for wet cleaning and disinfection of floors. The authors discuss the hardware and software components used in the robot's design, as well as the algorithms used for obstacle avoidance and path planning. They also present experimental results demonstrating the robot's cleaning effectiveness and navigation capabilities in a hospital environment. Overall, the article provides valuable insights into the design and development of a floor cleaning robot specifically for hospital environments. The robot's autonomous navigation and cleaning capabilities make it a promising solution for improving the hygiene and cleanliness of hospital floors while reducing the workload of cleaning staff. The inclusion of a cleaning solution tank also adds an extra layer of disinfection to the cleaning process.

CHAPTER 3

AIM AND SCOPE OF THE INVESTIGATION

3.1 . AIM

The aim of this project is to create an autonomous medical assistance robot for floor sanitizing that can navigate through healthcare facilities and effectively sanitize floors to reduce infection rates. The project will involve researching and implementing appropriate hardware and software solutions to achieve this goal. The final product will be a fully functional prototype robot capable of operating in a simulated or real-world hospital environment, ultimately improving patient care and facility operations.

3.2 . OBJECTIVE

- To design and build a prototype robot that is capable of autonomously sanitizing floors in a simulated or real-world hospital environment.
- To assess the impact of the robot on infection rates and overall cleanliness in healthcare facilities.

To refine and optimize the robot's design and functionality based on feedback from healthcare providers and patients, with the ultimate goal of improving patient care and facility operations.

3.3 . SCOPE OF THE PROJECT

- Designing and building a prototype robot that is capable of autonomously sanitizing floors in a simulated or real-world hospital environment.
- Assessing the impact of the robot on infection rates and overall cleanliness in healthcare facilities, as well as the potential cost savings and operational benefits.

CHAPTER 4

MATERIALS AND EXPERIMENTAL METHODS

4.1 COMPONENTS USED :

- Arduino UNO
- HC-05 Bluetooth Module
- Relay Module
- Water pump module
- Battery 12v
- Battery 9v
- DC Motor
- Motor driver
- Ultrasonic sensor

4.1.1 Arduino UNO

A microcontroller board called the Arduino Uno is based on the ATmega328. It contains 6 analogue inputs, a 16 MHz crystal oscillator, 14 digital input/output pins (of which 6 can be used as PWM outputs), a USB connection, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery. The FTDI USB-to-serial driver chip is not used by the Uno, which is how it differentiates from all earlier boards. Instead, it has an Atmega8U2 that has been configured to act as a USB-to-serial converter.

The power pins are as follows:

- VIN - This is the input voltage of the Arduino board when it is powered by an external source as opposed to the 5 volts supplied by the USB connection or another regulated power source. This pin can be used to feed voltage to or access voltage that has been supplied by the power jack.
- 5V - The regulated power supply supplies electricity to the board's microprocessor and other components. This can be received from VIN using an on-board regulator, or it can be supplied by USB or another regulated 5V source.

- 3V3, a 3.3 volt supply produced by an internal regulator. The permitted maximum current usage is 50 mA.
- Ground pin, or GND.

Table 4.1 :Arduino UNO Specifications

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage	7-12V (recommended)
USB Interface	ATmega16U2
Analog Input Pins	6

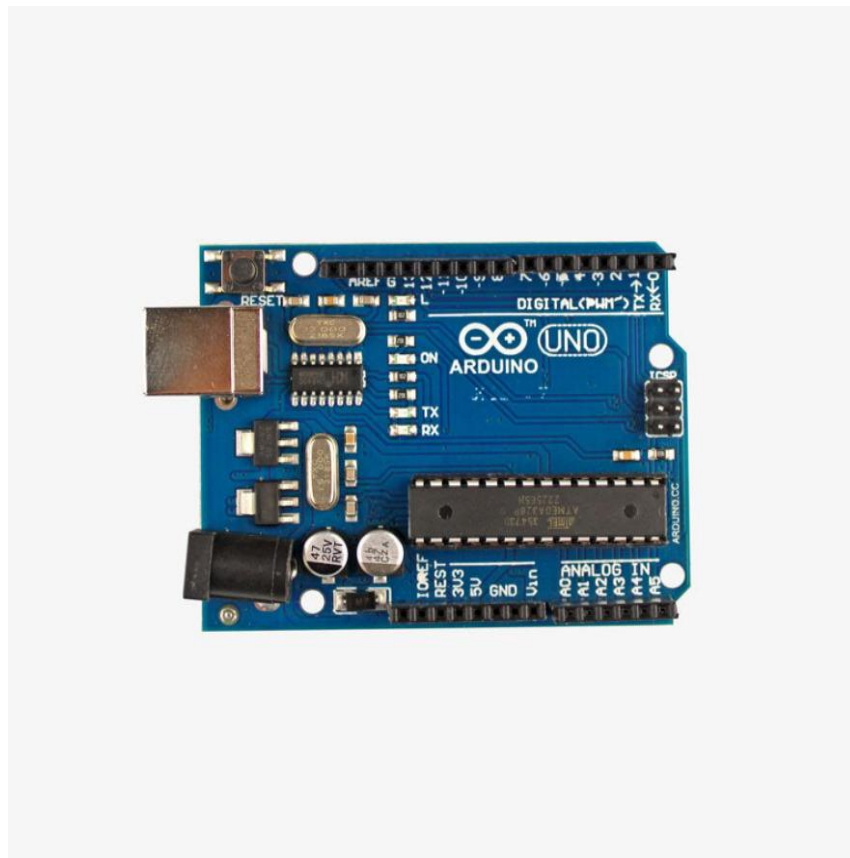


Fig: 4.1 : Arduino UNO

4.1.2 HC-05 - Bluetooth Module

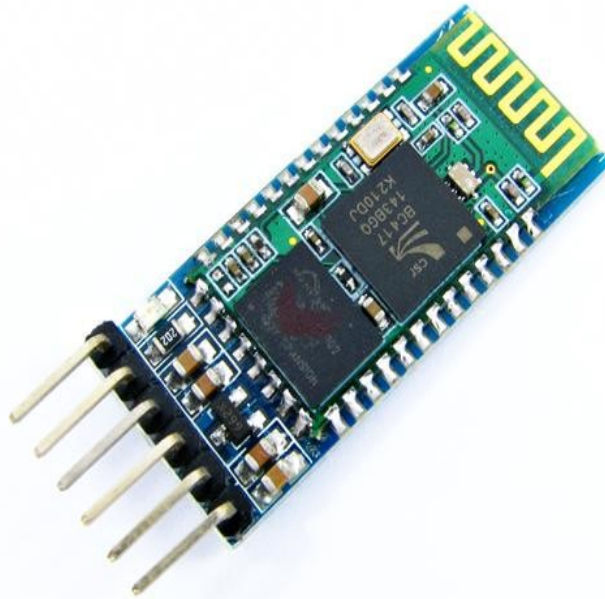


Fig: 4.2 : Bluetooth module

An accessible Bluetooth SPP (Serial Port Protocol) module, the HC-05 is made for setting up transparent wireless serial connections. A fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps modulator with a full 2.4GHz radio transceiver and baseband is available as a serial port Bluetooth module.

Bluetooth sequential modules enable all devices with sequential capabilities to communicate with one another through Bluetooth.

This has 6 pins ,

1. Key/EN: The Bluetooth module is often acquired in order mode. If the Key/EN pin is unavoidably set to high, the module will operate in order mode. In any event, it is naturally in information mode. In order mode, the HC-05's standard baud rate is 38400bps, while in information mode, it is 9600bps.

HC-05 module has two modes,

- Information mode involves the exchange of data between devices.
- Order mode: It makes use of AT orders, which are used to modify the HC-05's settings. The sequential (USART) port is used to convey these orders to the module.

2. VCC: Interface 5 V or 3.3 V to this Pin.
3. GND: Ground Pin of module.
4. TXD: Transmit Information in Sequence (remotely got information by Bluetooth module communicated out sequentially on TXD pin).
5. RXD: Gather details in order (got information will be communicated remotely by Bluetooth module).
6. State: It indicates if a module is connected.

