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Arduino Based UV Sanitization Robot

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Abstract: **The objective of using ultraviolet (UV) light is to clean or sterilize surfaces and spaces. Although UV-C is used because it kills germs, including bacteria and viruses, it is harmful to people as well. A UV Robot has been developed and put into use to perform disinfection without the involvement of humans. It follows a predetermined path. Robot technology has replaced manual labour and many of related robot appliances are now widely used. This work exemplifies the technology that suggested using robots to sanitize floors. Today's commercial places are getting more automated and intelligent. Commercial automation makes life more convenient and gives individuals more free time. However, a rise is anticipated, and commercial robot usage is changing. There are many robotic cleaners on the market, but very few of them sterilize floors with UV light. Designing and implementing a UV Sterilization Robot for Autonomous Dry Sanitization is the goal of this work. Instead of employing manual sanitizers, UV sanitization robots are intended to simplify the sanitization procedure. Three 20W UV led that emit beam of light were installed in it. Given the possibility that UV light is detrimental to humans, an encapsulated system based on Arduino Microcontroller and IR sensors is being used on top of device to detect movement and the existence of people or animals. Therefore, utilizing a UV robot to sterilize rooms the most efficient strategies to reduce contracting Corona virus and other harmful microorganisms.**

I. INTRODUCTION

Inactivating or eradicating microorganisms is the ultimate goal of disinfection and sterilization in order to stop the spread of infections and diseases that are carried by the air. Pathogens can spread through surfaces that are contaminated, either through contact or the air, increasing the risk of disease transmission. The likelihood of disease transmission is decreased with the help of proper disinfection and sterilization. The prevention and transmission of disease depends heavily on surface disinfection. A safe life is ensured by effective and regular environmental disinfection.
UV radiation is one of the greatest techniques available for disinfection. A particularly clear example of ultraviolet germicidal irradiation is the disinfection of surfaces in hospitals or other settings (UVGI). There are numerous uses for UV-C light in the sanitization and disinfection industries. Sanitation in hospital facilities and camps is a difficult task that calls for extreme precautions. But even with all these sophisticated precautions, there is still a risk involved.
This work seeks to reduce human interaction as much as possible by the use of robots to automate processes like sanitization. In this situation, robot use can lessen human exposure to viruses, which is crucial given the rise in epidemics. The sanitization robot is being designed and developed using the Arduino IDE software.

Hospital UV disinfection systems are created by a business named UVD Robots. Despite the fact that these robots are efficient at eliminating bacteria in hospital rooms, we 2 want to sell our design for more compact applications. We anticipate that restaurant users will be able to clean surfaces like tables using our approach. Comparing our UV solution to other available technologies, it will also be less expensive. The automated robot is vital to relieving staff stress by thoroughly sanitizing tables of disease - causing bacteria. The staff can set the equipment on the table to eliminate the disinfection portion of the process if they only have time to clean up crumbs and trash after customers depart.

To limit the occurrence of microorganisms, an affordable and efficient UV robot has indeed been developed. It follows the designated course and has the ability to penetrate difficult locations for efficient disinfection. Humans are threatened by excessive exposure to ultraviolet light from either naturally occurring sources or manufactured sources. Skin reddening, itching, and skin peeling occur when skin gets to ultraviolet rays because the skin cells absorb the UV rays and become damaged.
Skin malignancies, tissue damage, DNA damage, and cell and cell-related damage are all brought on by exposing skin to uv light. Numerous eye conditions, including Photokeratitis, Photo conjunctivitis, Cataract, as well as eye cancer and blindness, are brought on by exposure to ultraviolet light. UV radiation affects the immune system in addition to the skin and eyes. Our robot is therefore equipped with (motion sensor) IR sensors, which are mostly employed in burglar alarms and security systems, in order to overcome the aforementioned drawbacks. Security measures to identify human movement Such IR sensors are put on the robot's top to detect any movement (human or animal), at which point it automatically put off the UV light. The machine is made to follow a predetermined path because of the way it is created.

