Project Report: Automate Hand Sanitizer Dispenser using IoT

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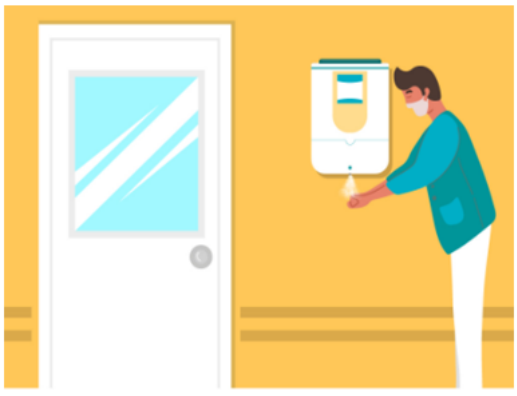

Under the Guidance of

Prof. Umang Patel

ABSTRACT

The end of 2019 witnessed the outbreak of Coronavirus Disease 2019 (COVID-19), which has continued to be the cause of plight for millions of lives and businesses even in 2020 and 2021.As the world recovers from the pandemic and plans to return to a state of normalcy, there is a wave of anxiety among all individuals,especially those who intend to resume in person activity. Studies have proved that use of sanitizers significantly reduces the risk of viral transmission as well as provides a sense of protection. Still the sanitizer dispensers are not hundred percent safe as they are operated through foot-pedal stands or a person which still possess a risk of spread.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.

Technology holds the key here. We introduce system that can dispense the hand sanitizer dispenser automatically when a person keeps the hand in front of dispenser. Our system consists of ultrasonic sensor to detect hands at a particular distance, motor to dispense sanitizer which are both controlled by Arduino UNO.This will help track safety violations, promote the use of sanitizer, and ensure a safe working environment.

Keywords: Arduino; Sensors and Motors; COVID-19; Sanitizers; Safety Improvement

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INTRODUCTION

1.1 Description

Corona Virus disease has spread to more than **213 countries** infecting more **7 million** people and killing over **403,202 globally**, according to data compiled by worldometer (as on June 5, 2020)

The world is fighting with Covid19 pandemic. There are so many essential equipments needed to fight against Corona virus. One of such most essential is Sanitizer. Firstly Sanitizer was not mandatory for everyone but as the day progresses scientist and Doctors have recommended everyone to use Sanitizer.

Rapid advancements in the fields of Science and Technology have led us to a stage where we are capable of achieving feats that seemed improbable a few decades ago. Technologies in Micro-Controllers and Sensors and Motors have made our lives easier and provide solutions to several complex problems in various areas. In a world battling against the Novel Coronavirus Disease (COVID-19) pandemic, technology has been a lifesaver. With the aid of technology, 'work from home' has substituted our normal work routines and has become a part of our daily lives. However, for some sectors, it is impossible to adapt to this new norm.

As the pandemic slowly settles and such sectors become eager to resume in-person work, individuals are still skeptical of getting back to the office. **65 percent** of employees are now anxious about returning to the office (Woods,2020). Multiple studies have shown that the use of Sanitizers reduces the risk of viral transmission as well as provides a sense of protection. However, it is infeasible to manually enforce such a policy on large premises and track any violations. Contact-less Hand-Sanitizer Dispenser proviedes a better alternative. Using a combination of micro-controller, motor and sensor we developed a robust system that can dispense sanitizer hundred percent contact free.

1.2 Problem Statement

Corona Virus disease has been spreading to more than **96.2M million people** and killing over **2.06M** till now. Despite the vaccine, the second wave of the virus has came and affect almost all countries imposed lockdown. So in such circumstances, social distancing and use of contact less hand sanitizers is an effective way to tackle the deadly corona virus.

1.3 Motivation

To limit Corona Virus spread, social distancing and observing hygiene standards like compulsory wearing of mask, use of hand gloves, face shield, and use of sanitizer is very important. So we are planing to develop a completely contact less hand-sanitizer dispenser.

1.4 Proposed Solution

Many Organizations are making it compulsory to follow social distancing and use hand-sanitizers.
Our Objectives are as follows:
To develop a completely contact free hand sanitizer dispenser.

1.5 Features

1. **Automatic Hand triggered dispenser,**
2. **Reminder for sanitizing Hands**
3. **Fluid Level Detection**
4. **Mobile and Email reminder for Bottle refilling.**
5. **Log Record of People using Dispenser (Count people)**

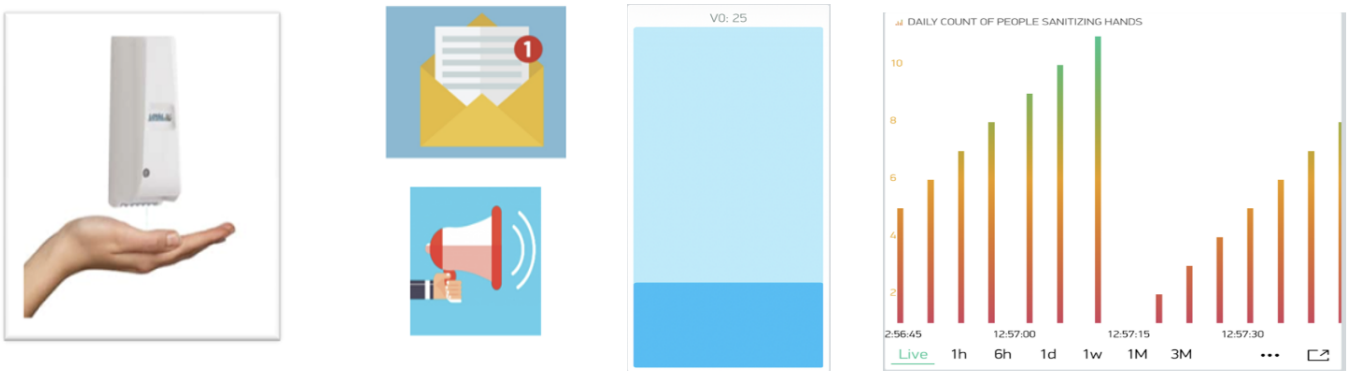

Figure 1: Features

REVIEW OF LITERATURE

In [1], the paper mainly says about sanitizing hands in the corona period is very essential.Because it can kill the Covid -19 virus. but use the of normal sanitizer bottle become very danger. When an infected person press the bottle trigger, The virus may spread from this hand sanitizer bottle. We can solve this by using Automatic hand sanitizer bottle. Automatic means, no need to trigger with our hand. Just place your hand near the bottle. the bottle will automatically trigger.in this paper they had proposed the method of an Ultrasonic distance sensor, DC waterpump and Arduino board. You can also use any other microcontroller. When we place our hand in front of the distance sensor, it will help to the Arduino to measure the distance from the sensor to object (here the hand). if the object in the desired range, Arduino will the help of ultrasonis sesnor will turn on motor and will trigger the sanitizer on the people hands.if the distance is not in the desired range the motor will stop rotating.In simple words When servo motor rotate, the trigger will press.

In [2], the paper mainly says about Severe Respiratory diseases, like the Corona virus Disease 2019 (COVID-19) spread when mucus or droplets containing the virus enter our body through our eyes, throat, or nose.Sadly, a lot of work that we regularly do requires us to touch several surfaces throughout the day. Moreover, unfortunately, a gathering/crowding is also an effective medium of transmission of this virus.During this COVID-19 global pandemic, one of the most fundamental and crucial ways to prevent the spread of this virus is sanitizing our hands frequently. Also, using smart appliances and maintaining social distancing are some of the principal ways we can restrict the deadly virus spread.This project is a complete automation setup for Home and Office for restricting the spread of COVID-19, using the Bolt IoT WIFI Module. This system includes automatic lighting with motion sensing using IR Sensor Module, Smart Appliances that can be controlled over the Bolt Cloud/App, frequent sanitizing reminder using a buzzer bell. Additionally, this system includes people to counter for the room to avoid overcrowding and maintain social distancing.
The project proposed the solution of Overcrowding alert has the following steps:
1. Read IR Sensor at Entry and Exit
2. Count number of people in the room
3. Is the number less than/equal to 5
4. If not, send Alert via Mail (using Mailgun)
5. Wait for 60 seconds(1 min)
6. Repeat the process

Mailgun is an Email automation service. It has a very powerful set of inbuilt functions for sending emails. Developers can process their email with the help of Mailgun API.