4.1.3 Relay Module

A 5V relay module is an electronic component that is used to control higher voltage and current devices using a microcontroller or other low-voltage control signal. It consists of a relay, which is an electrically operated switch, and other circuitry that allows it to be controlled by a digital signal. The relay module typically has multiple input pins, including a ground pin, a power pin, and one or more control signal pins, and multiple output pins that can be used to switch the high-voltage devices.

The main advantage of using a relay module is that it can provide electrical isolation between the low-voltage control signal and the high-voltage devices being controlled, which enhances safety and protects the control device from potential damage.

When using a relay module, it is important to ensure that the voltage and current ratings of the relay are appropriate for the devices being controlled. It is also important to ensure that the control signal voltage and current are compatible with the input pins of the relay module. Some relay modules may include additional features such as protection against reverse polarity, transient voltage spikes, and overcurrent conditions.

Overall, 5V relay modules are commonly used in various electronic applications such as robotics, home automation, and industrial control systems, where they can provide a reliable and safe way to control high-voltage devices.

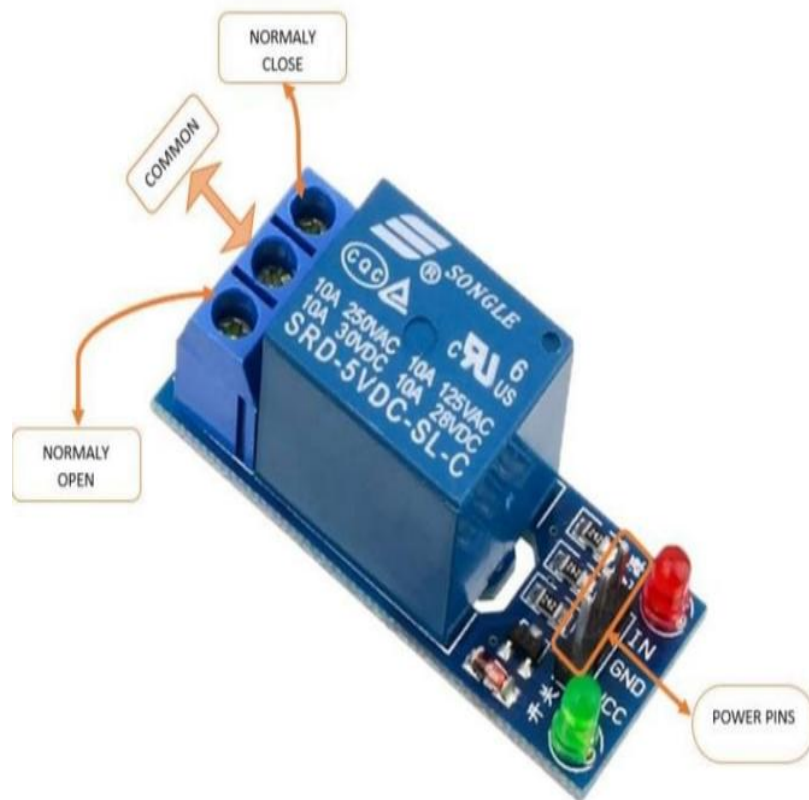


Fig: 4.3 : Relay module

Relay components features for one channel:

- 10A and 250V AC or 30V DC contact current.
- An LED signal is present on each channel.
- 12-volt coil voltage per channel.
- 5-12 V is the kit working voltage
- Input signal of 3 to 5 volts per channel.
- Two pins for each channel that are ordinarily open and closed.

Table 4.2 : Relay Module Specifications

Input Voltage	5V DC
Input current	15-20mA
Relay type	Single-pole double-throw (SPDT)
Contact rating	10A at 250V AC, 10AC at 30V DC
Coil resistance	70-80 ohms
Dimensions	25mm x 19mm x 17mm
Mounting	Through-hole mounting pr surface mounting
Maximum switching frequency	10 Hz

4.1.4 Water Pump module

A 12V water pump module is an electronic component that is used to control a 12V water pump using a microcontroller or other low-voltage control signal. It consists of a relay or transistor switch, which is used to turn the water pump on and off, and other circuitry that allows it to be controlled by a digital signal.

The main advantage of using a water pump module is that it can provide electrical isolation between the low-voltage control signal and the high-voltage water pump, which enhances safety and protects the control device from potential damage. Additionally, the module can provide various protection features such as overcurrent protection and overheat protection, which can prolong the life of the water pump and prevent damage to the module.

When using a 12V water pump module, it is important to ensure that the voltage and current ratings of the module are appropriate for the water pump being controlled. It is also important to ensure that the control signal voltage and current are compatible with the input pins of the module.

Overall, 12V water pump modules are commonly used in various applications such as hydroponics, aquariums, and irrigation systems, where they can provide a reliable and efficient way to control the water flow.

Table 4.3 - Water pump module specifications

Voltage	12V DC
Flow rate	5 LPM
Head height	3 meters
Noise level	40dB
Dimensions	90mm x 40mm x 35mm
Weight	200g
Materials	Plastic, stainless steel
Protection features	Overheat protection, dry-run protection, overload protection

4.1.5 Battery (12 V) :

A 12V battery is a type of rechargeable battery commonly used in automobiles, boats, and other vehicles. Here are some common specifications of a 12V battery:

- **Voltage:** A 12V battery has a nominal voltage of 12 volts, but the actual voltage can vary between 10.5V to 14.8V depending on the charge level and load on the battery.
- **Capacity:** The capacity of a 12V battery is measured in ampere-hours (Ah). The typical capacity of a car battery ranges from 30Ah to 100Ah, depending on the make and model of the vehicle. The capacity of a marine battery can be higher, typically between 75Ah to 200Ah.
- **Chemistry:** The chemistry of a 12V battery can be either lead-acid or lithium-ion. Lead-acid batteries are the most common type of 12V battery and are relatively inexpensive. Lithium-ion 12V batteries are more expensive but

have a longer lifespan, weigh less, and can perform better in extreme temperatures.

- Size and shape: 12V batteries come in various sizes and shapes, depending on the application. The most common shape is a rectangular or square box, with dimensions ranging from 7.7" x 5" x 6.2" to 13" x 6.8" x 9.4".
- Weight: The weight of a 12V battery can range from 20 lbs to 70 lbs, depending on the capacity and chemistry of the battery.
- Charging time: The charging time of a 12V battery depends on the capacity and chemistry of the battery, as well as the charging rate. A typical car battery can take 4 to 8 hours to charge fully, while a marine battery may take up to 24 hours to charge.



Fig: 4.4 : 12V Battery

4.1.6 Battery (9V)

A 9V battery is a small, rectangular-shaped battery commonly used in electronic devices such as smoke detectors, remote controls, and guitar effects pedals. It typically contains six small cells wired in series to produce a nominal voltage of 9

volts. The chemistry of 9V batteries can vary, but they are commonly made with alkaline or carbon-zinc cells. They have a relatively low capacity and are not rechargeable, meaning they need to be replaced once they have run out of power. 9V batteries are convenient due to their small size and portability, but they may not be suitable for high-drain applications due to their limited capacity.

Here are some common specifications of a 9V battery:

- **Voltage:** As the name suggests, a 9V battery has a nominal voltage of 9 volts. However, the actual voltage can vary between 8.4V to 9.6V, depending on the brand and type of battery.
- **Capacity:** The capacity of a 9V battery is measured in milliampere-hours (mAh). The typical capacity of a 9V alkaline battery ranges from 400mAh to 600mAh. The capacity of a 9V rechargeable battery can be higher, typically between 200mAh to 300mAh.
- **Chemistry:** The chemistry of a 9V battery can be either alkaline or lithium. Alkaline 9V batteries are the most common type and are relatively inexpensive. Lithium 9V batteries are more expensive but have a longer shelf life and can perform better at low temperatures.
- **Size and shape:** A 9V battery measures approximately 48.5mm x 26.5mm x 17.5mm (L x W x H) and has a rectangular shape with a snap connector at the top. The snap connector is used to connect the battery to the device.
- **Weight:** The weight of a 9V battery typically ranges from 45 grams to 50 grams.

- Shelf life: The shelf life of a 9V battery depends on the chemistry and the storage conditions. Alkaline 9V batteries have a shelf life of around 5-10 years, while lithium 9V batteries can last up to 10-15 years.

