Automatic Sanitization Dispenser

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Contents

1. Introduction to Automatic Sanitization Dispenser

The idea for the first automated dispenser was submitted by Guey-Chaun Shiau to be patented in 1989. The patent was under the name, "Automatic Cleaning-liquid Dispensing Device". The patent was issued in 1991. The patented device was under the following description: "An automatic cleaning-fluid dispensing device includes: a containing structure for containing cleaning fluid; a sensing device disposed on a base member being installed in the lower portion of said containing structure wherein said base member is provided with an outlet, a sensing circuit disposed on a circuit board, a motor arrangement electrically connected to the sensing circuit, an outlet for passing a light source of the sensing circuit therefrom so as to detect the presence of an external object closing on the light source; and a dispensing mechanism, which is composed of a push structure functionally connected with the driving motor and a pumping structure operatively engaged with the push structure, installed on the base member in connection with the sensing device; whereby when an external object closes to the sensing device, a given amount of the contained cleaning fluid in the containing structure will be automatically supplied for cleaning purposes." The implementation of automatic washroom supplies has increased dramatically. An increasing number of public locations and private institutions have been incorporating touchless technology into their washrooms.

1.1 Application:

- Public Places
- Hospital
- School & College
- Industries
- Office
- Factory and so on

2. INTRODUCTION TO YOUR MINI-PROJECT TOPIC

2.1 Problem Definition:

In this COVID-19 pandemic period which is a global outbreak, hand hygiene is the core preventive measure in the spread of the disease as advised by WHO (World Health Organization) which includes washing hands with water and soap regularly, hand sanitizing using hand sanitizers, etc.

Hygiene refers to the practices conducive to maintaining health and preventing disease especially through cleanliness such as washing hands, coughing in the elbow etc. Hand washing helps to prevent any diseases that spread through contact. In order to eliminate most of the germs on the hands, we need to apply a good hand washing practice. In most healthcare settings, alcohol-based hand sanitizers are preferable to hand washing with soap and water because it can be easily tolerated and it is also more effective at reducing bacteria. Hand sanitizer is a liquid, gel, or foam generally used to decrease infectious agents on the hands. A sanitizer is designed to kill germs on skin, objects and surfaces.

The aim of the project is to design and implement a low cost smart hand sanitizer dispenser with door controller. It is based on ARDUINO UNO R3 (Micro-controller), temperature sensor and Ultrasonic Distance sensor (an ultrasonic sensor is used to check the presence of hands below the outlet of the sanitizer machine), that can be placed and implemented at different stations such as bank doors, school gates, hospital gates etc.

In enforcing this hand sanitizing action before letting people in to where ever they intend to enter as some people are not willing to collaborate, some look at it as a wastage of their time and also sometimes security guards can let some people in without sanitizing and without check body temperature just because they are their friends or family or relatives, which is very risky. Therefore, the smart hand sanitizer is stationed at the entrance door and it is connected to the door in such a way that it controls it. That is to say, when a person(s) wants to access the entrance door, they must first sanitizer their hands and depict a normal temperature after being checked or else the door will remain locked. If you want to enter the premises put your hand under automatic sanitizer then the sanitizer outlet dropping some amount into your hands at that time thermal temp sensor automatically check body temperature, if temperature is normal it commands to the micro-controller to turn on the servo motor assuming it will open the entrance door and allow a person to enter and lighting up a green LED and in the other case if temperature is high the door will remain locked.

With Help of This smart sanitizer no need to touch anything. So it is true to say “TOUCH LESS DO MORE”.

2.2 Aim/Objectives:

An automatic soap dispenser is a device that dispenses a controlled amount of soap solution (or a similar liquid such as a hand sanitizer). They are often used in conjunction with automatic faucets in public restrooms. They function to conserve the amount of soap used and stem infectious disease transmission.

This project "Automatic Sanitization Dispenser" aims to design and implement a low cost smart hand sanitizer dispenser with door controller and the sole objective of the project is to reduce the spread of a disease.

2.3 Features:

- Convenient
- It is Easy to Use
- It is Low-Cost
- Enhances the hygiene of a person
- Contactless
- Sanitizes and checks temperature simultaneously

3. REVIEW OF LITERATURE :

1. Smart hand sanitizer dispenser: The main aim of this research is to design a smart hand sanitizer dispenser that dispenses optimum amount of sanitizer based on the palm image processing with enhanced IoT features. The research problem of this project is the hand sanitizer dispenser mostly provided in manual dispenser. This will make the hand sanitizer dispenser to be contaminated. The usage of the hand sanitizer also controlled by the individual behaviors. They may use it very little which will not achieving the purpose of using it to curb the infectious virus. They may also use is too much and it can be wasted. The method used to achieve the objectives of this project is by using the Raspberry Pi B+. The system is implemented by using Haar Cascade Classifier to detects the hand palm and measure the hand by using Euclidean distance and pixels per metrics. The system also consists of monitoring and alert features. The liquid level of hand sanitizer is monitored by using Node-RED. An alert system also constructs to remind the owner to refill the hand sanitizer. Other than that, PIR sensor is used to detect the presents of human in the nearby and give out a message through speaker to remind people using the hand sanitizer.