In [3], the paper mainly says about he outbreak of COVID-19 hits the world dramatically, the use of hand sanitizers have escalated. Hand sanitizers can help reduce our risk of catching certain infections. Hand sanitisers can also protect against disease-causing microbes, especially in situations when soap and water aren't available. They're also proven to be effective in reducing the number and type of microbes.The mainly cause of COVID-19 spread is when virus-laden droplets from infected person get inhaled by other persons. Recent studies shows that you can get this virus also by touching surfaces or objects contaminated by the infected person and after that touching your face and nose can easily make you a target of it. This gives me a motivation to make a touch-less IoT based sanitizer Dispenser.This project proposed the solution of The most Advanced Features in this project are: Automatic Hand triggered dispenser,Fluid Level Detection (so the dispenser can be refilled), Log Record of People using Dispenser (Count people).Make Analysis of data.This Dispenser have most of the required features. The project is based on cloud platform called BLYNK platform so useful data be can logged about the people sanitizing there hands regularly.

In [4], video they had shown how to play any mp3 audio with your Arduino without any module you just need a speaker for that and if available then use a Audio amplifier as here i am using a transistor TIP 120 for amplification of audio but the Arduino can only play **16 bit PCM 8kHZ audio** mp3 that mp3 should be coded using a encoder software the only down side is the low memory of Arduino uno allows us to play a audio of approx **4-5 sec** but you can use ARDUINO MEGA. The connections were really simple we used 0.5 watt speaker then directly connect the +ve pin of speaker to digital pin 11 on Arduino -ve pin of speaker to gnd if using **3 watt** speaker then use a tip120 transistor connect the 11 of Arduino to the base of transistor and -ve pin of speaker to the collector of the transistor emitter of the transistor to the gnd pin on Arduino.so the next part is coding part , so as you downloaded the the Arduino mp3.zip file which contains **PCM.zip file** so add this PCM.zip file as a library to the arduino then open the playback example available in the that PCM library , there in the sketch you have to edit the 2nd line of code in sample[] arrray which is of programem type you need to remove all the data in that aray paste the data which is copied to the clipboard by the encode audio software.o finally our code is ready so upload it to the arduino you'll hear your recorded audio from speaker.

SYSTEM OVERVIEW

3.1 SYSTEM ANALYSIS

3.1.1 Component List

Sr no	Components Required	Quantity	Price (Rs)
1	Water Pump 6-9V	1	55
2	Arduino UNO Board	1	325
3	Arduino UNO Cable	1	35
4	IR Sensor Module	1	50
5	Ultrasonic Sensor	1	75
6	12V adapter	1	100
7	Jumper Wire m/f	6 - 8	25
8	Jumper Wire m/m	6 - 8	25
9	Sanitizer Empty Bottle	1	40
10	Double sided Tapes	1	40
11	Node MCU CP2102	1	225
12	Water pipes	1m	40
13	Speakers *	2	80*
		Total	995 Rs

Ardiuno UNO Board :-

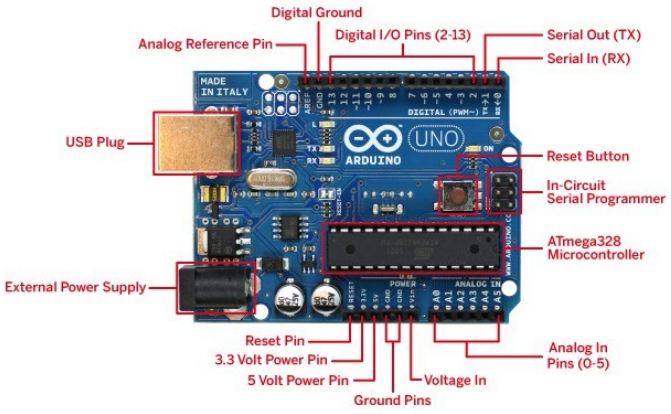

Figure 2: Arduino Uno R3

Microcontroller is the most important unit of the entire system. It is actually responsible for all theprocess being preceded. It will access and control all the peripheral devices or components, connected inthe system.The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) **ATmega328 AVR microcontroller.** It has **20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs).** Programs can be loaded on to it from the easy-to-use Arduino computer program.Each of the **14 digital pins and 6 analog pins** on the Uno can be used as an input or output, under software control (using pinMode(), digitalWrite(), and digitalRead() functions). They operate at **5 volts.**The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values).

Node MCU ESP8266 :-

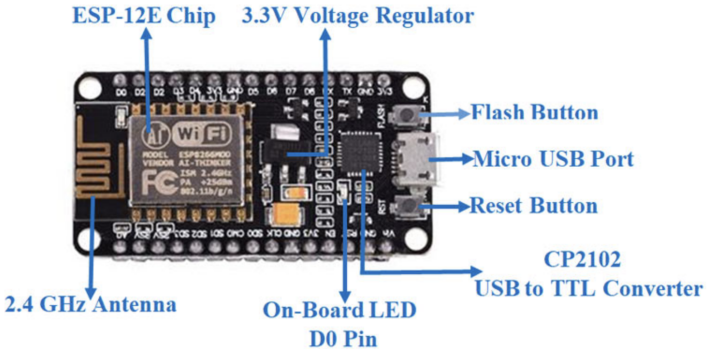

Figure 3: Node MCU ESP8266

The NodeMCU ESP8266 development board comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa **32-bit LX106 RISC microprocessor.** NodeMCU has **128 KB RAM and 4MB** of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.NodeMCU can be powered using Micro USB jack and VIN pin (External Supply Pin). It supports **UART, SPI, and I2C** interface.
Applications of NodeMCU :-

1. **Prototyping of IoT devices.**
2. **Low power battery operated application.**
3. **Network projects.**
4. **Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth functionalities.**

Water pump 5V :-

Figure 4: Water Pump 5-7V

A High Performance non submersible dc water pump is a device which has a hermetically sealed motor close-coupled to the pump body. Some part of assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitations a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. The non submersible pumps used in ESP installations are multistage centrifugal pumps operating in a vertical position. Although their constructional and operational features underwent a continuous evolution over the years, their basic operational principle remained the same. Condition: new: a brand-new, unused, unopened, undamaged item in its original packaging Mini Submersible Pump Motor: This is a low cost, small size Submersible Pump Motor. It can take up to **120 liters per hour with very low current consumption of 220mA.** Just connect tube pipe to the motor outlet, submerge it in water and power it.Single stage pumps are used for drainage, sewage pumping, general industrial pumping and slurry pumping.

IR Sensor :-

Figure 5: IR Sensor

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.The emitter is simply an IR LED **(Light Emitting Diode)** and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.
There are five basic elements used in a typical infrared detection system: **an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's** of specific wavelength used as infrared sources.
The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response.

Ultrasonic Sensor :-

Figure 6: Ultrasonic Sensor

Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. **HC-SR04 distance sensor is commonly used with both microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc.** The following guide is universally since it has to be followed irrespective of the type of computational device used.Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.
Application :-
1. Used to avoid and detect obstacles with robots like biped robot, obstacle avoider robot,path finding robot etc.
2. Can be used to map the objects surrounding the sensor by rotating it.
3. Depth of certain places like wells, pits etc can be measured since the waves can penetrate through water.

