



UV-C STERILIZATION ROBOT

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ABSTRACT

The covid-19 pandemic has brought everyone under the precautions of social distancing, sanitization, and other hygiene measures. A hospital worker cleans the hospital and sanitizes it despite all the steps within a covid patient's proximity. In this paper, a UV-C disinfection robot is developed as a replacement for humans. This Robot not only replaces humans within the proximity of a covid patient but also replaces the traditional not-proven-efficiency methods. The proposed system has a dual-mode; they are automated and manual mode. The automatic mode is used to avoid human intervention using object detection and algorithms. Manually, the humans control the Robot through a camera and remote. The main component which is distinguishing is the UV-C light. UVC light from the sun is invested in the Earth's ozone, so you're not commonly presented to it every day. Notwithstanding, there are different human-made versions of UVC light. UV-C can be used to sanitize surfaces, air, and liquids. UVC light kills microorganisms like infections and microscopic organisms by harming atoms like nucleic acids and proteins. Hence, this makes the embryo incapable of performing the necessary processes to survive. As UVC light is an attractive option for disinfection. Therefore, together the robot module and UV-C light make it an effective and efficient method for cleaning and sanitizing especially over coronavirus.

Keywords: UV-C light, Disinfectant, sanitization, covid-19, microorganism, coronavirus

1.INTRODUCTION

The project's objective is to achieve an effective and efficient method to sterilize the floor against germs, viruses, bacteria, and other microorganisms. The robot is to supplement the current cleaning cycle to reduce the spread of hospital-acquired infections (HAIs), infectious diseases, viruses, bacteria, and other harmful organic microorganisms using UV light. UV light is validated to be 99.9% effective against microorganisms.

Existing Method

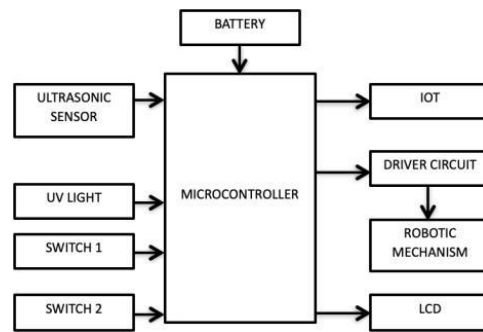
The sanitization and disinfection didn't come during the pandemic but are already practised. There are several methods in which the process is practised whereas few are just myths or unproven methods.

Traditional disinfection styles have been used for centuries. The most rigorous cleaning methods are with hot water, bleach, disinfectants, sanitisers, and detergents that can miss the dangerous microbes, and the efficiency rate of these methods is unknown. The existing system demands manual work.

In the worst-case scenario, the usage of strong cleansing agents may beget illness or even death as fumes caused by bleach, and other disinfectants are harmful to human lungs.

Proposed Method

We have designed an intelligent prototype module for disinfectant robots by using IoT to overcome the existing impacts. This proposed system is very helpful for automated and manual control of sanitizing mechanisms. The process will be equipped with one small electronics unit which consists of a Microcontroller, Ultrasonic sensor, UV light, Robot mechanism, and IoT module. By using an Ultrasonic sensor it can be monitored in front of obstacles. UV light is used in the sanitizing process. The manual mode of the robot is controlled by using both two switches and the automated mode of the robot is controlled by using IoT. The status will be displayed on LCD.

Block Diagram

Fig(1) Block diagram

❖ **COMPONENTS****HARDWARE REQUIREMENTS:**

- MICROCONTROLLER
- ULTRASONIC SENSOR
- UV LIGHT
- DRIVER CIRCUIT
- DC MOTOR
- BATTERY

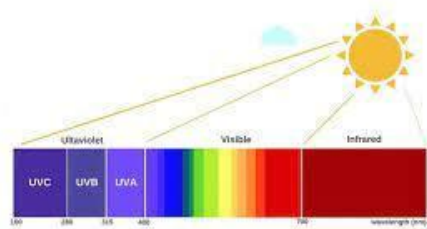
SOFTWARE REQUIREMENTS:

- EMBEDDED C
- ARDUINO IDE
- IoT

METHODS**COMPONENTS EXPLANATION**➤ **UV-C LIGHT**

UV light is a kind of radiation. It has more power than radio waves or apparent light but less energy than X-beam or gamma radiates. UV light is used in the disposal of microorganisms like infinitesimal living beings and diseases. Furthermore, its usage for killing SARS-CoV-2, the new virus that causes COVID-19, has been found. UV-C radiation is the most impressive of all the UV variations. UV-C radiation is a known sanitiser for air, surfaces, items, and water that can assist with moderating the gamble of procuring a disease and has been utilized broadly for more than 40 years. All microbes and infections tried to date (a large number throughout the long term, including different Covid) have positive feedback to the UV-C disinfection. In research facility testing, UV-C light sources inactivated most SARS-CoV-2 infections on a surface with an openness season of 6 seconds.