2. IoT-Based Sanitizer Station Network: A Facilities Management Case Study on Monitoring Hand Sanitizer Dispenser Usage: Maintaining hand hygiene has been an essential preventive measure for reducing disease transmission in public facilities, particularly during the COVID-19 pandemic. The large number of sanitizer stations deployed within public facilities, such as on university campuses, brings challenges for effective facility management. This paper proposes an IoT sensor network for tracking sanitizer usage in public facilities and supporting facility management using a data-driven approach. Specifically, the system integrates low-cost wireless sensors, LoRaWAN, and cloud-based computing techniques to realize data capture, communication, and analysis. The proposed approach was validated through field experiments in a large building on a university campus to assess the network signal coverage and effectiveness of sensor operation for facility monitoring. The results show that a LoRaWAN created from a single gateway can successfully connect to sensors distributed throughout the entire building, with the sensor nodes recording and transmitting events across the network for further analysis. Overall, this paper demonstrates the potential of leveraging the IoT-based Sanitizer Station Network to track public health mitigation methods in a large facility, which ultimately contributes to reducing the burden of maintaining public health during and post-pandemic.

3. Automatic Hand Sanitizer Container to Prevent the Spread of Corona Virus Disease: COVID pandemic has influenced human life in various sectors. Various attempts were made to reduce the virus transferring by work from home, social distancing, and also including hand hygiene. So far, most of the available hand sanitizers do not operate automatically. This article aims to make an automatic hand sanitizer where soap and water can come out automatically. Besides that, automated hand sanitizer will make notification to the owner, if the liquid has run out to the smartphone. The infrared (IR) will sense the presence of heat and motion of the object with the distance up to 50mm. It send data to the Arduino Nano to activate the pump. If the ultrasonic sensor detect the distance of water to he sensor 35 cm it will send data to node MCU that connect

to Blink server. It can transfer the data to the output devices such as smartphones or PC based on the Internet of Things (IoT). The results of the hand sanitizer testing that the system can run smoothly with a minimum detection error of transferring data.

4. IoT-Based Sanitizer Station Network: A Facilities Management Case Study on Monitoring Hand Sanitizer Dispenser Usage: Maintaining hand hygiene has been an essential preventive measure for reducing disease transmission in public facilities, particularly during the COVID-19 pandemic. The large number of sanitizer stations deployed within public facilities, such as on university campuses, brings challenges for effective facility management. This paper proposes an IoT sensor network for tracking sanitizer usage in public facilities and supporting facility management using a data-driven approach. Specifically, the system integrates low-cost wireless sensors, LoRaWAN, and cloud-based computing techniques to realize data capture, communication, and analysis. The proposed approach was validated through field experiments in a large building on a university campus to assess the network signal coverage and effectiveness of sensor operation for facility monitoring. The results show that a LoRaWAN created from a single gateway can successfully connect to sensors distributed throughout the entire building, with the sensor nodes recording and transmitting events across the network for further analysis. Overall, this paper demonstrates the potential of leveraging the IoT-based Sanitizer Station Network to track public health mitigation methods in a large facility, which ultimately contributes to reducing the burden of maintaining public health during and post-pandemic.

