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DESIGN AND IMPLEMENTATION OF AN AUTONOMUS SYSTEM FOR KILLING BACTERIA USING UV TECHNOLOGY

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ABSTRACT

Infection is a major problem for hospitals, Offices and some other places. latest safety technologies, human error safeguards, and autonomous mobility allows the UVD robot to disinfect any surface in any enclosed area, as a routine matter. The machine drives to user-defined area, where it navigates by joystick. UVD robot zapping bacteria and harmful microorganisms with concentrated UV light from many different angles. The robot can disinfect and kill diseases, viruses, bacteria, and other types of harmful organic microorganisms in the environment, with ultraviolet light, by breaking down their DNA-structure. Currently, several countries have tested these robots successfully to disinfect their hospitals, public transports, office spaces, and other public places. We have implemented this UV robot in accost-effective way to expand the disinfection process to public places

ULTRAVIOLET GERMICIDAL IRRADIATION (UVGI)

Ultraviolet germicidal irradiation (UVGI) is a disinfection method that uses short-wavelength ultraviolet (ultraviolet C or UVC) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions. UVC is absorbed by RNA and DNA bases and can cause the photochemical fusion of two adjacent pyrimidines into covalently linked dimers, which then become non-pairing bases. In that UVGI light which discharge the low-pressure mercury(hg) from the lamp and LED are commonly used in UVGI applications and emit shortwave ultraviolet (100-280 nanometre) radiation, primarily at nm. Considering the covid 19 situation the inactivate of the same virus using UV light is considered here. Specifications of the UV light, the manufactures have given UV light intensity in terms of “microwatt per square centimetre” at distance of 1 meter. Micro watt per square centimetre stands for the energy passed through an area of one square centimetre within one second. UGVI is used in a variety of applications, such as food, air, and water purification.

Features Involved

The universal system is a bit complex as we have added some new technology and safety features to comply with the industry standards. The components used are FP video system, Ground station controller, The uv light tower, DC gear motor, RC radio controller

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Ground station controller

This is the remote controller of the robot. The screen shows the camera feedback received from the robot. The joystick is used to move the robot. UV lights can be turned on and off using the UV switch. The arming switch acts as a safety switch. it cuts down all the functionalities of the upon turning on.

Ground vehicle

This robot is moved by two wheels which runs by DC geared motors (differential drive robot). It has two caster wheels at the front and back maintain the balance. We can able to place the electronic control system and the battery, which is a 12v 35Ah lead acid battery inside the ground vehicle. Arduino mega is powered with the main battery through a voltage regulator module to reduce the voltage from 12V to 5V. a four channel RC radio receiver with PWM outputs are connected to the mega board. Motors are driven through a dual channel H bridge motor driver which is connected to the Arduino board. An inverter is connected between the UV lights and the battery and controlled using relay switch connected to the Arduino board.

Fig. 1 Ground station controller

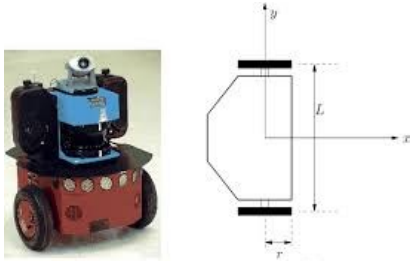

Fig. 2 Ground vehicle

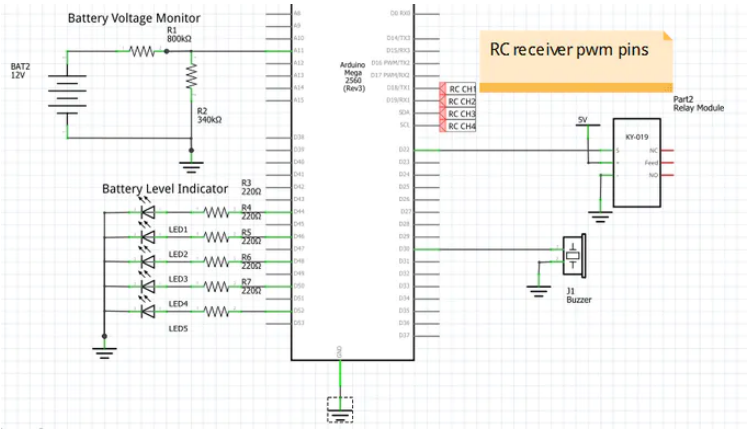

Fig. 3 Circuit Diagram

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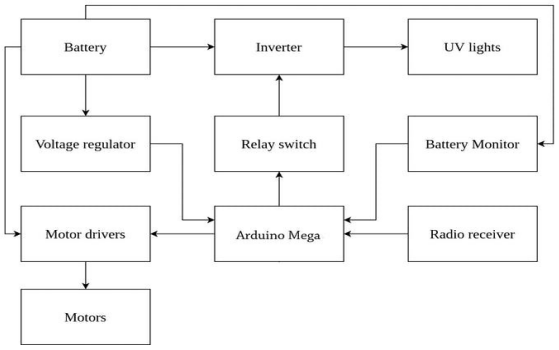

Fig. 4 Block diagram

UV LIGHT TOWER

In this robot we placed the UV bulbs which needs to separate electronic ballast unit to power up the bulb. The light tower contains 6UV bulbs that are placed around an aluminium cylinder which is made out of an aluminium sheet surrounded by it. Aluminium cylinder sheets acts as a reflector for UV rays.

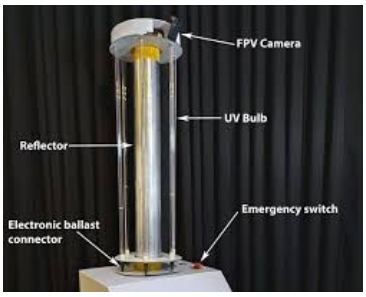

Fig. 5 UV Light tower

FPV VIDEO SYSTEM

Using an FPV system makes it easy to take video feed from the robot without using of any programming or connecting components. The robot has a camera and a video transmitter. only thing we have to do is connect the power to this system and then it automatically starts transmitting the video using 5.8GHz. The LCD screen with a built in 5.8 GHz video receiver. When you power up the screen it will start showing the camera feed.

EXPERIMENTS AND RESULTS

Before the robot begins its work, an environmental services technician cleans the room. Norman Regional uses chemicals that are approved by the Hospital Association and registered by the Environmental Protection Agency. After this process is complete, the technician brings the robot into the room and which is controlled by ground station controller making sure to close all windows and doors. Then the robot goes to work. An array of UV lamps mounted on top of the robot and sends a pulsating light that disinfects all surfaces the light touches. Timing depends on the size of the room, but the disinfection process takes about 15 to 25 minutes.

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For safety, the robot operates when people are not around, using its ground station controller detect motion and shutting the UV lights off if a person enters the area. The robot's UV array emits 20 joules per square meter per second (at 1-meter distance) of 254-nanometer light, which will utterly wreck 99.99 percent of germs in just a few minutes without the robot having to do anything more complicated than just sit there.

CONCLUSION

By the end of our work, the prototype the robot was tested in terms of disinfecting robot with ultraviolet lights by controlled by ground station controller. The results are much appreciable and gave us a new hope to proceed further.

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