It's important to note that specific specifications may vary depending on the brand and type of 9V battery. Additionally, some 9V batteries may have different chemistries, such as lithium or nickel-metal hydride, which can affect their performance and specifications.



Fig: 4.5 : 9V Battery

4.1.7 DC Motor

A DC (direct current) motor is an electric motor that converts electrical energy into mechanical energy. It operates by using an electromagnetic field generated by the flow of direct current through the motor's windings to create a rotational motion. DC motors can be powered by a wide range of voltages and are commonly used in a variety of applications such as robotics, automotive, and industrial machinery.

There are two main types of DC motors: brushed and brushless. Brushed DC motors have a rotating armature (rotor) and a stationary magnetic field (stator), and use brushes and a commutator to switch the direction of the current flow to the armature windings. Brushless DC motors, on the other hand, have a stationary armature (stator) and a rotating magnetic field (rotor) created by the use of permanent magnets or electromagnets.

DC motors are known for their high torque-to-size ratio, which makes them suitable for applications where space is limited. They also have a relatively simple design, making them easy to control and maintain. However, brushed DC motors require regular maintenance due to the wear of the brushes and commutator, and brushless DC motors can be more complex and expensive.

When selecting a DC motor, it is important to consider factors such as the required speed, torque, and power, as well as the operating voltage and current. It is also important to choose a motor that is appropriate for the application and the environment in which it will be used. Overall, DC motors are widely used in many industries and applications due to their versatility and reliability.

Table 4.4 : DC Motor Specifications

Operating Voltage	12V
No load speed	Depending on model
Stall Torque	Depending on model
Shaft diameter	Depending on model
Operating Temperature	-10°C to 60°C
Motor Body dimensions	Various based on model
Weight	Various based on model

It's important to note that specific specifications may vary depending on the type and model of the 12V DC motor. Additionally, other specifications such as current draw, power consumption, and efficiency may also be relevant depending on the intended application of the motor.



Fig : 4.6: DC MOTOR

4.1.8 Motor Driver

A motor driver is an electronic circuit that is designed to regulate the speed, direction, and rotation of a motor. It is a crucial component in many systems that use motors, such as robotics, electric vehicles, and home appliances. Motor drivers come in different types, including brushed DC motor drivers, brushless DC motor drivers, stepper motor drivers, and servo motor drivers. They typically accept a control signal from a microcontroller or other control device, and output a PWM or voltage signal that controls the power delivered to the motor. Additional features such as overcurrent protection, overtemperature protection, and fault detection may be included in some motor drivers. It is important to choose a motor driver that is compatible with the specific motor being used, as well as the power

requirements and control signals of the system. The efficiency of a motor driver is also an important consideration, as it can affect the overall power consumption and heat dissipation of the system.

These quadruple high-current half-H drivers are the L293 and L293D. With voltages ranging from 4.5 V to 36 V, the L293 is intended to deliver bidirectional drive currents of up to 1 A. With voltages ranging from 4.5 V to 36 V, the L293D is intended to deliver bidirectional drive currents of up to 600 mA. Both devices are made to drive inductive loads in positive-supply applications, including relays, solenoids, dc and bipolar stepping motors, among others.

Table 4.5 : Motor Driver Specifications

Input voltage	4.5V-36V
Peak output current	600mA per channel (1.2A total)
Continuous output current	200mA per channel (400mA total)
Number of channels	2
Control signal input	TTL/CMOS compatible
Operating temperature range	-40°C to 150°C
Power dissipation	4W
Package type	16-pin DIP or SOIC
Protections	Overcurrent, thermal shutdown

Please note that the actual specifications may vary depending on the manufacturer and specific variant of the L293D motor driver.

Table 4.6 : Truth Table

Pin 1	Pin 2	Pin 7	Function
High	High	Low	Turn anti-clockwise (Reverse)
High	Low	High	Turn clockwise (Forward)
High	High	High	Stop
High	Low	Low	Stop
Low	X	X	Stop

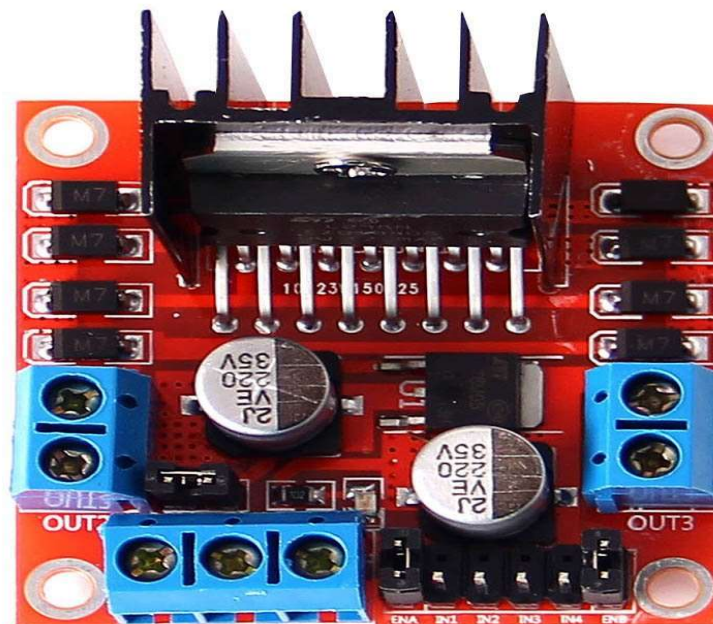


Fig 4.7 - Motor Driver

4.1.9 Ultrasonic Sensor

An ultrasonic sensor is a device that uses sound waves to detect the presence, proximity or distance of an object. It works by emitting a high-frequency sound wave and then measuring the time it takes for the sound wave to bounce back after hitting an object. The sensor then uses this time measurement to calculate the distance between itself and the object. Ultrasonic sensors are commonly used in robotics, automation, and industrial applications where they can provide accurate and reliable distance measurement. They are also used in automotive applications for parking assistance and obstacle detection. They can measure distances up to several meters and are typically used in applications that require non-contact distance measurement.

The main advantage of ultrasonic sensors is their ability to provide non-contact distance measurement, which can be particularly useful in applications where the object being measured is moving or where contact may damage the object or the sensor. They are also able to work in a wide range of environmental conditions, including darkness and low visibility.

Ultrasonic sensors have a number of different applications, including object detection and tracking, distance measurement, level measurement, and flow measurement. They are also used in a variety of industries, including automotive, manufacturing, and healthcare. When using an ultrasonic sensor, it is important to consider factors such as the range, beam width, and operating frequency, as well as the sensor's mounting and interface options. It is also important to ensure that the sensor is correctly calibrated for the specific application.

Overall, ultrasonic sensors are a reliable and widely used technology for distance measurement in a variety of applications. They offer several advantages over other distance measurement technologies, such as their ability to provide non-contact measurement and their ability to work in a wide range of environmental conditions. As technology continues to evolve, it is likely that ultrasonic sensors will continue to play an important role in a variety of industries and applications.