3.1.2 Software Requirements

1. Blynk Server

Figure 7: Blynk server

Blynk Server platform enables you to monitor and control device from anywhere in the world.responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. **It's open-source, could easily handle thousands of devices.**

2. Blynk App

Figure 8: Blynk app

Blynk app allows you to create amazing interfaces for your projects using various widgets we provide.It is a IOT platform to connect your devices to the **cloud,design apps to control them.** It analyse telemetry data and manage your deployed product at scale and handle easily.the features of blynk app is that it has Similar **API UI** for all supported hardware devices Connection to the cloud using: **WiFi,Bluetooth BLE, Ethernet, USB (Serial), GSM and Easy to integrate and add new functionality using virtual pins.**Now imagine: every time you press a Button in the Blynk app, the message travels to space the Blynk Cloud, where it magically finds its way to your hardware. It works the same in the opposite direction and everything happens in a blynk of an eye.

3. Arduino IDE

Figure 9: Arduino Ide

The Arduino Integrated Development Environment is a cross platfrom application that is written in function from **C and C++.**It is used to write and upload programs to arduino compatible boards.rograms written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file **extension .ino.** The editor has features for cutting/pasting and for searching/replacing text. The toolbar buttons allow you to verify and **upload programs, create, open, and save sketches, and open the serial monitor**.Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework.

4. Adacity

Figure 10: Adacity

Audacity is a **free and open-source digital audio editor and recording application software**, available for Windows, macOS, Linux, and other Unix-like operating systems.n addition to recording audio from multiple sources, Audacity can be used for post-processing of all types of audio by adding **effects such as normalization, trimming, and fading in and out.** Audacity has also been used to record and mix entire albums, such as by Tune-Yards.It is also currently used in the UK OCR National Level 2 ICT course for the sound creation unit.

5. Virtual Studio Code

Figure 11: Virtual Studio Code

Visual Studio Code is a freeware source-code editor made by Microsoft for Windows, Linux and macOS.**Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git.** Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality.

3.1.3 Libraries

1. Blynk Libraries

Blynk is the most popular Internet of Things platform for connecting any hardware to the cloud, designing apps to control them, and managing your deployed products at scale.With Blynk Library you can **connect over 400 hardware models** (including ESP8266, ESP32, NodeMCU, all Arduinos, Raspberry Pi, Particle, Texas Instruments, etc.)to the Blynk Cloud.

2. PCM.h

The library only has two functions: **startPlayback() and stopPlayback().** The first takes two arguments: the array of audio samples and its length.
For example: startPlayback(sample, sizeof(sample));
The stopPlayback() function doesn't take any arguments and will stop playback of the current sample.
Note that the example also uses a couple of unusual Arduino constructions. First, the sample[] array is declared using the keyword **PROGMEM**, which causes the data to be stored in the Arduino's program memory (Flash) instead of its RAM (which is much smaller). It also **uses the sizeof() function,** which returns the number of bytes used by an array.

3.2 ANALYSIS MODELING

3.2.1 Time Line

Time line chart for project Execution Phase

Parent Feature	Tasks	Done By	Start Date	End Date	Status
Topic Selection	1. Research of the topic. 2. Identifying the objective for the topic. 3. Discuss problem statement and finalizing the topic with Sir.	Automate hand sanitizer bottle – Karan shah To measure heart rate & body temperature - Kavish Shah	20/01/2021	22/01/2021	C
Design Timeline	1. Gathering existing knowledge and explore assumptions and unknowns to plan Timeline.	Both Members	28/01/2021	1/01/2021	C
	2. Identifying dates on calendar and take reference of semester plan.	Kavish Shah			
	3. Design the final timeline and submit it.	Karan Shah			
Identifying the components.	Selecting component to use. Easily available, efficient & Cost friendly.	Both Members	3/02/2021	9/01/2021	C
Identifying the Techniques.	Understanding the components, EDA tools to build knowledge on the topic.	Both Members	10/02/2021	12/02/2021	C
Design Circuit Diagram	will visualize different Techniques, refer videos , blogs & will design circuit Diagram.	Both Members	13/02/2021	16/01/2021	C
Making presentation	Detailed PPT which will include, problem statement, Literature survey, component list , circuit diagram , Conclusion & Applications etc.	Discussion on contents by both Members PPT design by – Karan Shah	17/02/2021	23/02/2021	C
Implementing Simulation	Drawn automate hand sanitizer diagram and implemented simulation in thinkercad using arduino , servo motor, and ultrasonic sensor.	Both Members	24/02/2021	2/03/2021	C
Discussion about Features	Discussion about adding some features in the project, Email and mobile notification for refilling, fluid level detection, speakers for reminding to sanitizing hands	Karan Shah	26/02/2021	27/02/2021	C

Partial Demonstration

Parent Feature	Tasks	Done by	Start Date	End Date	Status
Implementation of Hardware phase 1	Implementing required phase1 Hardware connections using circuit Diagram. Design and Testing for **partial demonstration.**	Hardware phase1 - Kavish Shah	24/01/2021	2/03/2021	C
Implementation of Code phase 1	Developed a code to automate hand sanitizer bottle, compile, debug & upload it for **partial demonstration**	Code phase 1 Karan Shah	3/03/2021	4/03/2021	C

Implementing of Code phase 2	Developed a code to get mobile and email reminder for filling the sanitizer bottle.	**Code phase 2 Karan Shah**	**5/03/2021**	**6/03/2021**	**C**
Implementation of hardware phase 2	Implementing required phase2 Hardware connections using circuit Diagram. Design and Testing for **partial demonstration.**	**Hardware phase 2 - Karan Shah**	**8/03/2021**	**10/03/2021**	**C**
Implementing project partially	Display the partial Demonstration of project	**Both Members**	**10/03/2021**	**17/03/2021**	**C**
Implementing Report project partially	Had put contents like abstract, introduction, system analysis , and simulation results	**Both Members**	**10/03/2021**	**17/03/2021**	**C**

Final Demonstration

Parent Feature	Tasks	Done by	Start Date	End Date	Status
Implementation of Code phase 3	Developed a code to get an interface in blynk app of fluid level detection i.e amount of sanitizer present in bottle and a chart of how much people sanitize their hands daily.	**Code phase 3 Karan Shah**	**20/03/2021**	**30/03/2021**	**C**
Implementation of Hardware phase 3	Done hardware connection i.e connecting ir sensor with node-mcu to count no of people santizing hands	**Hardware phase 3 - Karan Shah**	**1/04/2021**	**3/04/2021**	**C**
Implementation of Hardware phase 4	Connecting speakers with Arduino for getting reminders for sanitizing hands.	**Hardware phase 4 - Kavish Shah**	**4/03/2021**	**5/03/2021**	**C**
Implementation of Code phase 4	Developed a code to get an reminders for regularly reminders for sanitizing hands.	**Code phase 4 – Karan Shah**	**5/04/2021**	**8/04/2021**	**C**
Implementation of Final Hardware phase	After Discussing with sir, Implement the changes if required and connect remaining hardware connections with components. Fit all the components in a way that it will be stable and test it 2-3 times.	**Final Hardware phase - Karan Shah**	**10/04/2021**	**13/04/2021**	**C**
Implementation of complete Coding phase	Review all the code and make a changes if required and upload it in arduino and node MCU	**Final Code phase Kavish Shah**	**10/04/2021**	**12/04/2021**	**C**
Testing	Test the hardware component and code 2-3 times that it functions properly.	**Both Members**	**13/04/2021**	**16/04/2021**	**C**
Implementation of project	Display the final demonstration of project.	**Both Members**	**19/04/2021**	**28/04/2021**	**C**

Preparation of Report	Detail report with all the Implementation of hardware and software assumptions, observations, results, drawbacks, future scope etc. Take Reference from semester plan given, check all the plagiarism, Grammar, and make report in IEEE format and upload it.	**Both Members**	**8/03/2021**	**28/04/2021**	**C**

