2022 International Conference on Innovative Computing, Intelligent Communication and Smart Electrical Systems (ICSES) | 978-1-6654-7413-9/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICSES55317.2022.9914280

Development of a Mobile Disinfectant Robot with UV Lamps for the Prevention of Covid-19

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Abstract- Viral diseases like Covid-19 are infectious and attack human respiratory system. During this time, places such as the hospital, supermarket and stations where crowds gather are at high risk of contamination. People in the vicinity of these areas can spread the virus not only through physical contact but also by touching articles or objects which are prone to contamination. This is why a device that can clean those infected areas without spreading it to others is much needed. To help mitigate this infectious disease the project was created to build a disinfectant robot that can be used remotely without heavy maintenance and has only one major installation cost and no continuous costs. That is the reason behind selecting the method of UV lamps to help sanitize public areas that can be extended to any type of public space at low cost and to decontaminate the area without the use of sprayers or reagents. All of these virus cleansers come in the form of aerosolized sprays or solutions but cannot be used everywhere particularly to clean garment factories or industrial surfaces. So, the UV lamps were finally selected that will be installed on a movable base automatically.

Keywords—Viral, Covid-19, Contamination, Disinfectant robot, Ultraviolet, UV lights.

I. INTRODUCTION

Viruses and pathogens live in non-living areas in hospitals for up to a few days. The COVID-19 pandemic, in the form of the novel SARS-CoV-2 virus has severely affected the demand and supply of variety of disinfectants across the globe. The shortage of additional sanitizers and chemical purifiers, although worrying, is not the only important factor in providing hygienic facilities in health care. Some survey indicated that only 50 percent of the hospital's area was adequately cleaned during the patient's stay. Therefore, the laboratories and hospital areas are potential sources of transmission of the virus to the health care workers. Apart from hospitals, all the places with crowd are worthy competitors for the spreading of these

deadly viruses. And the need for disinfecting these places avoiding further contamination and spread has become more crucial. Cleaning and disinfecting the hospitals, rooms, closed space area manually isn't particularly straightforward. It scales up the risk of transmission, which in turn can lead to further spread of virus. So if a machine is used instead of our health care workers, it would bring more convenience and less risk to the society. UV robots are increasingly being promoted an easy and effective solution for rapids anitization of rooms and spaces in all are as in a single go. Sanitising robots appear to be appealing to hospital officials, largely because of the automaticity and obvious savings of reducing man power from cleaning hospitals and other evident places of contact of virus.

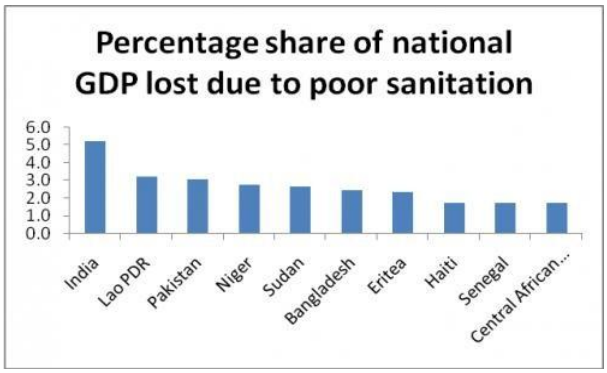


Fig 1. Loss of GDP due to poor sanitization

From the above graph, the importance of sanitization is clearly visible. It directly affects the lives of the people and the economy of the country. Ultraviolet Robot is a tele operated robot that is fitted with a UV light system. The system consists of a moving robot car and a base station controller. The user can control the robot using the joystick of the base station controller while watching the robot camera feed. UV robot sanitization utilises the intensity of

UV rays to eradicate germs and viruses. The robot can be controlled by the user via a WiFi module, moreover its GUI allows us to control the robot within any hospital room without being physically present. All of these features assist us in lcaeningthe room according the requirements. The UV lights destroy the reproductive systems of the germs, and hence ensures zero to minimum replication of the same. These robots can kill germs and kill diseases, germs, germs, and other pests of nature, by ultraviolet light, by breaking down their DNA. The most common and well- known method of disinfection in public places is to spray 70% liquid-based alcohol. Recently, the World Health Organization (WHO) announced that it is indeed dangerous to use disinfectant regularly in public places. This cancause problems with the respiratory system because of their strong odour, irritate the skin, and may even cause imbalance in the environment.

