

Corona Disinfection Robot by Using Uvc Technology

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Abstract

The UV-C or Ultraviolet C technology has targeted to disinfect microorganisms or microbes by demolishing nucleic acids and DNA/RNA. To further improve that we are going to combine this UVC technology with Robotics, our technology is now targeting to disinfect corona virus or any other microorganism from the floors, Patient rooms, ambulances etc. This technology has a wide range of application in the medical field. Because of this system we do not need to contact the virus affected persons room directly for sanitization purpose. This will restrict or prevent the spread of the virus. A normal people can able to control this system easily. This system going to be a great alternative for sanitization (both alcohol and HOCL based sanitization). In our system there are four wheeled Robot roaming around the surface and one UVC lamp mounted on the centre position on the robot set up that generates a light that can disinfect microorganisms up to a distance of eight feet on either side within 30 minutes exposure time. This system is extremely portable, light weight and easy to operate. We are going to tell about how we are going to use UVC technology, elaborately in this article.

Keywords: UVC, Sanitization, Disinfection, Robot.

I INTRODUCTION

On 31 December 2019, tremendous amounts of cases of pneumonia of unknown reason in the city of Wuhan in China reported to the WHO (World Health Organization). The world Health Organization has officially announced or declared the coronavirus disease 2019 as a pandemic. Till now we are in the state to stop the spread of the virus by keeping social distancing, wearing mask and deep cleaning or sanitization. This Corona virus disease caused by SARS-CoV-2 which can affect our respiratory system (sinuses, throat, lungs, windpipes). It spreads mainly through affected 1) Person-to-person contact, 2) Affected objects (like surface, floors, room etc)-to-person. The person-to-person spread could be avoided by wearing masks and by following social distancing. But the second type of spread could only avoid by deep sanitization of surfaces or objects. That's why here we are going to use the UVC technology which will easily disinfect the virus by destroying the RNA of the corona virus. The main application of this technology is to control the Corona virus spread not only

corona this technology will disinfect the all kind of microorganisms. So it will be going to be a great system during pandemic periods.

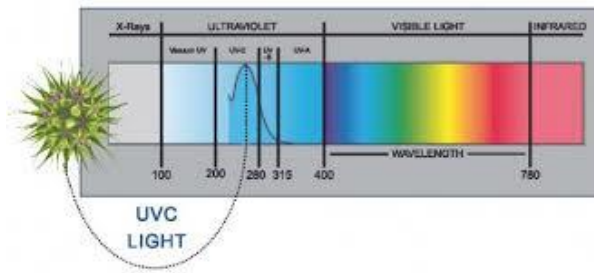


Figure 1. UVC Spectrum

II HISTORY

¹In late 1845, it became known about that microorganisms have the ability to respond to light. It is a base for the history of studying Ultraviolet C like a way to kill virus, bacteria and other organisms.²In 1877, Downes and Blunt inspected that subjecting test tubes holding Pasteur's solution to sunlight which was averted the growth of microorganisms inside the tube. Further they continued their experiment for longer duration, the experimented tubes remained microorganisms-free for some months. ³After between 1933-1935 William F Wells proves droplet nuclei hawking or spewing and showed that they can be killed in the air with the help of UVC technology.⁴After that in between 1937-1941, Wells later observes that upper room ultraviolet germicidal irradiation averted measles lay out in common schools. Nevertheless, he had a difficulty to rendering this discovery. But these early discoveries were the foundation for further research and advancements in UVC disinfection.⁵In 1972, Kethley and branch discovered that for the best disinfection need to consider the factors lamp locations and air movement patterns playing a vital role.⁶From 1985 to 1992 after the decades of decline there is an unexpected spread of TB(Tuberculosis) in the united states which leads to the interest in UVGI air disinfection methodology. ⁷After the year 2004 to present specialized UVC bulbs, light modules and controls have been introduced and being used. After, this UVC technology mostly used in food factories and hospitals. There are so many advancements and researches happening in this UVC technology day by day.