Far UV-C with a wavelength of 222nm has been considered a safe germicidal option for not being harmful to human skin. UV-C light is fastened to the robot's base so that the UV-C radiation does not come in direct contact with humans



Fig(2) Wavelength of UV



Fig(3) UV-C LED

➤ MICROCONTROLLER

Arduino Uno is a microcontroller board given the ATmega328P. It has 14 computerized input/output pins (of which 6 can be utilized as PWM yields), 6 analogue inputs, a 16 MHz quartz, and a USB connecting port. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter. Arduino Uno has several facilities for communicating with a computer, another Arduino board, or other microcontrollers.



Arduino UNO

Fig (4)

➤ ULTRASONIC SENSOR

The Ultrasonic sensor is used for object detection and prevention of crashing of the robot against a wall or any other larger objects. The ultrasonic transmitter starts the timer when it initiates to emit ultrasonic waves in a direction and the timer is stopped when the wave sent is sent back by the encounter obstacles. Ultimately, the ultrasonic receiver would stop the timer after receiving the reflected wave.



Fig(5) Ultrasonic sensor

A combination of DC motor and driver circuit is connected to the wheels for the mobility of the robot.

➤ SWITCHES

The Automated mode of the robot is triggered by using two switches each defining one predefined path and the Manual mode of the robot is controlled by using IoT over wifi connectivity.

➤ LCD

The current status of the operation will be displayed on LCD.

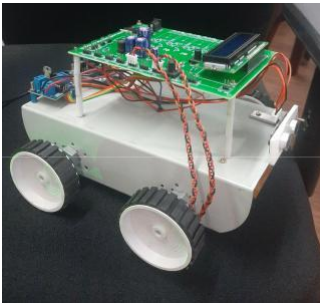
❖ *AUTOMATED MODE*

The robot takes the best possible predefined path given by coding to navigate itself within the given floorplan in automated mode.

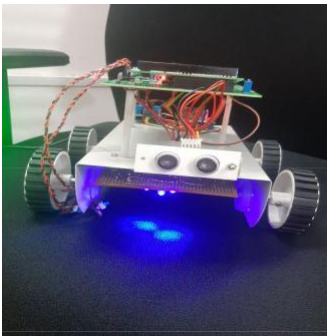
❖ *MANUAL MODE*

In manual mode, the robot can be controlled by four keys that represent the robot's movement in four directions: forward, backward, rightward, and leftward over the wifi using the IoT module.

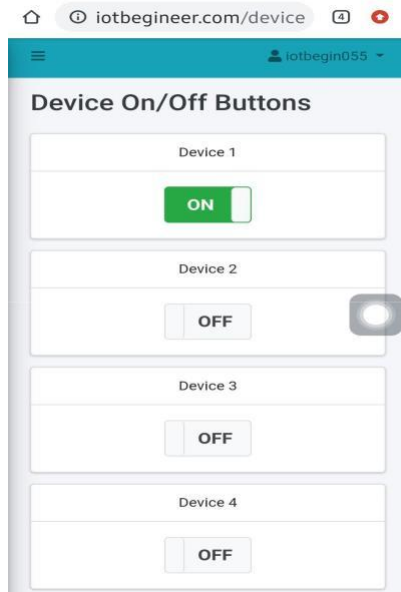
III. RESULTS AND DISCUSSIONS



Fig(6) Side view of the Robot



Fig(7) Front view of the Robot



Fig(8) Screenshot of APP

These are the images of the side and front views of the prototype built based on the proposed system. The following image is a screenshot of wireless manual control (for manual mode) that is connected over wifi for the direction of movement of the robot. The UV Disinfecting Robots come with a user-friendly operating system which makes them convenient and efficient for scheduling disinfection tasks and monitoring the progress of disinfection. The UV-C radiation seems to be very efficient at around 99.9% and is the most suitable choice when compared with other traditional methods used. The developed product has dual-mode, which comforts the user to reduce work and increase efficiency by being safe. The additional camera helps monitor the robot car move in both modes. The object detection mechanism is enhanced and integrated in a way that works through the automatic mode. Still, we can witness that the object detection mechanism is not as efficient as automatic mode due to the lack of a floor plan. Hence the automatic mode is still under improvement, whereas the manual method is structured in such a way that the user needn't go within the proximity of the patient, not the harmful UV-C ray.

IV. CONCLUSION

The current Covid pandemic has enhanced technologies in many field areas, while medical is one of the prominent. The sterilization robot is one of the promising innovations and developments for the hospital today. The product can still improve its efficiency and usability as this development is scalable. The study of disinfecting systems helped us determine our choice to develop a disinfectant robot. The UV-C robot can be controlled both automatically and manually. The UV-C light used in the robot can kill viruses like coronavirus and other microorganisms within a stipulated period. The robot can also work on its own using the object detection algorithm; therefore, in this project, we made a Robot using UVC lamps that would disinfect large areas by killing bacteria and viruses without causing any harm to human beings. Keeping the effects in mind, we have ensured that it won't cause any impact on human skin or any other body parts.

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