II.LITERATURE REVIEW

[1] Since the outbreak, pesticide and pathogen decontamination has attracted attention. To kill germs, several techniques such as solvents, gases, and chemicals are used. However, these methods would pollute the environment, which is a separate issue for humanity. The authors have created a robot that employs Ultraviolet mechanics to kill germs in a variety of environments, including homes, buildings, and health centers. UV-C rays are effective against the virus and are particularly effective at breaking down virus DNA, preventing them from reproducing and infecting humans.Three UV-C lights are utilized to destroy microorganisms from all directions covering 360 degrees with the telescope. It is operated by a Mobile app and a Bluetooth wireless connection. Operators can securely control the at any place inside or outside the room premises thanks to wireless controls. The UV-C lights are also turned off automatically by the robot's timer. The robot is controlled by an micro controller. For convenient operation, the Bluetooth module is attached. In addition, debugging is a breeze with the micro controller's built-in console. Bluetooth is chosen because to its low cost and energy consumption. As a result, it is suitable for brief wireless transmission.

[2] With a few proposals from a variety of industry areas, this study uses ultraviolet germicidal irradiation, which has been a well-known and widely utilised approach for more than 60 years. UVGI is utilised to eradicate local microorganisms that have emerged as a source of illness during the present epidemic. UVGI, on the other hand, poses a health risk to humans, and these are potential areas where robots can soon prove themselves useful during the pandemic. Robot navigation is a challenging task that is influenced by a variety of circumstances, including the location of the robot to be navigated and the attributes of the robot. In the case of an antibioticrobot, it must accomplish the following task:is to employ the amount of UVGI required to eradicate the target virus in each case. Calculating the amount and intensity of light that reaches each point of the room. This situation is crucial in determining whether the work is completed or not. This paper presents a monitored performance and activity study of three targeted computer systems that can be used to develop low-cost portable robots for disinfection and sanitization purposes. In addition to the significant difference in total processing time across platforms, testing have revealed that they have the potential to process irradiance in the area during operation. The Raspberry pi 2 is the most versatile microprocessor and cost effective too, was able to map 7.1 degrees per second. As a result, analytical platforms of all types can be considered suitable for designing a low-cost robot.

[3] This paper shows a low cost UV robot for the purpose of disinfecting hospitals and factory spaces from communicable diseases. The robot can automatically detect any object using machine learning models that give some amount of free control. Its MCU (main control unit) is operated by WiFi, with the smartphone acting as a receiving device, allowing for the safe control of UV lamp sanitization and disinfection.

[4] UV light was used as an agent by the researchers in this investigation. UV devices are investigated and classified based on their disinfectant unit, combined disinfection agents, and order types. Their findings show that a mobile robot is the most effective device for killing microorganisms, thus they created "i-Robot UV." This robot is outfitted with a central column that is surrounded by eight UV lamps and has two more on the top. On a mobile basis, this column is stationary, and several sensors are integrated to measure conditions around it on the one hand, and to detect objects to avoid collisions on the other.While being monitored by a Wi-Fi

connection from a phone or a tablet, the robot may estimate the disinfection time automatically. When humans are present, the I-Robot UV shuts off to keep people safe, as it employs UV light to disinfect rooms and equipment. Through the lamp, the device can kill 99.9% of bacteria and a variety of other organisms.

[5] This work portrays the operation and application of UV- Disinfection Robot used in hospitals, to stop and reduce the spread of Hospital Acquired Infections (HAIs), infections and microscopic organisms. The UV-DR is created by BlueOcean Robotics in coordinated effort with driving college.To conclude, the test was done in Denmark, showed a huge decrease in microscopic organisms was presented to Sanitization Robot'sUV-light.

[6] This paper shows the Microscopic organisms and infections get by on lifeless surfaces in medical clinics for as long as a day and can be even longer. The worldwide COVID-19 pandemic because of the novel Covid SARS-CoV-2 has tested the accessibility of sanitizers. COVID-19 pandemic has animated the creation of bright (UV)- sanitization robots by organizations and establishments in China. However,there is very less data about their functional detail.