Figure 12: Timeline chart

3.2.2 Block Diagram

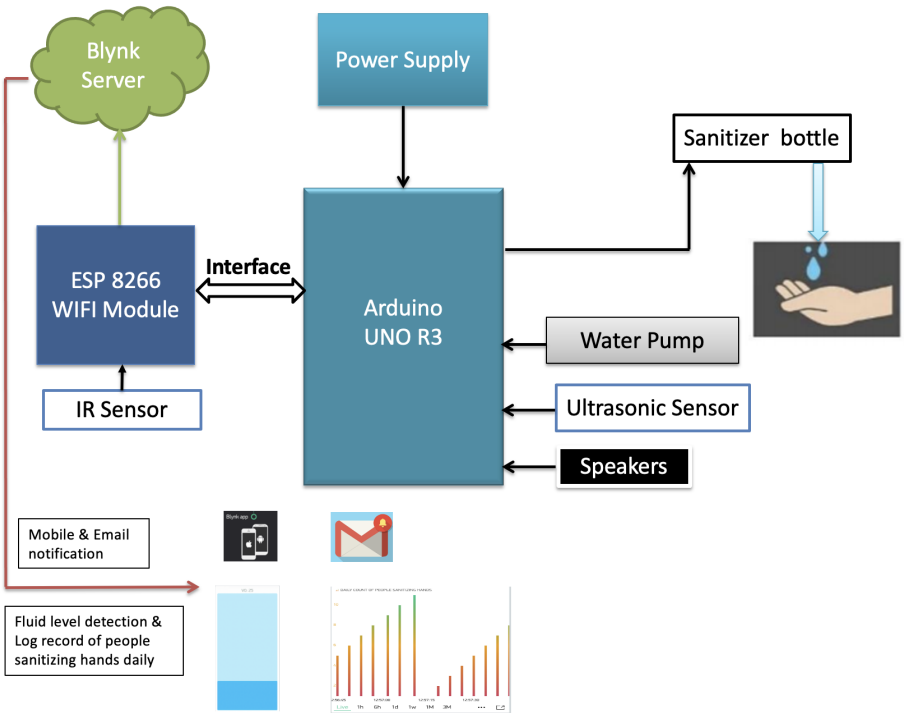

Figure 13: Block Diagram

3.2.3 Circuit Diagram

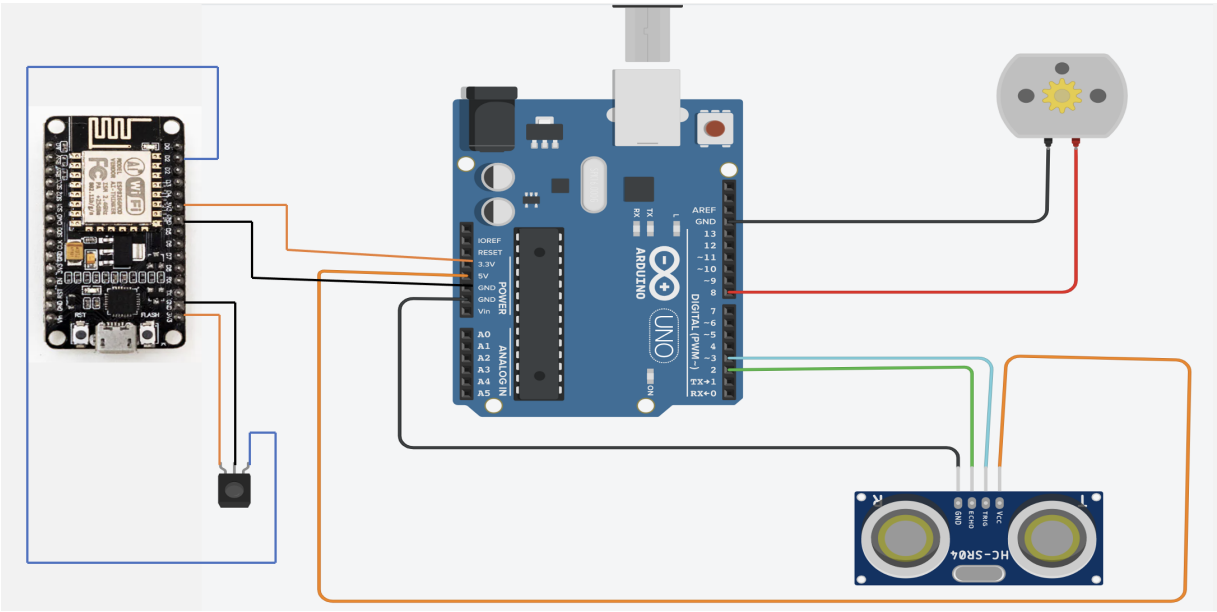

Figure 14: Circuit Diagram

4 METHODOLOGY

4.1 Work Flow

Technique to automate hand sanitizer dispenser.

When we place our hand in front of ultrasonic sensor, Arduino will read the signals from these sensors and if hands are in a **desired range** it will **trigger** and then the **and will turn on the DC motor** after receiving signal from **Arduino** and people will be able to santize thier hands.

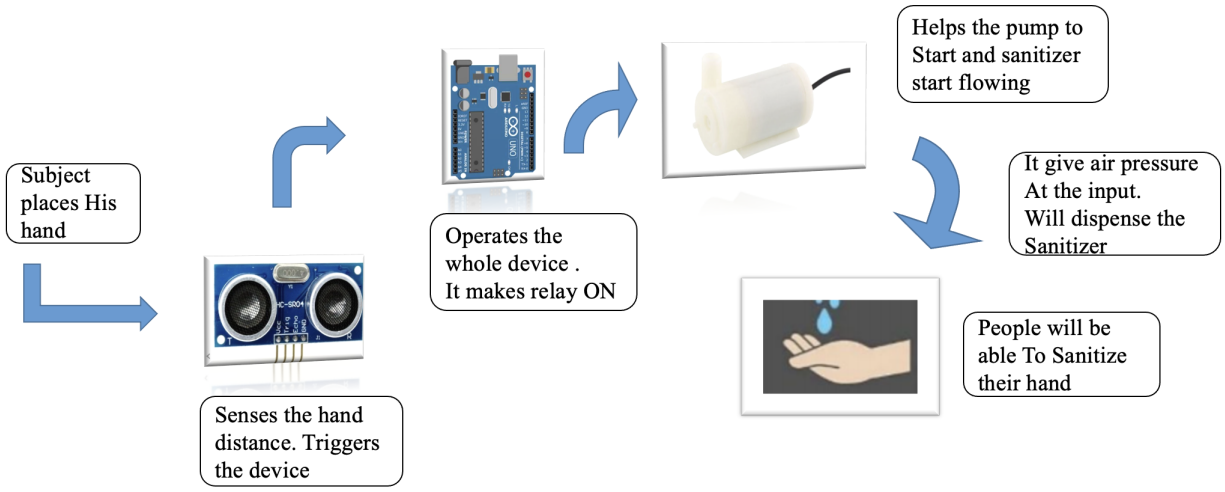

Figure 15: System Design to automate hand sanitizer dispenser

Technique to get Reminder from Speakers to sanitize hands

So Speaker are connected to the ardiuno at pin no 4. the mp3 recorded voice is been formatted to 16bit pcm frequency rate to 8000Hz using audacity. so if the object is not in the desired range the speakers will say **Sanitize your hands before entering the premises.** if the object is in the desired range as the arduino triggers the dc motor the speakers will say **Thankyou for sanitizing your hands and have a nice day!**

