

Hands Free Corona Virus Fighter

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Abstract— Viruses such as COVID-19 are transferrable through touch and contact. There are WHO guidelines to regularly wash hands with soap or sanitize hands regularly to reduce the risk of infection. Dispensing of sanitizer and liquid soap from bottle and storage would require manual intervention. In this paper we propose a novel design of touch-less sanitizer machine [1] and touch-less soap dispenser machine [1] to reduce the risk due to contact. The system can sense the proximity with the help of infrared sensor and sends signal to the microcontroller. The controller processes the sensor data & actuates the pump and the solenoid valve. The sanitizer liquid dispenses through mist nozzle. The devices like mobile phones, electronic car keys, TV and AC remotes, paper currencies etc. cannot be washed with soap nor can be sanitized. In this paper we propose a novel design of touch-less mobile controlled UVC [2] disinfecting chamber to disinfect such liquid sensitive devices from corona virus using UVC radiation in closed chamber.

Keywords: Contactless Sanitizer, Aerated Nozzle, Contactless Soap Dispenser, UVC Disinfecting Chamber, Linear Actuator, Servo Motor, Motor Driver IC, Infrared Proximity Sensor, MLX90614 Contactless Temperature Sensor, Speaker, Buzzer, Solenoid Valve, Flow Controller, Arduino UNO Micro-Controller, Switched Mode Power Supply, Bluetooth Module, Diaphragm Pump, LCD Module, Relay, RO Outlet Waste Water Storage, Contactless Water Dispenser, COVID-19, SARS-Cov-2

I. INTRODUCTION



Fig. 1: The prototype of the actual working project.

Coronaviruses are a large family of viruses that are known to cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). A novel coronavirus (COVID-19) was identified in 2019 in Wuhan, China. This is a new coronavirus that has not been previously identified in humans. The corona virus mainly transmits by the direct contact. People may become infected, by touching surfaces that have been contaminated by the virus, when touching their eyes, nose or mouth without cleaning their hands. To prevent the spread of this deadly corona virus

infection avoid touching surfaces, especially in public settings or health facilities, in case people infected with COVID-19 [2] have touched them. Clean surfaces regularly with standard disinfectants. Frequently clean your hands with soap and water, or an alcohol-based hand rub.

II. ALGORITHM INVOLVED

- 1) A person at the entrance will hear an alerting tune.
- 2) He/she will measure the temperature which will be displayed on the LCD.
- 3) Depending on the type of surface he/she will use sanitizer (as dry disinfectant) or liquid soap (as wet disinfectant).
- 4) The LCD will display the count, the number of times the sanitizer or the soap can be used again.
- 5) The stored waste water from the outlet of the RO purifiers will be used for washing hands (with liquid soap).
- 6) The essential items which cannot be sanitized or washed will be placed inside the UV chamber for disinfection.

III. PRINCIPLE OF OPERATION

An automatic soap dispenser [1] is a device that dispenses a controlled amount of soap solution (or a similar liquid such as a hand sanitizer). Infrared sensors detect infrared energy that is emitted by one's body heat. When hands are placed in the proximity of the sensor, the infrared energy quickly fluctuates. This fluctuation triggers the pump to activate and dispense the designated amount of soap.

The advancement of the automatic soap dispenser further creates an even more sterile environment. When various individuals use the pump, they will leave behind a variety of virus and bacterial colonies. These colonies will interbreed and lead to a more resistant strain of virus and bacteria that can re-contaminate different hands and would not be completely eliminated by the anti-bacterial soap. Wider spectra or higher levels of resistance, in the colonies that are present, are due to interaction and/or complementation between the resistance genes. Without having a wide variety of individuals touching the pump, bacterial transmission will be eliminated.

The mechanisms of the dispenser that work for soap may also work for other liquids: soap, hand sanitizer, lotion, laundry detergent etc. The wide range of possibilities extends the use of the dispenser to various other locations other than the bathroom.

A. Arduino UNO

Arduino [4] is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. In this project we have used arduino UNO for configuring our project based on our needs and the functions and commands

that we wanted to be implemented in our project “Hands Free Corona Fighter”.

B. IR Proximity Sensor

An infrared sensor [7] is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. In this project we have used IR proximity sensor for detecting the presence of hands near the nozzle for ejecting sanitizer and liquid and also detecting the presence of hands near temperature sensor for measuring the temperature.

C. MLX90614 Temperature Sensor

MLX90614 [10] is a temperature measurement device works on infrared radiations. It is the best choice for such applications where we cannot easily reach to measure temperature because it provides non-contact measurement of temperature. It has Infra-Red radiation receptive thermopile and ASSP (Acoustics Speech and Signal Processing) on same TO-39 cascading. In this project we have used MLX90614 temperature sensor for measuring the temperature of people at the entrance without any physical contact with the person. Thus, this project discourages the transmission of virus and pathogens from contaminated surface contact.

D. Switched Mode Power Supply (SMPS)

Switched circuits are becoming popular, many electronic systems are designed with power supplies which consist of a simple transformer, a rectifier, and a filter to remove ripple voltage from the output. Correct power supply design requires a knowledge of the current in the transformer windings. Practical designs of power supplies often include circuits in which the ripple voltage is not low and the capacitor recharge time is not near zero. In this project we have designed switched mode power supply [3] through which we have stepped down 230V A.C. power supply into D.C. supplies of 24V for the solenoid valve, 9V for the linear actuator and 5V for the electronic components.

