Ultra Violet Assisted Sanitization for COVID infections using Robotic Platform

Sudesh Garg, Vinay Singh Marwal, Chandramohan Kumar, Prem Singh
Department of Mechanical Engineering, Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur -302017 (INDIA)
Email: sudesh.garg@skit.ac.in, vinaysingh@skit.ac.in, chandra.mohan@skit.ac.in, prem.singh@skit.ac.in
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Abstract- In the year 2020, we all experienced COVID pandemic which had affected our lives and health. When one comes into contact with infectious virus such as COVID, SARS etc., it makes us sick. Most of the time hands are contaminated with infectious viruses through touch and contact. To keep away from contamination, hands ought to be washed or cleaned consistently, as per WHO rules. Therefore, in this paper, an attempt has been made in this direction to create such a robotic platform that will do the work of sanitization on its own without human interaction with the help of UV light and also represent the design and development of a smart sanitizing robot, which has been studied with the help of the process of sanitization, which can reduce the risk of human exposure to the virus. This is an open platform for disinfecting single plant conditions like workplaces, houses, and offices, among others.

Keywords- Sanitizer, UV rays, ESP 32, Covid-19.

1. INTRODUCTION

The COVID pandemic has completely changed the way of life in today's world. By the year 2020, not only all of us but the whole world will have experienced how this small, invisible virus has affected our lives and health. Due to this epidemic, the demand for robots, automated machines, and human contactless devices has increased as an alternative to humans working in various fields.Because of this type of destructive phenomenon, robots are increasingly being used for activities such as delivering food and food items and cleaning surfaces where there is a lot of human movement, and they have proven to be enormously valuable and helpful.To avoid this epidemic, all countries and governments are working continuously. Cleanliness has become very necessary in this time of epidemic because it prevents getting infected with this terrible virus and also helps in eliminating it. To address the needs of the World Health Organization, the certified sanitising system is a solution for personnel and surface decontamination [1]. The use of ultraviolet (UV) sterilisation equipment has become commonplace in order to kill any remaining germs or bacteria on surfaces by regular cleaning [2].

As we know, people go to the office to market their businesses, go to the hospital for treatment, and students go to school or college; thus, the risk of coming into contact with a virus also increases. In this pandemic, there is a need for continuous cleaning of all surfaces in offices, homes, and hospitals, which is necessary to prevent disease and maintain hygiene. In these epidemic times, sanitation has become a very essential trait, as it protects us from becoming contaminated with this terrible virus and thereby aids in the extermination of this global epidemic [3]. Sanitation is particularly challenging in these areas, necessitating extra caution. However, even with all of these high-tech safeguards, there is always a risk.

The purpose of this initiative is to build this type of robot where there is a need to continuously sanitise surfaces that come into contact with humans and also reduce as much human interaction as possible by using robots to automate operations. In this case, robots can aid in reducing human virus risk, which is becoming increasingly important as outbreaks grow. In these tough times, the robot's design features a smiling element that aids in spreading positivity. A new type of ultra violet (UV) has been identified and has been used in this automatic robot, in which it has been ensured that bacteria and viruses can be destroyed by UV rays [4]. The idea of these robots,that can quickly and easily disinfect an entire room or space, including all of its surfaces, is gaining traction among healthcare professionals, who see it as an appealing solution for a number of reasons, including automation and the potential for cost savings through a reduction in cleaning staff [5].

UV rays have such properties that when any bacteria or micro-organisms like fungi come in contact with them, they get destroyed, and their genetic material gets damaged as chemical bonds are severed within the DNA structure [6]. Also, that may aid hospitals in their ongoing struggle against bacteria persisting in patient rooms and causing new ailments. A level ground and changeable wheel track are utilised to examine the mechanical design of a wheel-based robot.

