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FLOOR CLEANING AND SANITIZING ROBOT

[1]Dr. Surekha R Gondkar, [2]Daniya Ali, [3]Pavitra Ramakrishnan
[4]Polu Sathwik Reddy [5]Tanusha Suresh

[1]Associate Professor (Electronics and Communication), BMS Institute of Technology and Management, Bangalore India
[2] Student (Electronics and Communication), BMS Institute of Technology and Management, Bangalore India[3] Student (Electronics and Communication), BMS Institute of Technology and Management, Bangalore India[4] Student (Electronics and Communication), BMS Institute of Technology and Management, Bangalore India[5] Student (Electronics and Communication), BMS Institute of Technology and Management, Bangalore India

Abstract: This paper reviews the developments in sanitizing and cleaning robots in terms of design, features and its capabilities. The COVID-19 has projected its light on the importance of maintaining decent amount of cleanliness and hygiene in public places. The proposed model here is highly beneficial in cleaning and mainly disinfecting surfaces, thereby reducing the risk of infection. Here, we will be reviewing the potential applications of this robot and the floundering that needs to be addressed for their widespread adoption.

Index terms: Dry sweeping and sanitizing, Bluetooth control, Object detection.

INTRODUCTION

The COVID-19 pandemic has caused a significantincrease in demand for cleaning and sanitizing solutions. This makes it challenging for the health- care workers to supply essentials in hospitals. This makes it an essential requirement to come up with a device which is able to sanitize a given area without human interference.

In response to this, researchers and engineers have been developing sanitizing and cleaning robots that can automate the cleaning process and reduce the riskof transmission of the virus. These robots are equipped with sensors and other advanced technologies that enable them to detect and sanitize surfaces, floors and air. Sanitizing and cleaning robots are autonomous machines designed to clean and sanitize indoor and outdoor spaces. These robots are equipped with various cleaning tools, such as brushes, vacuum cleaners, and disinfectant sprayers, to eliminate germs, dust, and other contaminants.

These robots use various technologies to navigate and clean spaces, including sensors, cameras, and artificial intelligence algorithms. Some of theserobots can be programmed to clean specific areas or follow a predetermined cleaning path, while others use machine learning algorithms to adapt to new environments and obstacles.

Sanitizing and cleaning robots have become increasingly popular in recent years, especially in public spaces like hospitals, schools, airports, and shopping centers. With the ongoing COVID-19 pandemic, the demand for these robots has skyrocketed, as they can help reduce the spread of thevirus by eliminating germs and other contaminants.

I. LITERATURE SURVEY

"Autonomous Disinfection Robot Using Ultraviolet- C Technology for Indoor Environments," by Alfonso J. Garcia-Cerezo, et al. (2021) - This paper describes the design and development of an autonomous robot that uses UV-C technology to disinfect indoor environments.

"Development of a Smart Robotic System for Sanitizing Indoor Environments Using Ultraviolet Light," by Ahmed Elgezery, et al. (2021) - This paperproposes a smart robotic system that uses UV light to sanitize indoor environments, and provides an evaluation of its effectiveness.

"Intelligent and Autonomous Mobile Robot for Cleaning and Disinfection in Public Spaces," by Maria-Pilar Alemán-Flores, et al. (2021) - This paper describes the development of an intelligent and autonomous mobile robot that can clean and disinfect public spaces, using a combination of UV-C and chemical disinfectants.

"Design and Implementation of a Mobile Robot for Cleaning and Sanitizing in Hospitals," by Amir Reza Sadri, et al. (2020) - This paper presents the design and implementation of a mobile robot that can clean and sanitize hospital rooms, using a combination of UV-C and hydrogen peroxide vapor.

"Autonomous Cleaning and Disinfection Robot for COVID-19," by Ramanathan Ramakrishnan, et al. (2020) - This paper describes the design and development of an autonomous robot that can clean and disinfect surfaces in indoor environments, using acombination of UV-C and ozone.

"Autonomous Robot for Cleaning and Sanitizing Large-Scale Environments," by Jie Fu, et al. (2021) - This paper presents an autonomous robot that can clean and sanitize large-scale environments using a combination of UV-C and chemical disinfectants.

