UV DISINFECTION ROBOT

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***Abstract*— (UV) light is used for the final resolution of cleaning or disinfecting the spaces and facilities. UV-C is used because of its antibacterial properties, specifically viruses, and infections, but it also prevents people. In line with these lines, to eliminate sewage without the intervention of humans, a UV disinfection Robot has been built and executed following the aforementioned method. Two 18W UV lamps were installed in every direction. Since UV light might be harmful to humans, an Arduino-functioned artificial frame next to the ultrasonic sensor is used at the bottom of the robot that detects movement and the presence of a human or an organism. In this way, one of the most effective ways to prevent contamination of SARS-COV-2 (Coronavirus) is to clean the spaces using a UV robot.**

Keywords— UV lamps, UV disinfection robot, ultrasonic sensors, SARS-COV-2,

I. INTRODUCTION

Robots utilizing various advancements are being conveyed on the forefront in the battle against Coronavirus. Among these robots, sanitization robots are exceptionally compelling. Models utilizing bright (UV) light are traveling through emergency clinics, medical care habitats, government structures, schools, universities and public focuses across the globe in a bid to sanitize surfaces. The utilization of computerized sterilization hardware diminishes human openness to the infection as well as ending up being more thorough and successful in purifying spaces. Bright light has been utilized has a powerful answer for eradicating harmful microbes, infections in clinics for quite a long time. The UV-C light has been recently used to battle other Covid, for example, SARS.This strategy for cleaning is exhaustive, quicker and less work concentrated than manual cleaning. UV-C likewise diminishes the need to clean with amazing synthetics. An issues that synthetic compounds present is being destructive on certain surfaces .Ultraviolet light has a record of achievement in lessening the presence of infections, microbes and different microorganisms that are a danger to human wellbeing by preventing them from performing fundamental cell capacities. As the battle against the Coronavirus pandemic heightens, germicidal UV lights can give the UV sterilization is obligated to, lessening and settle the spread.

The specific point of sanitation and disinfection is the inactivity or disposal of microorganisms to stay away from the spread of airborne diseases and pollution. A wet environment increases the risk of transmission of the virus through contact with the air or air. Official sanitation and hygiene guidelines to reduce the chances of transmission of the disease. Extra interest plays an important role in preventing infection and transmission. Successful and sustainable natural contraceptives ensure a healthy lifespan. For the determination of end purity, UV light is rare compared to other potential systems. Infertility closure in clinics or elsewhere is a clear picture of bright germicidal light (UVGI). UV-C light has a combined value for use in the field of sterilization and disinfection.

The range of UV rays is divided into three areas called UV-A, UV-B, UV-C. Immediately, UV-C rays are used for cleaning contacts as they have a frequency of 100-280nm and are strong enough to eliminate microorganisms. As UVC light is widely used in the cleaning industry, it can be used effectively as an important component of Crown's anti-bacterial properties. The worst point for hygiene and disinfection is the inactivity or removal of microorganisms to prevent the spread of airborne diseases and diseases. Damaged areas increase the risk of transmission of the virus through contact or air. Official sewage disposal and sanitation guidelines reduce the chances of transmission of infection. Surface sanitization plays a very important role in resistance and illness. Effective and regular sanitation for environmental conditions ensures safe health. For the purpose of end purity, UV light is prominent among other potential applications. The cleanliness of emergency room clinics or in any other area is an undeniable example of the bright germicidal light (UVGI). UV-C light has a different degree of use in the fields of contraception and disinfection.

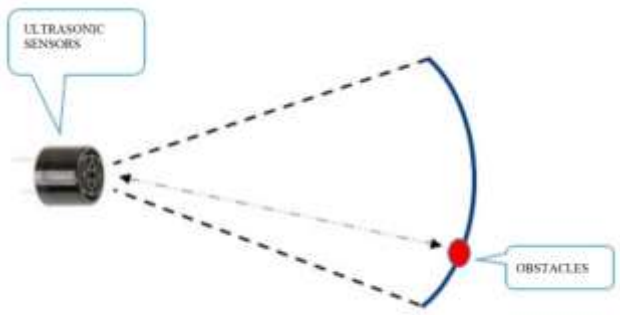

Figure 1. *Field view of ultrasonic sensors*

Ultrasonic sensors work by emanating sound waves at a recurrence excessively high for people to hear. They

then, at that point trust that the sound will be reflected back, computing distance dependent on the time required. This is like how radar estimates the time it takes a radio wave to return subsequent to hitting an item.