[7] In this paper, an automated UV robot for the purpose of sterilization has been proposed. The said robot is equipped with three cameras apart from ultrasonic sensors, motor driver, UV light emitter, webcam camera as well as controller box and wheels. The robot is capable of navigating through the room and detect the obstacles with the help of sensors. It can either be controlled manually via a website (connected via a Wi-Fi module) or can function automatically without any human intervention with the help of Machine Learning algorithms it is equipped with. It emits the light in the wavelength of C-band frequencies and has shown great potential in disinfecting the testing areas with utmostaccuracy.

[8] Here, a sanitization robot named STERILOID is suggested. The said robot is equipped with controller, wheels, a Bluetooth module, and a reservoir which has the sanitizer or sanitizing liquid stored in it. The STERILOID robot can either be controlled by the user using a mobile application connected with the help of a Bluetooth module as mentioned earlier or be completely automatic. It is equipped with two ultrasonic sensors which help the robot in navigating through its surroundings and eject the liquid and sanitize as and how it is required. STERILOID can also be used to sterilize roads, pavements and open spaces as well along with rooms and other closedconfinements.

[9] The execution of a robot are discussed in this work. It's an open-source robotic platform designed primarily for the purpose of cleaning single-plant environments. Single plant settings are defined as office spaces, homes, flats, and a few more enclosed areas. It comes with a Camera, a tracker camera, 3 UV-C lights, and an integrated computer that runs the necessary software. All of this is built on a differential robotic base where components present are layer wise with cleaning components at the bottom. It is capable of cleansing a one-floor apartment all by itself, independently. It receives the details of the surroundings from the cameras and the computer system processes and controls the robot accordingly. It is a completely autonomous robot and comes complete with a battery pack as well ascharger.

[10] This paper discusses about "Assistive Robot for Covid-19 (ARC-19)". This robot has two modes:- autonomousas well as semi-autonomous. The robot is equipped with UV light as well as the existing spraying system in order to perform any kind of cleansing task. It is equipped with a GPS sensor unit, a distance sensor and an object detection sensor. Its wheels, help in mobility and it is connected via a Bluetooth module to the device used by the controller. It has one main power unit for its power supply. All of this is controlled by the Main Control Unit. It collects the data from the sensors and controls the movements of the robot as well as decides which sanitization system (UV light or Spray) to use. After testing, the results indicate that the robot cleans 98% of the germs and other viruses, bacterias and pathogen including that of Covid-19.

III. Proposed Methodology

Robots are machine designed to work and to direct their space and time to humans. Local disinfecting using ultraviolet -C is the most extensively utilised method. UV-disinfection robots of all varieties provide flawless technology, administering disinfection by engaging active disinfectant radiation without mechanically removing pollutants or

organisms including viruses and bacteria.

