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DEVELOPMENT OF INNOVATIVE HEALTH GUARDIAN: UV-C DISINFECTION WITH SOLAR BATTERY CHARGING

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ABSTRACT

In today's world, the advancement of standard technology is accompanied by various challenges. The year 2019 experienced significant challenges that led to changes in several areas, particularly health. Most horrifyingly, many knowledgeable researchers and medical professionals have tried to find the solution but failed. This virus has not yet been cured. Many nations have proclaimed a state of emergency and issued movement control directives due to the virus's millions of fatalities and deep psychological scars. As a result, the government has taken several steps to stop the spread. However, The COVID-19 issue is still a challenge even after the availability of medicine and vaccine. Consequently, this effort is a step towards assisting us in avoiding this deadly infection. The initiative uses light technology, which efficiently kills viruses in water, air and germs. There are three types of UV rays: UV-A, UV-B, and UV-C. The nanometer-scale wavelength of these lights distinguishes them from one another. The wavelengths between 100 and 280nm are the most efficient for this eradication procedure. Additionally, this project makes use of solar-generated renewable energy. In conclusion, we always have strategies to avoid these COVID-19 symptoms because of the currents of modernity.

Keywords: health, UV-C, disinfection, solar battery.

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INTRODUCTION

Since 2019, the entire world has been affected by an unseen killer that caused a pandemic of respiratory illness which we all know as Coronavirus disease. This killing disease was caused by the virus called SARS-CoV-2. World Health Organization (WHO) the United Nations agency that provides leadership on global health matters first learned these cases on 31 December 2019. This case is reported after other diseases in Wuhan which are a cluster of 'viral pneumonia'.

Most people infected with COVID-19 recover without the need for hospital treatment, but around 15% become extremely severely ill and need respiratory assistance such as oxygen, and 5% become very sick and require intensive and periodic care. Furthermore, at a younger age, they can develop a severe inflammatory condition for a few days or weeks following an infection in rare circumstances. Other than that, people over the age of 60 are at the highest risk of developing severe sickness from COVID-19, and people who have medical problems such as obesity, high blood pressure, heart and lung difficulties, diabetes, or cancer are at a higher risk of getting a severe illness. Even so, anyone at any age can get infected by COVID-19 and have a chance to become extremely ill or the worst thing is death.

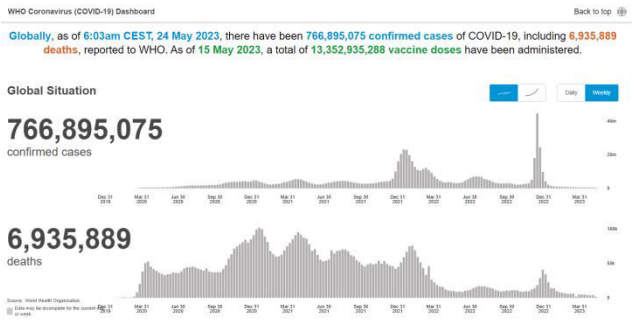

Figure-1. Global situation of COVID-19 data reported to WHO [1].

How does this disease transmit to another? There are several different ways that this virus can be spread, like close contact with each other. It can spread in microscopic liquid particles from an infected person whenever they are having cough, speak, sneeze, or breathe. When virus particles in the air are inhaled at close range, another person can become exposed to the virus. The virus can also spread in cramped and poor ventilation interior environments, where people prefer to stay longer. People can potentially contract the disease by touching their eyes, nose, or mouth after coming into contact with contaminated surfaces or things [2].

Until now, the most effective strategy to avoid and slow down the spreading is to know about the virus and how the virus transmits. Staying at least 1 meter apart from others to protect yourself and others from infection, use a well-fitted mask and often wipe or apply an alcohol-based rub to kill the germs at your hand. Also, get vaccinated to boost our antibodies and follow local guidance. The researcher has done so many studies to help our world fight against the disease. Therefore, some products to have been invented using various techniques including, light technology which is Ultraviolet-C (UV-C).

Figure-2. Several products against COVID-19.

UV-C lamps are also called "germicidal" lamps. In the pharmaceutical sector, UV-C radiation has long been used. UV-C radiation has been used to disinfect water, air, and several surfaces [3]. Also, UV-C radiation effectively decreases the spread of microorganisms such as tuberculosis for decades [4]. UV-C radiation has been proven to manipulate the outer protein coating by the SARS-Coronavirus [5]. The destruction ultimately inactivation of the virus. Thus, UV-C radiation may also be effective in inactivating and destroying the SARS-CoV-2 virus, which is the virus that causes the Coronavirus Disease 2019 (COVID-19) on any surface [6].

