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Automatic Hand Sanitizer Dispenser Using Arduino

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Abstract: ***The COVID-19 pandemic has had an effect on human life in many different fields. There have been several attempts to stop the virus from spreading, including working from home, avoiding social gatherings, and practicing hand hygiene. Since the COVID-19 virus can spread through touch and contact, there are WHO recommendations to regularly wash or sanitize hands to lower the risk of infection. Sanitizer storage and dispensing from the bottle would both require manual intervention. And the majority of the hand sanitizers that are currently on the market don't work automatically. In order to lower the risk from contact, this article intends to create an automatic hand sanitizer that is used in hospitals, workplaces, offices, schools, and much more.Here, the system uses an ultrasonic sensor to detect proximity and sends a signal to the microcontroller (Arduino UNO). The controller activates the solenoid valve and pump after processing the sensor data. As a result, a mist nozzle is used to disperse the sanitizing liquid.***
Keywords: Arduino, Ultrasonic sensor, Sanitizer

I. INTRODUCTION

In recent years, the world has witnessed the unprecedented spread of infectious diseases, highlighting the importance of maintaining hygiene and cleanliness. One of the simplest and most effective ways to prevent the spread of diseases is by frequently sanitizing one's hands. However, manually dispensing hand sanitizer can be time-consuming and lead to cross-contamination. In response, automatic hand sanitizer dispensers have become increasingly popular. This research paper explores the development of an automatic hand sanitizer dispenser using Arduino and an ultrasonic sensor. Arduino is an open-source platform that allows for the easy integration of various sensors and controllers. The circuit designed here includes an ultrasonic sensor HCSR-04. The sensor scans for hands approaching the machine to determine its proximity. A decision is made by the controller to simultaneously activate the pump and valve in order to dispense the liquid sanitizer through a mist nozzle once the sensor delivers a signal to the microcontroller. The paper provides an overview of the design and construction of the dispenser, including the necessary components and circuitry. Additionally, the paper discusses the programming of the Arduino microcontroller, which allows for the customization of the dispenser's features and functionality. Finally, the paper evaluates the performance of the automatic hand sanitizer dispenser, including its accuracy and reliability in dispensing sanitizer. The results of this research can help to inform the development of more effective and efficient solutions for maintaining hygiene and preventing the spread of diseases.

II. LITERATURE SURVEY

The research paper discusses how the advent of the new Coronavirus (SARS-CoV2) has presented unexpected challenges to human health. Reduced disease transmission is another goal of the paper. In the absence of a vaccine or effective antiviral medications, hand cleanliness is an essential aspect of efforts to limit the spread of the virus that causes COVID-19, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

The efficiency of various quantities of two formulations of WHO-recommended hand sanitizer and two variants on the COVID-19 virus were tested in the hand sanitizer study by the researchers. The WHO suggests using two formulas: (1). 80 percent ethanol, 1.45 percent glycerol, 0.125 percent hydrogen peroxide, and (2). 1.45% glycerol, 0.125% hydrogen peroxide, and 75% 2-propanol. These formulations, however, failed below the European Norm 1500's requirements for effectiveness.Thus, the (1) was the modified version used in this study. 80% ethanol, 0.725% glycerol, 0.125% hydrogen peroxide, and (2). 0.125% hydrogen peroxide, 0.725% glycerol, and 75% 2-propanol. The modified versions had a reduction factor of >= 5.9, whereas the WHO formulation had a reduction factor of >= 3.8. This study demonstrated the potency of alcohol-based hand sanitizers, which significantly lowered infection rates—by 30%. The study also discusses the structure of viruses and how it differs from bacteria, explaining that viruses have single-stranded or double-stranded RNA or DNA enclosed in "capsids," can only multiply in the presence of a host, and are referred to as "living entities".

Bacteria also have a nearly identical structure consisting of DNA or RNA as well as a "cell membrane" and can multiply without a host. The paper also provides a comprehensive comparison of hand sanitizers and soaps, foams versus gels, and shows that high concentrations of ethanol can reduce the amount of virus particles present in hands and thus demonstrate the efficacy effectiveness of alcohol-based hand sanitizers.

III. METHODOLOGY

A. Materials/Components

1) Arduino UNO

One of the most important components in our project is Arduino UNO. It acts as a central processing unit and controls all the other components. Arduino is used to make a proper synchronization between all other components.