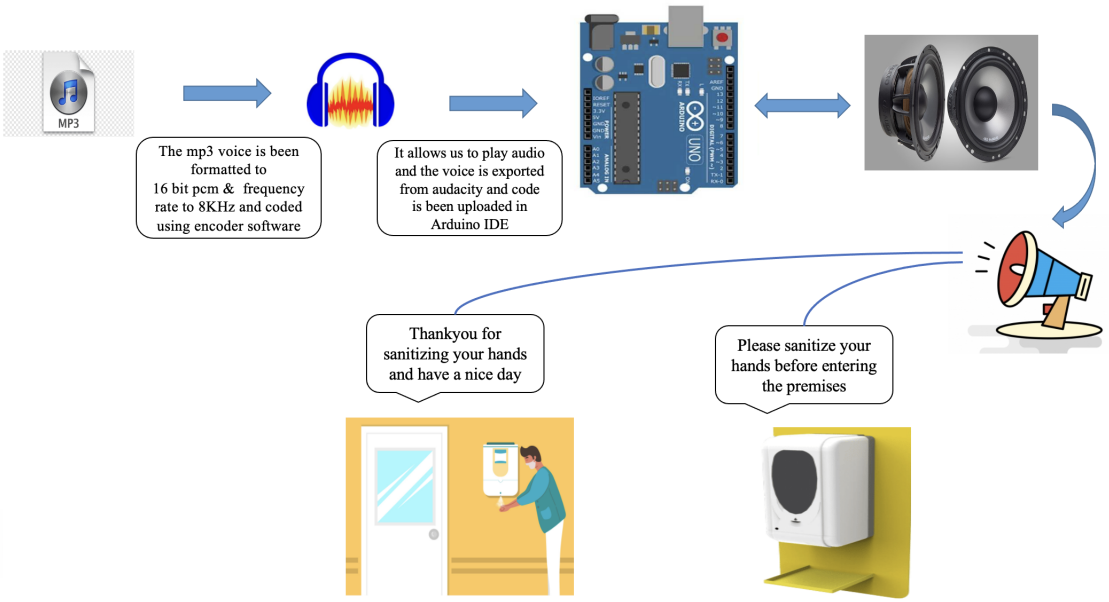

Figure 16: System Design to get Reminder for Sanitizing hands

Technique to get Email & mobile notification reminder for refilling sanitizer bottle.

So ardiuno is interface with Node MCU wifi Module.using blynk app we can set an alert.so for counting no of people santizing thier hands we are using IR sensor.so now **if the no of people exceeds the value of alert,** then with the help of **blynk server and mobile app an Email notification** will be send as areminder to refill the hand sanitizer bottle.

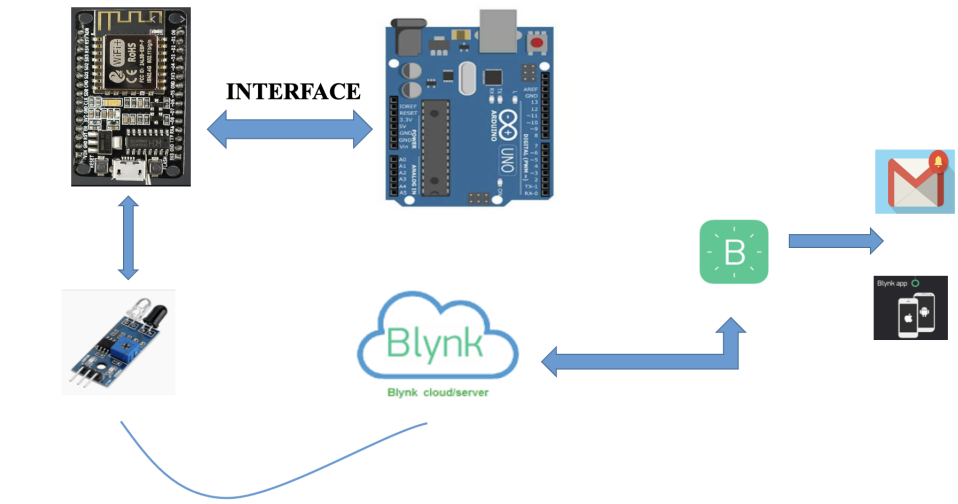

Figure 17: System Design to get Email & Mobile Reminder for Refilling Sanitizer Bottle

Technique for Fluid Level Detection and Log record of people using Dispenser.

So ardiuno is interface with Node MCU wifi Module. using blynk app we can set an value i.e suppose at this count the santizier fluid will be at the empty point and need to refill it. so for counting no of people santizing thier hands we are using IR sensor.so as **people starts sanitizng thier hands** and as the **count of no of people sanitizing thier hands increases, fluid level indicator starts decreasing.**also People can **live monitor** the amount of fluid present in the sanitizer bottle with the help of **blynk server on mobile app.**we can also see the log record of people sanitizing thier hands daily while setting a **virtual pin V1** in code & analyze the records on superchart on mobile application using blynk app.

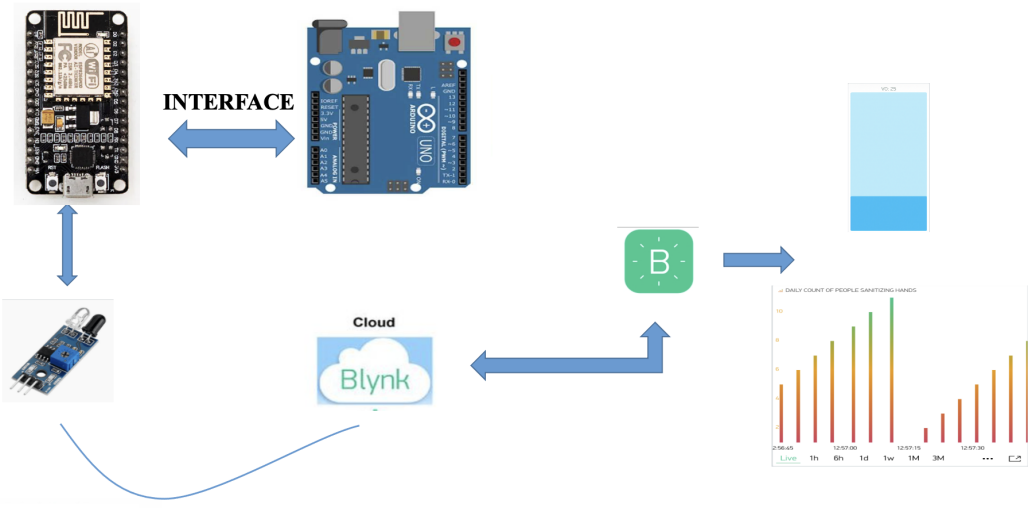

Figure 18: System Design for Fluid Level Detection and Log record of people using Dispenser

4.2 CODE

4.4.1 For Hand Sanitiser Dispenser

Step 1: Initialize the variable

```
const int trigPin = 3;
const int echoPin = 2;
#define DCwater_pump 8
    // defines pins
    long duration;
    int distance;
```

Trig pins :- Triggers ultrasonic sound pulses
Echo pins :- Produces a pulse when reflected signal is recieved

Step 2: Configurize pins into Input and Output

```
void setup()
{
    pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
    pinMode(echoPin, INPUT); // Sets the echoPin as an Input
    pinMode(DCwater_pump, OUTPUT);
    Serial.begin(9600); // For serial communication
}
```

Step 3: Conditions

```
void loop()
{
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);
    //Distance calculation
    distance= duration*0.034/2;
    // Printinng the distance on the Serial Monitor
    Serial.print("Distance: ");
    Serial.println(distance);
```

1. So to clear the **trig pin** we have to set that pin on a **Low state for 2us** Now for generating ultrasounds waves we have set **trig pin** on **high state for 2us**.Using **pulseln function** we have read the travel time put the value into variable duration function will return **length of pulse in microsecond.**

2. So now for calculating distance,we all know **speed of sound is 340m/s**, but we need in cm, so its **0.034cm/us.** so now you will be wondering why we **divided it by 2**

3. From **echo pin** we will get **double** the no because sound waves travel **fordward and bounce backward.** so in order to get **distance in cm**,we multiply the **recieved travel time value from echo pin by 0.034 and divide it by 2.**

```
if (distance < 10)
{
 digitalWrite(DCwater_pump,HIGH);
 Serial.println("DC Pump is ON Now!!");
 delay(2500);
 digitalWrite(DCwater_pump, LOW);
 Serial.print("Pump OFF");
   delay(1000);
}
else
{
 digitalWrite(DCwater_pump,LOW);
 Serial.println("DC Pump is OFF Now!!");
 delay(500);
}
}
```

if the object is in the desired range of **10cm** from ultrasonic sensor, arduimo will **trigger the motor and motor starts rotating** and if it is **not in the desired range,** the motor will **stop rotating.**

