PLC Based Remote Sanitizer and Water Dispenser for Public

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Abstract— Washing and sanitizing hands have become an important need in daily affairs as the global Covid-19 problem continues to emerge. The contactless dispensing system helps to disinfect hands without touching the surface, reducing cross-infection and spreading. In this context, efforts have been made to develop a portable hand sanitizer along with water dispensing system. Hands are placed beneath sanitizer spray nozzle; it sprays alcohol-based aerated mist sanitizer of 10 ml in 4 seconds in a single action. The entire operation is done through a PLC. The Infrared sensor and timer logic are interfaced to ensure contactless, precise operation, and full hand disinfection. The tank capacity decides the utility period and frequency of replacement. During the sanitization period, the glass is filled with water through the tap in 2.5 sec and it will be remotely controlled through PLC programming. The proposed model can be used in the public domain and offices for sanitizing hands as well as dispensing water remotely.

Keywords: COVID-19, Sanitizer, Automatic Water Dispenser, PLC, Automation

I. INTRODUCTION

The demands for sanitizing hands and contactless dispensing of water before they drink at public avenues like hospitals, function halls, offices, malls, etc. To keep public away from spreading virus in crowded places is becoming very important and necessary aspect. The virus is transmitted through direct contact with respiratory droplets of an infected person and also from and touching surfaces contaminated with the virus. The infection control guidance issued by the various government agencies for healthcare professionals about preventing coronavirus spread are N95 and Other Respirators, Facemasks, Eye Protection, Gowns, Gloves, etc. The COVID-19 virus may survive on surfaces for several hours, but simple disinfectants can kill it. Public health measures are everyday preventive actions that include: washing hands often with soap and water; and cleaning frequently touched surfaces and objects.

Currently very few companies producing Automatic mist-based totally sanitizer dispensing gadget in India which is controlled by solenoid valve and some are based on Arduino. The use of such a technology leads to very tough for the maintenance purpose in the present situation. No company in the market is providing the sanitization unit with the automatic water dispensing, it's far very a lot essential to equip all public locations with computerized sanitizer dispensing unit. Due to the spread of Covid-19, there's enough demand for this product. To protect the peoples from virus and to serve water in public place is a very difficult task to server as well as recover. It is very difficult to sanitize serving boy. Keeping in mind the safety as well safe serving of drinking water this project plans to first sanitize hands and then pick the glass for drinking.

II. LITERATURE REVIEW

Author developed an Automatic Liquid filling in a moving bottle mounted on a plate of different height using Programmable Logic Controller. The Geneva mechanism is used to rotate the table through electrical synchronous motor. The water filling is achieved primarily based on the preset value of the timer governed by the PLC programming [1] Author Reviewed the data of hand washing and hand disinfecting in health care setting. New research of the in vivo efficacy of alcohol-based hand rubs and the low incidence of dermatitis associated with their use are reviewed. Recent studies demonstrating the value of multidisciplinary hand-hygiene merchandising packages and the capacity position of alcohol-primarily based hand rubs in enhancing hand-hygiene practices are summarized [2]. Author developed the sanitizer dispenser with the help of ultrasonic sensor it senses the presence of hand below the dispenser at specific distance and after the detection the pump will spray the sanitizer on hands. After that it will automatically be ready for next presence with the desired quantity of sanitizer. This all process in controlled by the Arduino nano [3].

The hands of healthcare workers are the most common mode of transmission of healthcare associated illnesses from patient to patient and within the healthcare setting. The most critical item to consider in hand cleanliness. A method to stop antibiotic resistance from spreading, as well as lowering healthcare-associated infections (HCAIs), yet in most circumstances, worker adherence to best practices is still low. The elements that influence hand hygiene compliance are discussed in this paper. [4] Author developed the automatic hand sanitizer with the help of IR sensor and ultrasonic sensor. The soap and water are used to sanitize the hands. The IR sensor will sense the presence below 50 mm and sends the signal to the Arduino and pump will be started. Same time it will also check the level of water with the help of ultrasonic sensor and if the level is low, it will send the message to user smartphone. [5] Author studied the concept of automatic hand sanitizer and made the price competitive and efficient dispenser with the help of IC555, LED, and Transistor SL100. As the hands obstruct the signal form LED the resistance is increased of LDR. Because of resistance it will give the signal to the IC 555 which will give the signal to the relay and pump will start and spray the sanitizer. [6]

