DESIGN AND DEPLOYMENT OF A SMART TOUCH-LESS SANITIZER DISPENSER AT WORK PLACES USING IOT

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Abstract: Demand for hand sanitizers has surged since the coronavirus broke out and spread around the world. Hand sanitizers are usually applied by squirting the sanitizer liquid when one presses a pump with one's hand. This causes many people to come into contact with the pumphandle, which increases the risk of viral transmission. Therefore, this paper proposes the design of an automatic, non-contact hand sanitizer system in a cost-effective manner using internet of things. The smart touchless hand sanitizer dispenser is capable of dispensing 5ml alcohol-based sanitizer. Apart from dispensing an alcohol-based liquid under proximity, the proposed system is capable of displaying of body temperature using IR sensor, indicates low level of dispensing liquid to refill the hand sanitizer, and notifies the administrator by push notification if any person passes by without the usage of hand sanitizer. The proposed system could be used in various facilities, including but not limited to malls, educational institutions, offices, hospitals.

Index Terms **- Hand Sanitizer, Internet of Things (IoT), IR sensor, Ultrasonic Sensor.**

I. INTRODUCTION

As we all know, the COVID-19 outbreak hit the world and changed our lifestyle. Contact transmission occurs when contaminated hands touch the mucosa of the mouth, nose, or eyes; the virus can also be transferred from one surface to another by contaminated hands, which facilitates indirect contact transmission. Consequently, hand hygiene is extremely important to prevent the spread of the COVID19 virus. It also interrupts transmission of other viruses and bacteria causing common colds, flu and pneumonia, thus reducing the general burden of disease. There has been increase in availability and usage of hand sanitizing products to prevent COVID-19 virus outbreak. The main advantage of these products seems to be that they are more trusted, quicker and easier to use. They also provide alternative way to cleanse the hands when water and soap are not available.

The main advantages of using hand sanitizer are it requires less time than hand washing, act quickly to kill microorganisms on hands, are less irritating to skin than soap and water. Using hand sanitizers is usually considered to be an effective hand hygiene regime for people at work places who have resumed to work post lockdown. Practicing hand hygiene, includes the use of alcohol-based hand rub (ABHR) or handwashing, is a simple yet effective way to prevent the spread of pathogens and infections at work places. This paper aims at safety measures that can be incorporated post lockdown when people resume to their work using internet of things technology.

We are living in an age where tasks and systems are fusing together with the power of IoT to have a more efficient system of working and to execute jobs quickly. The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different systems, while providing data for millions of people to use and capitalize. Internet of Things (IoT) is a concept that visualizes all objects around us as part of internet. Internet of things coverage is very wide and includes variety of objects like smart phones, digital cameras, sensors, etc. Once all these devices are connected to each other, they enable more and more smart processes and services that support our basic needs, economies, environment, health etc. IoT has various applications which is been discussed in [1], [2], [3].

Traditional method of washing hands with soap and water, although the most effective method to rid of germs and impurities, proves to be a cumbersome process. Hence, in both healthcare and community settings, alcohol-based hand sanitizers have become a popular alternative to the traditional handwashing with soap and water. The main objective of this paper is to provide a safe means for hand sanitization using contactless mechanism without human intervention in a cost-effective manner using IOT.

The main intent of this paper is -

- To develop a prototype which enhances the safety features of the people at work places.
- To design a system which promotes the usage of smart touch less hand sanitizer which helps in prevention of spreading deadly diseases.
- To design a system that alerts the system administrator if any person passes by without the usage of hand sanitizer.
- To design a model which improves hygienic and health factors at work places.

The contents of the paper are as follows, section II explains about related work, section III interpret about proposed algorithm, section IV explain about hardware and software components used in development of smart touchless hand sanitizer dispenser, section V discuss about experimental results, section VI explains about concluding remarks and future enhancement.

II. RELATED WORK

In the past, there exists some research works in development of automatic hand sanitizer. A novel design of automatic hand sanitizer dispenser was proposed based on ultrasonic sensor SC-04. The sensor senses the proximity of hands under the machine, sends a signal to a microcontroller, and the controller takes decision to actuate the pump and valve simultaneously to dispense the liquid sanitizer through a mist nozzle. It has been seen that during testing, 3 seconds are sufficient to sanitize the hands with mist spray, which can be changed as per user's need through program [4].

Two ways of automatic hand wash sanitation is described. One is the without a microcontroller and other is with a microcontroller, of which the former was descripted. In automatic hand sanitizer without microcontroller, the transistors are used to detect and control the motor pump of the sanitizer. When the IR signal is detected by the human hand, it sends the signal to the transistors to turn ON the pump motor to supply 2mL or 3mL of sanitizer to the human hand with the help of an RC delay controller. The human will be easy to make a hand wash without pressing or giving an external touch to the system. The difference between automatic hand sanitizer, with and without microcontroller is that cost is high, easy to configure and maintain with microcontroller compared to without it [5].