4.4.2 Fluid level Dectection and Email & mobile notification Reminder for refilling sanitizer bottle

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
BlynkTimer timer;

int count=0;
boolean state = true;
char auth[] = "yC48lmJ-6Hebu_QMg3QIrBTRvXlUCzV0"; //Auth code sent via Email
char ssid[] = "Karan_Shah-uo1Sh"; //Wifi name
char pass[] = "Mksn@1303";  //Wifi Password
int flag=0;
int distance;

void notifyOnThings()
{
  int isButtonPressed = digitalRead(D1);
  if (isButtonPressed==0) {
    count++;
    Serial.print("count >> ");
    Serial.println(count);
      Blynk.virtualWrite(V1,count);
    delay(4000);
     if(count<10 && count==0)
      {
        Serial.println("FULL");
        Blynk.virtualWrite(V0,100);
      }
           else if(count<10 && count==3)
      {
        Serial.println("THREE QUATER");
        Blynk.virtualWrite(V0,75);
      }
```

Using virtual write we have given **pin V1 to count.** so if the count is less than 10 and no one has sanitize his hands the fluid indicator will show **100%** filled in the blynk interface.
As the person start sanitizing thier hands the count increases and **as the count increases the fluid level indicator decreases** at the **count of 3** the fluid indicator will show **75%** filled in the blynk app.

```
  else if(count<10 && count==5)
       {
         Serial.println("HALF");
         Blynk.virtualWrite(V0,50);
       }
           else if(count<10 && count==7)
       {
         Serial.println("QUATER");
         Blynk.virtualWrite(V0,25);
       }
```

As the person start sanitizing thier hands the count increases and as the **count increases the fluid level indicator decreases.** at the **count of 5** the fluid indicator will show **50%** filled in the blynk app and as soon as it comes at the **count of 7** the fluid indicator will shows **25%** filled in the blynk app.

```
  else if(count>10)
     {
       count=0;
         Serial.println("Reminder of refilling the santizer bottle");
         Blynk.email("karanshah2019@gmail.com", "Reminder!!!",
         "Refill your sanitizer Bottle");
         Blynk.notify("Reminder!!! - Refill your Sanitizer Bottle");
        flag=1;
     }
  }
   else if(isButtonPressed==0)
   {
     flag=0;
   }
}
void setup()
{
Serial.begin(9600);
Blynk.begin(auth, ssid, pass);
pinMode(D1,INPUT_PULLUP);
timer.setInterval(1000L,notifyOnThings);
}
void loop()
{
  Blynk.run();
  timer.run();
}
```

As the count of number of people sanitizing thier hands **exceed to 10 or greater than 10 an email and mobile notification is send** with the help of **blynk.email and blynk.notify** for reminder to refill sanitizer bottle.So in this way the technique of fluid level detection, log record of people sanitizing thier hands, and get email and mobile notification for refilling sanitizer bottle works.

4.4.3 Reminder for people to sanitize their hands

```
#include "Talkie.h"
#include "PCM.h"
#define Voice 4
Talkie voice;
const unsigned char sample[ ] PROGMEM = {
126,127,128,128,128,128,128,127,128,128,128,129,129,128,127128,128,
127,126,127,128,129,128,127,126, 127, 128,128, 126, 126, 127,
127,127, 127,127,127,126,127,126,127,128,128,128,128,128,127,128,128,
128,129,129,128,127,128,128,127,126,127,128,129,128,127,126,
127,128,128,126,126,127,127,127,127,127,127,126,127,
};
 const unsigned char sample_1[ ] PROGMEM = {
 126,127,128,128,128,128,128,127,128,128,128,129,129,128,127,128,128,
 127, 126,127,128,129,128,127,126,127,128,128,126,126,127,127,127,127,
 127,127, 126, 127,126,127,128,128,128,128,128,127,128,128,128,129,
 129,128,127,128,128,127,126,127,128,129,128,127,126,127,128,128,126,
 126,127,127,127,127,127,127,126,127,
};

 void loop()
{
 if (distance < 10){
// voice setup it will say thankyou for sanitizing your hands and have a nice day!
 startPlayback(sample, sizeof(sample));
 delay(3500);
 }