This study aims to create a user-friendly automatic faucet that can be easily plugged into an ordinary water pipe for a standard hand-washing routine. The faucet uses the proximity sensor to find the presence of hands and start the hand disinfection process automatically. To ensure hand sanitize it will first drop the mixture of soap and water. The time for scrubbing is indicated by buzzer and LED light. This test revealed that health practitioners agree that the faucet makes hand-washing easier. To improve usability, a fully automatic hand-washing faucet was created utilizing the

Interaction Design approach. [7] Author developed the automatic hand sanitizer with the help of ultrasonic sensor and the Arduino nano microcontroller. The working of this hand sanitizer is as hands are sensed by ultrasonic sensor the signal sends to the mcu of the Arduino which sends the signal to the pump which is in the sanitizer tank and then pump spray the sanitizer through the nozzle as per the distance sense by the ultrasonic sensor. Even at same time the live cases of covid are also shown on display to create the awareness. [8]

Author developed the automatic sanitizer dispenser system which is compatible with the various size of containers so that if user need to change the sanitizer, he did not require to change the whole system. They can use the same system with various sanitizer tanks [9] Author developed the hand sanitizer system with the use of proximity sensor and the microcontroller. As the hands are sense by the sensor the signal goes to the pump and pump spray the sanitizer through the nozzle. They developed the system which is robust and economic to use in public places [10] Author studied the automatic water dispenser system and improves with the addition of sensors which can detect the TDS of water, temperature of water. Also, the sensor which shows the level of water so that the peoples get the good quality of water with the minimum wastage of it. [11]

III. METHODOLOGY

A. *Development of Conceptual Model*

The 3D conceptual model is created using the solid works software, the details of the model and their part list is shown in Figure 1

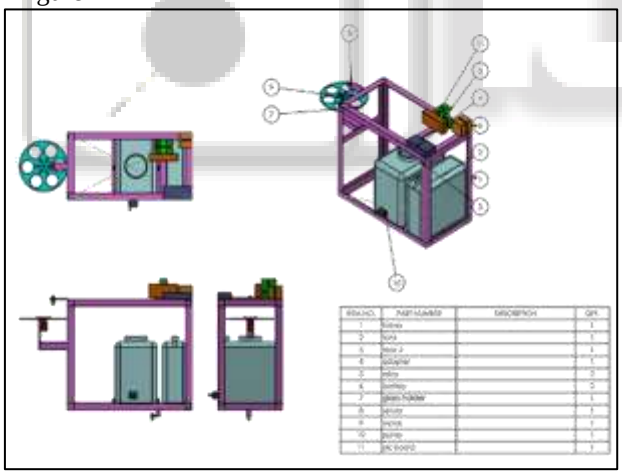

Fig. 1: Three views of the model

Before developing the model, some assumptions are made which is the quantity of sanitizer and water will not more than desire. The water glass should fill 250 ml of water. The material consider for frame is mild steel which is economical and has a good strength. The bare weight of the model is 15 kg. The size of the model is 390 × 200 × 330 mm.

B. *Development of Experimental setup*

The assembled PLC board and other electromechanical components are mounted inside the back compartment of MS cabinet, electrical wiring and mechanical fittings are made. Switches, LED etc. are fixed to the front side enclosure. Place the sanitizer tank having the required capacity (2L in this case) in the front compartment enclosure. Fix the mist atomizer and sensor in the lower portion of the unit. The Automatic Mist based sanitizer Dispensing machine is tested for required performance by adding alcohol-based sanitizer in the container and proper power source. The experimental setup images is shown in the Fig 2.