4. System Description:

4.1 Design:

4.1.1 Block Diagram:

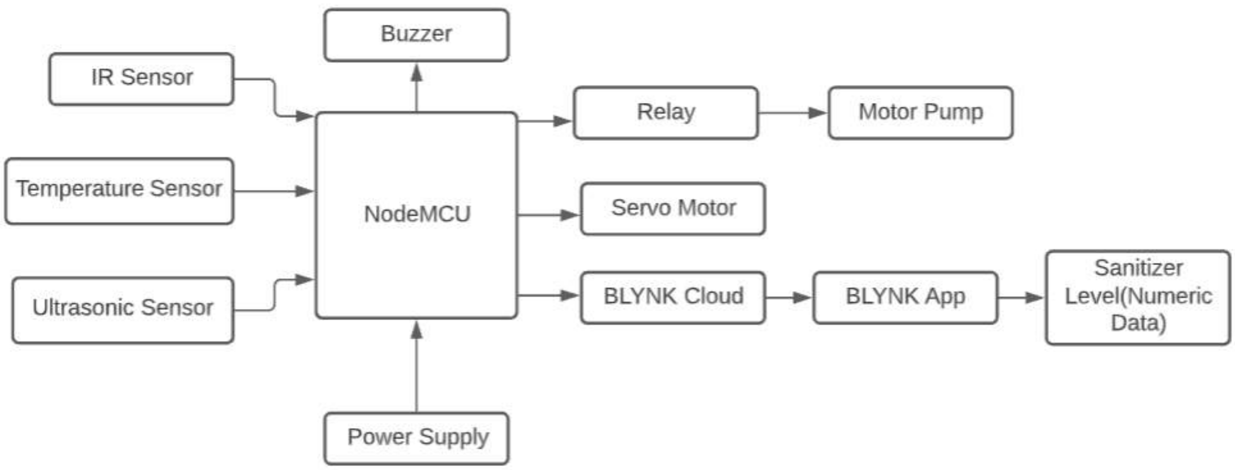


Figure 4.1: Block diagram of Automatic Sanitization Dispenser

4.1.2 Flowchart:

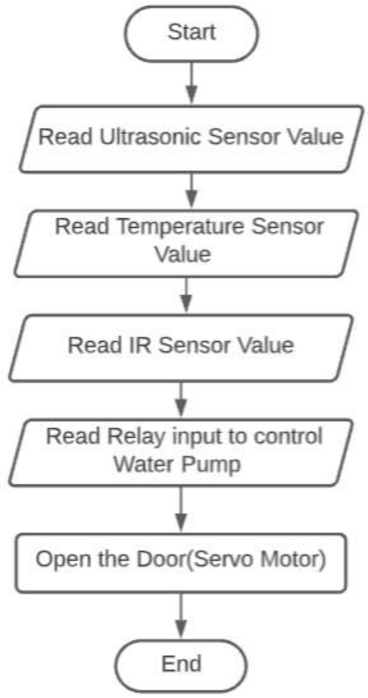


Figure 4.2: Flowchart of Automatic Sanitization Dispenser

4.2 Hardware Circuit:

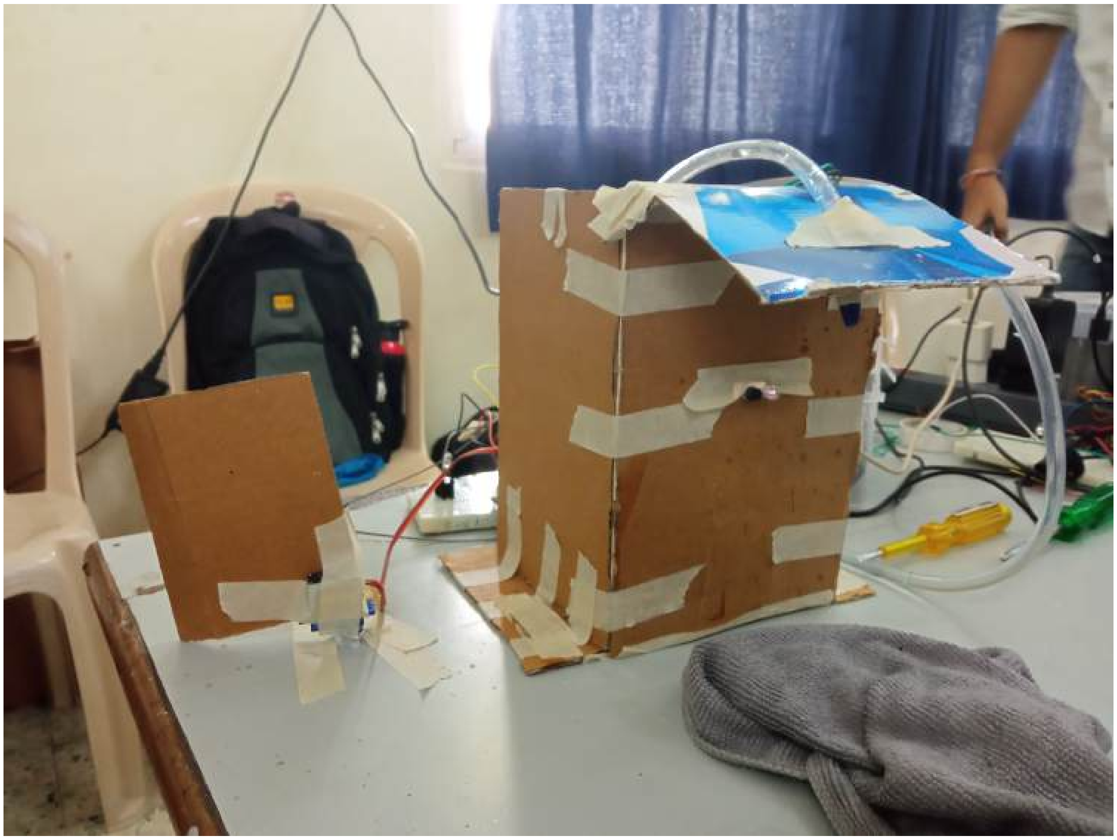


Figure 4.3: Hardware Setup of Automatic Sanitization Dispenser

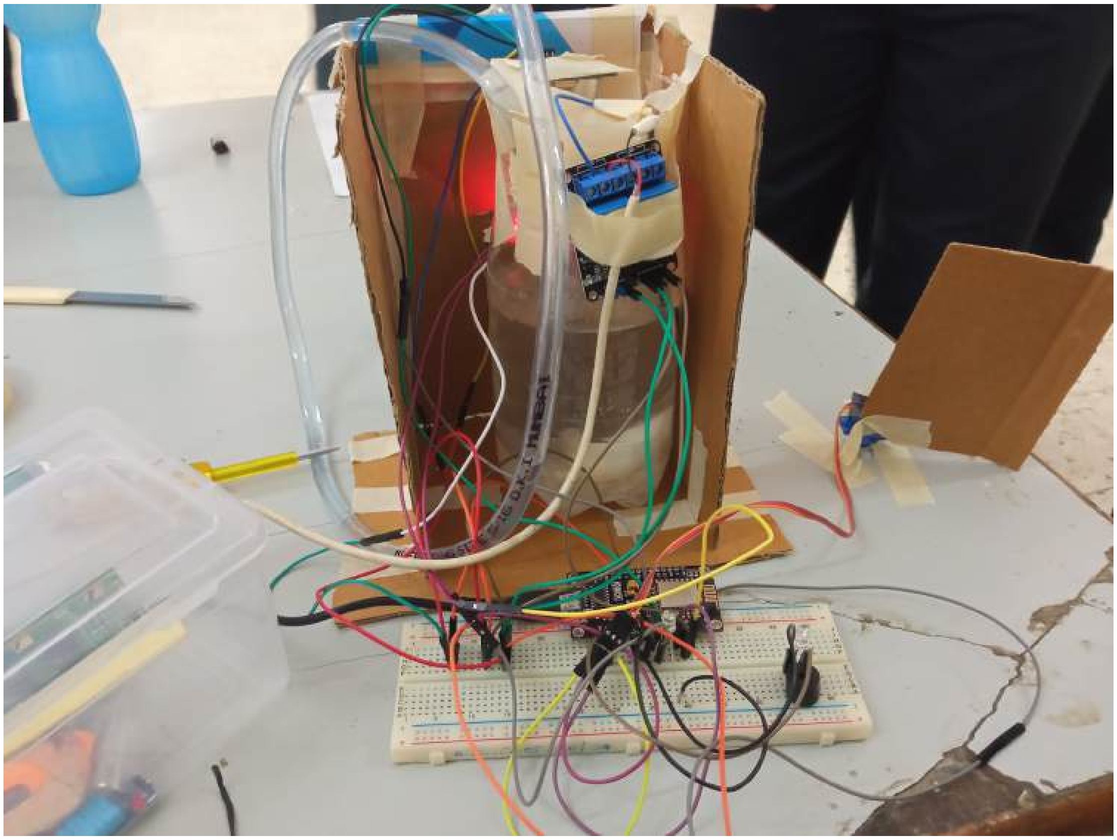


Figure 4.4: Hardware Setup of Automatic Sanitization Dispenser

4.2.1 Components List:

1 NodeMCU Esp8266
2 Breadboard Mini
1 Relay
1 Motor Pump
1 Ultrasonic Distance Sensor
1 Power Supply
4 LED
1 IR Sensor
1 Buzzer
1 Temperature Sensor[LM35]
1 Micro Servo
1 LCD

4.2.2 Details of components:

1) NodeMCU Esp8266:
NodeMCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc, it can solve many of the project's needs

alone. The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

2) Micro Servo:
Micro Servo Motor SG90 is a tiny and lightweight server motor with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos.

Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire. There is a minimum pulse, a maximum pulse, and a repetition rate. A servo motor can usually only turn 90° in either direction for a total of 180° movement. The motor's neutral position is defined as the position where the servo has the same amount of potential rotation in the both the clockwise or counter-clockwise direction. The PWM sent to the motor determines position of the shaft, and based on the duration of the pulse sent via the control wire; the rotor will turn to the desired position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position. Shorter than 1.5ms moves it in the counter clockwise direction toward the 0° position, and any longer than 1.5ms will turn the servo in a clockwise direction toward the 180° position.

When these servos are commanded to move, they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is called the torque rating of the servo. Servos will not hold their position forever though; the position pulse must be repeated to instruct the servo to stay in position.

3) IR Sensor:
An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.

4) Motor Pump:
A Motor pump is a mechanical device, used to move the liquids/gases from one place to another by using mechanical action. The working principle of the water pump is, it converts the motor's energy from mechanical to fluid flow. These are classified into various types based on the technique they use for supplying the liquid like direct, gravity and displacement.

A pump operates by using a mechanism like rotary or reciprocating and they consume energy for performing mechanical work to move the liquid. Pumps use several energy sources for their operations like manual, wind power, electricity, engines, etc. These are available in many shapes based on its application like medical to large industries.

5) Buzzer:
A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or

piezoelectric (piezo for short).

6) Ultrasonic Distance Sensor:
The Parallax PING))) ultrasonic distance sensor provides precise, non-contact distance measurements from about 2 cm (0.8 inches) to 3 meters (3.3 yards). The PING))) sensor works by transmitting an ultrasonic (well above human hearing range) burst and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width the distance to target can easily be calculated.