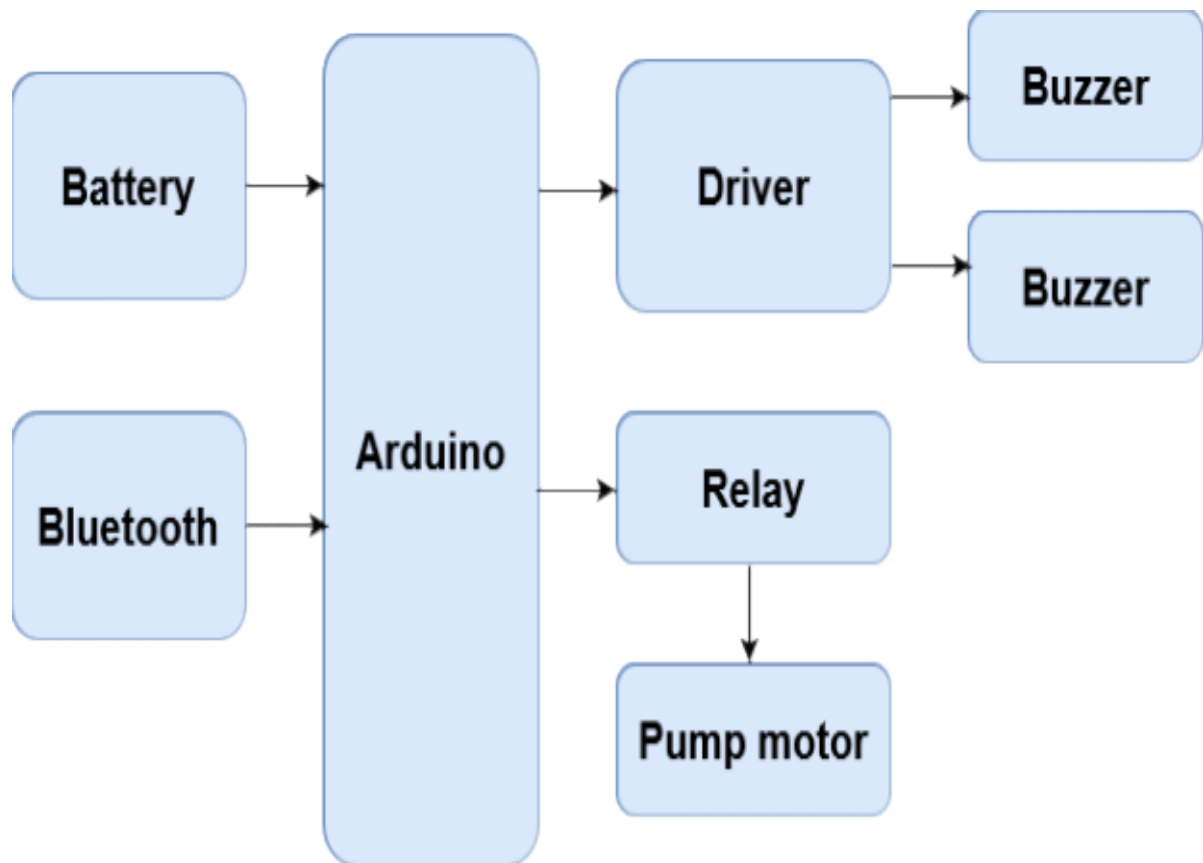
Table 4.7 - Ultrasonic Sensor Specifications

Operating Voltage	5V-12V
Operating current	<20mA
Operating frequency	40kHz
Output	Digital signal (HIGH/LOW)
Dimensions	45mm x 20mm x 15mm
Weight	8g
Measurement accuracy	+/- 1cm



Fig : 4.8: Ultrasonic sensor

4.2 METHODOLOGY OF FLOOR SANITIZING ROBOT



4.3 PROGRAM FOR ARDUINO UNO

```
char t;

const int trig =3;

const int echo =4;

long duration;

int distance;

void setup() {

pinMode(3,OUTPUT);

pinMode(4,INPUT);

pinMode(13,OUTPUT); //left motorsforward

pinMode(12,OUTPUT); //left motors reverse

pinMode(11,OUTPUT); //rightmotors forward

pinMode(10,OUTPUT); //right motors reverse

pinMode(9,OUTPUT); //relay

pinMode(6,OUTPUT);//buzzer

Serial.begin(9600);

}

void loop() {
```

```

    digitalWrite(trig, LOW);

    delayMicroseconds(2);

    digitalWrite(trig, HIGH);

    delayMicroseconds(10);

    digitalWrite(trig, LOW);

    duration = pulseIn(echo, HIGH);

    distance = duration * 0.034 / 2;

    //Serial.println(distance);

    delay(500);

    if(Serial.available()){

        t = Serial.read();

        //Serial.println(t);

    }

    if(t == 'F'){          //moveforward(all motors rotate in forward direction)

        digitalWrite(10,HIGH);

        digitalWrite(11,LOW);

        digitalWrite(12,HIGH);

        digitalWrite(13,LOW);

```

```
}
```

```
else if(t == 'B'){    //move reverse (allmotors rotate in reverse direction)
```

```
    digitalWrite(10,LOW);
```

```
    digitalWrite(11,HIGH);
```

```
    digitalWrite(12,LOW);
```

```
    digitalWrite(13,HIGH);
```

```
}
```

```
else if(t == 'L'){    //turn right (left side motors rotate in forward direction,right side  
motors doesn't rotate)
```

```
    digitalWrite(10, LOW);
```

```
    digitalWrite(11, HIGH);
```

```
    digitalWrite(12, HIGH);
```

```
    digitalWrite(13, LOW);
```

```
}
```

```
else if(t == 'R'){    //turn left (right side motors rotate in forward direction, leftside  
motors doesn't rotate)
```

```
    digitalWrite(10, HIGH);
```

```
    digitalWrite(11, LOW);
```

```
    digitalWrite(12, LOW);
```

```

    digitalWrite(13, HIGH);

}

else if(t == 'P')//RELAY MODULE

{

    digitalWrite(9,LOW);

}

else if(t == 'Q'){

    digitalWrite(9,HIGH);

}

else if(t == 'S'){    //STOP (all motors stop)

    digitalWrite(10,LOW);

    digitalWrite(11,LOW);

    digitalWrite(12,LOW);

    digitalWrite(13,LOW);

}

if (distance < 20)//stop function

{

    Serial.println("U");

```

```
digitalWrite(10,LOW);

digitalWrite(11,LOW);

digitalWrite(12,LOW);

digitalWrite(13,LOW);

delay(1000);

digitalWrite(10,LOW);

digitalWrite(11,HIGH);

digitalWrite(12,LOW);

digitalWrite(13,HIGH);

delay(2000);

digitalWrite(10,LOW);

digitalWrite(11,LOW);

digitalWrite(12,LOW);

digitalWrite(13,LOW);
digitalWrite(6,HIGH);delay(200);digitalWrite(6,LOW);delay(200);digitalWrite(6,HIGH);delay(200);digitalWrite(6,LOW);delay(200);
digitalWrite(6,HIGH);delay(200);digitalWrite(6,LOW);delay(200);digitalWrite(6,HIGH);delay(200);digitalWrite(6,LOW);delay(200);

}

}
```

- The program is written in the Arduino programming language, which is based on C/C++. It is designed to control a robot with various motors, a relay, and a distance sensor.
- At the beginning of the program, the pins used for the ultrasonic sensor, motors, relay, and buzzer are defined using the `pinMode()` function. Serial communication is also started at a baud rate of 9600.
- In the `loop()` function, the ultrasonic sensor is used to measure the distance of an object in front of the robot. The duration of the pulse from the sensor is calculated using the `pulseIn()` function, and the distance is calculated using the formula $\text{distance} = \text{duration} * 0.034 / 2$, which converts the duration into centimeters.
- If there is any data available from the Serial monitor, it is read using the `Serial.read()` function and stored in the variable 't'.
- The program then checks the value of 't' using a series of if-else statements. If 't' is 'F', the robot moves forward by setting the pins for the left and right motors to move in a forward direction. If 't' is 'B', the robot moves backward by setting the pins for the left and right motors to move in a reverse direction. If 't' is 'L', the robot turns right by setting the pins for the left motor to move in a forward direction and the pins for the right motor to stop. If 't' is 'R', the robot turns left by setting the pins for the right motor to move in a forward direction and the pins for the left motor to stop. If 't' is 'P', the relay module is turned off, and if 't' is 'Q', the relay module is turned on. If 't' is 'S', all motors are stopped.
- If the distance measured by the ultrasonic sensor is less than 20 cm, the robot stops and performs an obstacle avoidance routine. First, the robot stops all motors, then moves backward by setting the pins for the left and right motors to move in a reverse direction. After a delay of 2 seconds, the robot stops moving backward and stops all motors. Finally, the buzzer is turned on and off several times to signal that an obstacle has been detected.