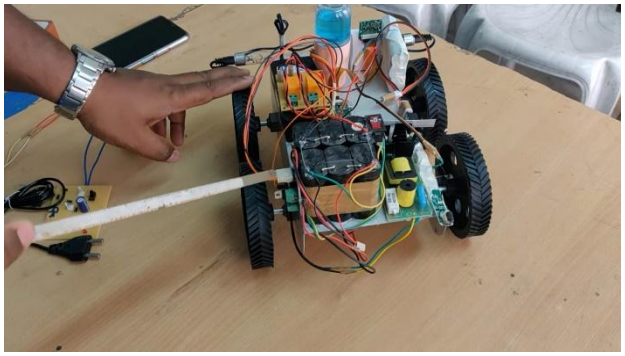


Fig 2: Working Model of Proposed Methodology

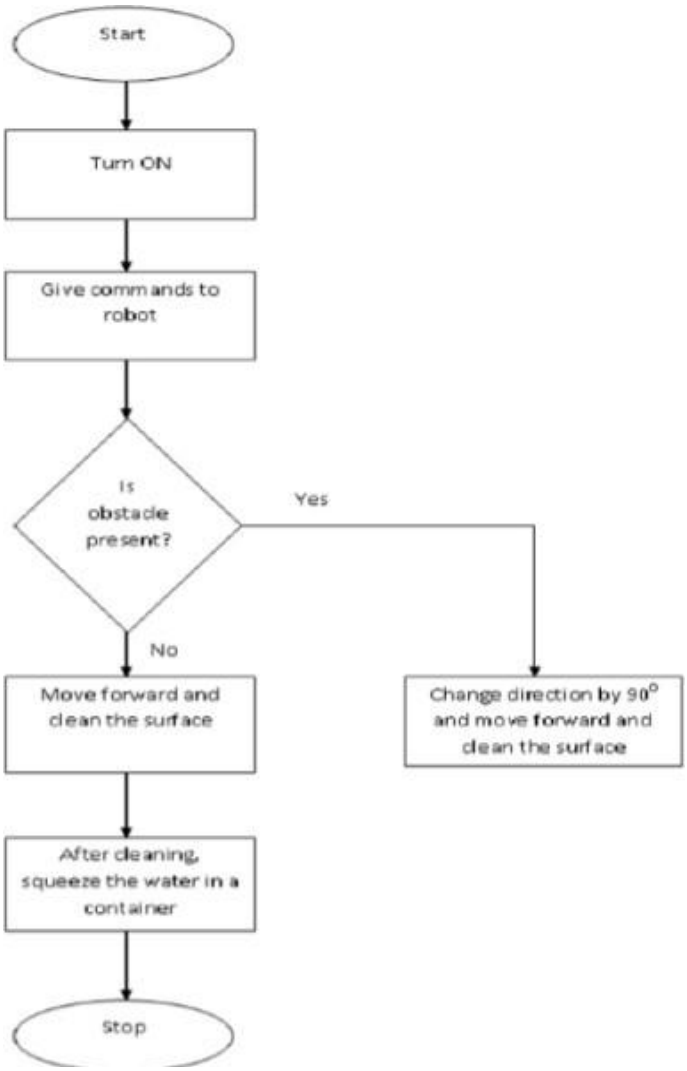
Germs etc are all killed by ultraviolet light with a wavelength of 254 nm (UV-). A well-known constraint of this type of technology is shading with UV-light, where more can be exposed due to blockage or inaccessibility. UV-intensity is significantly reduced by shade and distance, limiting the effectiveness of the disinfection process. According to recent literature, UV-antimicrobic systems can effectively reduce bacterial contamination in vitro environments. In fact, this has been shown in ambulances, patients' rooms, and contaminants in opperating rooms. The function of the initial infusion, pollution, applied energy, and exposure period is efficiency. This differs depending on the microorganism and in the case of germs, whether they are in the form of a plant or a spore. Most importantly, UV disinfection equipment should be secured before usage in each room or set, and monitored after first deployment. It is critical to define the UV-specific device's locations in clinical settings in order to assure the UV-optimal device's performance and achieve antibacterial effectiveness..Currently, the WHO (World Health Organization) and the Enter for Disease Control (WH & D) recommend several methods for killing microorganisms. Isopropyl alcohol (> 70%), bleach, and hydrogen peroxide are the most often used antibiotics. All of these disinfectants are available in the form of aerosolizedsprays and solutions that could be used locally. They do, however, have a number of issues. Because the majority of these chemicals used as disinfectants are liquids, they have limitations as these can not be used at every place, especially to sanitize and clean industries or industrial areas.

IV. OBJECTIVES

The objectives of the project include:

- Controlling robot from remote places.
- Using pi camera for lives treaming.
- Using DC motors to moves the robot.
- Using IOT technology.
- It sanitizes our surroundings.
- It consists of UV lamp to kill the virus.
- To achieve this task using ESP-32 processor.

DATA FLOW DIAGRAM



V. WORKING

The main controlling device of this prototype is ESP 32 camera module which is a microprocessor which has built-in Wi-Fi and Bluetooth which makes the ESP 32 a nearly stand-alone solution for many tasks, with more

than enough local intelligence. There are 2 DC motors to move the robot forward, backward, left and right. These two DC motors are controlled by a L293D motor driver. The controlling unit and the motors along with the motor drive ris powered by there charge able batteries. We have used 12V, 2A i.e. (24W) power supply. This configuration of batteries is attained by three 4V, 1A battery into series resulting into 12V, 1A. Then those three batteries having 12V, 1A is kept in parallel with similar batteryofsameconfigurationi.e.12V,1 Are sulting in to 12V, 2A, 24 watt of power supply. The battery setup needs approximately 7-8 hours to get charged completely.

There is a Pi-camera installed on top of the robot. The Picam will capture live data with regards to its surroundings and then send it to a particular IP address through internet. The user will be observing this lives treaming on them obileand according to that the user will control the robotic vehicle through the web page and as well as control the sanitizer and UVl amp from the webpage. The UVl amps and the fogsprayer containing the sanitizer liquid are controlled by the two electromagnetic relays which are again controlled by the ESP32. The main controlling device of the project is ESP32 camera module which is interfaced with input and output modules.