It detects the distance of the closest object in front of the sensor (from 3 cm up to 400 cm). It works by sending out a burst of ultrasound and listening for the echo when it bounces off of an object. It pings the obstacles with ultrasound. The Arduino or Genuino board sends a short pulse to trigger the detection, then listens for a pulse on the same pin using the pulseIn() function. The duration of this second pulse is equal to the time taken by the ultrasound to travel to the object and back to the sensor. Using the speed of sound, this time can be converted to distance.The 5V pin of the Ultrasonic sensor is connected to the 5V pin on the board, the GND pin is connected to the GND pin, and the SIG (signal) pin is connected to digital pin 7 on the board.

7) Power Supply:
A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

A power supply unit (PSU) converts mains AC to low-voltage regulated DC power for the internal components of a computer. Modern personal computers universally use switched-mode power supplies. Some power supplies have a manual switch for selecting input voltage, while others automatically adapt to the mains voltage.

The energy efficiency of a power supply drops significantly at low loads. Therefore, it is important to match the capacity of a power supply to the power needs of the computer. Efficiency generally peaks at about 50–75% load. The curve varies from model to model.

8) LED (Red, Blue, Green):
A light releasing diode is an electric component that emits light when the electric current flows through it. It is a light source based on semiconductors. When current passes through the LED, the electrons recombine with holes emitting light in the process. It is a specific type of diode having similar characteristics as the p-n junction diode. This means that an LED allows the flow of current in its forward direction while it blocks the flow in the reverse direction. Light-emitting diodes are built using a weak layer of heavily doped semiconductor material. Based on the semiconductor material used and the amount of doping, an LED will emit a colored light at a particular spectral wavelength when forward biased.

9) Temperature Sensor[LM35]:

LM35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature. The output voltage can easily be interpreted to obtain a temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration.

10) Relay:
IoT Power Relay is a controllable power relay equipped with four outputs that help to create an Internet of Things project with safe, reliable power control. With the IoT Power Relay you can easily control the power going to a device with an Arduino, Raspberry Pi or other single-board computer or microcontroller.

4.3 Implementation Methodology:

Steps:

- Step 1: Take one NodeMCU ESP8266, and all the components that are listed above
- Step 2: Connect the components to the NodeMCU as per the diagram.
- Step 3: The working is such that , after the machine starts it checks the Ultrasonic Sensor value i.e if the sanitizer container is empty or not.
- Step 4: Then it checks the body temperature of the person ,if it is normal (less than 38.00 degree celsius), if it is normal then sanitization process continues, and if not then a buzzer will start beeping with a Red LED simultaneously turning ON.
- Step 5: Next it checks the IR Sensor Value,i.e. to detect the person's hand and is it below the flow pipe for the purpose of sanitizon.
- Step 6: Finally, after the person is well sanitized he is ready to go inside, this is shown by the servo motor, which opens and Green LED glows.