- The loop() function then repeats from the beginning, continuously checking the distance and responding to commands received from the Serial monitor.
- The program uses an ultrasonic sensor to measure the distance between the robot and an object in front of it. The sensor emits a sound wave and measures the time it takes for the sound to bounce back. The distance is calculated based on the time taken for the sound wave to travel to the object and back to the sensor.
- The program uses the serial communication interface to receive commands from an external device, such as a computer or a smartphone. The robot can move forward, backward, turn left or right, stop, and activate a relay module, depending on the command received.
- The program also includes a safety feature that stops the robot when it detects an object within 20 centimeters. When an object is detected, the robot stops, reverses for two seconds, and activates a buzzer to alert the user. This feature helps prevent the robot from colliding with objects and potentially causing damage or injury.
- The program also includes a distance sensor, which is connected to pins 3 and 4 of the Arduino board. The sensor sends out a sound wave and measures the time it takes for the sound wave to bounce back. Based on this time measurement, the program calculates the distance between the robot and an obstacle in front of it. If the distance is less than 20 cm, the robot stops and emits a series of beeps from the buzzer to indicate that an obstacle has been detected. After the beeps, the robot moves back for 2 seconds, turns right for 2 seconds, and then stops again.
- The program also includes a relay module that is used to control an external device. If the command 'P' is received via serial communication, the relay module is turned off. If the command 'Q' is received, the relay module is turned on.

4.4 3D DESIGN OF THE FLOOR SANITIZING ROBOT

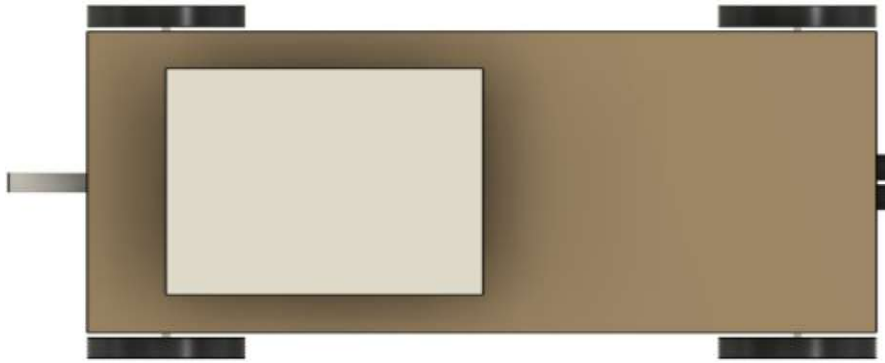


Fig: 4.9 : Top view of the 3D Design

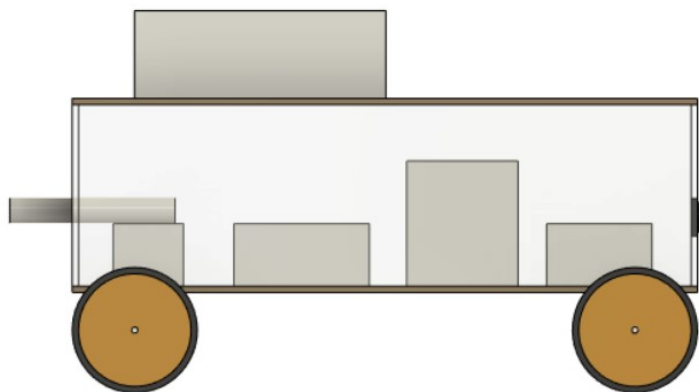


Fig: 4.10 : Side view of the 3D Design

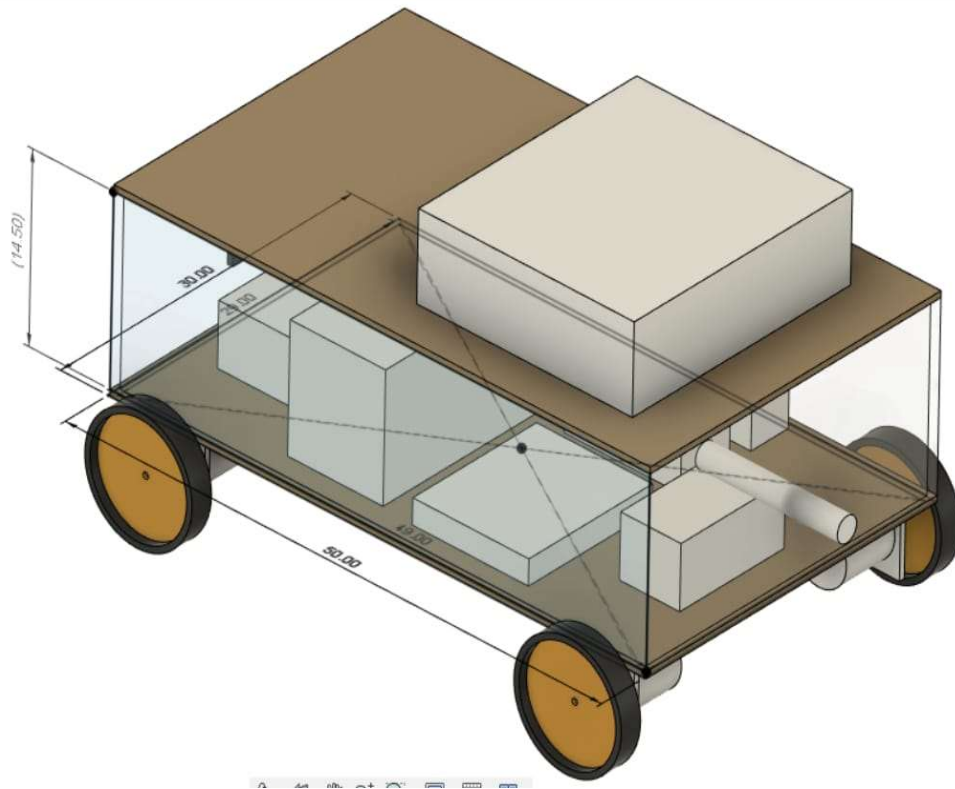


Fig : 4.11 : Isometric view of the 3D Design

Figures 4.9,4.10,4.11 Are The Cad Renders Of The Floor Sanitizing Robot Which Was Created Using Autodesk Fusion 360. These 3D Models Helped Us In The Fabrication Of The Final Prototype. The 3D Cad Render Provides a Detailed And Realistic View Of The Floor Sanitizing Robot, Highlighting Its Design Features And Functionality.