In figure 1 we can see the field view of ultrasonic sensor we used it for object detection were it sends sound and receives it back and gives the signal to microprocessor and microprocessor controls direction with combination of ultrasonic sensors and microcontroller it acts like obstacle avoider.

II. BACKGROUND

A. Ultra Violet Disinfection :

By the 1930's, UV light was being used regularly in all air and water emergency clinics and in any area where bacterial infection was a main concern. UV light gained prominence during the 1950's by helping to eliminate TB. Strong UV-C light during sterilization breaks the DNA of microorganisms in these lines killing the volume of the life form to replicate it, can be considered dead as it can increase its value continuously. DNA and RNA absorb the UV-C Which are the foundations that promote sub-atom formation by contact called image shading. Rapid exposure to UV-C rays on a person's skin or eyes promotes disease. Sufficiency depends on the opening time and the distance to the source material.

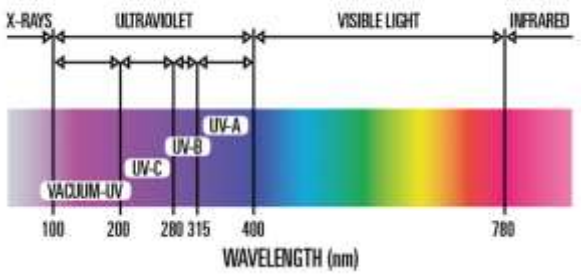

Figure 2. *Electromagnetic spectrum of UV light.*

The immediate openness of UV-C can be hazardous to people however after going through glass or straightforward plastic packaging, for example the UV beams from sun passing through Ozone layer, the light that happens to it is only the blue light, barring the UV-C radiation.

B. Harmfull Effects Of Ultraviolet Rays :

Not only benefits but when there is not much disruption of UV lamps that damage the human limit for light beams from accessible sources or created sources affecting humans. By the time the skin is exposed to the emissions of Bright, the skin cells are damaged by inserting Bright rods and lead to skin irritation, itching and peeling of the skin. The forcing of the skin into bright rays also causes damages for cell, tissue and DNA, and also skin diseases.

Lightening of the eyes causes many eye problems Photograph conjunctivitis, Waterfall and similarly can cause damaging growth of the eyes and blurred vision. Light rays affect the skin and the eye as well as the sensitive structure. In line with these lines, to stay away from the evils described above, our robot is provided with ultrasonic sensors used mainly for crime alarms and safety devices to detect human movements. These sensors are located in the lower part of the robot to detect any growth (human / creature). The robot is programmed to follow a predetermined pattern.

C. Formula Of Time Required And Brightness of Coronavirus :

To determine the timing of the coronavirus activation exposure, it is important to identify the UV energy level. The brightness or energy unit is transmitted as a microwatt per centimeter square (µW / cm2), which is the energy in each region at a given time. UV sterilization ratios are part of the total power of UV-C light and the opening length and are given by (I). From this, the required duration of UV sanitization (e.g. Covid inactivity) is directly proportional to the radiant UV segment as shown under condition (ii).

Equations:

Brightness = Luminosity (w) / 4π distance ^2(cm^2)

----(i)

Time = UV dose (µWsec/cm^2)/Brightness(µW/cm^2)

----(ii)

III. LITERATURE SURVEY

[1] PacharawanChanprakon, et al. They have developed an UV contraceptive robot to kill the virus. This robot uses ultrasonic sensors to avoid collisions and these sensors and the webcam is used to direct the robot. The robot uses three UV lamps to cover a wide range of disinfection. The mobility, speed of this robot, and UV light can be controlled by the operator.

[2] Thomas Rubaek, Merima Cikotic, Simon Falden "Evaluation of The UV Disinfection Robot", In this paper, we can say that they have planned and carried out a practical UV sanitization robot with Bluetooth control. The sanitization is done thru a pre-characterized way without worker mediation, The UV robot needs in any event requires around a minute to disinfect the surface around.

[3] O. Hachour, "Path planning of Autonomous Mobile robot", In this paper it clarifies about the self-ruling robots which work without human administrators are needed in automated fields. To accomplish assignments, self-governing robots must be keen and ought to choose their own activity. At the point when the self-sufficient robot chooses its activity, it is important to design ideally relying upon their errands.

