IOT Based Full Body COVID Sanitizer and Count Analysis

Miss. Wakchaure Shruti[1], Miss. Varpe Priyanka[2], Miss. Tungar Priyanka[3],
Miss. Tupe Shweta[4], Prof. V. S. Gadakh[5]

Students, Department of Electronics and Telecommunication Engineering[1,2,3,4]
Students, Department of Electronics and Telecommunication Engineering[5]
Amrutvahini Plytechnic, Sangamner, Maharashtra, India

Abstract: *Covid-19 is a serious pandemic which the entire world is facing at present. As a measure of prevention from the deadly virus whose vaccine is not yet available, WHO recommends application of alcohol based sanitizers (60% alcohol content) to parts which are expose to the virus. People are using hand sanitizers to wash hands frequently which have been proved effective till date. Since sanitizers are effective in preventing covid-19, it would be a good idea to sanitize the whole body. In this research, development of a short tunnel which sprays sanitizers when people pass through it is designed. The Smart Disinfection and Sanitation Tunnel is a demonstration of how It has been designed to provide maximum protection to people passing through the tunnel in around 15 seconds. Which can help the community to fight against the COVID-19. The main idea of this project is to make a tunnel that can try and prevent the spread of COVID-19. This disinfection and sanitation tunnel is prepared in order to sanitize people within 15 seconds from any possible bacteria. This tunnel can disinfect a person fully from head to toe in a time span of just 15 seconds and the solution used is completely harmless.*

Keywords: Disinfection Tunnel, IOT web server, Count Analysis, PIC Microcontroller, Full Body Sanitization.

I. INTRODUCTION

The purpose of the presented IoT based sensor-fusion assistive technology for COVID-19 disinfection termed as "Smart epidemic tunnel" is to protect an individual using an automatic sanitizer spray system equipped with a sanitizer sensing unit based on individual using an automatic sanitizer spray system equipped with a sanitizer sensing unit based on human motion detection. Design/methodology/approach The presented research work discusses a smart epidemic tunnel that can assist an individual in immediate disinfection from COVID-19 infections. The authors have presented a sensor fusion-based automatic sanitizer tunnel that detects a human using an ultrasonic sensor from the height of 1.5 feet and disinfects him/her using the spread of a sanitizer spray. The presented smart tunnel operates using a solar cell during the day time and switched to a solar power-bank power mode during night timings using a light-dependent register sensing unit. Findings The investigation results validate the performance evaluation of the presented smart epidemic tunnel mechanism. The presented smart tunnel can prevent or disinfect an outsider who is entering a particular building or a premise from COVID-19 infection possibilities. Furthermore, it has also been observed that the presented sensor-fusion-based mechanism can disinfect a person in a time of span of just 10 s. The presented smart epidemic tunnel is embedded with an intelligent sanitizer sensing unit which stores the essential information in a cloud platform such as Google Fire-base. Thus, the proposed system favours society by saving time and helps in lowering the spread of coronavirus. It also provides daily, weekly and monthly reports of the counts of individuals, along with in-out timestamps and power usage reports.

Practical implications: The presented system has been designed and developed after the lock-down period to disinfect an individual from the possibility of COVID-19 infections. Social implications the presented smart epidemic tunnel reduced the possibility by disinfecting an outside individual/COVID-19 suspect from spreading the COVID-19 infections in a particular building or a premise. Originality/value the presented system is an original work done by all the authors who

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have been installed at the Symbiosis Institute of Technology premise and have undergone rigorous experimentation and testing by the authors and end-users.

II. LITERATURE REVIEW

There have been several papers published in several journals on hydroponics systems in recent years; which suggest how hydroponic plant systems work: Joshi (2020) has proposed a portable kiosk model which is designed based on the conducted CFD simulations. However, the proposed study represents a simulation-based approach which is very difficult to implement in real-time situations [5]. Maurya et al. (2020) have proposed a disinfection tunnel approach to protect society from external infections.

However, the proposed system did not facilitate timestamp recording and cannot detect humans from a height of 1.5 feet [6]. Gupta et al. (2020) have proposed a system to maintain social distancing measures using ITS infrastructures for a smart city. The presented research work only discussed a proposal and future directions. It did not provide any of the amenities such as disinfection tunnel and sanitizer spray to protect the society from external infections [4]. Murthy (2020) has proposed a tiny sanitizer system for disinfecting passenger luggage. However, the system was not designed to disinfect humans. It also did not facilitate timestamp recording and the count of the number of people [10]. Kim and Lee (2020) have proposed a screening system to scan individuals who are suffering from fever or respiratory like illnesses. The proposed system was not designed to disinfect individuals externally [6].