 else{
  // voice setup it will say plz santize your hands before entering the premises!
  startPlayback(sample_1, sizeof(sample_1));
   delay(3500);
}
}
```

Simulation diagram and hardware setup for automatic hand sanitizer dispenser

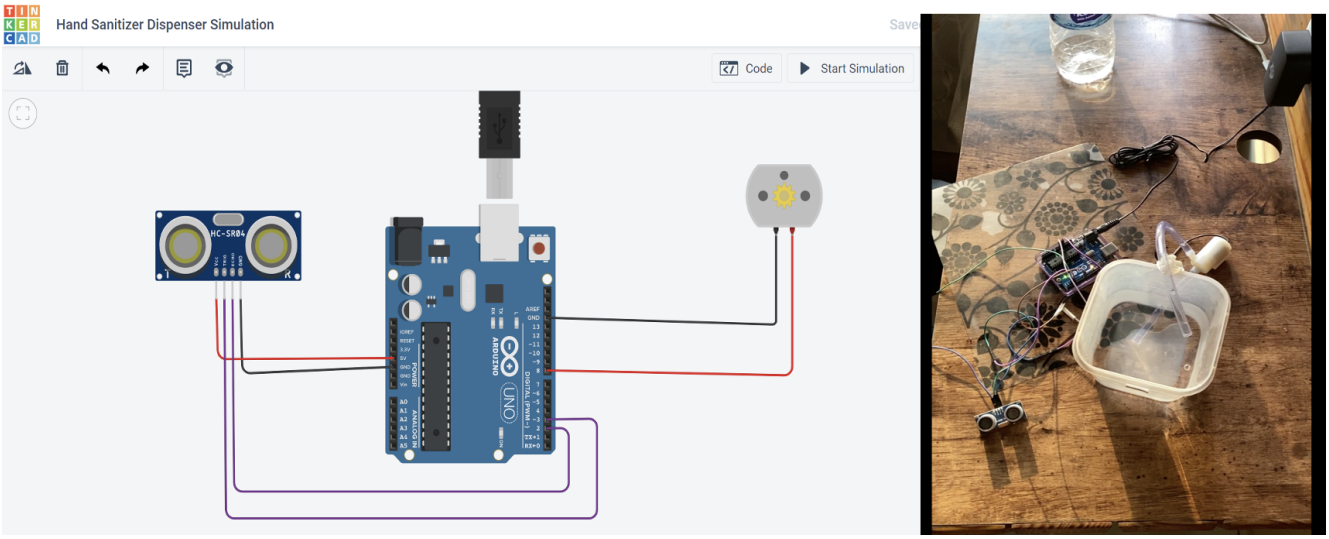

Figure 19: Simulation diagram and hardware setup for Automatic hand sanitizer dispenser

4.3 SIMULATIONS RESULTS

Case 1 :-
If the hand is in the desired range, the ardiuno will trigger the motor motor starts rotating

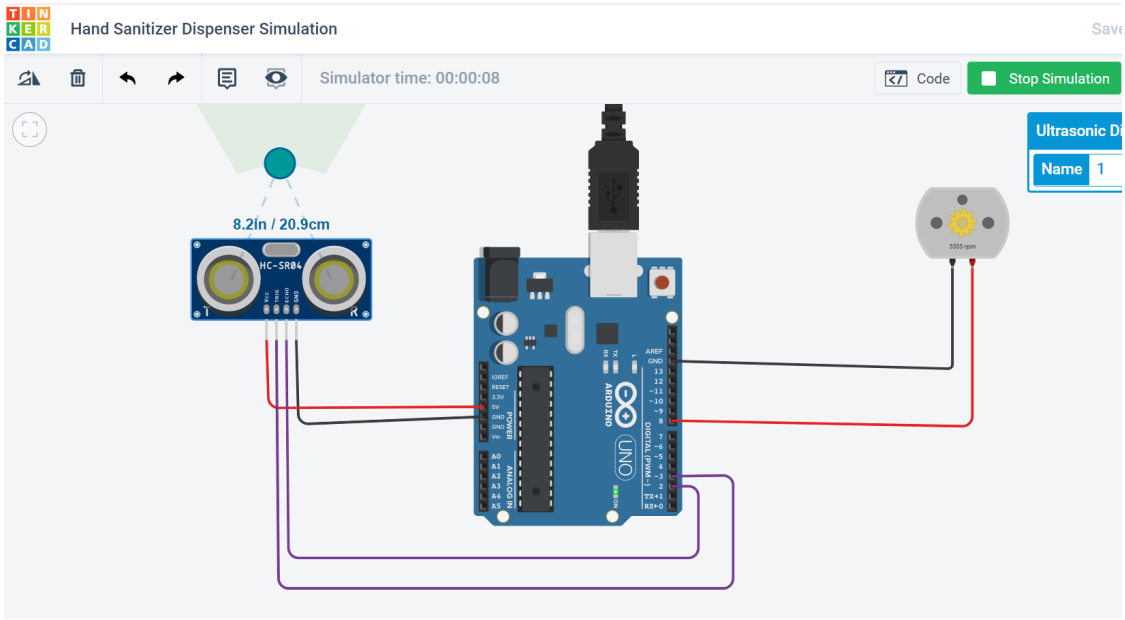

Figure 20: Simulation results (a)

Case 2 :-
If the hand is not in desired range, the ardiuno will not trigger the motor so the motor will not run.

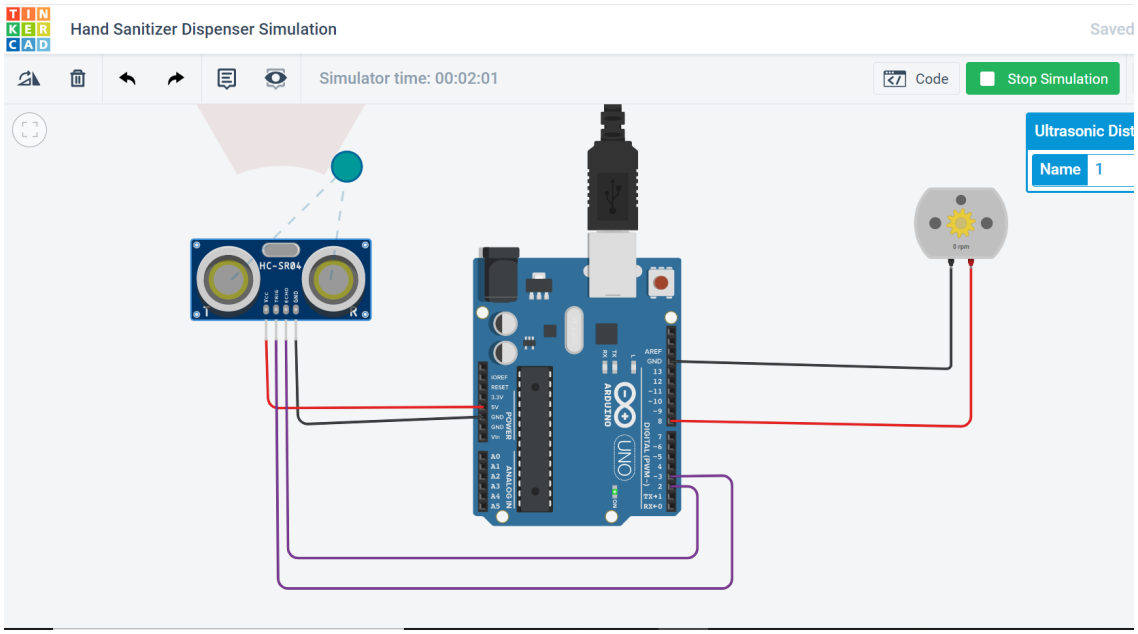

Figure 21: Simulation results (b)

DESIGN

5.1 Hardware Design

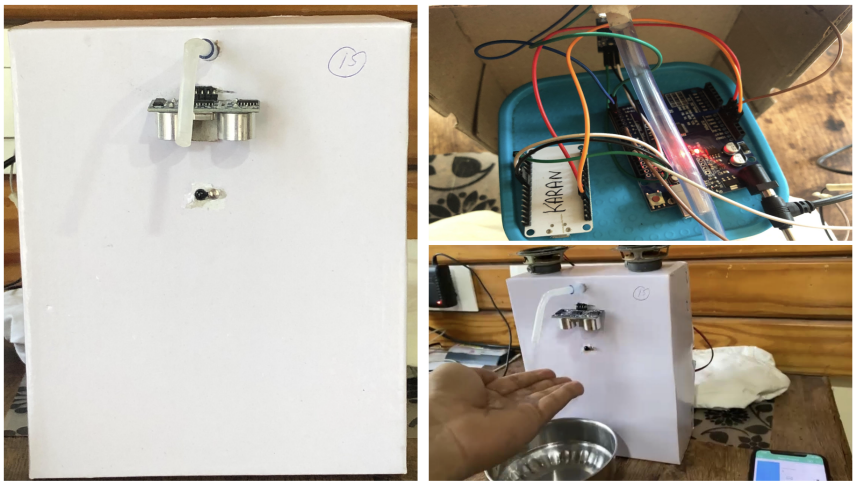

Figure 22: Hardware Design)

5.2 User Interface

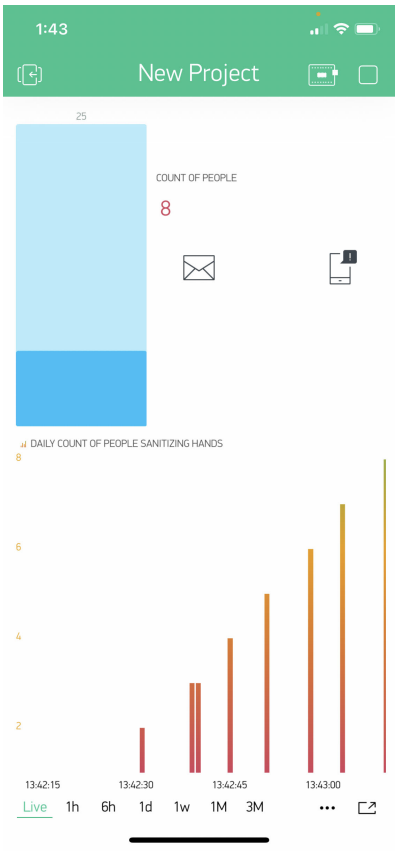

Figure 23: Application design (Blynk app)

RESULT AND DISCUSSION

when the first person starts sanitizing his hands the fluid level detector in interface with blynk app shows **100 %** filled and the counter shows **1 which indicates one person has sanitize his hands** and superchart is shown to indicate log records of people sanitizing thier hands daily. after sanitizng the speakers also says **thank you for sanitizing your hands and have a nice day!**

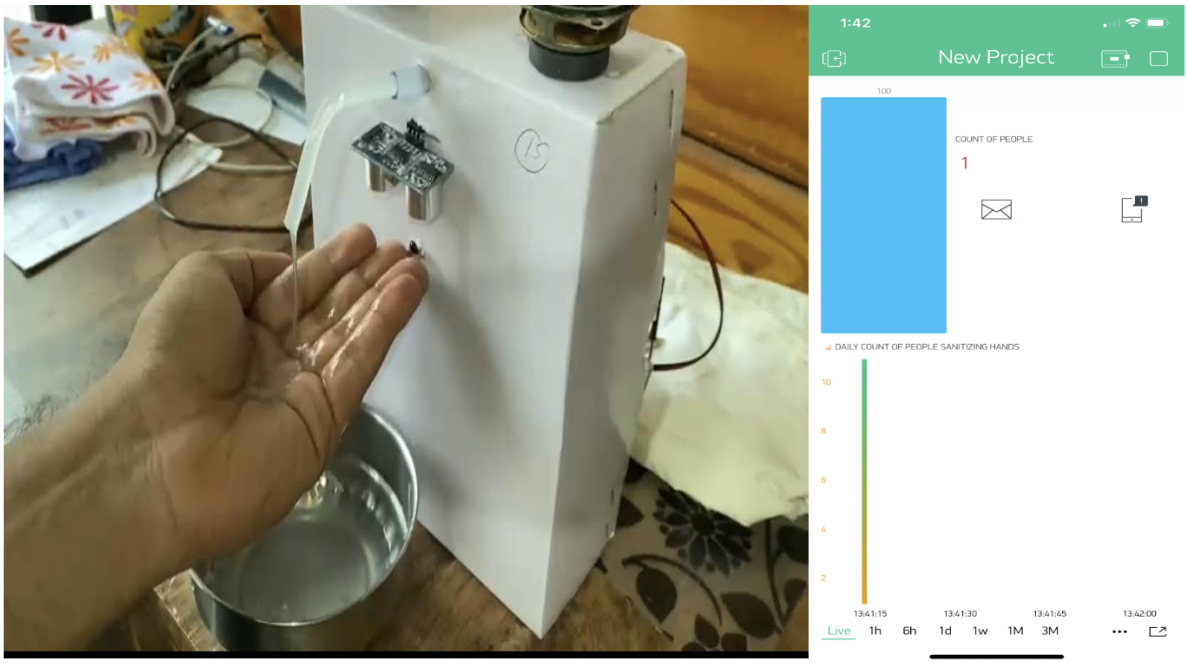