[4] Jui-HsuanYang, et al. "Effectiveness of An Ultraviolet-C Disinfection System for Reduction of Healthcare Associated Pathogens" This paper says that, the oddity of the current investigation is the exhibition of the effect of the UV-C sterilization framework against development of infections. NTM (NON-TUBERCULOUS MICRO BACTERIA) have been progressively answered to cause iatrogenic circulatory system disease, 6 catheter-related contamination, skin and delicate tissue diseases.

[5] Aladin Begic, et al. "Application of Service Robots for Disinfection in Medical Institutions" In this paper they have proposed the help sanitizer robots which are straightforward and powerful in sterilization in clinical establishments. These are partial computerized frameworks which reduce the microscopic organisms and MRSA in room touch surfaces and cleared by MRSA affected people.

[6] Noriyuki YAGI, et al. worked on disinfection robot with high wavelength by using UV-LED. This projects looks at the disinfection impacts of ultraviolet rays and demonstrates that UV-LED is equipped for cleaning embarrass microbes. This paper proposes that UV-LED is more modest and more brilliant compared to light pressured mercury light, so UV-LED can be utilized with the end goal of cleansing adequately.

IV. METHODOLOGY

The UV sanitization robot has a little structure factor and can be killed by activation of UV light without involvement of people so no harm is done. Key parts of the robot are three ultrasonic sensors, two UV lights, regulator (arduino), power supply battery. The stature of the robot is around 123 centimeters.

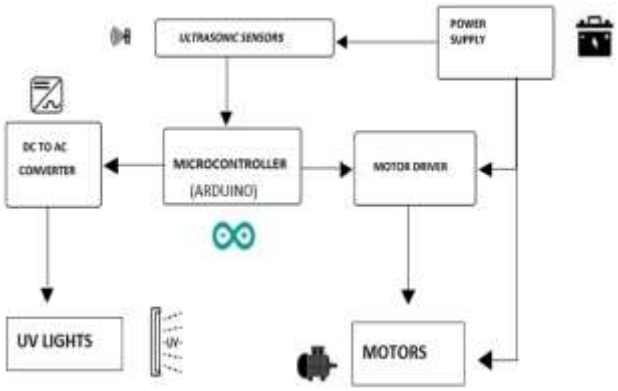

Figure 4. *Block diagram of control framework*

Figure 4 shows the block diagram of whole system. Here a microcontroller will be used to control the operation of UV lights using DC to AC converter. Based on ultra-sonic sensors input, the robot will move inside a room avoiding obstacles. The actual plan of connection UV light and Robotic system is shown in figure 5.

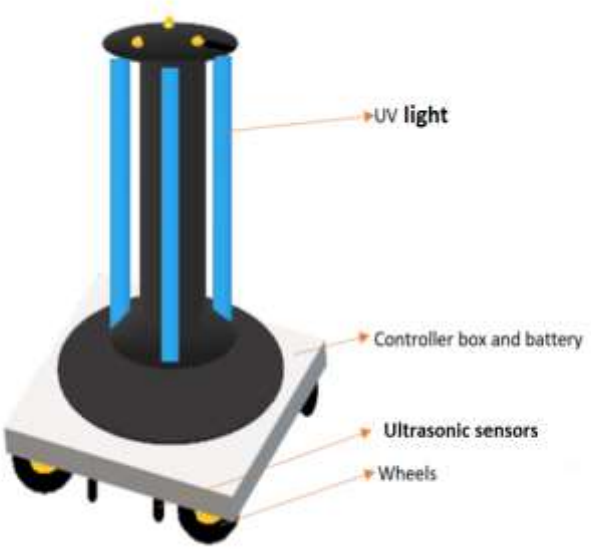

Figure 5. plan of UV Disinfection robot

The primary war room of the robot is the miniature regulator. It is customized to recognize individuals or creatures with the assistance of three ultrasonic sensors which are fixed on lower part of the robot to cover a wide point. On the off chance that an individual is distinguished while sterilization measure is going on, the robot stops and the UV light gets killed. When the individual vacates the area or working territory, the UV lights are automated itself and the sanitization cycle continues further until the interaction is finished. The robot has three ultrasonic sensors at the bottom of the base to follow the well-defined-path.

Figure 6. *Equipment connection*

The microcontroller (Arduino) shown in figure 6 controls the direction of the robot based on the signals received by the sensors via motor driver which controls the movements of the motor

The DC to AC converter is used to convert the DC current from the power supply to AC current shown in figure 7 which is used to power the UV lights. The design and the block diagram of the robot is shown in the figure 4.