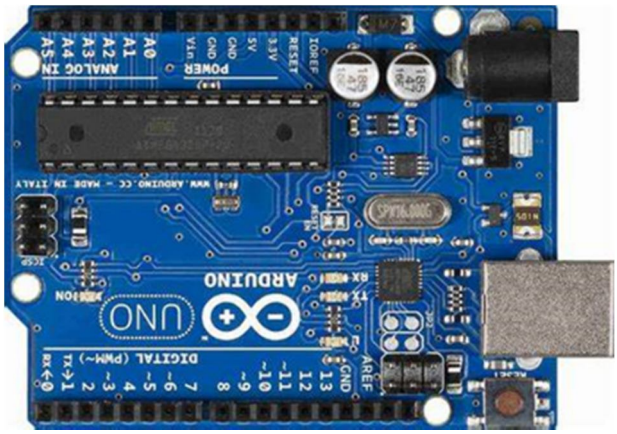

Fig. 1. Arduino Uno

2) Arduino IDE

An open-source software programme called the Arduino Integrated Development Environment (IDE) is used to create and upload code to Arduino boards. The Arduino IDE features a text editor that allows users to write, modify, and save code written in C or C++. The IDE also includes a compiler that translates the code into machine-readable instructions that can be executed by the microcontroller.

3) Ultrasonic Sensor

The HC-SR04 ultrasonic sensor is a commonly used sensor for measuring distance or detecting objects. Its working principle involves emitting high frequency sound waves (ultrasound) and then measuring the time it takes for the sound waves to bounce back after hitting an object. Based on this time measurement, the sensor can calculate the distance to the object.

a) Power Supply: DC 5V
b) Working Current: 15mA
c) Working Frequency: 40Hz
d) Range: 2 cm – 400 cm/4m
e) Resolution: 0.3 cm
f) Angle of Measurement: 15 degree
g) Trigger Input Pulse width: 10uS
h) Dimension: 45mm x 20mm x 15mm

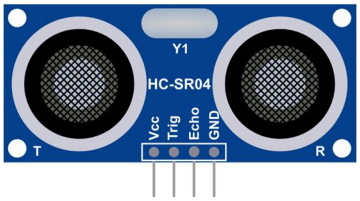

Fig. 2. Ultrasonic Sensor

4) Pump

A mechanical device called a pump is used to push water onto a fire to extinguish it. It pumps water using a simple motor.

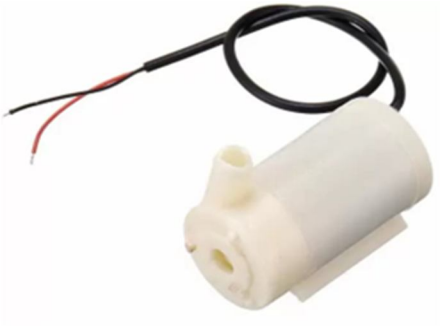

Fig. 3. Mini Water Pump

5) Relay

Relay is one of the most important components in this project. We used a relay as a switch. It is being used here to control the water pump by switching its states between NO (normally open) and NC (normally closed).

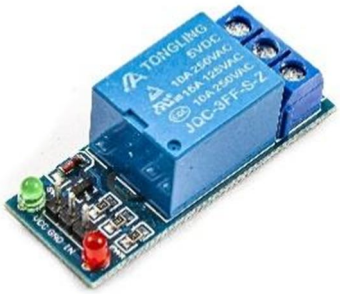

Fig. 4. Relay

B. System Architecture

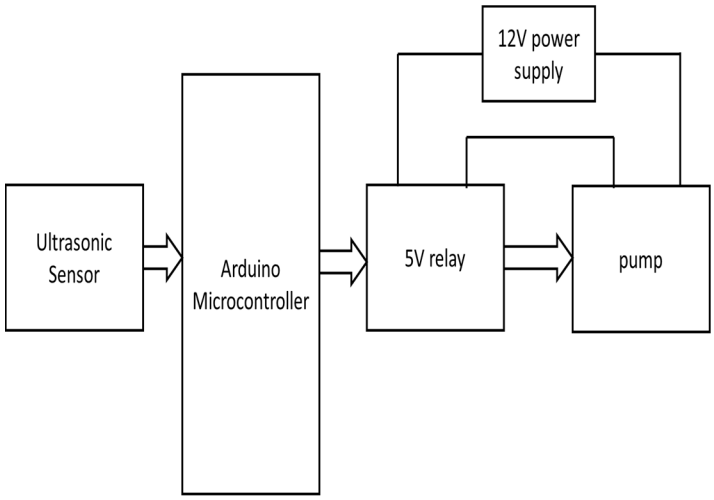

Fig. 5. System diagram

Here we use Arduino UNO microcontroller to control the entire system and we use ultrasonic sensor which gives information to the Arduino, when hand is detected by the sensor then it send signal to the Arduino and then Arduino sends the signal to the relay, relay is connected to the mini water pump and we provide 12V supply to the pump through the 12 V battery. In order to spray the liquid sanitizer through a spray nozzle, the pump is turned on for one second after the relay receives the signal from Arduino.