Kwon et al. (2020) have proposed a drive-through screening system for the scanning of individuals to detect COVID-19 symptoms and collect the samples of individuals. However, the proposed system was not designed to disinfect COVID-19 individuals in a drive- through [10]. Qu et al. (2020) have proposed a system to protect CT equipment and radiographers from COVID-19 infection possibilities. However, the proposed system was not designed to disinfect radiographers externally using sanitizer like chemicals [11].

Liang (2020) has done a detailed survey of COVID-19 prevention methodologies and treatments. However, the proposed system was not designed to disinfect the people from the COVID-19 disinfections [12]. Poon et al. (2020) have proposed a gynecological scan system for COVID- 19 patients. The system was also capable to perform obstetric scans and was designed to perform safety cleaning of medical equipment. However, it was not designed for the disinfection of humans [13]. El Majid et al. (2020) have proposed a preliminary design of wristband-like disinfection system to disinfect human hands. However, the proposed system did not facilitate to disinfect other parts of the body [3]. Takagi and Yagishita (2020) has carried a detailed discussion on the principles of safety and usage cautious usage of medical equipment. However, they did not propose any disinfection framework in the proposed research work [7]. Ahmad (2020) have proposed a standalone solarpowered mobile infected for disinfecting various things such as mobiles, keys, wallets, money and many more. However, they did not design this system for human disinfection purposes [1].

Dabh(2016) and Mohite et al. (2016) have tried to propose a unique geofencing based system to do real-time tracking of health patients. However, the system was not designed for the disinfection of health patients [2-9]. Lippi et al. (2020) have discussed various bio-safety measures to prevent clinical laboratories from COVID-19 infections. However, the proposed system did not discuss or present any disinfection-based approaches for humans [8].

III. SYSTEM OVERVIEW

The IoT plays a major role in the automation process. Obstacle detector circuit is used to detect whether or not a human is present inside the tunnel. If human is present, it must spray sanitizer from various nozzles connected to the liquid sprayer pump. It stops spraying as soon as the tunnel is empty. The block diagram of the system is shown in Figure 1. Obstacle detector circuit Obstacle detection can be realized by using ultrasonic range sensor. The module is compatible with microcontroller board. This sensor will be installed at the entrance of the disinfection chamber. A relay is connected to the pump. Electronic circuit is going to control automatically the liquid sprayer pump through the relay. It sprays sanitizers automatically to person inside the tunnel structure. In addition to these, a mechanical structure of the tunnel is required. A suitable tank is also required for the storage of sanitizer.
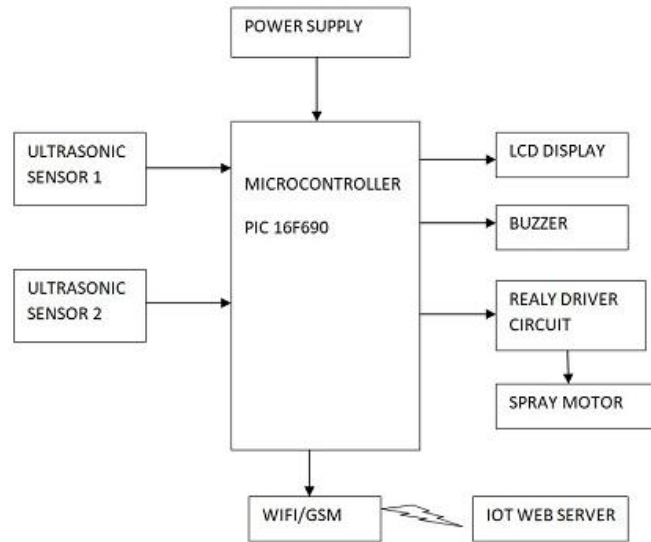
Figure 1: Bock diagram of system

Basically, it is a Door and tunnel type attractive design in which two side enclosed with s.s. sheet and other two side are open for entry and exit purpose and it is also enclosed with plastic sheets. When human enters in the tunnel or machine at that time sensors which are placed top center and side center senses human body and gives output to the circuit and circuit gets activated and whole system activates and all 3 sprayers gets activated and starting to spray towards center of the tunnel and all 3 sprayers sprays on the human body and it will automatically stops after 10-15 seconds. Because 10-15 second is enough for Sanitization. When Sprayer stops then human can exit from front side means exit side. So this machine can sanitize 4-5 humans in a minute and 250-300 humans in an hour and send count data IOT server.