4.4 Code:

```
#include <ESP8266WiFi.h>
#include <ThingSpeak.h>

long myChannelNumber=1712328;
const char myWriteAPIKey[]="XL6WBOP65Q6H68R8";
 const int trigPin = D5;
const int echoPin = D6;

WiFiClient client;

long duration;
int distance;

int persons=0;
```

```
int at=0;

#include <Servo.h>
Servo servo;


void setup() {

   persons=0;

  servo.attach(D3); //D1
  servo.write(0);


//   put your setup code here, to run once:
  pinMode(D1, INPUT);   //IR
  pinMode(D2, OUTPUT); //pump

  pinMode(D7, OUTPUT); //red
  pinMode(D8, OUTPUT);  //green
  pinMode(D0, OUTPUT); //buzzer

  pinMode(A0, INPUT); //Temp

  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input

  digitalWrite(D2, LOW);
  Serial.begin(9600);


  WiFi.begin("Manish","mkanish22");
  while(WiFi.status() != WL_CONNECTED)
  {
    Serial.println(".");
    delay(500);
  }

  Serial.println("Connected");
  Serial.println(WiFi.localIP());


  ThingSpeak.begin(client);
}

void loop() {
  // put your main code here, to run repeatedly:
```

```
digitalWrite(D8, LOW);

 digitalWrite(trigPin, LOW);
 delayMicroseconds(2);
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);
 duration = pulseIn(echoPin, HIGH);
 distance = duration * 0.034 / 2;
 Serial.print("Distance: ");
 Serial.println(distance);


 float t = analogRead(A0);
     double sv = (t * 3100.0) / 1023;
     float temp = sv / 10;
     Serial.print("Temp: ");
     Serial.println(temp);

 ThingSpeak.setField(3,distance);
 if (distance < 10) {

 digitalWrite(D0, LOW);

   int a = digitalRead(D1);
   Serial.println(a);
   //delay(100);
   if (a == 0)
   {
     float t = analogRead(A0);
     double sv = (t * 3100.0) / 1023;
     float temp = sv / 10;
     Serial.print("Temp: ");
     Serial.println(temp);
     ThingSpeak.setField(1,temp);

     if(temp<45)
     {
       Serial.println("Temperature is normal");
       if(at==0)
       {
         digitalWrite(D2, LOW);
         at=1;
         delay(300);
         digitalWrite(D2, HIGH);

          int pos;
```

```
          digitalWrite(D8, HIGH);
           for(pos=0;pos<=180;pos++)
          {
           servo.write(pos);

          }
          delay(1000);

           for(pos=180;pos>=0;pos--)
            {
             servo.write(pos);

           }

            delay(1000);

            persons=persons+1;
            ThingSpeak.setField(2,persons);
            int confirm=ThingSpeak.writeFields(myChannelNumber,myWriteAPIKey);
            digitalWrite(D8, LOW);
        }
        else
        {

         digitalWrite(D2, HIGH);
        }
      }
      else
      {
        Serial.println("Temperature is high");
         digitalWrite(D7, HIGH);
      }
    }
    else {
      digitalWrite(D2, HIGH);
     at=0;
     digitalWrite(D7, LOW);
    }

  }
  else
  {
    digitalWrite(D2, HIGH);
   digitalWrite(D0, HIGH);
   delay(200);
  }

}
```

4.5 Results:

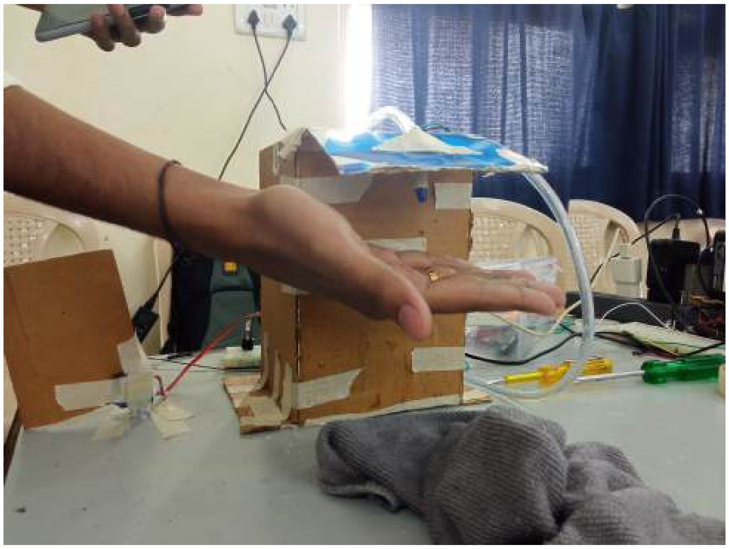


Figure 4.5: Automatic Sanitization Dispenser machine, ultrasonic and temperature sensor functions first