4.5 EXPERIMENTAL SETUP

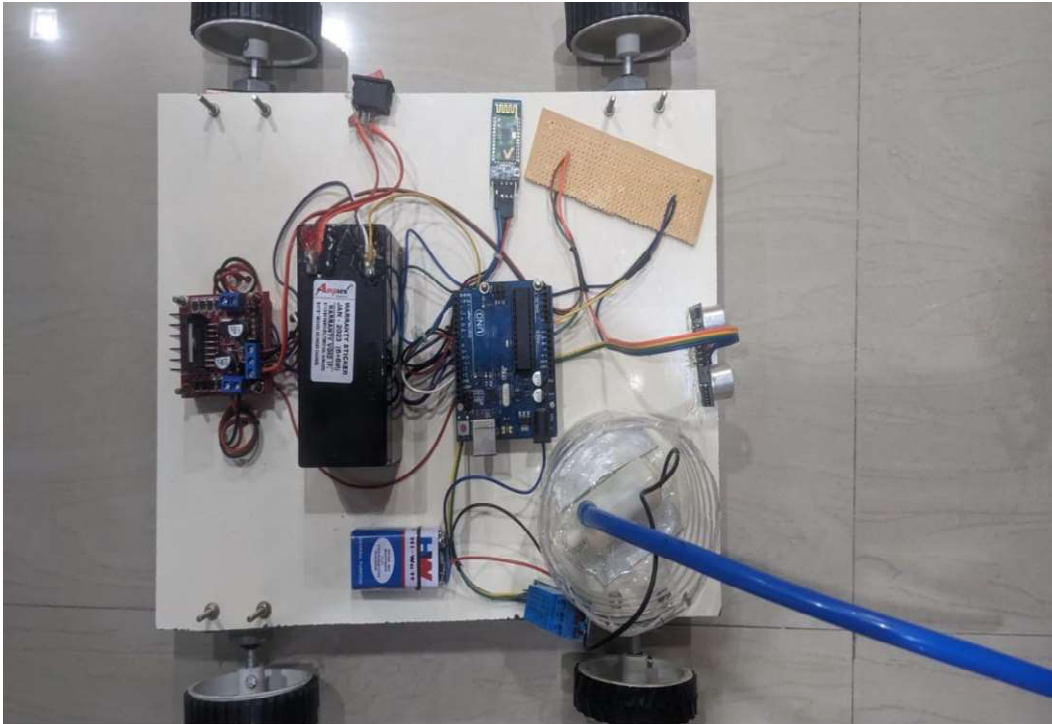


Fig: 4.12 : Top view of Base mounting of the Robot

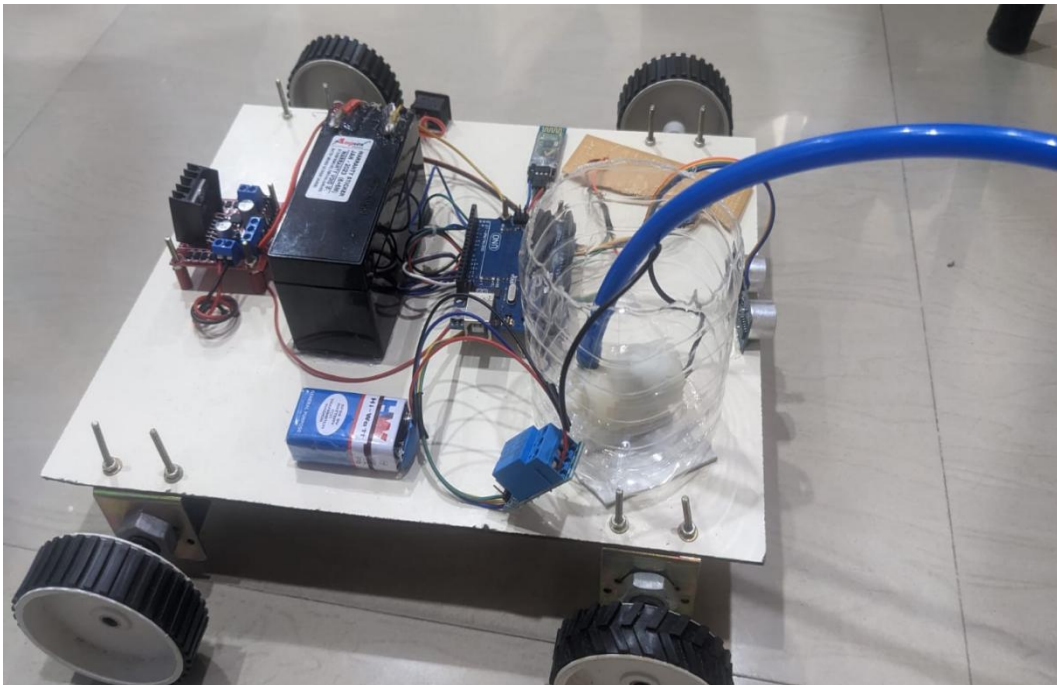


Fig: 4.13 : Isometric view of base mounting of the Robot

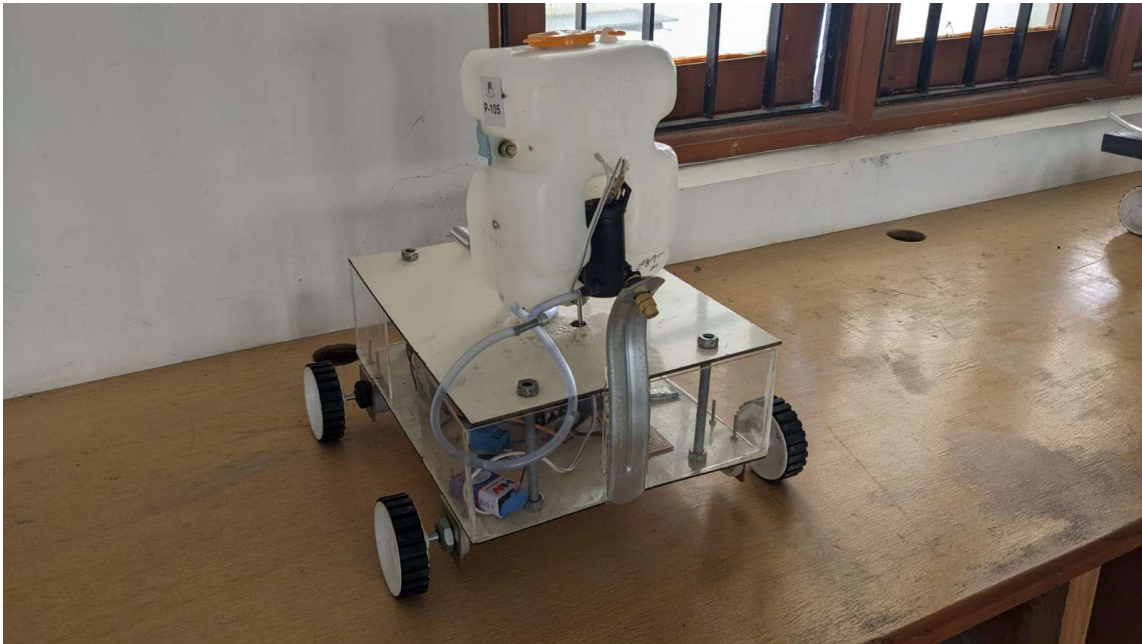


Fig: 4.14 : Isometric view of the Floor Sanitizing Robot

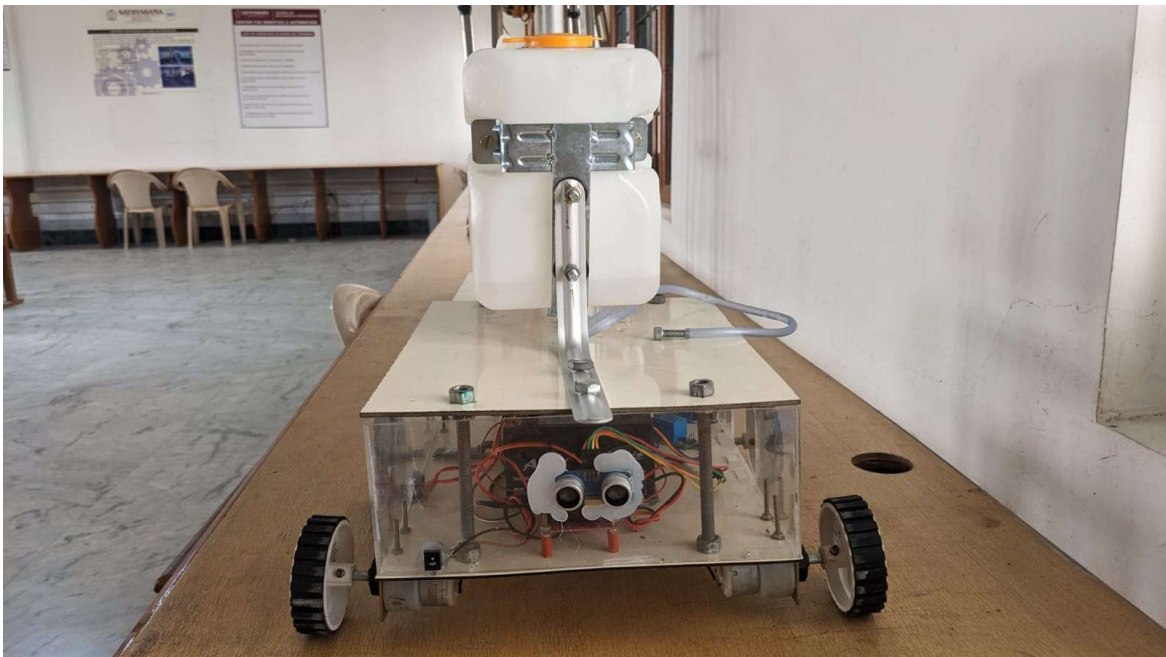


Fig: 4.15 : Front view of the Floor Sanitizing Robot

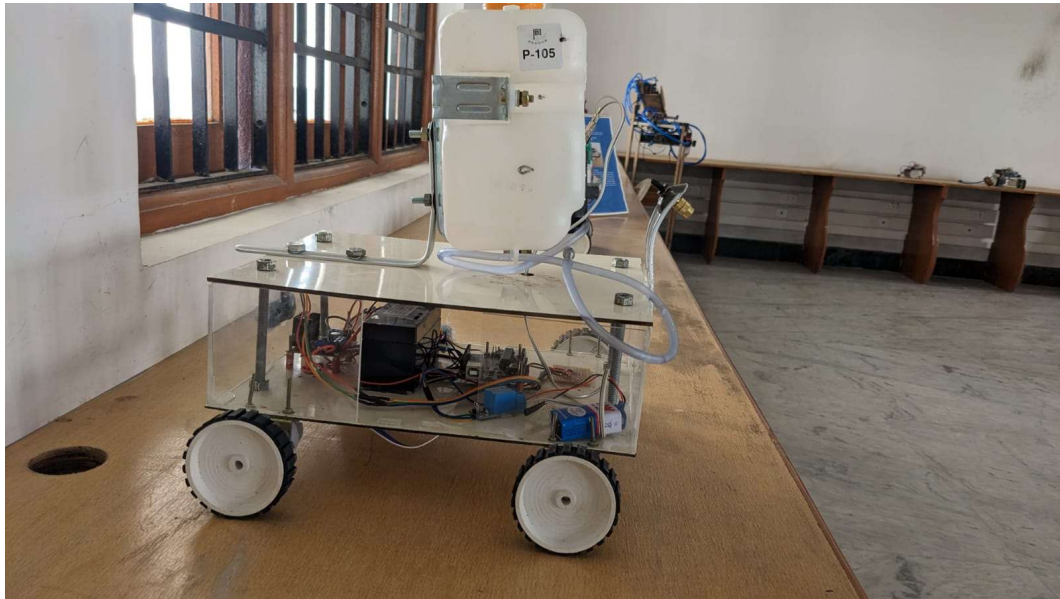


Fig: 4.16 : Side view of Floor sanitizing robot



Fig : 4.17: Back View Of Floor Sanitizing Robot

Figures 4.12,4.13 are the mounting works done for the robots , Figures 4.14,4.15,4.16,4.17 are the pictures of the final outcome of the product. The components used in this prototype are visible and the liquid is filled in the container placed in the top.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 RESULTS

There have been a few exploration concentrates on directed on the utilization of clinical help robots for floor disinfecting purposes. Here are a few key discoveries:

Further developed Disinfection: As per a review distributed in the Diary of Emergency clinic Disease, clinical help robots were viewed as powerful in diminishing bacterial tainting on clinic floors. The investigation discovered that involving robots for floor sterilization decreased bacterial counts by dependent upon 80%, prompting a huge improvement in generally speaking disinfection.

Efficient: One more review distributed in the Diary of Clinical Frameworks found that clinical help robots can save a lot of time contrasted with conventional manual cleaning techniques. The investigation discovered that utilizing robots diminished the time expected for floor tidying by up to half, permitting medical services staff to zero in on other significant undertakings.

Practical: As per a review directed by specialists at the College of California, San Francisco, clinical help robots for floor disinfecting can be financially savvy over the long haul. The investigation discovered that the underlying interest in a robot can be balanced by the reserve funds in labor costs and further developed disinfection over the long run. clinical help robots can likewise assist with further developing security in medical care settings. A review distributed in the Diary of Emergency clinic Disease found that involving robots for floor cleaning diminished the gamble of medical care related contaminations, which can be a significant wellspring of mischief for patients.

5.2 DISCUSSIONS

Generally speaking, the exploration proposes that clinical help robots for floor disinfecting can be a compelling and cost-saving answer for medical care settings, further developing sterilization and diminishing the gamble of medical services related diseases.

Studies have shown that clinical help robots for floor cleaning can essentially decrease the quantity of microbes on emergency clinic floors. For instance, a review distributed in the American Diary of Disease Control found that the utilization of UV-C sanitization robots decreased the occurrence of medical services related diseases by 30%.

Notwithstanding their adequacy in decreasing the spread of contamination, clinical help robots for floor cleaning can likewise save time and work costs for medical services offices. These robots can work nonstop, cleaning and sanitizing floors in understanding rooms, corridors, and different regions, without the requirement for human mediation.

In general, the utilization of clinical help robots for floor disinfecting can be a viable device for keeping a perfect and safe medical care climate. Notwithstanding, it is critical to take note of that they ought to be utilized related to other disease control measures, like hand cleanliness and legitimate cleaning conventions.

The design of a medical assistance robot for floor sanitizing can be adapted to meet the specific needs of health care facilities. The robot can be equipped with different cleaning equipment and solutions, depending on the type of flooring and the cleaning requirements. It can also be programmed to operate in different areas of the facility, depending on the layout and the needs of the facility. As technology continues to advance, the development of medical assistance robots for floor sanitizing will continue to evolve and improve, making it a valuable addition to any health care environment.

CHAPTER 6

CONCLUSION

