Arduino-Operated Fog Disinfectant Hand Washing Device

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Abstract - Since the onset of the COVID-19 pandemic in the modern world, regular handwashing, often multiple times a day, has been strongly advised and is being followed by everyone. This practice, however, results in significant water wastage, which poses challenges that may surpass those of the pandemic itself. To mitigate this issue, we have developed a solution that enables handwashing with reduced water consumption. With the help of the Arduino, we have developed a devise which employs a fog-based system to promote water efficiency. It features an integrated tank located directly beneath the unit, where a safe herbal disinfectant solution is mixed with water before being sealed. When a user places their hands near the UV sensor the sense the hand, while an Arduino Uno microcontroller monitors the distance, triggering the pump to dispense the hand sanitizer. This automated dry handwashing machine utilizes fog disinfection and can be used as an alcohol-based hand sanitizer dispenser, making it suitable for use in hospitals, workplaces, offices, schools, and more. Alcohol serves as an effective disinfectant compared to liquid or solid soaps, as it does not require water for rinsing due to its volatile nature, evaporating quickly upon contact with the skin. Research confirms that an application of over 40% alcohol can effectively eliminate the virus from hands. Keywords, Arduino. ultrasonic sensor.

I. INTRODUCTION

Numerous emerging societies share a prevalent practice of consuming food with their hands, highlighting the critical need for hand hygiene. Proper hand washing is the most effective method to minimize the transmission of diseases. Various illnesses, such as fevers, colds, diarrhea, and sore throats, can be spread through contact with unclean or inadequately washed hands. Maintaining hand cleanliness was one of the most beneficial actions during the COVID-19 pandemic. Regular hand washing can prevent many gastrointestinal and respiratory infections. Both hand sanitizers and thorough hand washing are effective means of eliminating bacteria that can facilitate illness transmission. This healthy practice is particularly advantageous for vulnerable populations, including children, and plays a significant role in combating deadly virus. Indeed, it is a vital strategy for managing the spread of the pandemic and for infection control. As previously mentioned, frequent hand washing with disinfectant is essential in the battle against the epidemic. However, washing hands with soap and water can be water-intensive, and many individuals tend to wash their hands thoroughly for 10 to 20 seconds. During this process, only 20 to 25 percent of the water contacts the skin, while the rest flows over the surface. The goal of the dry hand washing machine project utilizing Fog disinfectant is to provide an efficient and convenient hand hygiene solution in situations where water is scarce or impractical. By incorporating Fog disinfectant into the machine, the system aims to effectively eliminate harmful bacteria and viruses from hands without requiring water, making it suitable for various settings, including public areas, offices, hospitals, and remote locations. The machine is designed to feature an intuitive interface, rapid operation, and dependable disinfection capabilities.

We aim at creating a fog disinfection system for hand hygiene is innovative and addresses a significant challenge in maintaining cleanliness, especially in environments like schools where time is limited. Here's a structured approach to help you develop this project further. To design and prototype a dry hand washing machine that utilizes fog disinfection to sanitize hands quickly and effectively without the need for water. This project has the potential to significantly improve hand hygiene practices in settings where traditional handwashing is impractical. By focusing on user experience, safety, and efficacy, you can create a solution that not only saves time but also promotes better health outcomes. As you move forward, continuous testing and feedback will be crucial to refine the design and ensure its success.

II. LITERATURE SURVEY

From the literature survey we can observe that how water is used in our day today life for washing hand and scope to reduce by using alternate devices. We even had background study on the Arduino system integration in automation.

P. Manikandan, M [1] The proposed automated hand sanitizing system represents a significant advancement in promoting hand hygiene while reducing the risk of cross-contamination. By integrating technology with user-friendly design, this system can play a crucial role in maintaining public health, especially in the context of ongoing and future health crises.

P.Niranjan [2] This literature review presents an analysis of research regarding the effectiveness of fog disinfectants in eliminating bacteria and viruses from surfaces. It summarizes the ability of these disinfectants to reduce microbial contamination and their effectiveness in reaching and sanitizing hard-to-access areas on hands. The study assesses the performance of fog disinfectants against various bacteria and viruses commonly found on hands, utilizing a combination of laboratory experiments and field trials. In the laboratory, standardized methods are used to inoculate surfaces with microbial cultures, followed by fog disinfection treatments that apply different formulations and concentrations of disinfectants. The assessment of each disinfectant's efficacy is based on the extent of microbial load reduction compared to untreated control surfaces.