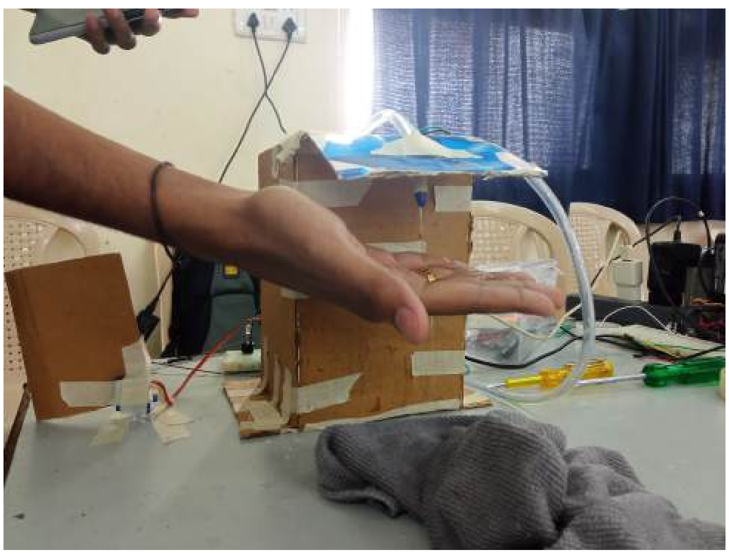


Figure 4.6: The machine dispenses sanitizer when hand is detected by IR, after checking the temperature

