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JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Topic: Automatic Sanitizer Dispenser

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Abstract

Viruses such as COVID-19 are transferable through touch and contact. Hence it is required to clean or sanitize hands regularly to reduce the risk of infection. Dispensing sanitizer from bottle and storage would require manual intervention. We are designing a touchless sanitizer machine to reduce the risk due to contact. The system can sense the proximity with the help of an ultrasonic sensor and sends a signal to the microcontroller. The controller processes the sensor data & actuates the pump and solenoid valve. The sanitizer liquid dispenses through a mist nozzle. And when it crosses a certain number of people it would automatically fill the bottle.

Introduction

Sanitization means cleaning or sterilizing an object or body parts like hands or the whole body. Sanitization can be done in many ways including UV Sanitization, Soap Sanitization, Alcohol Sanitization, Bleach Sanitizing and so on. Of the above methods, alcohol was found to be more useful for human beings since it is harmless on skin surface, vaporizes easily and kills most of the viruses, bacteria, and also removes dirt in our hands. Alcohol may be expensive for mass scale sanitization of buildings or rooms and a major disadvantage is that alcohol is highly inflammable and requires careful storage to avoid catastrophe. Alcohol also makes hands dry since it absorbs moisture, and hence also needs the addition of moisturizers. Alcohol based hand sanitizers are also provided with antiseptic disinfectants like Chlorhexidine Gluconate. Minimum concentration of alcohol in hand sanitizers must be greater than 70% for effectiveness against viruses. But, repeatedly touching the hand sanitizer containers to get a drop of sanitizer again initiates contact with persons, which may be risky. Hence there is a need for a non contact based hand sanitizer dispenser.

Literature Survey

The paper mainly says about the hospital grasped infections, which is about 2 Million Patients per year. It also says that handwashing is important and also effective with proper hand washing steps, but washing with soap and water is time consuming for peak hours in hospitals. This paper also showed the effectiveness of the alcohol based hand sanitizers, which reduced infection rates by a whopping 30%. They used hand sanitizers with 60 to 70 percent ethanol or isopropanol for reducing the significant number of pathogens. The patients were also given about 4.25 ounce containers of hand sanitizer alongside their beds.

For 10 month period of using hand sanitizers showed a result of 36.1% infection reduction. In [2], the paper says about the infection caused by drug resistant microorganisms which causes increase in death rate and also complications, the multidrug resistant bacteria includes Methicillin Resistant Staphylococcus aureus(MRSA), Extended Spectrum Beta-lactamase (ESBL) producing bacteria, Multidrug Resistant Pseudomonas aeruginosa(MDRP), which are very common worldwide.

Hence they emphasize the use of alcohol based hand sanitizers since the alcohol based hand sanitizers had negative association with MRSA isolation rate, which means that hand hygiene is very important in hospitals. In [3], the paper talks about the emergence of the novel Coronavirus(SARS-CoV-2), which has caused unexpected challenges to the health of the people of this world. The paper also aims at reducing the transmission rate of the disease.