In recent times, the need for effective infection control measures in healthcare facilities has become increasingly evident. Healthcare-associated infections (HAIs) continue to be a significant problem worldwide, causing significant morbidity and mortality, as well as incurring high healthcare costs. Proper cleaning and disinfection of surfaces, including floors, is essential in preventing the spread of HAIs. However, manual cleaning of floors is a time-consuming and physically demanding task that may not always achieve optimal results.

In response to this challenge, the development of medical assistance robots for floor sanitizing has emerged as a potential solution. These robots have been designed to automate the process of cleaning and disinfecting floors, thereby reducing the workload of healthcare staff and improving hygiene in healthcare facilities.

Medical assistance robots for floor sanitizing come in various sizes and designs, depending on the specific needs of the healthcare facility. They are equipped with sensors that enable them to navigate through the facility autonomously and avoid obstacles. They are also fitted with cleaning equipment, including brushes, sponges, or microfiber pads, which are used to scrub and disinfect floors. Some robots are designed to use UV-C light or other disinfectants, such as hydrogen peroxide, to achieve optimal results.

One significant advantage of medical assistance robots for floor sanitizing is their ability to operate continuously without breaks, thereby ensuring that the floors are cleaned thoroughly and efficiently. They are also designed to cover large areas, allowing for faster cleaning times and reducing the need for manual labor. Moreover, the use of robots for floor sanitizing minimizes the risk of human error, which can occur when staff members become fatigued or distracted.

However, there are several challenges associated with the design and implementation of medical assistance robots for floor sanitizing. One of the main concerns is the safety of patients and staff, as robots may accidentally collide with individuals or equipment in the facility. Thus, it is essential to design robots with sensors that can detect the presence of people or objects and stop the robot from moving or change direction accordingly. It is also important to ensure that the robot does not interfere with the operation of medical equipment or disrupt patient care.

Another challenge is the compatibility of the robot with various types of flooring. The robot's cleaning equipment must be able to effectively clean and disinfect a variety of surfaces without causing damage. The robot's design must also be adjustable to accommodate changes in the layout of the facility, as well as new equipment or furniture that may be added.

In conclusion, the development of a medical assistance robot for floor sanitizing has the potential to greatly improve hygiene and infection control in healthcare facilities. The use of such a robot can minimize the spread of infectious diseases, reduce the workload of healthcare staff, and increase overall efficiency in healthcare settings. The design and implementation of a medical assistance robot for floor sanitizing requires careful consideration of various factors, such as the type of flooring, the size and layout of the facility, the cleaning solution and method used, and the safety of patients and staff. It is also important to ensure that the robot is user-friendly, easy to operate, and cost-effective. Overall, a medical assistance robot for floor sanitizing has the potential to revolutionize the way healthcare facilities approach infection control and hygiene, making it a valuable addition to any healthcare environment.

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ANNEXURE:

- Review paper on the title of “Medical Assistance Robot For Sanitizing Floors” by S.Buveneswaran, Navin.I, S.Sivasaravanan has been presented in iCAM conference conducted by Sathyabama Institute of Science and Technology, Chennai on November 4th, 2022.
- Review paper on the title of “Medical Assistance Robot For Sanitizing Floors” by S.Buveneswaran, Navin.I, S.Sivasaravanan has been communicated in Materials Today: Proceedings and been waiting for acceptance from reviewers.
- Research Paper on the title of “ Medical Assistance Robot for Floor Sanitizing” by S.Buveneswaran, Navin.I, S.Sivasaravanan has been presented in the ICDTM Conference conducted by Sastra University, Thanjavir on April 7th , 2023.