E. Solenoid Valve

A solenoid [5] control valve is a kind of isolation valve that is an electromechanical device allowing an electrical device to control the flow of gas or liquid. The electrical device causes a current to flow through a coil located on the solenoid valve, which in turn results in a magnetic field that causes the displacement of a metal actuator. The actuator is mechanically linked to a valve inside the solenoid valve. This mechanical valve then opens or closes and so allows a liquid or gas either to flow through, or be blocked by the solenoid valve. In this control system, a spring is used to return the actuator and valve back to their resting states when the current flow is removed. In this project we have used solenoid valve to open and close the sanitizer and liquid soap flow electrically in order to avoid any physical contact and thus the virus spread.

F. Diaphragm Pump

A diaphragm [5] pump (also known as a Membrane pump) is a positive displacement pump that uses a combination of the reciprocating action of a rubber, thermoplastic or teflon diaphragm and suitable valves on either side of the diaphragm to pump a fluid. When the volume of a chamber of either type of pump is increased (the diaphragm moving up), the pressure decreases, and fluid is drawn into the chamber. When the chamber pressure later increases from decreased volume (the diaphragm moving down), the fluid previously drawn in is forced out. Finally, the diaphragm moving up once again draws fluid into the chamber, completing the cycle. Diaphragm Pumps deliver a hermetic seal between the drive mechanism and the compression chamber, allowing the pump to transfer, compress, and evacuate the medium without a lubricant. In this project we are using diaphragm pump for pressuring the sanitizer in order to spray it through the aerated nozzle.

G. Flow Controller

Liquid flow controllers [6] can be used to measure and control flow rates of various types of liquid-based samples. Liquid flow controllers will typically be used in applications that require a constant flow rate and can compensate for varying pressure changes. In this project we have used flow controller to adjust the amount of liquid (sanitizer, liquid soap or water) coming out from the outlet pipe.

H. Aerated Nozzle

A spray [6] nozzle is a precision device that facilitates dispersion of liquid into a spray. Nozzles are used for three purposes: to distribute a liquid over an area, to increase liquid surface area, and create impact force on a solid surface. In this project we have used aerated nozzle to minimize the wastage of the sanitizer liquid and achieve maximum efficiency.

I. Bluetooth Module

HC-05 is a Bluetooth [9] module which is designed for wireless communication. This module can be used in a master or slave configuration. Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth. In this project we have used Bluetooth module to control the “Hands Free Corona Fighter” using mobile phone and also exchange the information between them.

J. UVC Lamp

A new study has shown that 99.9% of coronaviruses can be killed when exposed to far-UVC [2] light. Currently, the viruses can be killed by conventional germicidal UVC light at a wavelength of 254 nm wavelength, however, this wavelength is not safe for humans. For this study, the researchers looked at using far-UVC light at a wavelength of 222 nm, which cannot penetrate through the eye or the outer, dead layer of skin – meaning it cannot damage human cells. The researchers believe that far-UVC light will be safe to use in occupied indoor public places to reduce the risk of transmission and infection of COVID-19.

K. Relay

A relay [8] is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. In this project we have used relay to operate the UVC lamp and the solenoid valves using the 3.7V output signal from the arduino UNO. When the signal from the arduino UNO is high then the relay is switched ON and the connected device starts to operate and when the signal from the arduino UNO is low then the relay is switched OFF and the connected device stops to operate.

L. Servo Motor

A servomotor [5] is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft. In this project we have used servo motor to design the linear actuator and also decide the final positions of the servo motor i.e., the open and close positions of the door in the UV chamber.

M. Linear Actuator

A linear actuator [5] is an actuator that creates motion in a straight line, in contrast to the circular motion of a conventional electric motor. In this project we have used the linear actuator to open and close the door of the UV chamber. In this way no one will touch the door of the UV chamber in order to open or to close it, the door will automatically be opened and will be closed using electrical linear actuator, so direct contact of the door by different persons in public can be avoided and thus the virus and other pathogens cannot be transmitted from an infected person to an uninfected one. This project discourages the transmission of virus and pathogens from contaminated surface contact.

N. Alerting Systems

The following electronic components have been used for alerting about various conditions: -

1) Buzzer

A buzzer [5] is a device which makes a buzzing or beeping noise. Buzzer is considered to be an indicator, which indicates something is happening in circuit. We have used a buzzer for alerting when the temperature of the body goes above normal body temperature (98°F).

2) Speaker

A speaker [5] is a device which is used to generate audio signals. We have used speaker for generating melodious tunes and music, such that a person at the entrance pays attention to the "Hands Free Corona Virus Fighter" and never forgets to use it.

3) LCD Module

A Liquid Crystal Display [5] (LCD) is a 16x2 LCD is named so because it has 16 Columns and 2 Rows. An LCD Display is used to display the temperature of the object, the remaining counts of the sanitizer, the remaining counts of liquid soap and the welcome scrolling message.

IV. CONCLUSION

An indigenous device for touch free disinfection of hands is developed to deliver sanitizer mist as long as hand(s) are kept below the delivery nozzle. A single fluid nozzle with low flow rate is used to generate aerated mist, which provides full coverage to both hands with few milli liter (ml) quantity of sanitizer. The quick response of the sensor not only ensures timely delivery of sanitizer mist but also reduces the wastage to almost zero.

UV 'C' light with 270 nm wavelength is useful for sanitization of any exposed surfaces and items of daily use. The UV lamps used in the sanitization box emits 170 nm which produces ozone and is able to take care of the unexposed area on the surfaces of the objects placed in the box.

The automatic contactless soap dispenser prevents the soap dispensing unit from direct contact and from the infected virus. The waste water from the outlet of RO purifiers can be stored in a chamber. This water can be discharged automatically without any contact to wash soapy hands.

ACKNOWLEDGMENT

We would like to express our deepest gratitude to our guide Mr. Deependra Sharma for his valuable guidance, consistent encouragement, personal caring, timely help and providing an excellent atmosphere for doing research. All through the work, in spite of his busy schedule, he has extended cheerful and cordial support for completing this project work.

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