II. Related Research

The following references demonstrate the influence on the development of the intelligent health assistant robot. There are few research publications discussing medically relevant robots. A companion robot and anthropomorphic (manlike) medical helper have been created by Marcin Zukowski et al. for children's hospitals.This section includes a thorough summary of the literature. Aladin Begic suggested using low-tech, high-impact disinfectant robots for cleaning medical facilities. These are semi-automated methods that lower the levels of MRSA and heterotrophic bacteria on high-touch surfaces in rooms where MRSA patients have recently left. Training staff members to use the robots is part of implementation, and the device must function while the room is empty.

An ultraviolet sterilisation robot for disinfection has been invented by Pacharawan Chanprakon, Tapparat Sae-oung, Treesukon Tree bupachat sakul, Pimkhuan Hannanta-anan, and Wibool Piyawattana metha. To avoid running into obstacles, this robot uses webcam cameras and ultrasonic sensors. The robot navigates using the signals from these sensors and the webcam. This robot disinfects by illuminating a 360° angle with three UV lamps. The user can control this robot's movement, speed, and UV lamp on/off via a website connected to the same Wi-Fi network.

Sterilization utilising 365nm UV-LED has been proposed by Noriyuki YAGI, et al. This study investigates UV-LED sterilisation effects and establishes that UV-LED can kill morbific bacteria. This study makes the assumption that because UV-LEDs are smaller and bright than low-pressure mercury lamps, they can be used efficiently for sterilising.

To stop the spread of infections and HAIs, Thomas Rubaek and colleagues created a UV-Disinfection robot (HAIs). The robot is often used to clean specific locations in hospitals and other settings. This robot is intended to eradicate various bacterial species.

The Hyper Light Disinfection Robot, developed by Jui - Hsuan Yang et al., proved successful in eliminating a variety of multi drug resistance microbial agents that are frequently seen in hospitals. On areas with shadows, the Hyper Light Disinfection Robot's efficiency was quite low. Due to the risk of UV exposure to other patients undergoing treatment or present in the same room, using this UV-C device in a double or triple room may not be practical. Due to safety precautions, this device cannot be put to use in rooms full of people or wide open areas. Consolidated ultraviolet beams are released in the method of UV sanitising to kill bacteria and other hazardous germs, with a disinfectant rate of 99 percent demonstrated.

III. Methodology

Hardware Components

1. ARDUINO UNO

The Arduino Uno is a microcontroller board created by Arduino.cc that is placed upon the Microchip ATmega328P microprocessor. A number of association for the advancement and other circuits can be connected to the board's digital and analogue i/o pins. It accepts 7 to 20 volts of power, but can also be plugged by an external power supply or a USB cable. In some ways, it resembles the Arduino Nano and Leonardo. The Italian term "uno," that also means "one," has been chosen to represent the Arduino Software's launch. The Arduino Uno is the first in a series of USB-based Arduino microcontroller. It formed the basis for subsequent Arduino releases, along with older iterations of the Arduino IDE. A bootloader that comes pre-installed on the board's ATmega328 allows new code to be uploaded to it even without an external interactive element.

Fig. 1 Arduino Uno

2. MH-B IR SENSOR

Infrared motion sensors, that create and absorb infrared radiation, use radar technology. This radiation is reflected ahead to the device's receiving antenna when it strikes nearby objects. The device can assess how much an element is from the device and identify mobility in the surrounding region using digital techniques.

Fig. 2 IR Sensor

3. HC- SR04 ULTRASONIC SENSOR

It is a 4-pin module with the following pin names: Vcc pin, Trigger pin, Echo pin, and Ground pin. This device is fairly common and is utilised in many applications where sensing objects or measuring distance is necessary. The transceiver are formed by two projects that resemble eyeballs on the front of the module. An ultrasonic wave is transmitted by the transmitter, travels through the air, and is detected more by receiver module when it is directed back towards the sensor by any object.