C. Flow Chart

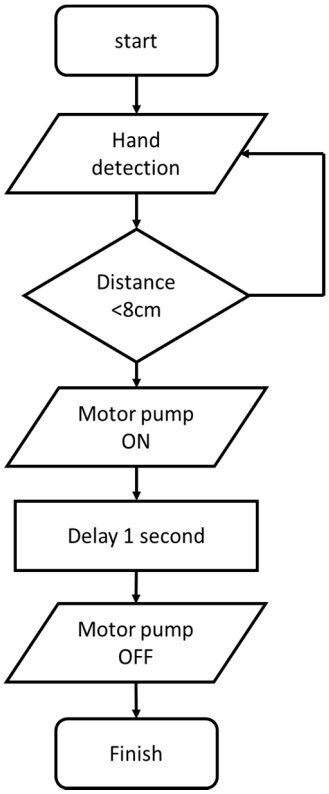

Fig. 6. Flow Chart

As shown in Fig. 6 flow chart , we start with an ultrasonic sensor then if the hand is detected by the sensor within a distance less than 8 cm then the pump is turned ON. If not then the loop gets executed again and again till hand is detected. Pump is ON only for one second then OFF for four second and if after four second hand is detected then again pump is ON for one second. And finish.

D. Circuit Diagram

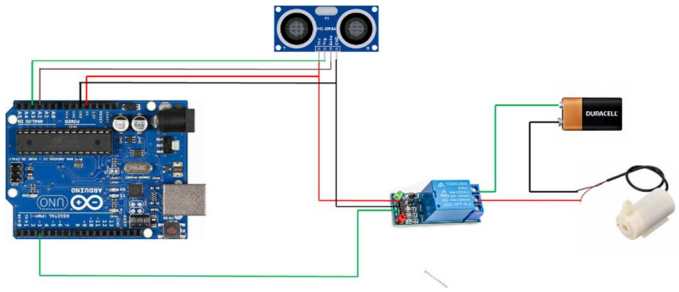

Fig. 7. Circuit

As shown in Fig. 7, we use an Arduino UNO microcontroller to control the whole system. We use an ultrasonic sensor to detect the presence of a hand. Sensor has four pins: Vcc, ground, trigger, echo. The Echo and trigger pins are connected to the analogue A2 and A3 pins of Arduino UNO respectively. The Vcc and GND pins are connected to the 5 volt and GND pins of the Arduino respectively. We use a 5 Volt relay which acts as a switch. Relay has six pins Vcc, ground, digital I/O, NO, NC, common pins. The Vcc, ground and digital pins are connected to 5 volt, ground and digital I/O pin 3 of Arduino board respectively. The common pin is linked to one terminal of the pump, while the normally closed (NC) pin is connected to one terminal of the 12-volt battery, NO remains open. The remaining terminals of the pump and battery are connected to each other.

IV. RESULT

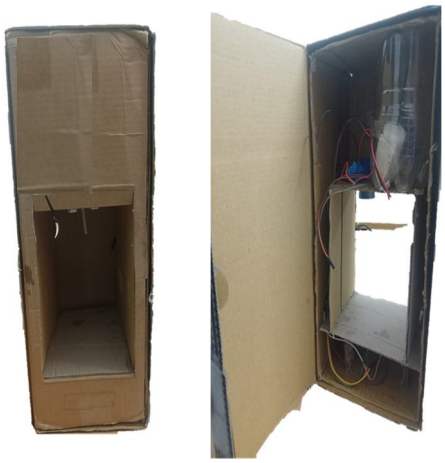

Fig. 8 Model

The performance of the proposed automatic hand sanitizing device can be evaluated by testing the success rate of the device. The probe uses an Arduino microcontroller to calculate the distance between the sensor and the user's hand placed beneath it. Once the distance is less than 7 cm, the relay pump pushes out a few ml of liquid alcohol-based sanitizer, and the distance is fetched every 1000ms. Components like pumps, relays and Arduino microcontrollers are tested. To test the ultrasound sensor, the hand was placed at different distances of 5 cm, 7 cm, and 10 cm, and the test was performed on 10 people with 10 detections per person to determine the distance between the hand and the sensor.

V. FUTURE SCOPE

Automatic hand sanitizer dispensers can help to promote good hand hygiene practices, reduce the spread of germs, and improve overall hygiene.

This paper discusses how automatic dispensation mechanisms can be efficient in case of hand sanitizers, but there are limitations to this which can be resolved in the future.

The integration of automatic hand sanitizer dispensers with the Internet of Things (IoT) can allow for remote monitoring, data collection, and analysis. This can help in tracking the usage of the dispensers, identifying areas where more dispensers are needed, and ensuring the availability of hand sanitizer at all times. Automatic hand sanitizer dispensers can be designed to be energy-efficient, using low-power components, and rechargeable batteries. This can help in reducing the environmental impact of the dispensers and lowering operational costs.