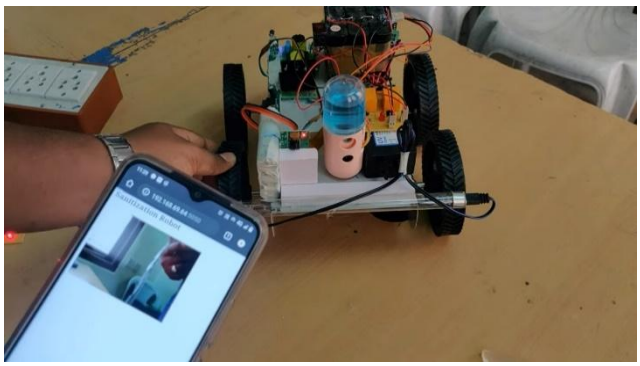


Fig 3: UV lamp and sanitizer on model

The UVl amps and sanitizerd is penser can be controlled by switching electro magnetic relays. Here relay acts like as witchtoon and off the sanitizer and UVl amp.12V, 2amps battery and power bank are used to give the power supply of the robot and ESP-32 module.The main controlling device of the project is ESP 32. The ESP 32 takes upto 20 seconds to boot up when power is switched on and then by controlling those electromagnetic relays it handles the operation of UVl amps and Robot movement. It connects the user interface to the physical working of the robot.

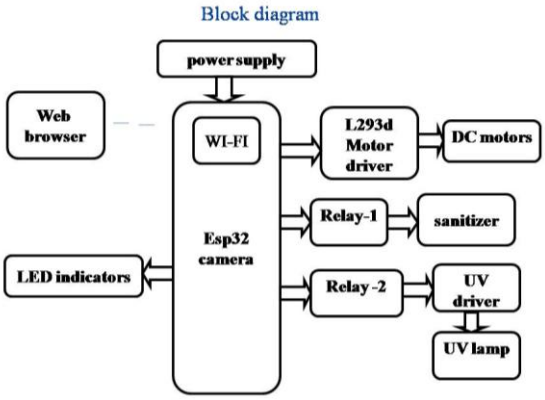


Fig 4: Block Diagram

The whole robot can be controlled by a Smartphone or any user interface via the Wi-Fi. By switching on the hot spot of the device we can connect it to the Raspberry PiZero W microprocessor as it has abuilt in Wi-Fisetup. The whole connection can be viewed on a phoneora desktop via a network an alyzerappor software. The same user device can be usedtoviewthestreamingfromthePicameraandtogivec ommandtotherobotto move and release the sanitizer from the fogsprayer /dispenser.

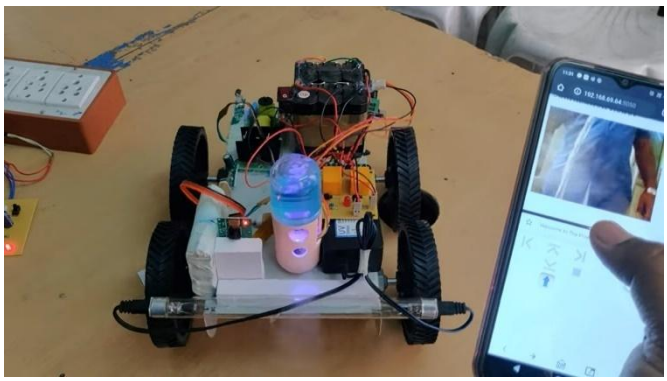


Fig 5: Working of sanitizer and UV Lamp mounted on model

VI. Conclusion

The life of every person is being affected by the Covid-19 pandemic. Even though the vaccination has arrived but still the outbreak is not stopping and different variants are evolving. Since prevention is better than cure and hence we have developed a UV robot that will help in disinfection and sanitizaton of places which are prone to contamination and spreading of these viruses. A low-cost UV robot has been developed with the aim of disinfecting hospitals and industrial areas against Covid-19 and similar infectious diseases. Our model consist of a four-

wheeled well-designed robot, incorporating both a light-based UV technology system and a traditional anti-microbial/viral disinfectant spray system to destroy novel corona virus and other harmful pathogens. After the stationing of this robot it will be an efficient component of the health and medical science sector and can play a major and key task in eradicating the life threatening virus like COVID-19 in the region, reducing the health risks of leading health workers.

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