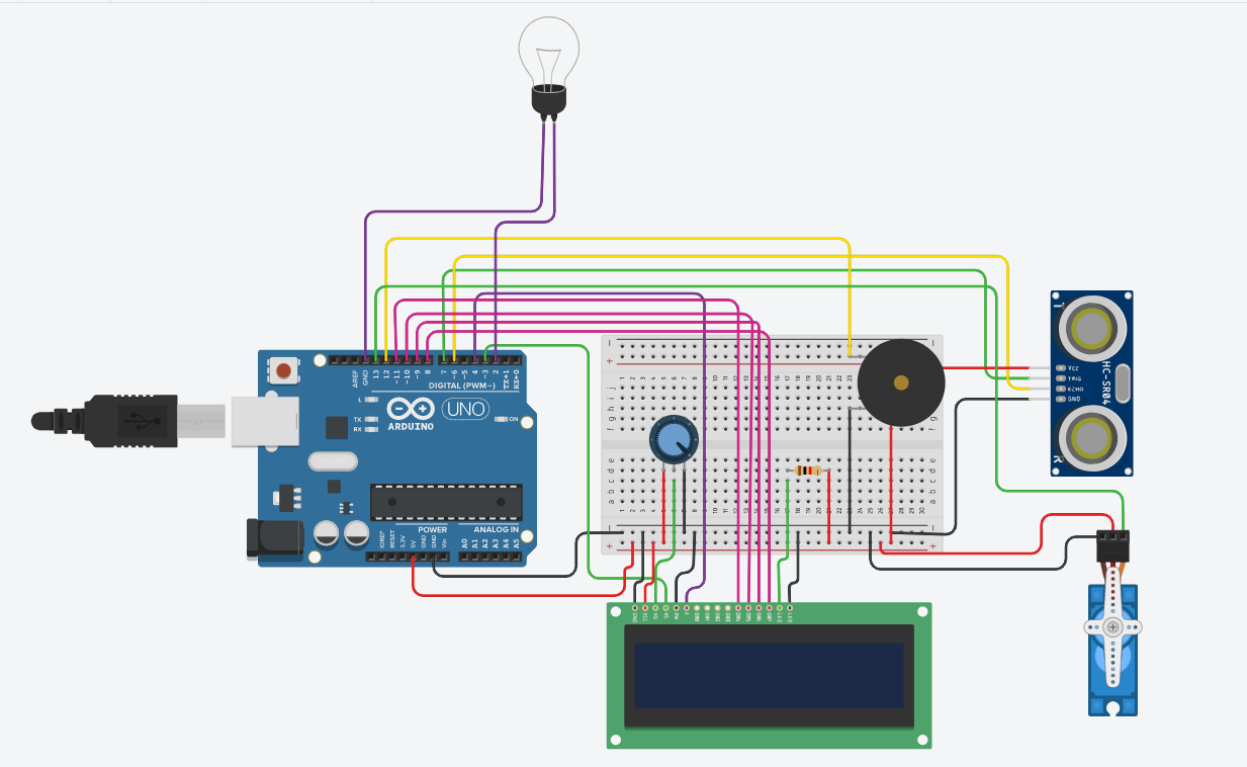
Proposed Method

The system consists of proximity sensors based on ultrasonic principles. The sensor used in the system is SR04 to sense if the hands are under the machine or not. The cabinet design was originally fabricated for the water RO system and has been modified for the purpose of sanitizer dispensing action. The sanitizer storage section is on the front side upper region. Filters have been removed and the water dispensing tap has also been removed. Mist nozzle has been added at the bottom side of the cabinet. The pump is used to suck the sanitizer and pump it with a pressure to the nozzle. The solenoid valve has also been used to control the opening of the nozzle and to facilitate the dispensing of liquid sanitizer. Pipes and attachments helped to make it easy to fabricate.

Components

Name	Component	Quantity
U1	Arduino Uno R3	1
SERVO1	Positional Micro Servo	1
U2	LCD 16 x 2	1
Rpot1	250 kΩ Potentiometer	1
PIEZO1	Piezo Buzzer	1
R1	1 kΩ Resistor	1
DIST1	Ultrasonic Distance Sensor	1
L1	Light bulb	1

Circuit Setup



Working of Proposed Method

Block diagram of the system is as shown above. The sensor senses the proximity of hands when placed under the machine. It works on ultrasonic waves reflection principle. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules include ultrasonic transmitters, receiver and control circuit. The basic principle of work:

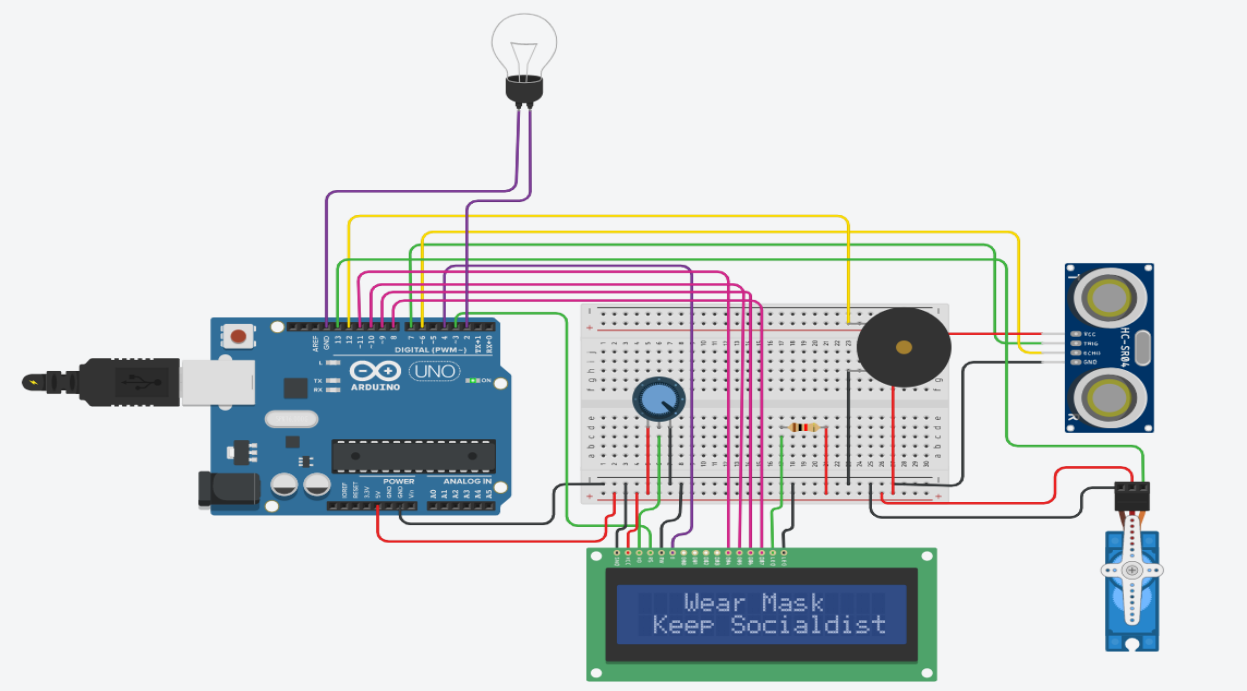
(1) Using IO trigger for at least 10us high level signal,

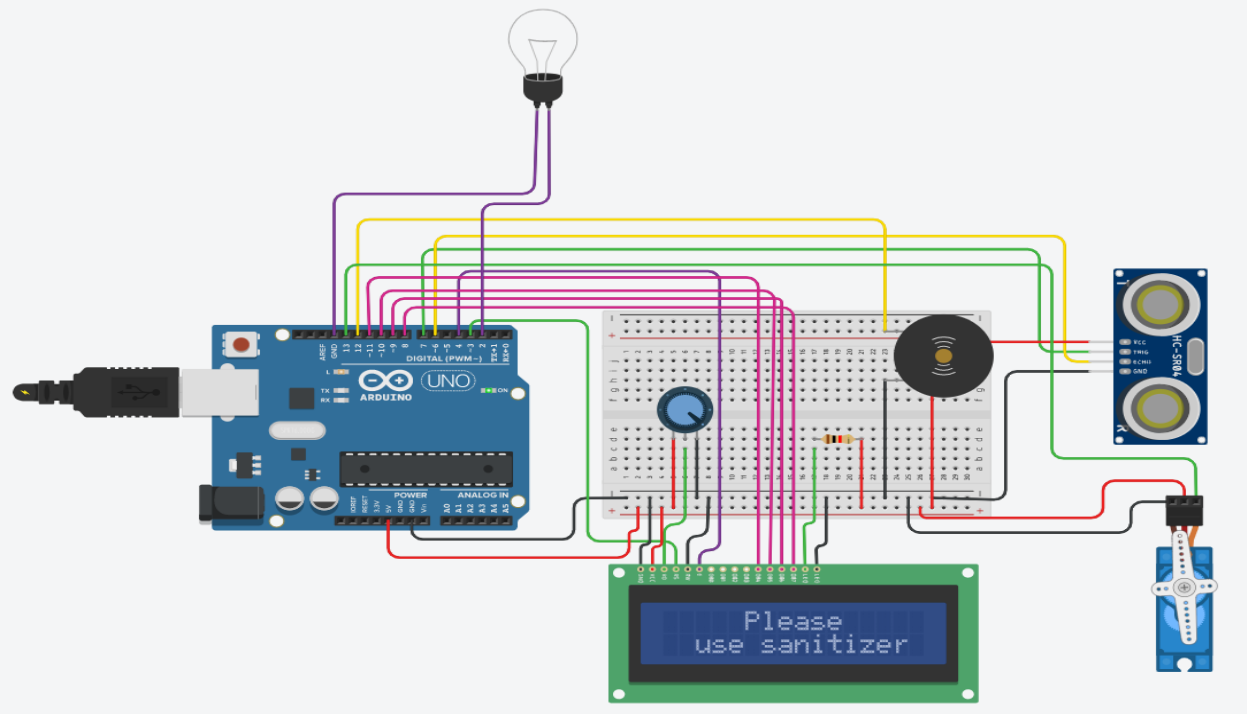
(2) The Module automatically sends eight 40 kHz and detects whether there is a pulse signal back.