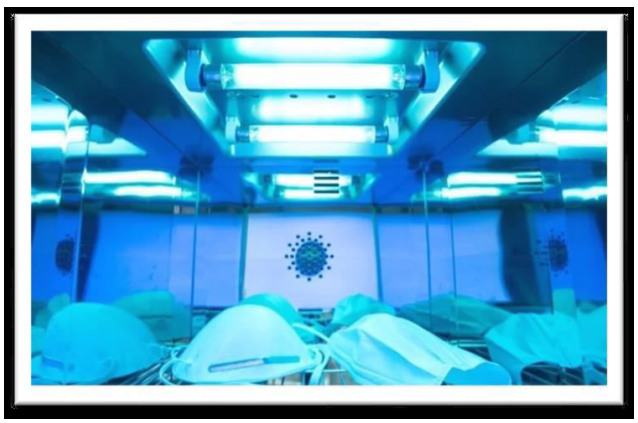

Figure-3. UV-C light prototype device.

Figure-4. Autonomous robots helping kill coronavirus in Hospitals using UV-C light technology.

METHODOLOGY

Figure-5 shows the block diagram and Figure-6 shows the flow chart for this project on developing the portable UV-C disinfecting device.

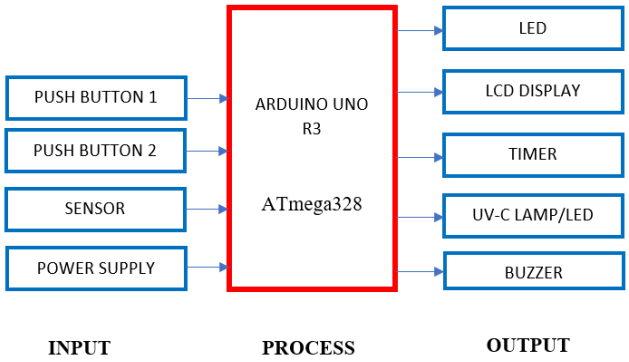

Figure-5. Block diagram for this project.

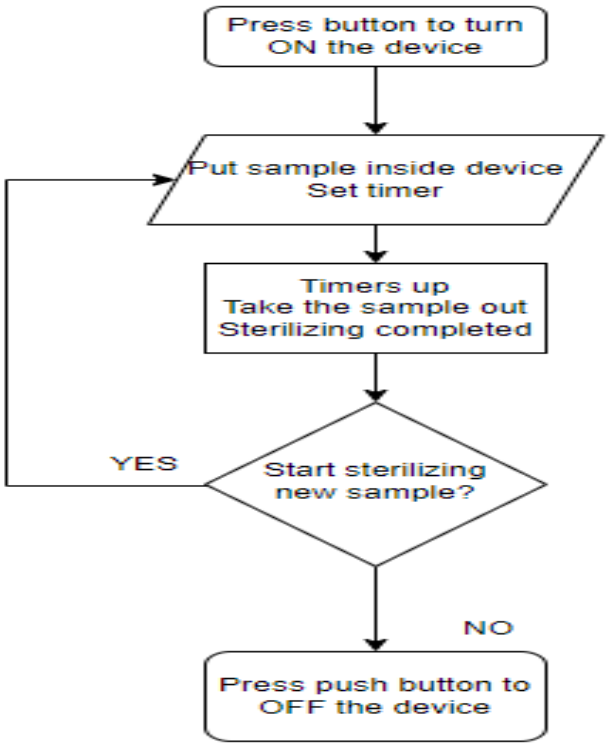

Figure-6. A Flowchart of the project.

The component used for this project is Arduino Uno, a relay, lithium-ion batteries, Solar Panel, buttons and some wires. The Arduino Uno will act like a brain that will control every operation of the project. Figure-7 shows the circuit diagram of all hardware connections and Figure-8 shows the complete prototype for this project.

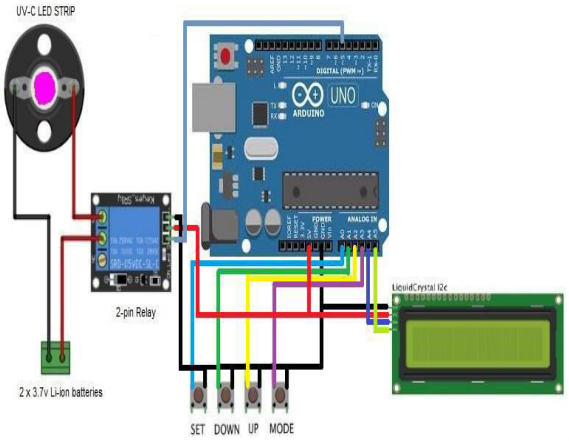

Figure-7. Circuit diagram of the project.