M. A. Rahman, [3] The automatic fogger mechanism-based hand sanitizer represents a significant advancement in infection prevention technology. By addressing the challenges of traditional sanitization methods, this project aims to enhance public health safety, particularly in the context of ongoing and future infectious disease outbreaks. Through careful design and implementation, it has the potential to make a meaningful impact in both healthcare and community settings.

Yusuf Abdullahi [4] The Arduino platform, particularly the Arduino Uno, provides an accessible entry point for individuals interested in electronics and programming. By understanding the hardware components and utilizing the Arduino IDE, users can create a wide range of projects. This paper serves as a foundational guide, equipping readers with the knowledge to explore and innovate with Arduino technology. After reading this paper, you should have a basic understanding of the Arduino Uno and be ready to embark on your own projects.

N. K. Kumar [5] The Fog-based Contactless Handwash Kit represents a significant step forward in promoting hygiene practices while addressing the critical issue of water conservation. As societies continue to navigate the challenges posed by the pandemic, such innovative solutions will be

essential in fostering safer public environments and encouraging responsible health behaviors. Further research and development in this area could lead to even more effective strategies for combating infectious diseases in the future.

CT Yang [6] the findings from this study and the implementation of the intelligent monitoring system represent a significant step forward in enhancing indoor air quality in healthcare settings. By leveraging technology to monitor and manage air quality, hospitals can create safer environments for patients and staff alike. Future research could explore the long-term impacts of such systems on health outcomes and operational efficiency in various healthcare settings.

Based on the inputs from the above study we are integrating the inputs and develop the Aurdino intigrated automated hand sanitization system.

III. PROPOSED SOLUTION

A. *Problem statement*

We selected this project due to the challenges observed in our current situation. The process of washing hands before meals consumes a significant amount of water, and students have limited time for lunch. By implementing a fog system, we can utilize fog disinfectant to effectively sanitize hands without the need for rinsing, thereby minimizing the time required for handwashing and potentially enhancing adherence to hygiene standards. The primary challenge is to develop a dry handwashing machine that employs fog disinfection. This machine aims to facilitate proper hand hygiene in scenarios where traditional handwashing facilities are not readily available or feasible, eliminating the necessity for water.project idea of creating a fog disinfection system for hand hygiene is innovative and addresses a significant challenge in maintaining cleanliness, especially in environments like schools where time is limited.

B. *Aim and Objectives*

The aim of the dry hand washing machine project utilizing Fog disinfectant is to deliver a practical and efficient hand hygiene solution in environments where access to water is restricted or unfeasible. By incorporating Fog disinfectant into the device, the system is designed to eliminate harmful bacteria and viruses from hands without requiring water, making it appropriate for diverse settings, including public areas, workplaces, healthcare facilities, and remote sites. The machine is expected to feature an intuitive interface, rapid operation, and dependable disinfection, thereby enhancing public health and hygiene standards.

C. *Scope of the Project*

The project involves designing a hand washing system that uses fog disinfectant and a UV sensor connected to Arduino. It is meant for hand washing and could be used in government schools. For students can use any herbal or alcohol-based solution for washing. Our aim is to make a portable hand washing which could also be used during travel.

IV. METHODOLOGY

According to the proposed system, a structure was designed and shown in the block diagram. The model can be stored safely and is made at low cost. It is flexible for future improvements. Each component was programmed and tested separately for safety and compatibility, using Arduino UNO and various computers before integration into one Arduino IDE.

A. *DESIGN*

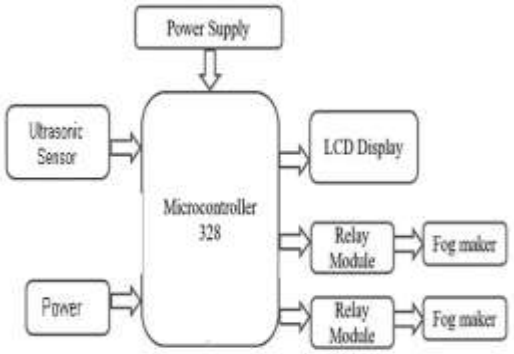

Fig: 1 Design setup of system

B. *Components Required*

SI. No.	Components	Quantity
1	Actuator	1
2	Arduino UNO	1
3	Arduino Nano	1
4	Humidifier spray module	1
5	Relay module	1
6	LCD display	1
7	Ultrasonic sensor	1
8	IR sensor	1
9	DC motor	1
10	Moisture sensor	1
11	Battery	1
12	Arduino IDE	1
13	Wire	As required