"A Review of Cleaning and Disinfection of Hospital Environmental Surfaces Using Automated Machines," by Shu-Chen Huang, et al. (2021) - This paper provides a comprehensive review of automated machines used for cleaning and disinfecting hospital environmental surfaces, including robots.

"A Disinfection Robot for Large-Scale Environments with an Ultraviolet-C Light-Emitting Diode Array," by Hanjie Zhang, et al. (2020) - This paper describes the design and implementation of a disinfection robot that uses a UV-C LED array to sanitize large-scale environments.

"Robotics in the Time of COVID-19: A Review of the Literature and Considerations for the Future," by Katherine Pratt, et al. (2021) - This paper provides a review of the literature on the use of robots for cleaning and sanitizing during the COVID-19 pandemic, and discusses future considerations for thistechnology.

"Design and Development of a Sanitizing Robot for COVID-19," by Ashutosh K. Tripathi, et al. (2021) - This paper describes the design and development of a sanitizing robot that can disinfect indoor environments using a combination of UV-C and chemical disinfectants.

These papers highlight the various approaches to designing and implementing cleaning and sanitizing robots, as well as their effectiveness in reducing the spread of infectious diseases. They also provide insights into the challenges and future considerations for this technology.

Overall, these research papers provide insights intothe design and development of cleaning and sanitizing robots for various indoor environments, including hospitals, public spaces, and homes. They also demonstrate the effectiveness of these robots in reducing the spread of infectious diseases.

DESIGN AND FEATURES OF THEROBOT

Sanitizing and cleaning robots come in different designs and configurations, depending on their intended use. Some are designed to sanitize floors, while others are intended for cleaning surfaces and air. The most common features of these robots include:

Sensors: These robots are equipped with sensors that enable them to detect the presence of dirt, dust, and other contaminants. Some sensors can also detect the presence of viruses and bacteria on surfaces.

UV-C Light: Ultraviolet-C light is a powerful disinfectant that can kill viruses and bacteria on surfaces. Many sanitizing robots use UV-C light to sanitize floors and surfaces.

Autonomous Navigation: Some robots are equipped with autonomous navigation systems that enable them to move around a room without human intervention. These robots use sensors and cameras to navigate around obstacles and avoid collisions.

Remote Control: Some robots can be controlled remotely, enabling operators to direct them to specific areas that need cleaning.

BLOCK DIAGRAM

The three main operations that we are focusing on in this project is Sweeping, Sanitizing and Object detection. Following block diagram clearly illustrates the functionality of the robot.

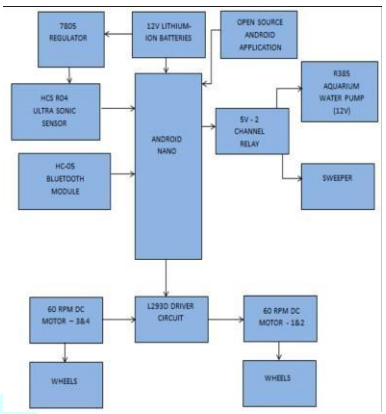

Figure 1: Block diagram

Arduino Nano is the microcontroller used here which acts as the central control of the robot. Arduino Nano is a compact device which helps in communication with various devices and is programmed using a computer.

The robot is controlled using voice commands. Thus any desired operation to be performed by the robot is sent via the Bluetooth application (which is installed on the user's cellular system) to the Bluetooth module. After receiving the command, the Bluetooth module sends the intended command to the microcontroller which comprehends the requiredaction.

Here the robot performs two main operations, sweeping and sprinkling. This is alternated using a two channel relay which runs on 5V Lithium-Ion batteries.

The movement of the robot is controlled using L293Ddriver circuit. This driver circuit is responsible for controlling the two DC motors which are affixed on the front of the robot. The two DC motors are further used to run the wheels of the robot, thus enabling the robot to move in the desired direction (forward, backward, right, left etc).