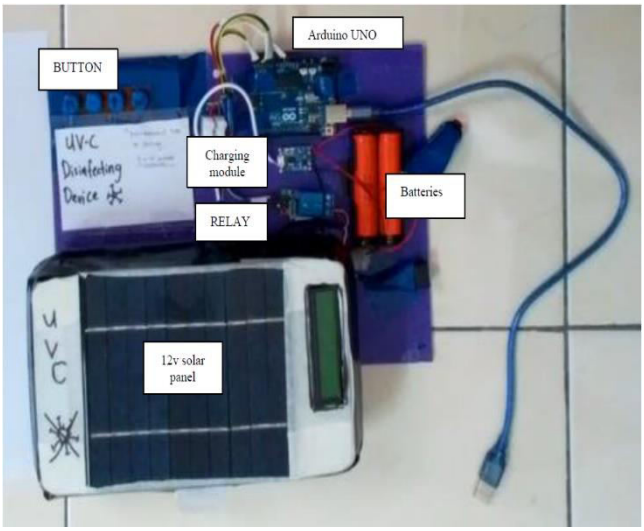

Figure-8. Complete prototype of this Project.

Detecting the Presence of UV-C Light

To make sure the UV-C is present in the device. UV test card has been used. The card will be put in the device for 1 minute and it will show the present by the colour appearing on the card. The intensity will be measured by the colour. If the purple colour becomes darker, that means, the intensity of UV light is more vigorous. Figure-9 shows the UV test card after a minute placed in the device.

Figure-9. The UV test card after being placed in the device for 1 minute.

Mold Bread Test

The mold bread test, referred to as the bread mold experiment or bread mold science experiment, is a fundamental biology activity frequently carried out in educational settings to illustrate the growth and progression of mold in food. This experiment entails observing the mold's development on a slice of bread exposed to various environmental conditions. The mold bread test will be done in this project to see the effect of UV-C. The step is shown and explained in Table-1.

Table-1. Step for mold bread test.

Step	Explanation	Result
1	Turn ON the device.	LCD display "UV-C disinfecting, TIMER"
2	Label all the plastic bags as; Control Before 3 minutes 5 minutes 10 minutes	
3	Spray water 3 times on every 5 slices of the bread. This step is to foster fungal growth.	
4	The first bread will be labeled as 'control' which is the clean bread so that we can see the difference with the dirty one. Then put it into the plastic bag as labeled.	
5	Rub the second bread with the smartphone using that will be put in the 'before' plastic bag.	

6	Turn ON UV-C disinfecting device and placed the smartphone in the device for 3 minutes. After that, take out the phone and rub the third bread with the smartphone and place the third bread in the '3 minutes' plastic bag.	
7	Repeat step 6, but put the phone inside the device for another 2 minutes. After that, rub again the fourth bread on the smartphone using that will be put in the '5 minutes' plastic bag.	
8	Repeat step 7, but put the phone in the UV-C device for another 5 minutes. The last bread will be put in the '10 minutes' plastic bag.	
9	Leave the bread at room temperature and avoid it from direct sunlight to let the fungi grow on it for at least 5 days	
10	After 5 days monitor the growth of the fungi and differentiate the amount of fungi growth for each slice of bread.	

RESULTS AND DISCUSSIONS

From Table-1, after 5 days indicates that the portable UV-C disinfection device is a proven method to control, reduce or kill all germs effectively in a minimum of 10 minutes inside the device. One of the primary advantages of our portable UV-C disinfecting device is its compact and lightweight design, making it highly convenient for use in various settings. The device's portability allows for easy deployment in houses, schools, offices, public transportation, and other locations with high footfall. Its practicality enables rapid disinfection of frequently touched surfaces, such as doorknobs, handrails, and shared equipment, contributing to enhanced hygiene and safety. In addition, the portability of the device also allows for flexibility in disinfection practices, enabling users to use it for any objects as needed such as smartphones, wallets and car keys. It is crucial for all people to sterilise all their belonging after going out since it is better to prevent than cure.

The incorporation of solar battery charging technology adds a sustainable dimension to our UV-C disinfecting device. By harnessing solar energy, the device becomes independent of traditional power sources, reducing electricity consumption and minimizing the overall environmental impact. This feature is especially beneficial in areas with limited access to electricity or during emergencies where power supply may be disrupted. Moreover, the solar charging capability ensures continuous operation and eliminates the need for frequent battery replacements, enhancing the device's usability and long-term cost-effectiveness.

CONCLUSIONS

The development of a portable UV-C disinfecting device with solar battery charging presents a significant advancement in disinfection technology. This innovative device offers a sustainable and efficient solution for disinfection needs, providing flexibility, portability, and user safety. By harnessing the power of UV-C light and solar energy, this device contributes to global efforts in combating the spread of infectious diseases while promoting environmentally friendly practices.

ACKNOWLEDGEMENT

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