Table: 1 Components Required

C. *Over view of system working*

When the Fog Disinfection Dry Hand Washing Machine is activated, the system initiates a series of procedures to verify the proper functioning of all components, as well as to boot up and accurately calibrate the hand-sensing sensor. Prior to generating any fog, a test must be performed to ensure the foggers are operating correctly. If the foggers do not activate immediately, the system will remain in standby mode until they do. Once operational, the fog maker converts the disinfection solution into fine droplets, prompting the system to adjust its processes and create a soft, magical mist. Finally, users can cleanse their hands with this gentle mist in the designated hand room. Upon activation of the system, the disinfection solution will be dispensed in fine droplets. The fog generated during this process is intended to ensure that the hands of all users are completely sanitized.

The device operates by dispersing its internal fog into a designated area specifically designed for this purpose. This is the space where individuals washing their hands are required to place their hands. The fog saturates the entire Hand Chamber, ensuring that hands are thoroughly and effectively sanitized.

The system prompts the user to begin handwashing after the fog in the Hand Chamber has settled, indicating that it has served its purpose of disinfecting the hands. This suggests that individuals should commence the handwashing process now that the fogging has concluded.

To ascertain whether an individual has properly cleaned their hands, it is essential to evaluate several factors, such as the

level of mist exposure and the remaining contamination on the hands. The subsequent action is only taken once it is confirmed that the hands are clean. If this is not the case, the process returns to Step 2 for the procedure to be repeated.

The sterilization process concludes when the machine powers down following the effective cleansing of the hands. It provides users with visual feedback regarding the thoroughness of the sanitization. Furthermore, this approach conserves energy and ensures that the device is ready for future use.

D. PROGRAM

```
int relay=7;
#include <LiquidCrystal.h>
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
int trigPin = 8;
int echoPin = 9;
void setup()
{
 Serial.begin(9600);
 pinMode(relay, OUTPUT);
 lcd.begin(16, 2);
 lcd.print(" Hand sanitizer ");
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}

void loop()
{
 long duration, distance;
 digitalWrite(trigPin,HIGH);
 delayMicroseconds(1000);
 digitalWrite(trigPin, LOW);
 duration=pulseIn(echoPin, HIGH);
 distance =(duration/2)/29.1;
 Serial.print(distance);
 Serial.println("CM");
 delay(10);
 if((distance<=10))
 {
 digitalWrite(relay,1);
 lcd.setCursor(0, 1);
 lcd.print("Sanitizing hand ");
 }
else
 {
 digitalWrite(relay,0);
 lcd.setCursor(0, 1);
 lcd.print("No hand detected");
 }
}
```

E. CIRCUIT CONNECTIONS

Project on dry hand washing machine by fog disinfection and UV lighting. The fog disinfection will be done with the mist maker and UV lighting disinfection will be done with the UV light and the hand deduction will be done with help of ultrasonic sensor. The timing needs to set from the keypad. So 10 seconds and based on the time selection the system will disinfection for the respective time. If we remove the hand before that time completion then it will provide the audible alert through this buzzer and the so-called status continuously display on this 16 by 2 LCD screen. So the whole system driven by this Auridon board which is taking care of inputs from these control buttons and also ultrasonic sensor is input and output modules are like relays so these relays are easy to control the fog mist maker as well as the UV light. So one relay for the two sanitization for fog disinfections and another relay for the UV light on and off. So on this system regulatory power supply board which will take 230V AC input and provide and provide as a five volt constant DC output so that will be the input to this breadboard. So from this breadboard we will be distributing that five volta throughout the input and output module of our projects. Parallel 230V is given as input voltage to the UV lights through this electromagnetic relay and another electro relay to control the four disinfections directly. We can refill the sanitization nothing about four disinfections. Press and rotate anticlockwise. we can open the cap. we can fill that with sanitization and next press and rotate clockwise so that it gets locked.