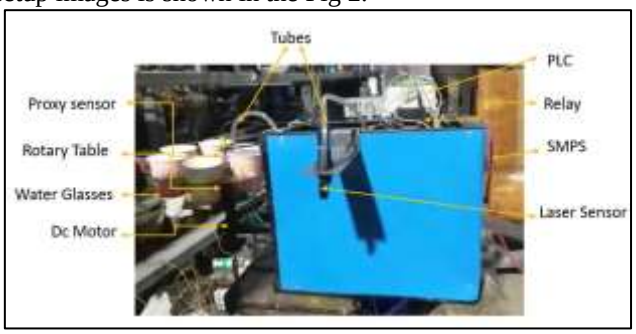

Fig. 2: Experimental Setup

C. *System Component*

SMPS is an electronic electricity deliver gadget that uses a switching regulator to switch electric electricity correctly. It is a power supply unit used to convert the dc voltage into the desired output i.e., 24volt. We used the SMPS to provide the desired current to the motor, sensor and pump for proper operating of component. Relay is a switch that works electromagnetically, to switch between the on and off state, it is mainly used to protect the part form damage during the abnormal current condition.

An electric battery is a type of electric power source that works on the principle of electrolysis that is conversion of chemical energy to electrical energy. The electrodes dipped in the chemical play an important role as it connects to the external connections. DC pumps are used to supply the sanitizer and water from tanks. The proximity sensors are used the sense the location of the water glass. The DC motor is used for indexing the bottles. The Fig. 3 shows the indexing table used for filling the water which automates the operation touch free.

Fig. 3.Glass Filling Mechanism

D. *Programmable Logic Controller*

PLC programming is popularly used in industries to automate the industrial manufacturing process. Fig. 4 shows the Delta PLC model. The entire process of sanitization, water dispensing and indexing of water glass are coordinated with the help of PLC ladder diagram.

Fig. 4: Delta PLC

The algorithm implemented to make the process automatic is explained through flow chart shown in Fig. 5.

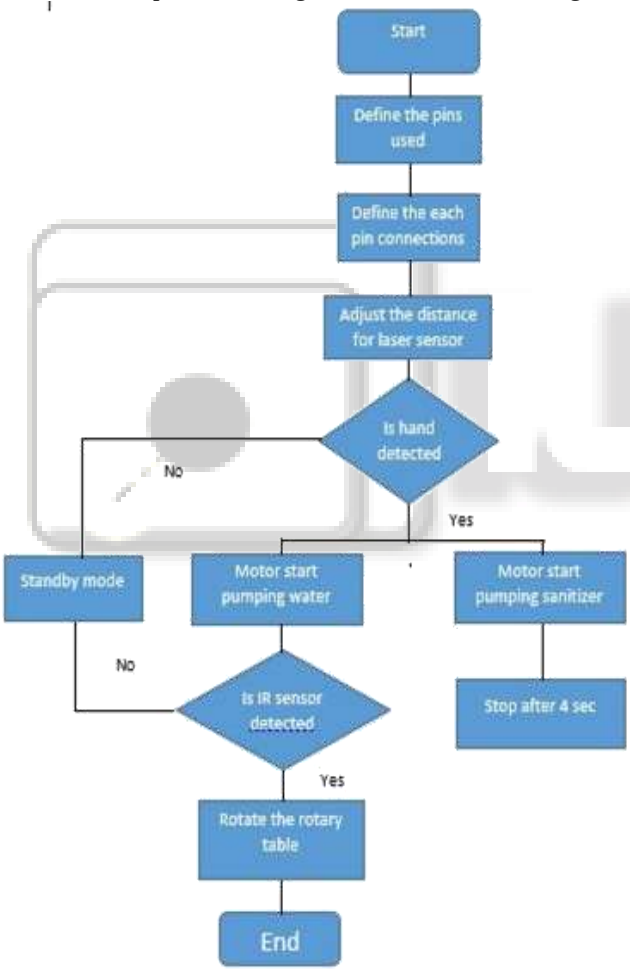

Fig. 5: Flow chart of the proposed method

The hand is brought below sanitizer pipe, laser sensor sense the hand and activate the sanitizer pump. At the same time water dispenser motor also activated by the PLC. Simultaneously indexing table also rotates and positions the empty glass just below the water nozzle. SMPS and 12v DC power supply battery backup unit provide power to water dispenser, rotary table and sanitizer dispenser. The operating logic is based on PLC in which sensors input the signals to the motor, solenoid and pumps. The motor is placed at the bottom of table to rotate it according to command received from PLC. The working setup is shown in Fig. 6.

Fig. 6: Working Setup

The results at various PLC time settings are obtained for the dispensing of sanitizer and water is given in table 1.

