Smart Ultra-Violet Disinfection Box

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Abstract - Covid19 changed all of humankind in 2020. Due to its fast and efficiently spreading nature, everyone forced to use face masks and gloves to protect everything from that touch. Covid-19 outbreak was crucial for everyone. Proper cleaning & disinfecting are important for reducing spread of Covid-19. So disinfecting contaminated surfaces is an important step in preventing the spread of infectious diseases and putting a stop to pandemics around the world. Maintaining safe and sanitary public spaces can be difficult, especially when multiple people touch the same surfaces on a regular basis if not properly maintained. Hand-held disinfection equipment is used to clean public places and frequently touched surfaces. Nowadays, various environmental public settings worldwide, from hospitals and health care facilities to shopping malls and airports are considering implementation of UV disinfection devices for disinfection of frequently touched surfaces and circulating air streams. Moreover, the general public utilizes UV sterilization devices for various surfaces, from doorknobs and keypads to personal protective equipment, or air purification devices with an integrated UV disinfection technology.

***Key Words*:** Covid-19, UV disinfection, Sanitization, Arduino Uno.

1. INTRODUCTION

Ultra Violet radiations, Chlorination, washing with soap and heating are some methods of sterilizing. Ultra Violet light is the best sterilizing and disinfectant agent, used for domestic as well as clinical purpose. Food packets, books, stationery, medical equipment's, toys, electronic gadgets like mobile phones, laptops, wrist watches, etc can be sterilized with UV radiation whereas other methods of sterilization cannot be used. UV light does not release any waste and is eco-friendly, if used in a controlled manner. UV radiation is a range of electromagnetic waves with shorter wavelength (high frequency and energy). The wavelength from 100-280 nm known as UV-C is the best disinfectant used for purifying water, air, sterilizing vegetables and surgical equipment's. Research has shown that UV-C wavelength can kill harmful fungi, protozoa, bacteria and viruses like SARS-CoV-2 Virus. For solving this problem in this project, we developed Smart Ultraviolet disinfection box.[7]

The system makes use of 2 UV-C tubes to achieve this task. Ultraviolet light is a form of electromagnetic radiation of a light with more energy than visible light, but less energy than x-rays. It can be classified into UV-A (315-400nm), UV-B (280-315nm) and UV-C (100-280nm). The higher energy UV rays can damage DNA and RNA via cross linking of thymidine and Uracil nucleotides, respectively. The damage caused to DNA and RNA [8] can result in destroying of replication of these organisms as it removes them from core. Now UV C has been proven to kill all viruses within a matter of seconds.

2. LITERATURE SURVEY

VGI modules are typically produced from low pressure mercury lamps that emit light from 100–290 nm, typically at a wavelength of 254 nm [1]. This wavelength is close to the wavelength that can kill bacteria, which is 265 nm.

A study of N95 FFR infected with influenza A H1N1 [2] found a reduction of 3 log after a UVGI dose of 1 J/cm2 was administered for 60–70 seconds. This dose has been supported by additional studies, and higher doses (> 1 J/cm2) provide reduced benefit.

Mijo Jose, Sreebha M S, Mr. Anil M [3] have proposed It is an box type sterilizer. A C-band UV light is used in the hollow rectangular wooden box for sterilizing. One side of the boa is a door. UV tube is placed at one side of the box. The object to be sterilized is placed inside the box.

Milad Raeiszadeh and Babak Adeli* [4] have proposed In this work, fundamentals of UV disinfection phenomena are addressed; furthermore, the essential parameters and protocols to guarantee the efficiecy of the UV sterilization process in a human safe manner are systematically elaborated.

Aladin Begic in his paper named "Application of Service Robots for Disinfection in Medical Institutions" [5] discussed about various service robots which are used in medicine industry mainly for disinfecting surrounding.

Cleveland Clinic Lerner Research Institute and Case Western Reserve University School of Medicine, Cleveland, OH, USA [6] states that One method of preserving our current supply of N95 filtering face-piece respirator (FFRs) is through cycles of decontamination and reuse with ultraviolet germicidal irradiation (UVGI).2–6 Ultraviolet (UV) light is a form of electromagnetic radiation with more energy than visible light, but less energy than x-rays. It can be categorized into UV-A (315-400 nm), UV-B (280-315 nm), and UV-C (100-280 nm).

3. OBJECTIVES

1. To develop Smart Ultraviolet Disinfection Box.
2. To reduce the human effort and attention.
3. To develop a device based on Ultraviolet Light.
4. To develop a simple system helpful to prevent disease.

4. METHODOLOGY

The Smart Ultraviolet Disinfection Box is a state-of-the-art device designed to harness the power of ultraviolet (UV) light for effective and efficient disinfection. UV light has long been recognized as a potent germicidal agent, capable of eliminating a wide range of pathogens, -including viruses, bacteria, and fungi.