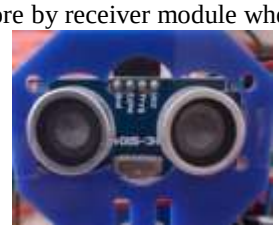

Fig. 3 Ultrasonic Sensor

4. UV LED

Since they don't emit ozone, use less energy, and don't contain hazardous mercury, UV LEDs are now more eco friendly. The use of UV-C LEDs is expanding quickly in applications including germicidal (UVGI) for the cleansing of air, surfaces, and water.

5. L298n MOTOR DRIVER

Seen between motors as well as the control circuits, motor drivers serve as an interface. While the controller circuit operates on signals with minimal current, the motor requires a considerable quantity of power. Motor driver therefore is having the job of intaking a reduced control signal and converting it to a greater output that can move a motor.

Fig. 4 Motor Driver

6. DC MOTOR

DC motors helps to move the robot when it is connected to the motor driver; every time the motor driver receives the trigger signal, the motor moves in accordance with the trigger at the specified speed.

WORKING

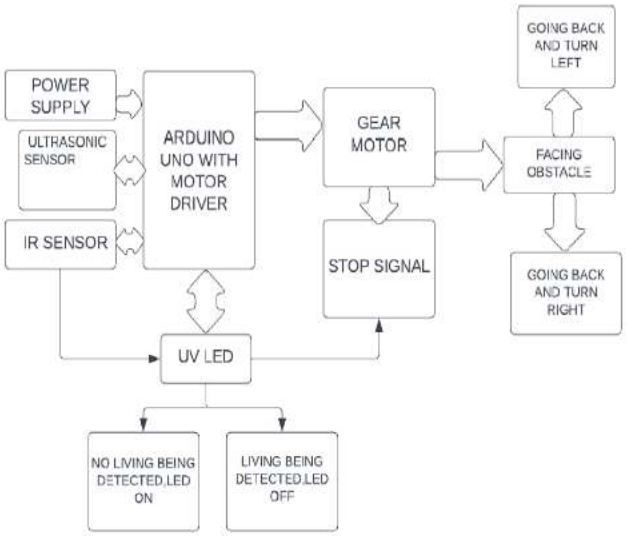

Fig. 5 Block diagram - Proposed system of UV Sanitizing Robot.

The instant the robot gets turned ON, disinfection begins. The robot follows the specified line to another directed spot whenever the cleaning of a certain area is finished. The space or location is thoroughly cleaned by repeating this process. When an animal or person enters the working area while the UV lights are still disinfecting it, a command is sent to turn them off automatically. Before communicating with the robot, the computer chip processes the information that the IR sensors first collected. The robot remains in its current location if decontamination is not performed. After a little wait, the IR sensors check for human presence by generally detecting infrared radiation from a defined range of the surrounding region. Robot restarts after the IR sensors determine that no people or animals are inside its line of sight, at which point the UV light

automatically turns on to complete the operation. The machine can be programmed to disinfect another area or be switched off after thoroughly sanitizing a space.

IV. Results

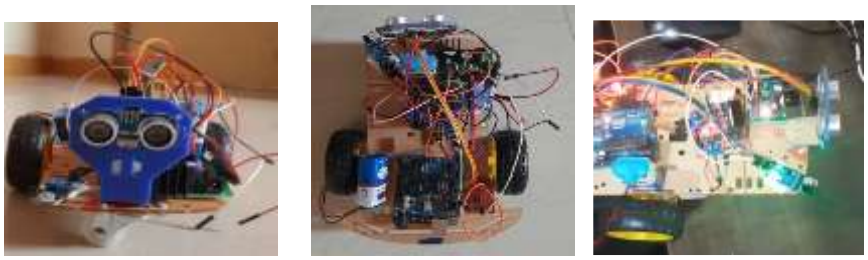

Fig. 6 UV Sanitizing Robot

The robot was created and built with the intention of disinfecting surfaces.The examination of the effectiveness of the robot in both a 12x12 and 15x15 foot space. Our robot needs 25 minutes to thoroughly clean a 12x12-foot space free of any impediments or signs of people or animals. A 15x15 foot room needs to be cleaned in 26 min 49 sec. When an animal or human is detected, the machine takes much greater action. The process of disinfection stops while they are there, giving time to disinfect. The duration of effort based on the distance in between device and the individual as well as their walking speed.