2. MODELLING AND DESIGN

The robot is capable of effectively killing microorganisms on the floor, such as fungi, bacteria, and viruses, and has significant effects on them. An automatic sanitising robot is such a tool that helps in killing the virus effectively and with the help of changing the DNA structure of harmful microorganisms [7]. The proposed robotic Platform system uses the following modules and components:

Table: 1 Module and Components in Robotic Platform: Sanitization on Wheels

SN	Main-Component	Specification
1	ESP 32 Cam Module	PCB antenna Gain 2 dBi, WIFI+bluetooth dual-mode,Cameras with
2	UV Light Lamp	Philips, Model Number DGIN21043-245
3	Lipo Battery	12 V ,2200 mAh,4.4 Wh
4	AC Inverter Circuit Board	Micro Controller Board,150 W 12-220V
5	L 298 Motor Driver	Double H –Bridge,L-298N, 46V, 2A
6	Dc Motors	12 V,300 RPM, 6mm with internal hole

The Platform of the product is made up of a 5mm thick sheet of dimension 500 mm *300 mm. All the components and modules are attached on this Platform. The proposed schematic of Automatic Sanitizing Robot is given below

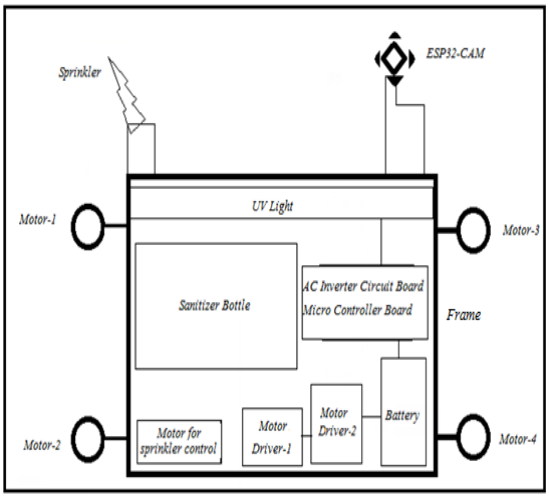

Fig. 1: Schematic of Automatic Sanitizing Robot

2.1 ESP 32 cam module

In the current era, IoT enabled devices are being used extensively. A microcontroller with similar key features has been employed to build this automatic sanitization robotic platform [8]. This special microcontroller has a micro SD card as well as an inbuilt video camera, which makes it a complete cam module. This ESP32- cam module is easy to use as well as low cost, thus making it an ideal module for IOT enabled devices to perform a number of functions such as tracking of image of object and recognizable proof.

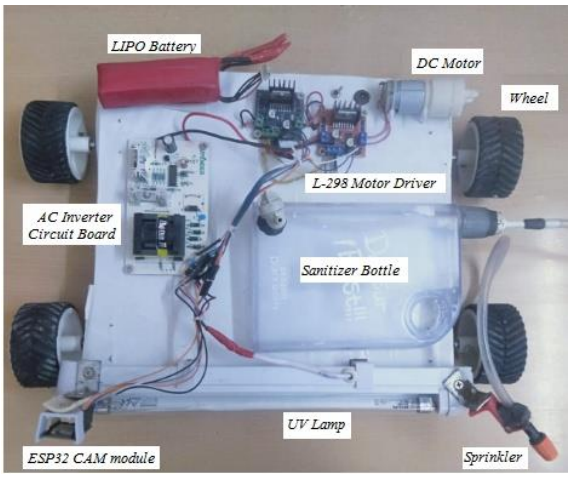

Fig. 2: Top View of Robotic Platform: Sanitization on Wheels

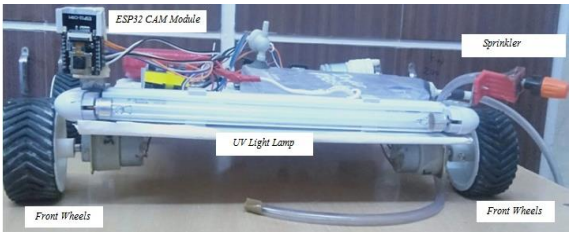

Fig. 3: Front View of Robotic Platform: Sanitization on Wheels

Fig. 4: ESP 32 Cam module

At the top of the ESP32 -cam board, a micro SD card reader is attached with a socket and a connector for the camera module. The special thing about this module is that the components are attached to the circuit board, which is printed on both sides of the module. Similar to the LED flash inside a mobile phone camera, this module also has a white LED light, which makes the module smart enough to illuminate the object, and it is mounted on the top right of the module.