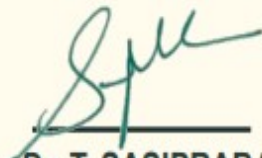
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CERTIFICATE

THIS IS TO CERTIFY THAT

—◆ **Mr. S. BUVANESWARAN** ◆—

Student, School of Mechanical Engineering, Sathyabama Institute of Science and Technology, Chennai, India has presented a paper entitled *“Medical Assistance Robot for Sanitizing Floors”*, in the second International conference on “Advancements in Materials Science and Technology – iCAM 2022”, organized by Sathyabama Institute of Science and Technology, Chennai, India in association with Alexander Dubček University of Trenčín, Slovakia, during November 02–04, 2022.


Dr. T. SASIPRABA
[ORGANIZING SECRETORY]
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Dr. P. KUPPUŠAMI
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Buvanesh S <buvaneshcap@gmail.com>

Editor Decision - Revise on your article MATPR-D-23-01526R2

1 message

SHYJU T S <em@editorialmanager.com>

Sat, Apr 22, 2023 at 3:55 PM

Reply-To: SHYJU T S <shyju@sathyabama.ac.in>

To: BUVANESWARAN S <buvaneshcap@gmail.com>

Ms. Ref. No.: MATPR-D-23-01526R2

Title: Medical Assistance Robot for Floor sanitizing - A Review

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Dear Mr BUVANESWARAN S,

The reviewers have commented on your above paper. They indicated that it is not acceptable for publication in its present form.

However, if you feel that you can suitably address the reviewers' comments (included below), I invite you to revise and resubmit your manuscript on (or) before May 10, 2023 .

Please carefully address the issues raised in the comments.

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References in this manuscript must be in ascending order starting from 1. but in this manuscript after the reference 3, directly 13 is coming.. it should be in order starting from 1 to 31. otherwise this paper can not be accepted.

← Revisions Being Processed for Author

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Action	Manuscript Number	Title	Date Submission Began	Status Date	Current Status
Action Links	MATPR-D-23-01526R3	Medical Assistance Robot for Floor sanitizing - A Review	May 05, 2023	May 05, 2023	With Editor

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Medical Assistance Robot for Floor Sanitizing - A Review

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Abstract:

In recent years, there has been a growing demand for automated cleaning technologies that can effectively sanitize surfaces in public spaces, especially in the wake of the COVID-19 pandemic. The floor sanitizing robot is one such technology that has gained popularity due to its ability to clean and disinfect floors without human intervention. This robot is designed to be user-friendly and efficient, with a compact and lightweight design that allows it to easily move around and clean even in hard-to-reach areas. It is equipped with powerful cleaning tools, such as brushes and nozzles, that can effectively remove dirt and grime from various types of floors, including tiles, hardwood, and carpets. The robot uses advanced sensors to detect obstacles and adjust its cleaning path accordingly, making it a safe and reliable cleaning solution for public spaces. It can be programmed to operate during off-hours, ensuring that it does not interfere with normal activities in the area being cleaned. Overall, the floor sanitizing robot is an important technology that can help maintain hygiene and cleanliness in public spaces, especially during times of heightened concern for public health and safety. Its efficient cleaning capabilities, combined with its ease of use and advanced features, make it a valuable tool for facility managers and cleaning professionals.

Keywords: Contactless, Sensors, Bluetooth, Sanitization, Robots.

1.Introduction:

Sanitation, which has become a crucial aspect in these pandemic times and plays a very important role in preventing us from becoming exposed to this harmful virus and so aiding in the eradication of this global pandemic, is very important.[1] The area where people rush for the treatment, i.e. the emergency rooms and hospital wards, is one of the major risk areas for exposure to this devastating infection. Sterilization in these regions is without a doubt testing and require exceptionally high measures to be taken.[2] Be that as it may, notwithstanding every one of these very good quality measures taken, there is consistently a gamble related to it. The goal of this review article is to show how to minimize human interactions as much as is physically possible while computerizing tasks like sterilization with robot aid. In this situation, the use of robots may reduce people's susceptibility to microbes, which has grown more important as the level of pestilence rises[3]. In the current epidemic situation, the robot can play a vital role. It reduces human participation in every area, from patient assessment to drug delivery system. Health associations were also instructed to maintain social distance from identified corona-positive persons[4]. It is the greatest test for specialists and medical services support staff. The public authority and clinical specialists are working constantly to shield individuals from contamination and contaminated individuals[5].

As of late some high-hazard and high-contact regions, smart route, and recognition frameworks are utilized. Further, robot likewise utilized in present day cultivating to increment efficiency[6]. A robot can assist a human in a variety of risky situations, like rescuing people from burning buildings, fighting off psychological oppression, disarming bombs, and other such situations. [7]

2. Objective:

During this pandemic circumstance, numerous emergency clinics are confronting the greatest issue is a deficiency of workers, and numerous medical services individuals are hesitant to go into the patient room. Sadly, regular medical clinics need to clean their floors for illness counteraction furthermore, to keep up with cleanliness. So to help with that we are planning to make a Floor sanitizing robot, to help cleaning the floors and prevent from infection.



International Conference on Digital Transformation in Manufacturing (ICDTM 2023) "Manufacturing Powered Through Digitalization"

April 07-09, 2023
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Certificate

This is to certify that Mr / Ms / Dr. S. BUVANESWARAN
has participated in the "International Conference on Digital Transformation in Manufacturing" held at School of Mechanical Engineering, SASTRA Deemed to be University, Thanjavur, India. He / She presented the paper entitled, "MEDICAL ASSISTANCE ROBOT FOR FLOOR SANITIZING"

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MEDICAL ASSISTANCE ROBOT FOR FLOOR SANITIZING

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Abstract

The primary factor in maintaining human wellbeing has always been the need for cleanliness and order. Recently, the use of modern cleaning technology has aided in the fight against dangerous diseases. One such modern advancement is the use of cleaning or sanitising robots. The use of mechanical cleaning tools is expanding globally. The concept of this robot's operation is cleaning freely placed things with the ultimate purpose of protecting people from infection. It weakens interpersonal ties in a variety of contexts. One of the major advantages of the robot that is anticipated is cleaning the ground surface. The number of pathogen infections has been quickly rising over the last couple of years, which has an impact on our daily lives. The rapid multiplication of hazardous pathogens that are transported from – anti surface to body due to insufficient sanitization of the surrounding region is the cause of the ongoing increase in these diseases in humans. Many autonomous robots have been constructed for cleaning tasks in the past, however they either have fewer cleaning processes built in or require direct human labour. Consequently, there is an unquestionable need for an automated inventory disinfectant robot that can clean, sanitise, and disinfect the floor surface by eliminating harmful pathogens using Hoover cleaner, sanitizer, and uv ray disinfection methodologies, respectively, without the direct involvement of humans.

Keywords: Robots, sanitization, sensors, cleaning, medical purpose.

INTRODUCTION

In recent times, people realized the importance of sanitization and the benefits of sanitization. The pandemic changed the mindset of people and their view on sanitization. Sanitization plays a vital role in preventing us from being exposed to many harmful viruses and infections . Hospitals are one among the places which are needed to be maintained with cleanness and free from infection. Sanitization in those areas are needed to be highly checked and maintained without any harm .

In the ongoing pestilence circumstance, the robot can assume a fundamental part. It diminishes human cooperation in each space, from patient evaluation to tranquilize conveyance framework. Wellbeing affiliations were additionally educated to avoid distinguished crown positive people. It is the best test for subject matter experts and clinical benefits support staff. The public power and clinical experts are working continually to safeguard people from defilement and polluted people. During this pandemic situation, various crisis facilities are standing up. The biggest issue is the lack of laborers, and various clinical benefits people are reluctant to go into the patient room. Unfortunately, customary clinical facilities need to clean their floors for sickness neutralization moreover, to stay aware of tidiness. For these issues faced in this places ,we thought of creating a robot for sanitizing the floors and to make the work of a human being less and even more in a easier way to do.

OBJECTIVE

The major goal of developing this medical support robot was to make it safer and easier to sanitise the floors in clinical spaces without endangering patient health.