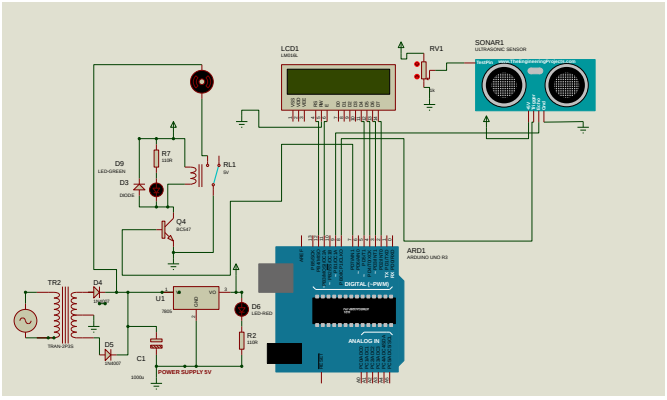

Fig: 2 Circuit Conncetion Drawing

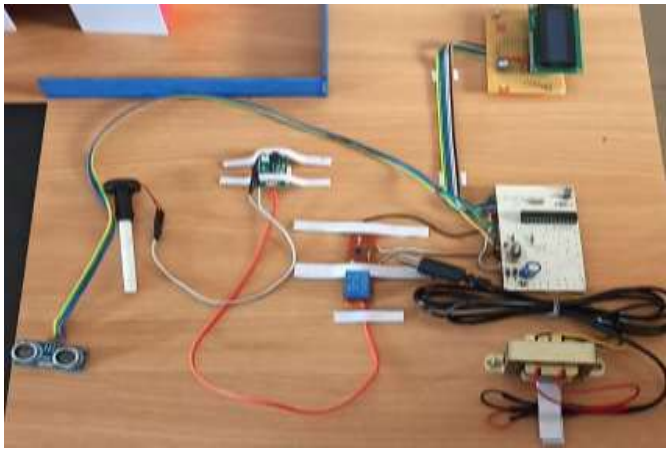

Fig: 3 Circuit Conncetion

V. TESTING AND RESULTS

To start the testing of the hand sanitization system the following steps to be followed. After a proper connection made with respect to individual components and its time to test the Project. So, to move on with the testing process firstly we need to connect the adaptor to the power supply which is step down by the transformer form 230V to 12V DC supply which is further converted to 12AC supply by a bridge rectifier this 12V AC supply is source for all the components.

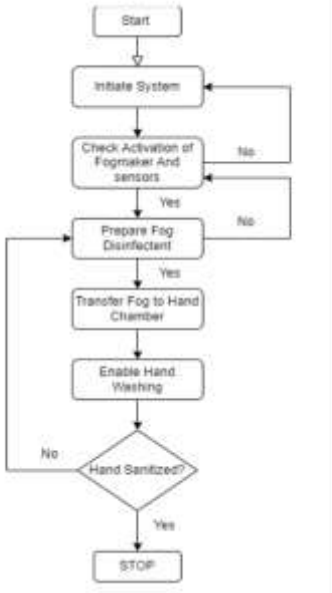

Fig: 3 Flow Chart of process

Power supply is made on displays the message as “Hand Sanitizer sanitizing hand” So when we place the hand the distance should be less than 10 centimetres. Then only the process will get you shoot on. The timing also here 5 sec. placing the hand. Right the timer is counting now. So, if we remove the hand before the completion, so the system virtuously power as a buzzer alert to intimate the user. You are not completely sanction for the respective time and then reinsert the hand.

Fig: 4 System activated displayed in LED

Fig: 5 Prototype model of a hand sanitizer dispenser

Hand sanitize will take for 5 sec as the same, we have considered in the program, which can be modified according to our need.

A. RESULTS

This project gives idea of how to save water using fog disinfectant method of washing hand. cardboard hand washing system was used as a prototype for testing purpose. It also reduces the water wastage and sanitize the hand properly. This project based on UV sensor which sence the hand which is controlled and monitored by arduino platform which are Free Open-Source Software. So, the implementation rate is inexpensive, and it is reasonable by a common person. Accomplishment of UV sensor makes it easy for automatic dipensing and microcontroller permits the system installation in more easy way. A simple prototype is discussed for this project purpose. This system's automated feature saves water and removes the issues of traditional tap installation and maintenance. It allows for safe and hygienic use without touching, enhancing safety and health. As society progresses, this perfect model is seen as an important step in sustainability and public health, promoting acceptance and ongoing innovation in hygiene technology.

VI. CONCLUSION

The main goal of this project is to design and implement a compact hand sanitize with fog disinfectant. The project tackles important issues in hand hygiene such as water scarcity, environmental impact, user acceptance, and compliance with regulations. The dry hand washing machine uses fog disinfectants and innovative solutions to provide a sustainable choice for areas with limited water. A clear plan for developing the machine includes research, design, testing, and implementation, allowing for future advancements. The project also highlights the need for hygiene education and environmental sustainability, aiming to raise awareness and encourage proper hand washing techniques for better public health and reduced ecological impact.

VII. REFERENCES

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