2.2 UV Light

In the present work, along with the use of sanitizer, UV light of Philips with model number DGIN21043-245 is also used. When the microorganisms are directly exposed to UV light, there is a mutation in their DNA and they are killed, or they would be unable to reproduce [9]. The UV light lamp is arranged on the frame in such a way that it works according to the ESP cam module and the microorganism on the desired surface is exposed to the UV light. Each robot needs to optimally treat the cultivation with UV-light.

Fig. 5: Philips UV Lamp

2.3 LIPO Battery

It is a device that alters the form of electrical energy into chemical energy by using the principle of electrochemistry. In mobile robots, basically three types of batteries are used, namely lithium-polymer, alkaline, and lithium-ion [10]. Lipo (Lithium Polymer) ion battery of 12V and 2200 mAh is used in the ongoing device. The lightness and pliableness of the lipo battery makes it special, that is why it will be the most in a mobile robot.

Fig 6: Lithium-Polymer Battery (Source: electronicscomp)

2.4 AC Inverter Circuit Board

For operating devices like kitchen appliances, microwaves, and electric lights, a power inverter is used, which converts the DC input power from a battery into conventional AC power. In this present work, a special kind of inverter board is used, which converts 12V DC current to 220V AC current for the small load UV light lamp supply to the low output voltage gear.

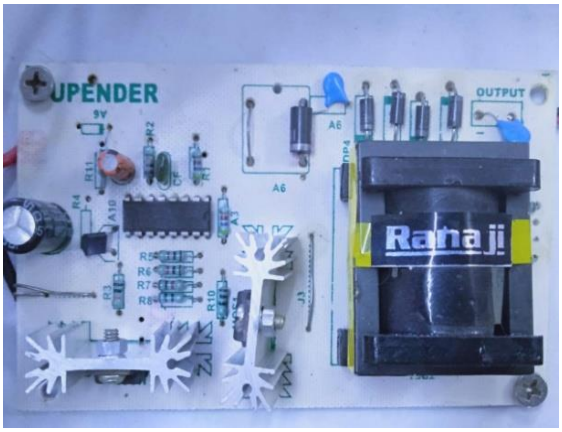

Fig. 7: AC Inverter Circuit Board

2.5 L298N Motor Driver

An H-bridge is used by a controller known as the L298N Motor driver to easily regulate the direction and speed of DC motors. In general, it has four different kinds of pins: input, output, enable, and power. Basically, it is employed to drive DC motors and stepping motors. Using a tiny voltage signal from a microcontroller or control system, we employ motor drivers to supply the motor with high power. The motor driver will rotate the motor in one direction while maintaining one pin as HIGH and one pin as LOW if the Central processing unit sends the motor driver a HIGH input.

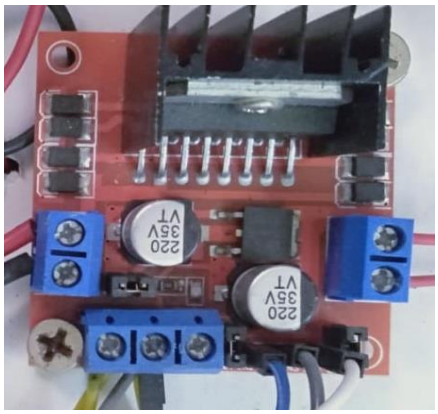

Fig. 8: L298N Motor Driver

3. OPERATION OF SANITIZING

When envisioning a complex wheel-based robot, difficulties in its path must also be considered [11]. When a wheel based robot moves on its route, many types of obstacles come into its path, which it has to avoid. To challenge this type of problem, in this present work, we used an ESP-32 cam module. This module has an on-board PCB antenna, a gain of 2 dBi, dual-mode WIFI + Bluetooth, and is compatible with cameras with built-in flash.In this way, we can operate this robotic platform because of the on board camera and Bluetooth mode.