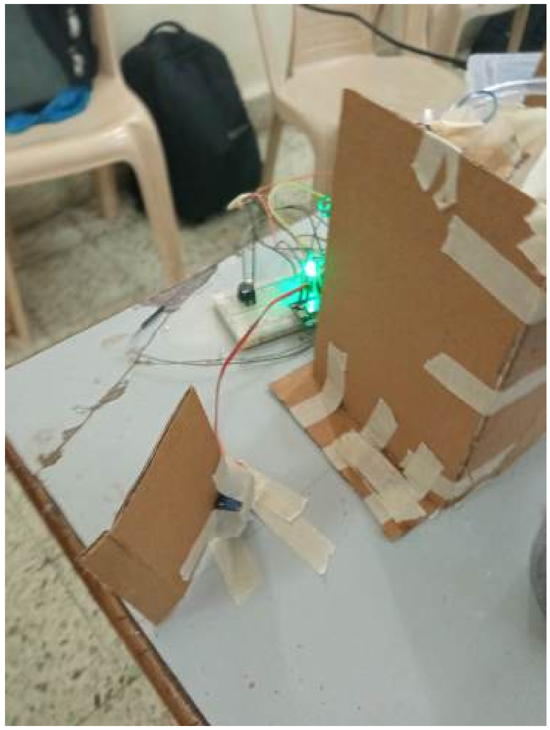


Figure 4.7: Normal Sanitization done is indicated by Green light

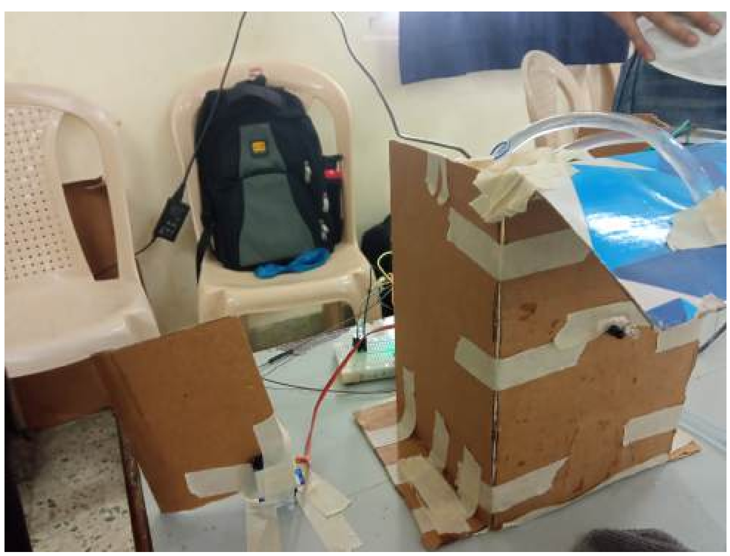


Figure 4.8: After the person is well sanitized, the door (servo motor) opens

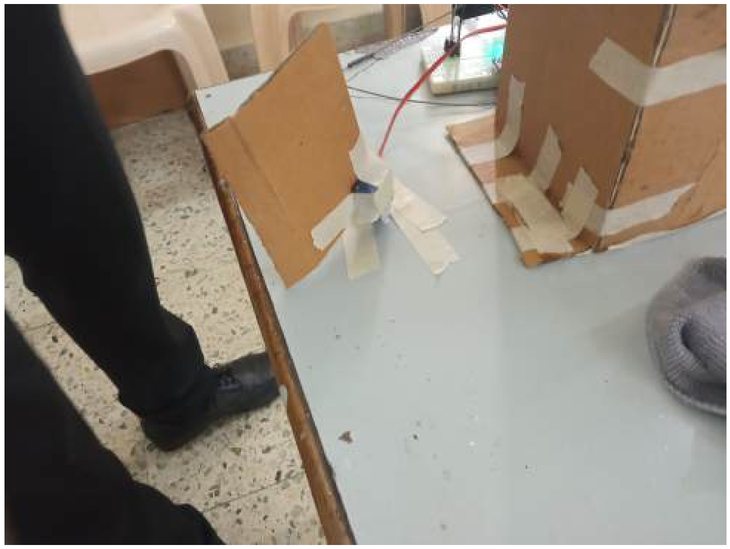


Figure 4.9: Servo Motor rotates 90 deg indicating door is open

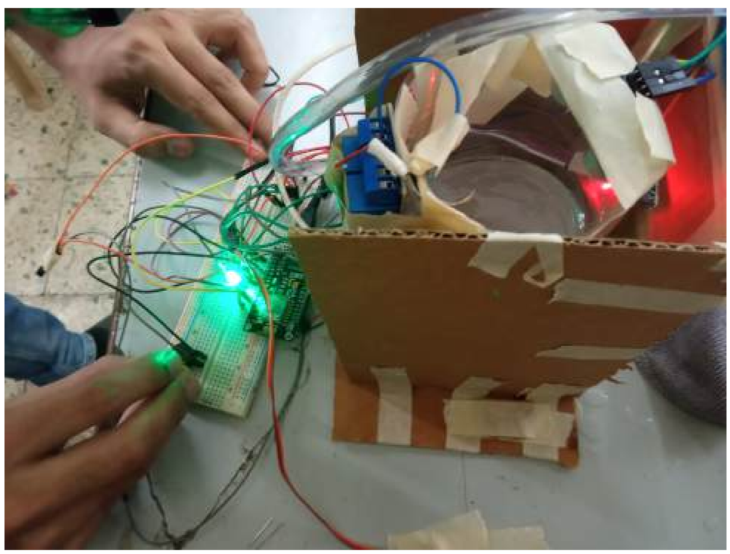


Figure 4.10: Successful process is shown by green LED

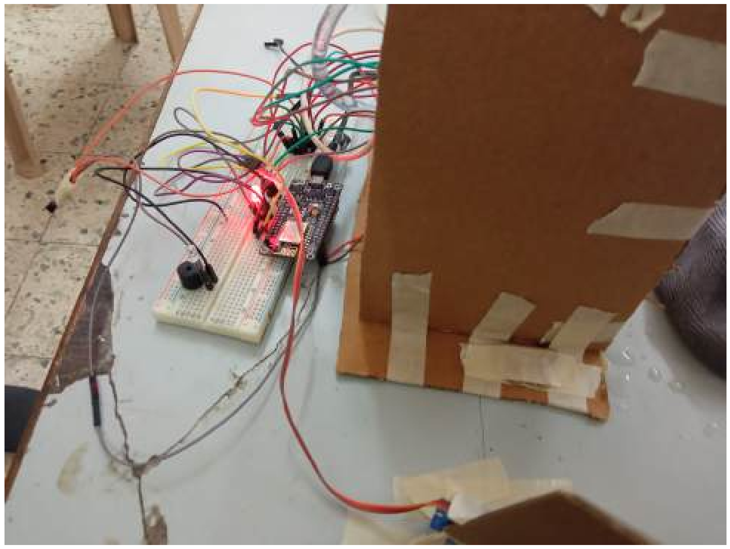


Figure 4.11: If the sanitizer container is empty, Red LED glows and buzzer starts beeping

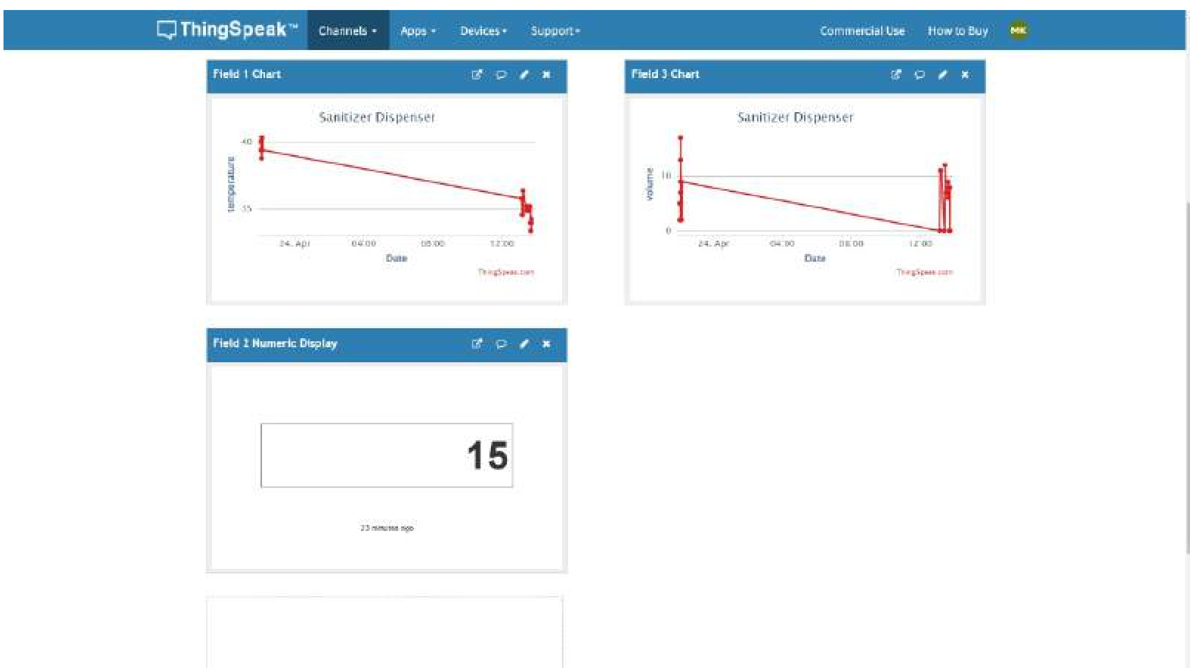
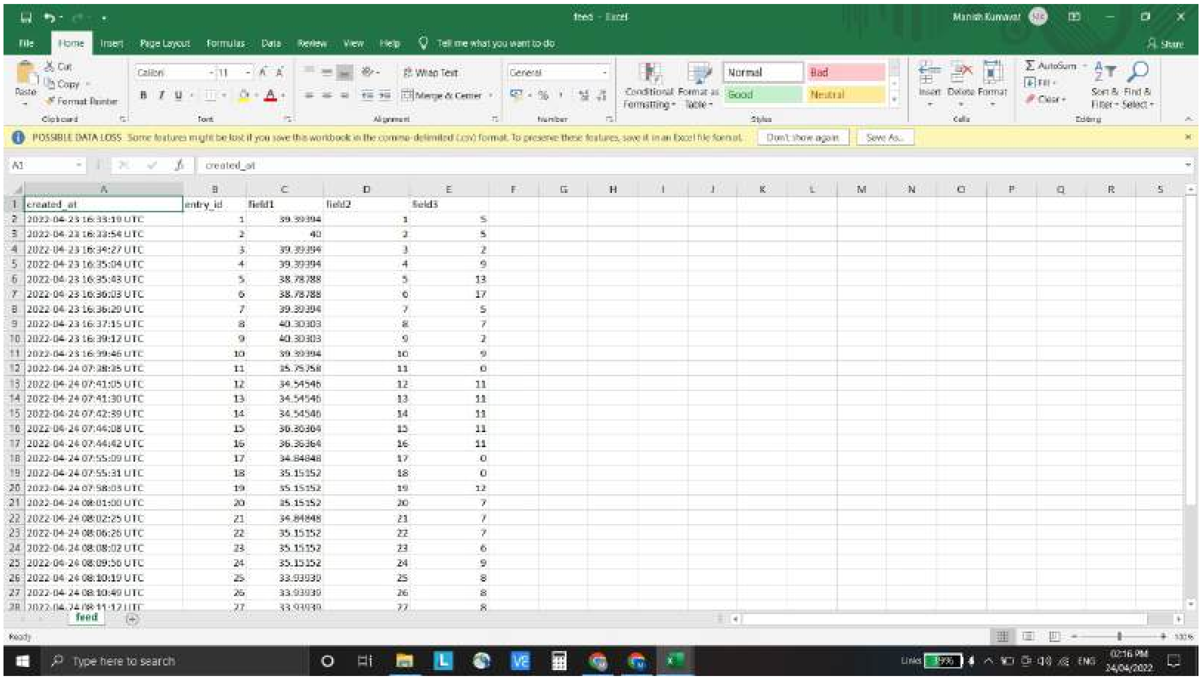