(3) If the signal is back, through a high level, the time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time×velocity of sound (340M/S) / 2.

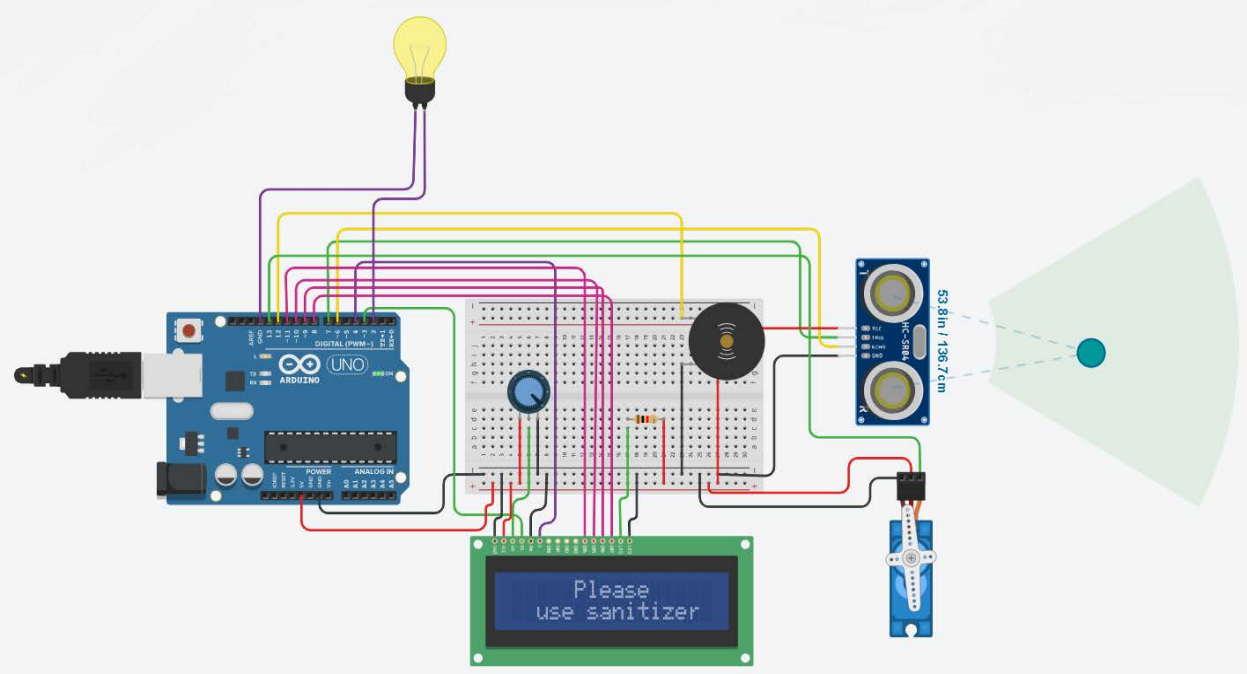
As the controller receives High signal from the sensor module it triggers the pump to pull water from the storage area and send it to the nozzle in mist form. The program runs the pump for 3 seconds. It has been seen during testing that 3 seconds are sufficient to sanitize the hands with mist spray. We can even change the time as per user needs through the program. When the sanitizer is almost empty, the bulb glows indicating a refill.