III HARDWARE DEVICES:

3.1. UVC Lamp:

It is a device which is used to generate an electric light which is bring out Ultraviolet C (UVC) light. It has a wavelength from the range 200 to 280 nm. Mostly it is being used to disinfect or inactivate the virus/bacteria/microorganism.

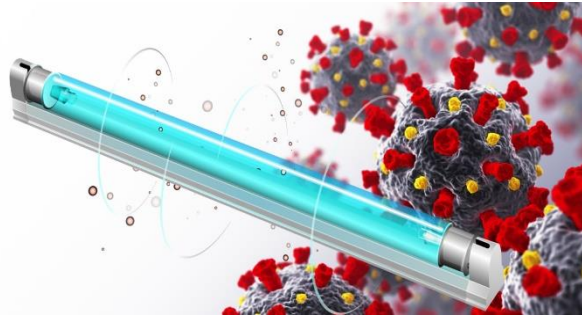


Figure 3. UVC Lamp(2600MAH)

Specifications (UVC Lamp):

- Voltage-160 volts
- Current-1.2 milliamps
- UVC power-65 watts
- Efficiency-34%.

3.1.1. How UVC disinfect corona virus:

UVC radiation clinically proven that can destroy the outer protein of the SARS-CoV-2 Virus. This leads to inactivation of virus. The UVC light is absorbed in the cellular RNA and DNA, destructing nucleic acids. This creates double bonds or dimers.

Table 1: Summary of Ultraviolet Studies on Coronaviruses

Microbe	D ₉₀ Dose J/m ²	UV k m ² /J	Base Pairs kb	Source
Coronavirus	6.6	0.35120	30741	Walker 2007 ^a
Berine virus (Coronaviridae)	7.2	0.32100	28480	Weiss 1986
SARS-CoV-2 (Italy-INM1)	12.3	0.18670	29811	Bianco 2020
Murine Coronavirus (MHV)	15.0	0.15351	31335	Hirano 1978
SARS Coronavirus (Frankfurt 1)	16.4	0.14040	29903	Eickmann 2020
Canine Coronavirus (CCV)	28.5	0.08079	29278	Saknimit 1988 ^b
Murine Coronavirus (MHV)	28.5	0.08079	31335	Saknimit 1988 ^b
SARS Coronavirus (CoV-P9)	40.0	0.05750	29829	Duan 2003 ^c
SARS-CoV-2 (SARS-CoV-2/HuDP/Kng/19-027)	41.7	0.05524	29811	Inagaki 2020
Murine Coronavirus (MHV)	103.0	0.02240	31335	Liu 2003
SARS Coronavirus (Hanoi)	133.9	0.01720	29751	Kariwa 2004 ^d
SARS Coronavirus (Urbani)	2410	0.00096	29751	Darnell 2004
Average	237	0.00972	including all studies	
Average excluding outliers	47	0.04943	excluding Walker, Weiss & Darnell	
Average for SARS-CoV-2	27	0.08528	two studies, 90% inactivation	

^a (Jingwen 2020)

^b (estimated)

^c (mean estimate)

^d (at 3 logs)

Figure 4. UV Studies on Corona viruses

3.2. Arduino Nano:

The Arduino nano is a compact, complete and breadboard-friendly based on the ATmega328 SMD package microcontroller. It has a mini-USB port. Power can be given through this mini-USB cable. This Arduino nano board does not need power select jumper.



Figure 5. Arduino nano development shield

In this nano board we are going to dump the code which will going to give control for our robot. Coding part would be done at Arduino IDE (Integrated Development Environment) software.