3.1 PIC 16F690 Microcontroller

The PIC16F range of microcontrollers from Microchip are 8-bit MCUs that incorporate Microchip's PIC® architecture into a variety of pin and package options, from space efficient 14-pin devices to feature-rich 64-pin devices. Devices with Baseline, Mid-Range or Enhanced Mid-Range architecture are available with numerous different peripheral combinations, giving designers flexibility and choice for their applications. The PIC16F631/677/685/687/689/690 family of microcontrollers is based upon Microchip's Mid-range core with an 8-level deep hardware stack and 35 instructions. These MCUs provide up to 5 MIPS, up to 7 Kbytes program memory, up to 256 bytes RAM and Data EEPROM of up to 256 bytes. On board is a configurable oscillator factory calibrated to ±1% accuracy.
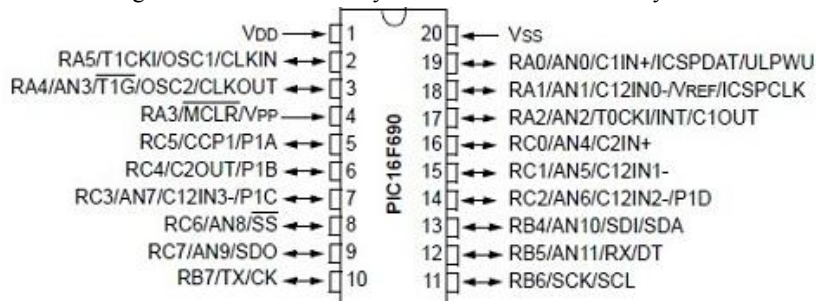

Figure 2: PIC16F690 Microcontroller

3.2 Ultrasonic Sensor

The ultrasonic sensor is success is due to its high reliability. Versatile in for object detection and level measurement, these sensors operate with extreme precision due to their high reliable sound wave technology. Ultrasonic HC-SR04 is

an ultrasonic ranging module that provides 2 cm to 400 cm non-contact measurement function. The ranging accuracy can reach to 3mm and effectual angle is < 150 It can be powered from a 5V power supply. The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy to-use package from 2 cm to 400 cm or 1" to 13 feet.

Fig.3 Ultrasonic Sensor

3.3 Relay Driver Circuit

A relay driver circuit is a circuit which can drive, or operate, a relay so that it can function appropriately in a circuit. The driven relay can then operate as a switch in the circuit which can open or close, according to the needs of the circuit and its operation. Since DC and AC voltages operate differently, to build relay drivers for them requires slightly different setup. We will also go over a generic relay driver which can operate from either AC or DC voltage and operate both AC and DC relays. Now that we're using a transistor to drive the relay, we can use considerably less power to get the relay driven. Because a transistor is an amplifier, we just have to make sure that the base lead gets enough current to cause a larger current to flow from the emitter of the transistor to the collector. Once the base receives sufficient power, the transistor will conduct from emitter to collector and power the relay.
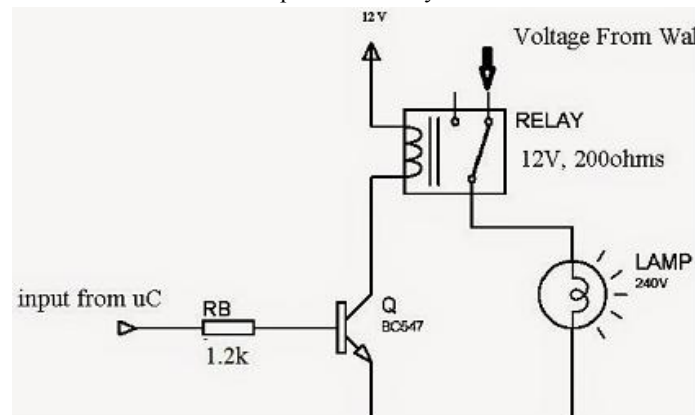