Output

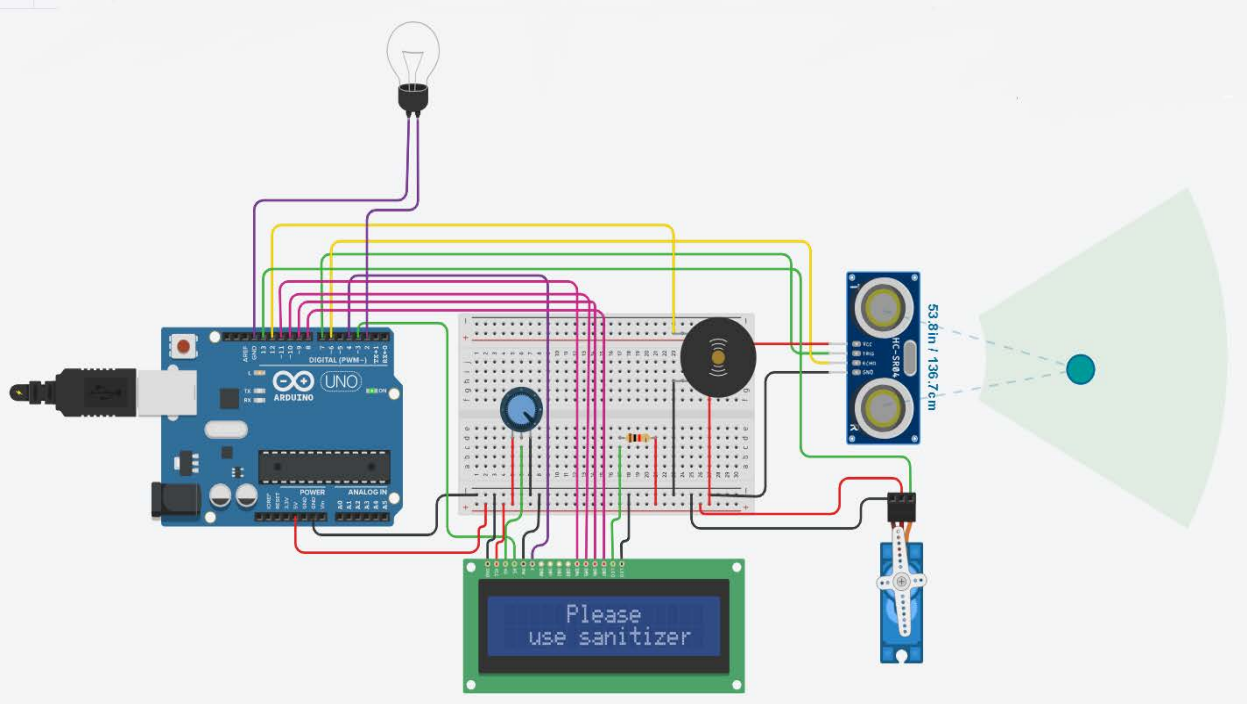




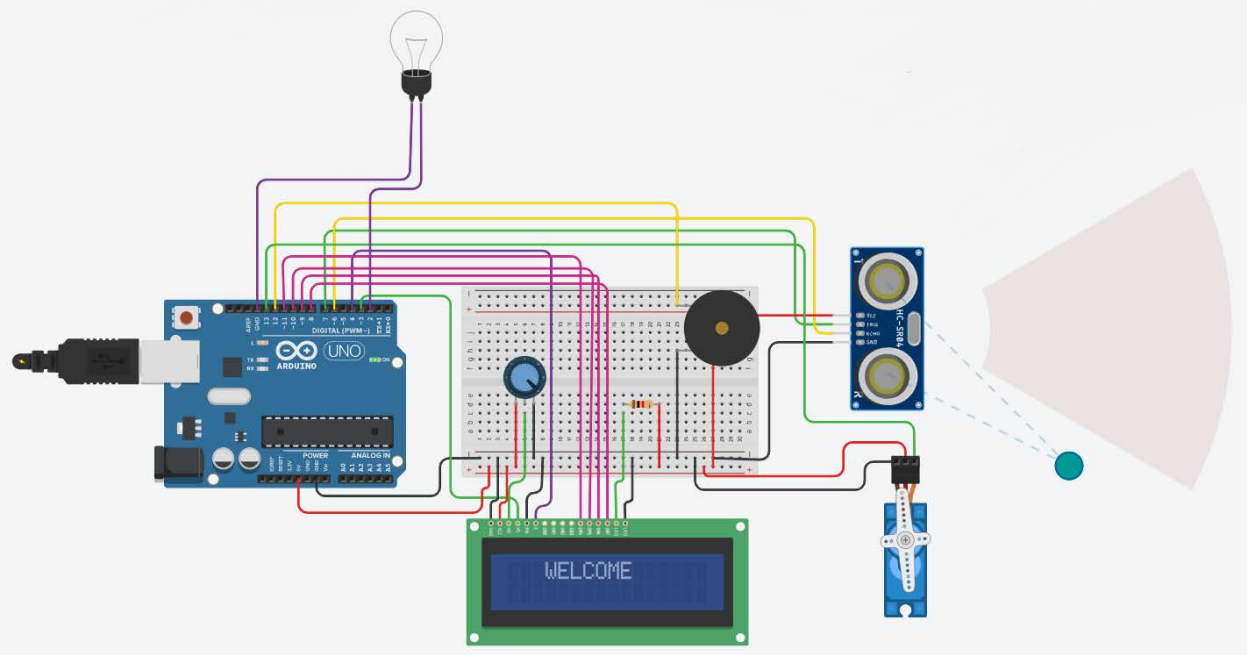
When the distance is within the range the servo motor rotates ie, the neck of the sanitizer bottle opens. In this stage the message ‘Please use sanitizer’ is displayed on the LCD.



When the count **>=** 5, the bulb glows indicating that the sanitizer bottle should be refilled.



After refilling, count set to 0 (count=0) and the process continues.



When distance is not in the range (distance greater than 200 cm) , sanitizer won't be disposed ie, servo motor stops working. During this process 'WELCOME' will be displayed on the LCD.

Serial Monitor

```
d = 136.05 cm
c : 1
d = 136.26 cm
c : 2
d = 135.54 cm
c : 3
d = 136.26 cm
c : 4
d = 134.64 cm
c : 5
d = 136.22 cm
c : 1
d = 134.83 cm
c : 2
d = 136.03 cm
c : 3
d = 134.64 cm
c : 4
d = 136.26 cm
c : 5
d = 334.29 cm
c : 0
d = 333.58 cm
c : 0
d = 333.58 cm
```

Conclusion

An automatic sanitizer dispensing machine designed and developed. The machine is wall mounted at entrance gates of society, schools, colleges or any commercial building. It can spray 40 times with 100 ml liquid and is effective in optimizing use of liquid sanitizer. The machine is tested for 24hour operation for more than a week and is working fine. It helped to reduce the contact for getting sanitizer and also reduce manpower employed to spray sanitizer with a spray bottle.

The power consumption is very low. For each spray the maximum current consumption is 2 Ampere at 24 V. It consumes 48W if run continuously for 1 hour. The control circuit is small in size and low cost as compared to available controllers. The power consumption is low and the system can help to achieve contactless sanitizer dispensers. It reduces the risk of community transmission of the virus.

References

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