There are, regrettably, certain restrictions. The fact that UV radiation cannot pass through tempered glass or other surfaces is the first important factor to take into account. The area above a certain altitude is not disinfected because the machine can only decontaminate up to a specific height. The second important thing is related to distance; the farther the robot, the less sanitization.

V. Conclusion

The design of the project of a truly automated, inexpensive UV disinfection robot are described in this work. This robot can sterilise surfaces using 20W UV lamps to protect people from the coronavirus. Since UV is fatal and toxic to all living things in addition to bacteria, disinfection is carried out including a pre-defined path without the involvement of humans. Coronavirus on the surface must be inactivated by the UV sanitizing robot for a minimum of 57 seconds. With help of IR motion detectors, device is able to travel round the room and automatically turn off the UV lamps when it detects people or animals, making it safe and possible to work at anyplace and from wherever by pre-allotting the duration of sterilization. UV sanitizing robot frequently operates in populated areas. Therefore, in addition to cleaning effectively, this robot should coexist peacefully with people. As a result, this robot can be given cognitive skills by using relatively straightforward and effective theoretical methods.

By analysing the surroundings and enhancing safety, the robot's cleaning performance can be considerably increased. This machine can be modified to use solar energy or another renewable energy source to reduce its environmental impact.

References

[1] Aladin Begic, “Application Of Service Robots For Disinfection In Medical Institutions”, Advanced Technologies, Systems, and Applications II. 2018

[2] Pacharawan Chanprakon, Tapparat Sae-OungTreesukonTreebupachatsakul, PimkhuanHannanta-anan, WiboolPiyawattanametha,, “An Ultra-Violet Sterilization Robot For Disinfection”, IEEE,2019.

[3] Noriyuki yagi, mirei mori, akiko hamamoto, masayuki nakano, masatake akutagawa, souko tachibana, akira takahashi, toshitaka ikehara, yohsuke kinouchi, “Sterilization Using 365 Nm Uv-Led”, 29th Annual International Conference of the IEEE EMBS Cité Internationale, 2007

[4] Thomas Rubaek, Merima Cikotic, Simon Falden, “Evaluation Of The Uv-Disinfection Robot”, 2016.

[5] RuchikaThukral, Gulshan, Ashwani Kumar and A.S. Arora, “Effects Of Different Radiations Of Electromagnetic Spectrum On Human Health.”, IEEE, 2020.

[6] RabiulHossen Rafi, Shuva Das, Nowsher Ahmed, Iftekhar Hossain, SM Taslim Reza, “Design And Implementation Of Line Following Robot”, IEEE, 19th International Conference on Computer and Information Technology, 2016.

[7] Hasan U. Zaman, Md. Majidul Haque Bhuiyan, Montashir Ahmed, SM Tarek Aziz, “A Novel Design Of Line Following Robot With Multifarious Function Ability”, IEEE, 2016.

[8] Aicha Moulay, Fatima Laoufi, TarakBenslimane, “Fpga-Based Car-Like Robot Path Follower With Obstacle Avoidance”, International Conference on Mathematics and Information Technology, IEEE,2020.

[9] Kazi Mahmud Hasan, Abdullah-Al-Nahid, Abdullah Al Mamun, “Implementation Of Autonomous Line Follower Robot For Various Purposes “, IEEE, 2013.

[10] Michael S. Shur, RemisGaska, “Deep-Ultraviolet Light Emitting Diodes”, IEEE TRANSACTIONS ON ELECTRON DEVICES,IEEE,2010.