Fig.4 Relay Driver Circuit

3.4 GSM Module

This GSM modem has a SIM800A chip and RS232 interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open an connection to that COM port at 9600 baud rate, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. When you send AT commands for example: "AT\r" you should receive back a reply from the SIM800 modem saying "OK" or other response depending on the command send. GSM module is used in many communication devices which are based on GSM (Global System for Mobile Communications) technology. It is used to interact with GSM network using a computer

Impact Factor: 6.252

Figure 5: GSM Module

3.5 LCD Display

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.
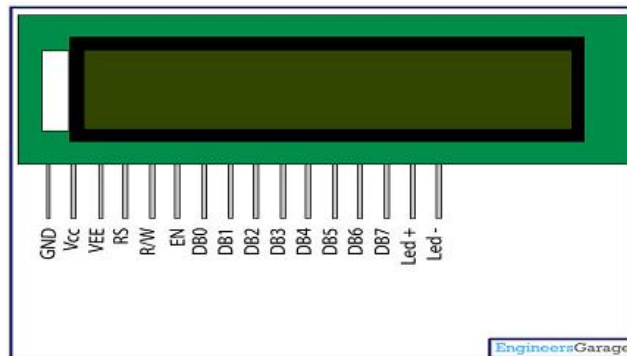

Figure 6: LCD Display

3.6 IOT

Internet of Things (IoT) is a network of physical objects or people called "things" that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of IoT is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster. IoT makes virtually everything "smart," by improving aspects of our life with the power of data collection, AI algorithm, and networks. The thing in IoT can also be a person with a diabetes monitor implant, an animal with tracking devices, etc. "The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction."

Things are either sensors or actuators. A sensor is something that tells us about our environment. Think of a temperature sensor, or even the GPS receiver on your mobile phone. Actuators are something that you want to control, things like thermostats, lights, pumps, and outlets. The "Internet of Things" brings everything together and allows us to interact with our things. For example, you could have your thermostat control itself based on where you're located.

3.7 ThingSpeak

ThingSpeak is IoT Cloud platform where you can send sensor data to the cloud. You can also analyze and visualize your data with MATLAB or other software, including making your own applications. The ThingSpeak service is operated

by MathWorks. In order to sign up for ThingSpeak, you must create a new MathWorks Account or log in to your existing MathWorks Account. At the heart of ThingSpeak is a ThingSpeak Channel. A channel is where you send your data to be stored. Each channel includes 8 fields for any type of data, 3 location fields, and 1 status field. Once you have a ThingSpeak Channel you can publish data to the channel, have ThingSpeak process the data, and then have your application retrieve the data.

3.8 Future Scope

In future, it is planned to experiment with various deep learning and computer vision frameworks for object detection on Raspberry Pi in order to achieve higher frame rate. Moreover, we would like to extend this solution with environment sensing mechanisms for adaptive building air conditioning and ventilation airborne protection in order to reduce the spread of coronavirus indoors [4, 8, 24], especially during summer. Finally, the ultimate goal is to integrate the system presented in this paper with our framework for efficient resource planning during pandemic crisis [25] in order to enable efficient security personnel scheduling and mask allocation, together with risk assessment based on statistics about respecting the safety guidelines and air quality.

IV. CONCLUSION

The Smart Disinfection and Sanitation Tunnel is a demonstration of how It has been designed to provide maximum protection to people passing through the tunnel in around 15 seconds. Which can help the community to fight against the COVID-19. The main idea of this project is to make a tunnel that can try and prevent the spread of COVID-19. The presented smart tunnel can prevent or disinfect an outsider who is entering a particular building or a premise from COVID-19 infection possibilities. In the undertaken study, an IOT-based full body sanitization and count analysis project assistive framework has been proposed to do real-time detection of individuals from a distance of 1.5 m. The presented smart epidemic tunnel starts functioning when a human id detected by an ultrasonic sensing unit equipped in a tunnel. After an individual is detected, the nozzles placed in a tunnel spray a sanitizer solution (made up from a mist of sodium hypochlorite) to disinfect an individual who has entered the tunnel. The major findings of this study are as follow:

- The presented smart tunnel can prevent or disinfect an outsider who is entering a particular building or a premise from COVID-19 infection possibilities within10 s.
- Furthermore, the tunnel has been designed in such a way that it can also disinfect a disabled person sitting in a wheelchair or a person riding a bike In the end, Web and mobile interface has been designed to provide daily, weekly and monthly reports of the counts of individuals, along with in-out timestamps.

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