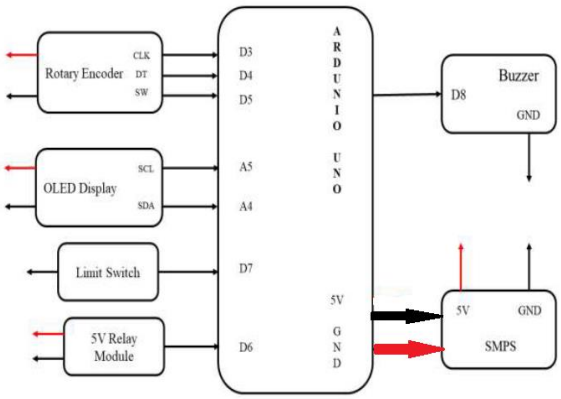

Fig. Block Diagram of Smart UV Disinfection Box

4-1 Component Details

4.1.1 Arduino Uno

Fig. 1: Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

4.1.2 UVC Tubes

Fig. 2: UVC Tubes

The UV-C batten is designed for the disinfection of surfaces and is suitable for a wide range of applications. The UV-C batten provides universal UV-C irradiance with homogenous distribution

4.1. 3 Rotary Encoder

Fig. 3: Rotary Encoder

A 360 Degree Rotary Encoder is a Bread Board Friendly extremely precise module that provides an indication of how much the knob has been rotated AND what direction it is rotating in. It is an incremental electro-mechanical device that converts the angular position or motion of a shaft or axle to digital code.

4.1.4 5V Relay Module

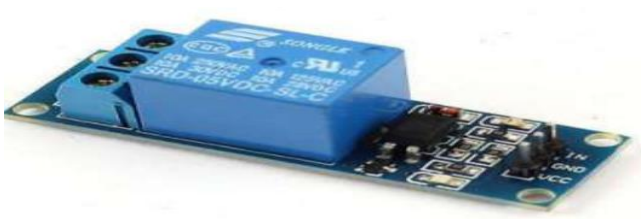

Fig. 4: 5V Relay Module

This is 1 Channel 5V Relay Board Module For Arduino PIC AVR DSP ARM.

4.1.5 0.96 OLED Display

Fig 5: 0.96 OLED Display

2.44 cm (0.96 Inch) Yellow/blue OLED LCD LED Display Module have Resolution of 128X64 and Viewing angle greater than 160 degrees. It is compatible for Arduino

4.1.6 LED

Fig.6: LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor

4.1. 7 Buzzer

Fig. 7: Buzzer

ADC buzzer consists of an electromechanical transducer, which converts electrical energy into mechanical vibrations that generate sound. It usually contains a coil and a magnet. When a direct current is passed through the coil, it creates a magnetic field that interacts with the magnet, causing the col to move back and forth rapidly. This movement produces vibrations, resulting in an audible buzzing sound

4.1.8 5V SMPS

Fig. 8: 5V SMPS

5 Volt 1 Amp Power Adapter takes an AC INPUT of 100-240V and gives 5V 1A DC output

4.1.9 PUC Foam

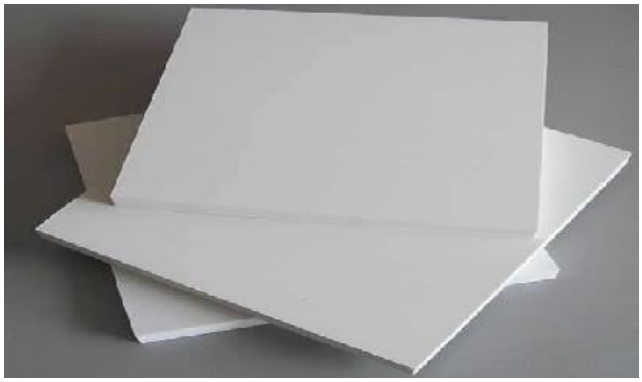

Fig. 9: PUC Foam

PUC foam sheet refers to a type of foam sheet that is made from Polyurethane (PU) foam. Polyurethane foam is a versatile material that can be used for a variety of applications due to its lightweight, durable and flexible nature.

5. CONCLUSIONS

1. Smart UV disinfection box incorporates several important features to ensure safety and efficiency.
2. The use of UVC lamps attached at the bottom and top of the box ensures that the entire surface of the items placed inside is exposed to the disinfecting UV light.
3. To enhance the effectiveness of the disinfection process, inside of the enclosure where the light will hit is covered with aluminum tape. This helps in reflecting the light evenly, ensuring thorough disinfection.
4. Safety is prioritized in the box through the inclusion of a limit switch.
5. The switch ensures that the lamps can only turn on or remain on when the door is closed, preventing any accidental exposure to UVC light. This feature provides an extra layer of protection for users.

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