Touch-less completely programmed sanitizer has been proposed with an inbuilt ultrasonic sensor (HCSR04) that detects hands when put beneath the gadget and administers the fluid sanitizer. The ultrasonic sensor has an echo and trig pins which are receiver and transmitter respectively, by the algorithms the sensor is adjusted to get trigger within the particular distance. When the hand is placed in the required distance, the sensor sends the signals to the Arduino nano then the Arduino nano sends signal to the 5V relay board, which is triggered and activate the motor to pump sanitizer. Additionally, the proposed unit provides the required amount of spillage and gets prepared for the next action rapidly within 4 seconds of duration [6].

Existing system do not provide a means to approximate body temperature of the person, and notify if the value is greater than the threshold value. If the person passes by the dispenser without usage, system do not enforce the sanitization process by any means including alerts or messages. Absence of alerting system if the dispensing liquid reaches the minimum value.

III. PROPOSED SYSTEM

The system architecture of smart touch less hand sanitizer is as shown in figure 1. It consists of temperature sensor, IR sensor, Arduino UNO, I2C module, DC Motor Pump, buzzer and LCD display. The detailed flow chart is shown in figure 2.
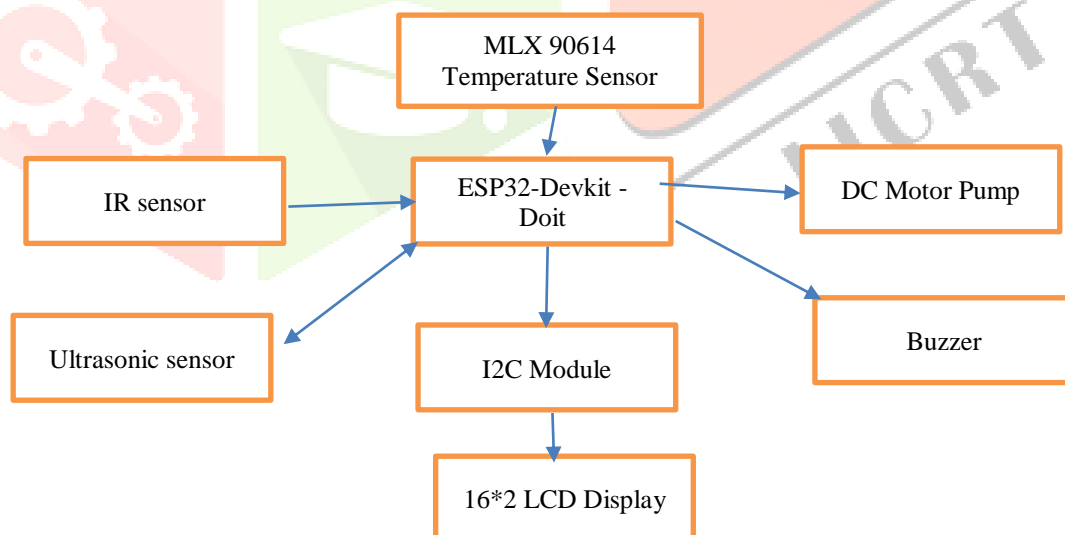