IV. Result & Discussion

The model developed consist of the sanitizer dispenser and water dispenser in which as hands sense by the sensor the sanitizer spray for four seconds, simultaneously water is dispensed in the glass and position of glass change by rotating the table. The developed model is tested successfully by varying the time in PLC and water dispensing rate.

PLC time (sec)	Sanitizer Dispenser (ml)		Water Dispenser (ml)	
	Expected	Obtained	Expected	Obtained
0.5	1.2	2	20	10
1	3.1	3.5	40	35
1.5	4.5	4.8	90	80
2	5.5	6	170	160
2.5	6.2	7.2	265	250
3	6.72	8	-	-
3.5	8	9.28	-	-
4	9.3	10	-	-

Table 1: Dispenser Readings

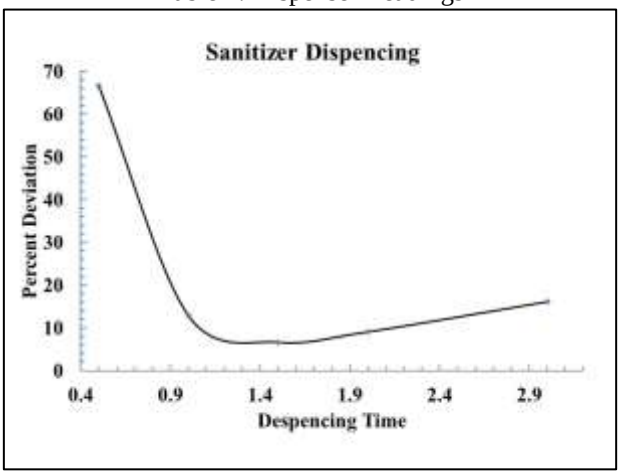

Fig. 7: Sanitizer dispensing deviation with respect to set quantity

The results obtained from the setup are satisfactory at 4 Sec time setting with provides with an accuracy of 7

present deviation in comparison with the expected quantity of 10 ml which provides optimal quantity. The delivery of sanitizer at 0.5 Sec provides maximum deviation of 67 present whereas rest of the results are within a deviation of 16 %.

The results are also obtained for dispensing water in glass, it reveals that at higher the value of time period will dispense the desired quantity. The delivery of water at 0.5 Sec provides maximum deviation of 50 present whereas rest of the results are within a deviation of 7 %. The trend line shows that more time is provided to deliver the water results in accurate dispensing of water is possible

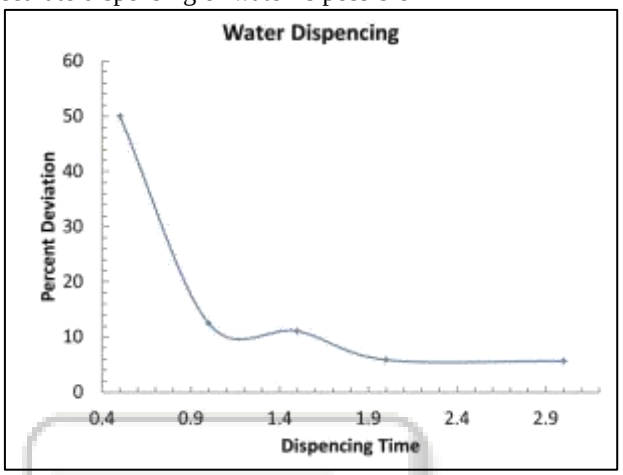

Fig. 8: water dispensing deviation with respect to Set quantity

The required dispensing quantity (250 ml) of water is possible to deliver in 2.5 Sec with the motor selected for the setup. The machine may be wall mounted at public places it can spray maximum of 10 ml of sanitizer in 4 sec. The system has a low power consumption and can assist in achieving contactless sanitizer dispensing. It lowers the chances of the virus spreading in the population

V. CONCLUSION

To address COVID-19 related problems, the setup was developed for Remote Sanitizer and Water Dispenser system. The proposed device dispenses both sanitizer and water with an optimal accuracy of less than 15 percent deviation with respect to set values of 250 ml of water and 10 ml of sanitizer. The system works smoothly that can prevent the spread of infectious pandemic like COVID-19 and dispensing of Hassle-Free drinking water in public places

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