VI. CONCLUSION

According to the paper, having contactless dispensing of hand sanitizer is key to prevent the spread of pathogens, and hand hygiene is a vital part of our daily lives.

This study presents a new design for an automatic hand sanitizer dispenser and provides a detailed description of the components needed to create the device. A circuit diagram is presented to demonstrate the interconnection between the components, including the microcontroller circuit (Arduino UNO). The diagram also depicts the piping conditions, which are further explained. Sequential diagrams and components of the original equipment are provided for better understanding. The algorithm used in the device is described using a flowchart that demonstrates its functionality. Based on the research results, we concluded that the hand sanitizer dispenser works optimally when the hands are 7 cm away from the sensor, which is the ideal distance for the hand sanitizer discharge.

VII. ACKNOWLEDGMENT

Firstly, we would like to express our gratitude to our course project guide Vijaykumar Bhanuse who gave us this opportunity to do such a good project on the Automatic hand sanitizer dispenser using relay and Arduino and also guided us to complete our project.

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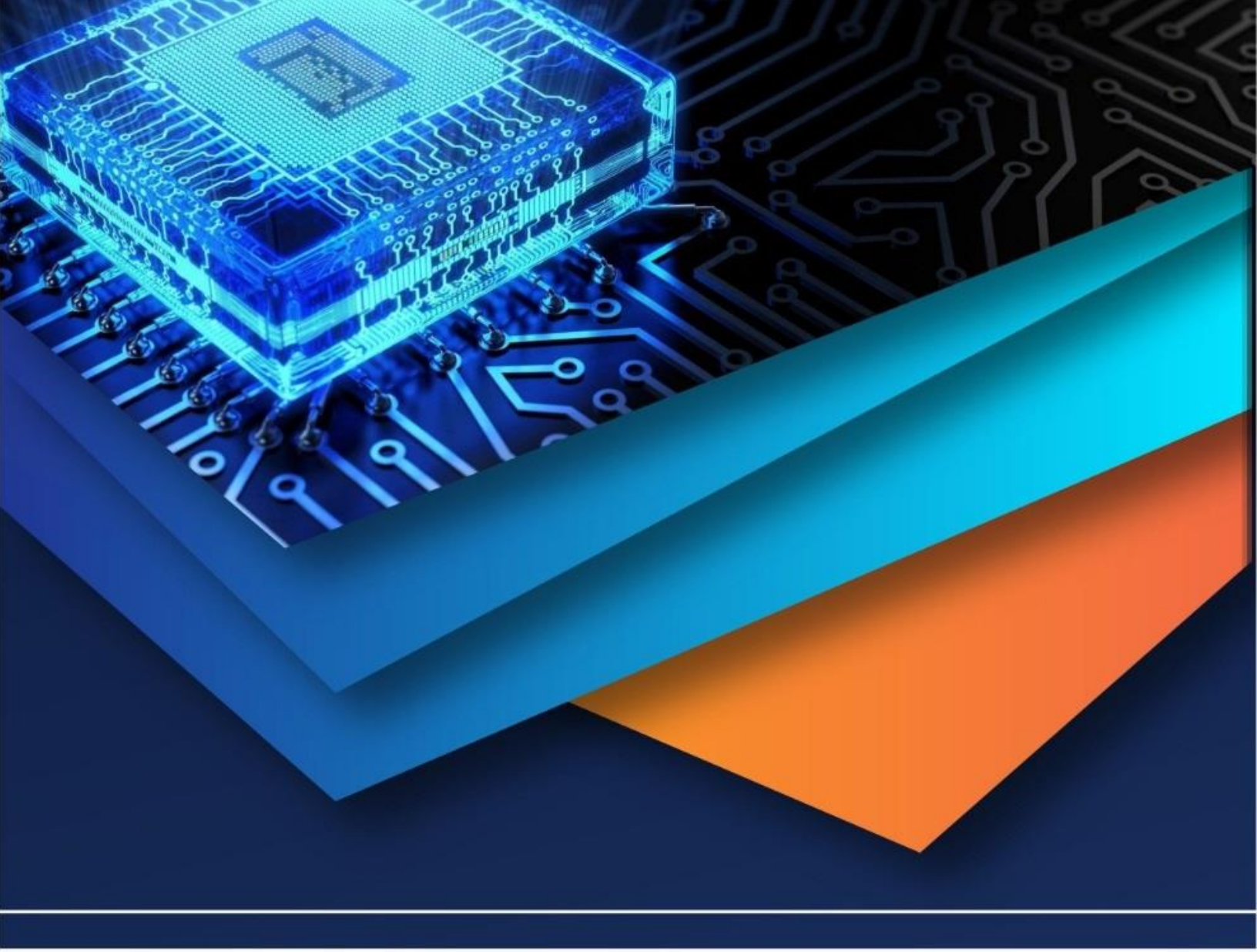

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