Figure 1: system architecture of smart touchless hand sanitizer

The working principle of smart touchless hand sanitizer is discussed as follows the data received from sensors to the controller, to check body temperature of the person, and notify if the temperature is greater than the threshold value which is (35c) then access to the person is denied to enter in to the premises. Then the controller dispenses fair amount of the sanitizer (5ml) if the temperature of the person is less than 35c, when hand is placed. An alert sound if the person passes by the dispenser without usage and also it informs the system administartor through push notification message.ultrasonic sensors are used indicate level of dispensing liquid in case of refilling it. The detailed flowchart is shown in figure 2. In automatic sanitizer dispenser, microcontroller is the main controller to survey the automation. Thermal, proximity, water level indicator sensors are connected to the controller. As the human approaches the setup, body temperature is approximated using thermal sensor, and if it is greater than the threshold value, an alert message is displayed on the LCD screen indicating the same. If the person passes by without using the setup, a buzzer will beep, which is commenced with the aid of proximity sensors. Notifies the administrator by push notifications if the person breaches the sanitization protocol. As the dispensing liquid reaches a minimum threshold value, an alert message is displayed on LCD using the liquid level sensor.
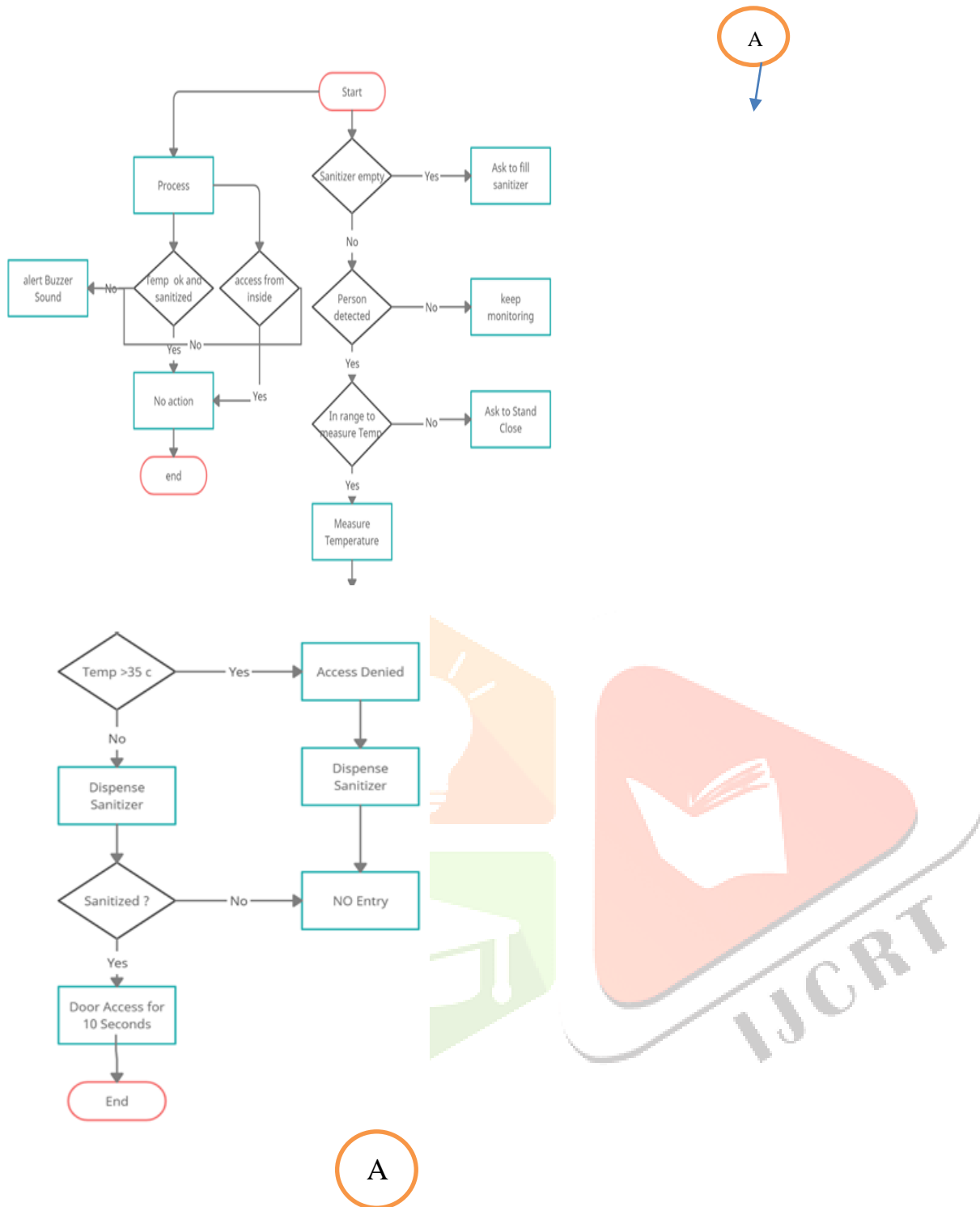
Figure 2: Flow chart of smart touchless hand sanitizer

IV. HARDWARE AND SOFTWARE COMPONENTS USED IN SMART TOUCH-LESS SANITIZER

- **ESP32 DEVKIT-DOIT:** ESP32 is a series of low-cost, low-power system-on-a-chip micro-controllers. It has integrated Wi-Fi and dual-mode Bluetooth radios. It has many of the capabilities of the Arduino and can be programmed with the Arduino IDE software and so is an easy upgrade path to wireless communications for Arduino users [9].
- **MLX90614 Non-Contact IR Sensor:** This sensor is used for measuring user's temperature, and comparing it to the ambient temperature [7].
- **HC-SR-04 Ultrasonic Sensor:** This sensor is used for measuring water level of dispensing liquid, and detecting the proximity of human being near the setup [10].
- **IR-730 IR Sensor:** This sensor is used to detect person exiting the door to prevent false detection [11].

- **C:** C is a general purpose, procedural oriented programming language supporting structured programming, lexical variable scope and recursion, among others, with a static type system
- **Arduino IDE:** The Arduino IDE supports the languages C and C++ using special rules of code structuring [12].
- **HD4470 I2C LCD Panel:** The display unit used to display information sent by the controller [8].
- **Buzzer:** A Buzzer of 5V used to convey various alerts to the human being.

V. EXPERIMENT AND RESULT

Figure 3: Indicating sanitizer level and detected a person

Figure 4: message display to stand close and displaying temperature

Figure 5: person's temperature being normal and granting access

Figure 6: place hand below to sanitize message display and dispensing sanitizer

Figure 7: door access duration and denying access

VI. CONCLUSION AND FUTURE ENCHNACEMENT

The utmost goal of this project was to use current advanced technologies to develop an automatic smart touch less hand sanitizing machine to improve hygiene and prevent the infectious viruses entering our body. Smart touchless hand sanitizer uses minimal hardware and software resources which are easy to install and use. It is much safer and more recommended due to its touch less property which zeros down any chances for cross contamination. The proposed system is capable to disinfect the hands with minimum time and human involvement. The future enhancement can be done by using circuit that can be powered by solar energy so that it uses green energy and does no harm to environment.

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