Since the user is controlling the robot from a distance they might not be able to view the possible object of collision. For this purpose, an ultrasonic sensor has also been affixed at the top of the robot which has thesole purpose of preventing the robot from collision. Thus whenever an object is detected, irrespective of the user command the robot automatically stops.

IMPLEMENTATION

The *HC-05 Bluetooth module* which is used here is based on the BC417 Bluetooth IC operation along with flash memory. It is a simple Bluetooth Serial port protocol module which is designed for transparent wireless serial connection setup.Communication is via serial communication whichmakes it easy to interface with microcontrollers.

In order to have Bluetooth communication between Arduino and a smart phone via HC-05 Bluetooth module, we need a mobile application. The android application that we have used here is AMR_Voice.

After installing the application and connecting theHC-05 Bluetooth module to Arduino these devices can be paired using the application as illustrated in the following steps.

The application is simple to use and very user friendly. When in use, the user should ensure that the Bluetooth module to be connected is in closeproximity with the cellular device.

The application helps in controlling the robot with spoken commands.

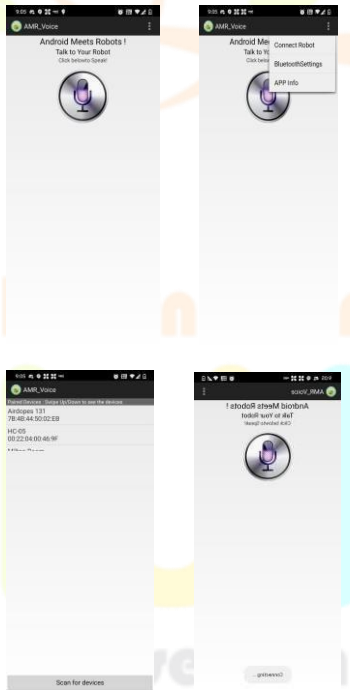

Figure 2: AMR_Voice Application

After the Bluetooth device has been connected. The operations of the robot can be controlled by sending voice commands via the application.

AREAS OF APPLICATION

Hospitals: Sanitizing robots can be used to sanitize hospital rooms, reducing the risk of infection and improving patient outcomes.

Public Spaces: Sanitizing robots can be used to sanitize public spaces such as airports, train stations, and shopping malls.

Schools and Universities: Sanitizing robots can be used to sanitize classrooms and other common areasin schools and universities.

Offices: Sanitizing robots can be used to sanitize offices, reducing the risk of infection and improving employee health.

FUTURE MILESTONE OF CLEANINGAND SANITIZING ROBOT

Increased Efficiency: Future sanitizing and cleaning robots will be designed to be more efficient and effective in cleaning tasks. They will be equipped with advanced sensors and algorithms that allow them to navigate through different environments, identify and locate areas that require cleaning, and clean them more thoroughly.

Improved Cleaning Mechanisms: There will be an improvement in the cleaning mechanisms of these robots, as new technologies such as ultrasonic cleaning, chemical-free cleaning, and high-pressure cleaning are developed. These mechanisms willensure that surfaces are thoroughly cleaned and sanitized without damaging them.

Integration with Smart Home Technology: Sanitizing and cleaning robots will be integrated with smart home technology, enabling them to communicate with other smart devices such as voice assistants, thermostats, and lighting systems. This integration will allow them to work in tandem with other devices to optimize cleaning tasks.

Self-Learning and Adaptability: Future sanitizing and cleaning robots will be equipped with advanced AI algorithms that enable them to learn from their environments and adapt to changes in their cleaning environment.
They will be able to detect and recognize different types of surfaces and adjust their cleaning techniques accordingly.

Increased Autonomy: As technology advances, sanitizing and cleaning robots will become more autonomous and self-sufficient. They will be able to carry out cleaning tasks without human intervention, and even schedule their own cleaning routines.

CONCLUSION

Sanitizing robot is a device designed to automate and streamline the process of cleaning and disinfecting areas or objects. It utilizes advanced technology and programming to efficiently sanitize various surfaces, eliminating harmful bacteria, viruses, and germs. By automating this task, the robot increases efficiencyand reduces the risk of human error, making it an effective tool in maintaining cleanliness and hygiene in different environments.

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