When we press the button on the remote in the app, it transmits the input signal given through that app to ESP Bluetooth, and then the signal goes to the ESP 32 cam. When ESP 32 cam detects any obstacle in the path of robot, that signal reaches again bluetooth control app through Bluetooth mode, and the camera identifies the image of that object. In this way, according to the instructions given, the robotic platform moves forward.

The system switches ON the UV light lamp and sanitises the desired surfaces through Bluetooth control with the help of a bluetooth control app. When the robot reaches near the surface that we have to sanitize, when we give the input signal through the bluetooth control app, our sprinkler system turns on, and that surface is sanitized.

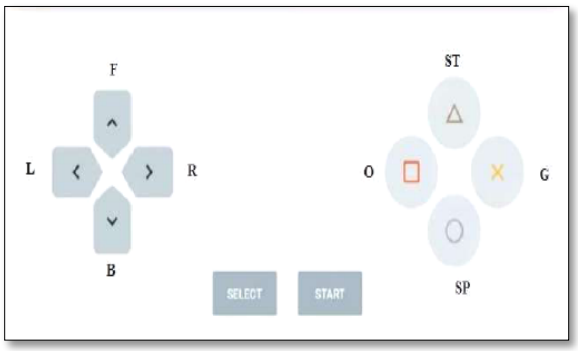

Fig. 9: Bluetooth Mobile Controller App
(Source: google play)

Table: 2 Function of button of Bluttoth App

SN	Button	Function
1	Forward-F	Allows robot to move forward
2	Backward-B	Allows robot to move backward
3	Left-L	Allows robot to move left side
4	Right –R	Allows robot to move backward
5	Start-O	Allows to start Spinkler
6	Stop-G	Allows to stop Spinkler
7	Stop-ST	Robot will stop automatically

4. CONCLUSION

UV-C can be a helpful alternative to solution-based solutions when surface disinfectants are in short supply, due to its well-documented antibacterial action. Also the efficiency is highly dependent on individuals and their motivation

Manual cleaning in each hospital is based on local procedures, training, understanding, renewal, and staff turnover of cleaning employees, as well as the control and inspection of their performance, notwithstanding best practise suggestions. Furthermore, evidence suggests that manual cleaning and disinfection are frequently becoming ineffective, resulting in enduring contamination.

In addition to destroying microorganisms on surfaces, disinfection robots provide reproducibility by automatically recording the disinfection process' operation parameters, allowing for quality assurance.As a result, automated disinfection could allow the disinfection process to be validated with repeatable and documented disinfection results.

UV – assisted sanitaization robots provide the following advantages:

• Robotic disinfection will be autonomous and standardised, eliminating the requirement for continual human presence at the disinfection site.
• As a result, hazardous UV radiation exposure to health care personnel can be prevented during the process.
• After manual cleaning and disinfection, applying UV-C as a final disinfection step reduces cross-transmission and healthcare-associated illnesses
• UV light disinfects without leaving any residues, making it a green disinfection procedure.
• UV light sanitization is fast and economical.

The efficiency of UV robots is also restricted by a few factors. Disinfection robots require a professional supervisor for configuring and overseeing the programme, and to reset after encountering unexpected difficulties, which takes extra time and disrupts regular routines. Cleaning robots can be useful tools, but they aren't being used to their best potential when they're being used in conjunction with regular maintenance procedures (like vacuuming).

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