Figure 4.12: Thingspeak Data Visualization



created_at	entry_id	field1	field2	field3
2022-04-23 16:33:10 UTC	1	39.39394	1	5
2022-04-23 16:33:54 UTC	2	40	2	5
2022-04-23 16:34:27 UTC	3	39.39394	3	2
2022-04-23 16:35:04 UTC	4	39.39394	4	9
2022-04-23 16:35:43 UTC	5	38.78788	5	13
2022-04-23 16:36:03 UTC	6	38.78788	6	17
2022-04-23 16:36:20 UTC	7	39.39394	7	5
2022-04-23 16:37:15 UTC	8	40.30303	8	7
2022-04-23 16:39:12 UTC	9	40.30303	9	2
2022-04-23 16:39:46 UTC	10	39.39394	10	9
2022-04-24 07:38:35 UTC	11	35.75758	11	0
2022-04-24 07:41:05 UTC	12	34.54546	12	11
2022-04-24 07:41:30 UTC	13	34.54546	13	11
2022-04-24 07:42:39 UTC	14	34.54546	14	11
2022-04-24 07:44:08 UTC	15	36.30304	15	11
2022-04-24 07:44:42 UTC	16	36.36364	16	11
2022-04-24 07:55:09 UTC	17	34.84848	17	0
2022-04-24 07:55:31 UTC	18	35.15152	18	0
2022-04-24 07:58:03 UTC	19	35.15152	19	12
2022-04-24 08:01:00 UTC	20	35.15152	20	7
2022-04-24 08:02:25 UTC	21	34.84848	21	7
2022-04-24 08:06:26 UTC	22	35.15152	22	7
2022-04-24 08:08:02 UTC	23	35.15152	23	6
2022-04-24 08:09:56 UTC	24	35.15152	24	9
2022-04-24 08:10:19 UTC	25	33.93939	25	8
2022-04-24 08:10:40 UTC	26	33.93939	26	8
2022-04-24 08:11:12 UTC	27	33.93939	27	8

Figure 4.13: Thingspeak Data

4.6 Conclusion:

Thus, we have successfully implemented and showed the working of our Automatic Sanitization Dispenser with the help of various components and sensors like IR Sensor, Ultrasonic Distance sensor, Temperature sensor and other components. Automatic hand sanitizer machine thus helps in non contact dispensing which is again important to prevent pathogen spreading and finally, hand hygiene is most important and must be part of our daily life, and this is done by making connections of the components and nodemcu coding is done accordingly.

4.7 CONSTRAINTS FOR REAL TIME DEPLOYMENT

1. Batteries wear down fast:
Most automatic dispensers rely on batteries to operate. So, they require regular and timely maintenance in terms of refilling the batteries.

2. Price factor:
Thes machines come with a fully automatic system, and quite understandably, these are more expensive than the manual ones.

3. Maintenance:
There is scepticism that an automatic dispenser is high maintenance. As the sanitizer dispenses automatically, it gets clogged in places, which requires timely cleaning. This also makes the place dirty and unhygienic.

References:

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3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7438695/
4. https://www.researchgate.net/publication/356843599 Smart hand sanitizer dispenser/
5. IoT-Based Sanitizer Station Network: A Facilities Management Case Study on Monitoring Hand Sanitizer Dispenser Usage./
6. Automatic Hand Sanitizer Container to Prevent the Spread of Corona Virus Disease./