Specifications (Arduino Nano):

- Operating Voltage 5V
- SRAM 2KB
- Digital input/output pins 14
- Analog input pins 8
- EEPROM 1KB
- Flash Memory 32KB
- Clock Speed 16MHZ
- Dimensions 0.7" * 1.7"

3.3. HC-05 Bluetooth Module:

The Bluetooth technology used for wireless or remote communication. It can transmit and receives the data wirelessly. The range of Bluetooth is around 10 meters. It can transmit both sound and data. The globally available bandwidth is 2.4 GHZ. HC-05 Bluetooth module can be used in master or slave mode. It is also used in industrial applications, GPS receiver and portable devices.



Figure 6. HC-05 Bluetooth Module

Specifications (HC-05):

- Frequency: 2.4GHZ ISM Band

- Speed: Synchronous (1Mbps/1Mbps) & Asynchronous (2.1 Mbps (Max)/ 160 kbps)
- Modulation: Gaussian Frequency Shift Keying
- Power Supply: +3.3VDC 50mA

3.4. *Motors*: Here motors are going to use for the movement of robot wheels. So that our robot can easily roam around the surface or floors to sanitize.

IV. CURRENT CHALLENGES

Current obstacles are the adaption to timing of this technology. This involves the understanding of the virus structure. The UVC light may be irritate human skin over a long period of exposure.

V. SCHEMATIC DIAGRAM:

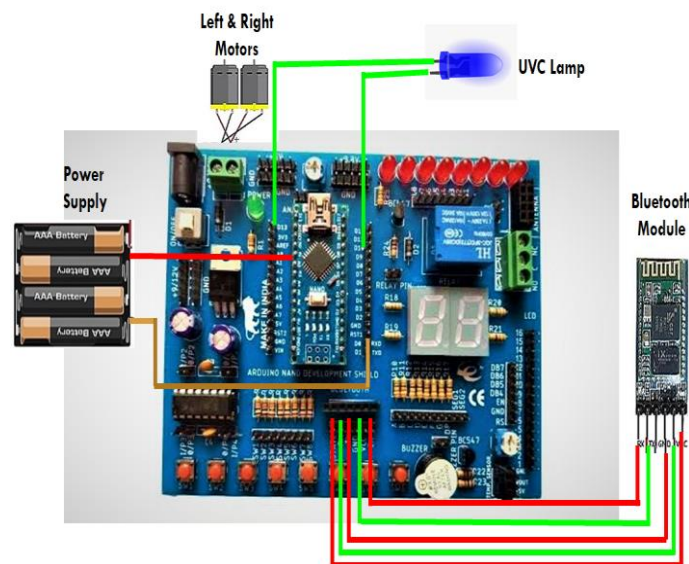


Figure7.Schematic Diagram Of Our Disinfection- Robot

VIII. APPLICATIONS:

This UVC light robot not only going to be useful in hospitals or medical field. It will also be going to be a great one for various sectors applications. They are,

- Agriculture field to protect crops from microorganisms.
- Public areas such as sluice rooms, schools, theatres, ambulances, buses etc.
- Food processing System.
- Medical testing and cleaning.
- Sterilization of home appliances.
- Mosquito-trapping.

IX FUTURE SCOPES

In future, on because of this technology we could easily control the spread of viruses or diseases by remotely during pandemic periods. People can easily operate this to prevent affected things-to-person virus/disease spread.



Figure 8. Future Scope

9.1 Limitations

The price is a considerable factor. The exact replicas can be produced by expertise persons only. Long-time exposure of human skin in UVC light may cause irritation. This technology requires devoted partners and progress capitalists to invest their money so that this could be rebellious.

CONCLUSION

Our machine going to use no chemicals, reaches floor to ceiling and is suitable for even the smallest of spaces. It is also extremely portable, meaning it can be used in areas such as ambulances, sluice rooms, theatres, patient rooms, and ambulances. This machine will be a light weight and easy to operate as compared to other alternative methods, that will sanitize the floor and disinfect corona virus remotely. In this *Covid-19 Pandemic* Situation we can easily Sanitize the room with it. This will become our need in future pandemic situations.

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