Figure 7. *Inverter circuit*

V. RESULT

The stature of the robot planned is 123 centimeters. The heaviness of it is about 6.5 kilograms. The robot that was planned and built is utilized with the end goal of surface sterilization. We have attempted the capability of our UV robot trailed a 14X12 feet room and 14x14 feet room. The average time consumed by our robot to disinfect a 10X10 feet room without any living being disclosure is 8 minutes.

The time taken for disinfection of a 15x15 feet room is 16min 49sec. If there should arise an occurrence of human or creature is recognition, the robot sets aside significantly more effort to sanitize as the sterilization interaction stops during their quality. The time relies upon the general length difference of the robot and the individual.

Since SARS CoV-2 can be transmitted straightforwardly from one individual to another by respiratory drops, proof recommended that it is communicated through interaction and fomites. Debased surfaces spread Human coronavirus, for example, SARS-CoV, Center East Respiratory Condition Covid (MERS-CoV), or endemic human coronavirus (HCoV) can continue to live on surfaces like metal, glass, or plastic for up to numerous days.

Here is the rundown of energy needed to kill various kinds of Covid, yet we don't have the foggiest idea about the specific illumination time required for SARS CoV-2. Notwithstanding, here is a table for different kinds of coronavirus and it is determined in j/m^2 for D90 portion (distance across of 90%) of UV light. A 18w cylinder can clean around 2.5 feet.

The table below summarizes the outcomes of studies that have been made on Coronavirus under brilliant light transparency, with the particular species appeared for every circumstance. The D90 regard shows the splendid part for 90% inactivation.

Indeed, all infection types of equivalent group have a comparative construction and a comparative RNA strand length. UV light examinations led previously were utilized to decide the UV radiation portion needed for 90% infection decrease (i.e., the log-decrease portion). Doses for a 90% obliteration of most microbes and infections range from 2000 to 12000 µW/cm2. The robot uses 2 UV lights in a round example to cover 360° and boost the productivity

Table 1. *Energy required to kill different corona virus*

virus	D90 dose (exposure) required	Irradiation Wavelength (nm)
Coronavirus	7 J/m2	222-254
Berne virus (Coronaviridae)	7 J/m2	222
Murine Coronavirus (MHV)	15 J/m2	240
zCanine Coronavirus (CCV)	29 J/m2	254
Murine Coronavirus (MHV)	29 J/m2	254
SARS Coronavirus CoV-P9	40 J/m2	254
Murine Coronavirus (MHV)	104 J/m2	260
SARS Coronavirus (Hanoi)	134J/m2	270
SARS Coronavirus (Urbani)	241 J/m2	365
Average	67 J/m2	250

So regardless of whether we contrast SARS CoV-2 with most elevated D90 portion of SARS Covid (Urbani), wanted direct calculation of time in seconds is as per the following data.

Exposure time = 241 J/m^2 (x) 4 (x) 3.14 (x) 1.8 /80
= 28 sec.

Every light has an 18–20-watt yield power. The measure of splendor for a distance of 2 feet away can be determined as:

Brightness = 20∗3(W)/ 4∗ π∗(158.49)2(cm^2)
=0.00018886W/cm^2
=188.86 µW/cm^2

An UV portion of 10,600 µW sec/cm^2 is needed for 90% infection decrease which can be well-thought-out as furthest constraint of log decrease middle portion (in low absorbance media). Subsequently, the time needed to kill virus is communicated as:

Time = 10,600(µW sec/cm2)/ 188.86(µW/cm2)*2
=26 sec.

VI. CONCLUSION

We have planned practical UV sanitization robot which can possibly kill the infection present on the surfaces by disinfecting it with the assistance of 18w UV lights. The robot shown in figure 8 is intended to explore self-governing utilizing the ultrasonic sensors. Which empowers the robot to move around the room and sanitize the infection present with no human contribution. This robot requires less an ideal opportunity for the inactivation of infection that are available on a superficial level. Henceforth, the plan of our robot has shown an incredible capacity to clean the surfaces by inactivating the infections present. Accordingly, making the climate more secure.

Figure 8: Final UV disinfection robot

The UV robot frequently works in inhabited environmental factors. Hence, this robot ought to clean effectively as well as agreeably coordinate with people. Thus, we can upgrade intellectual capacities to this UV robot by straightforward and effective hypothetical methodologies. The sterilization productivity can be upgraded with the climate change alongside the wellbeing to robot. To make it greater climate well disposed.

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