Figure 24: Experimental result (a)

As the third person finishes and 4^{th} person start sanitizing his hands the fluid level detector interface with blynk app shows **75 %** filled and the counter shows **4 which indicates 4 person has sanitize thier hands** and superchart is shown to indicate log records of people sanitizing thier hands daily.after sanitizng the speakers also says **thank you for sanitizing your hands and have a nice day!**

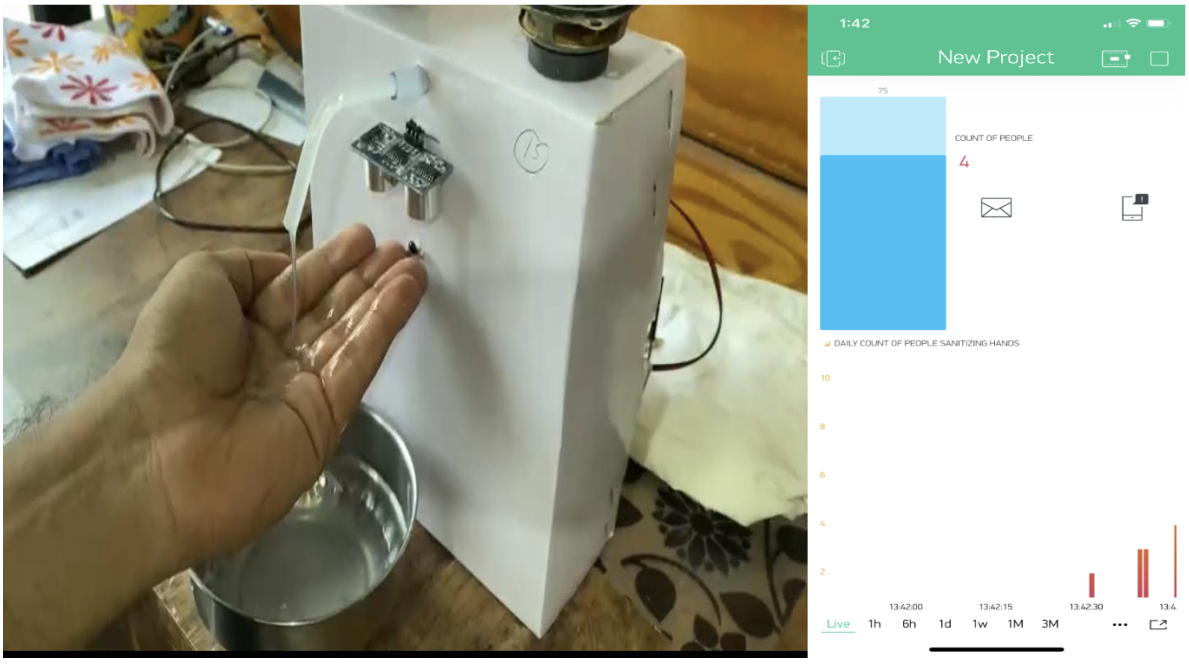

Figure 25: Experimental result (b)

As the 5th person finishes and 6th person starts sanitizing his hands the fluid level detector interface with blynk app shows **50 %** filled and the counter shows **5 which indicates five person has sanitize thier hands** and superchart is shown to indicate log records of people sanitizing thier hands daily.after sanitizng the speakers also says **thank you for sanitizing your hands and have a nice day!**

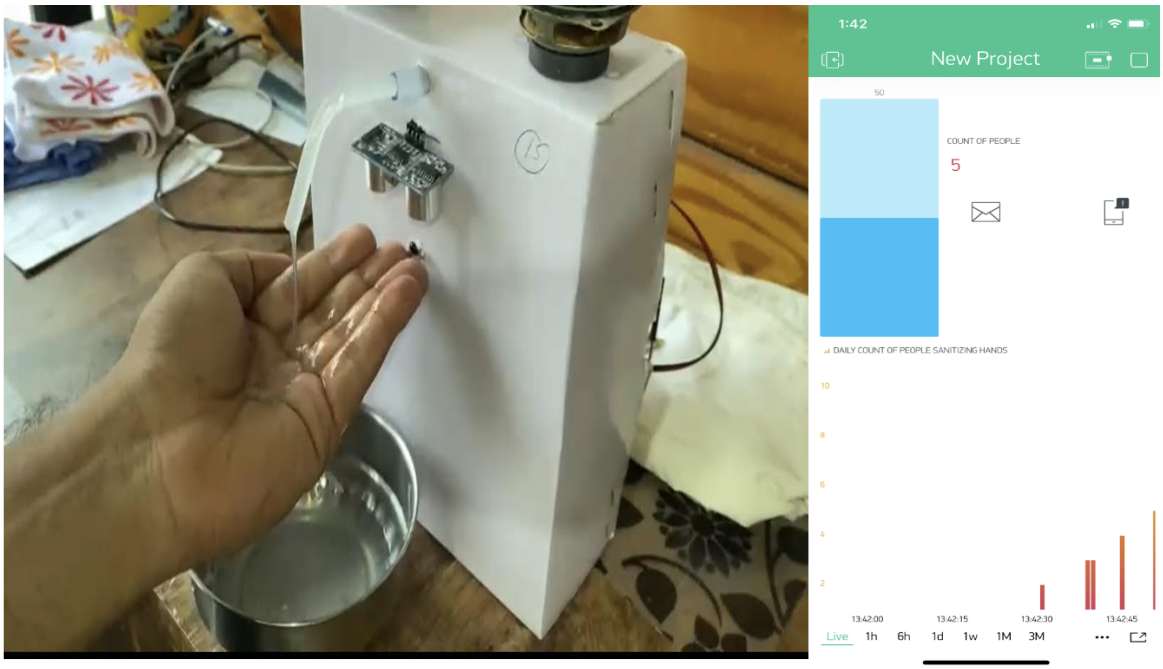

Figure 26: Experimental result (c)

As the 7th person finishes and 8th person start sanitizing his hands the fluid level detector interface with blynk app shows **25 %** filled and the counter shows **7 which indicates seven person has sanitize his hands** and superchart is shown to indicate log records of people sanitizing thier hands daily.after sanitizng the speakers also says **thank you for sanitizing your hands and have a nice day!**

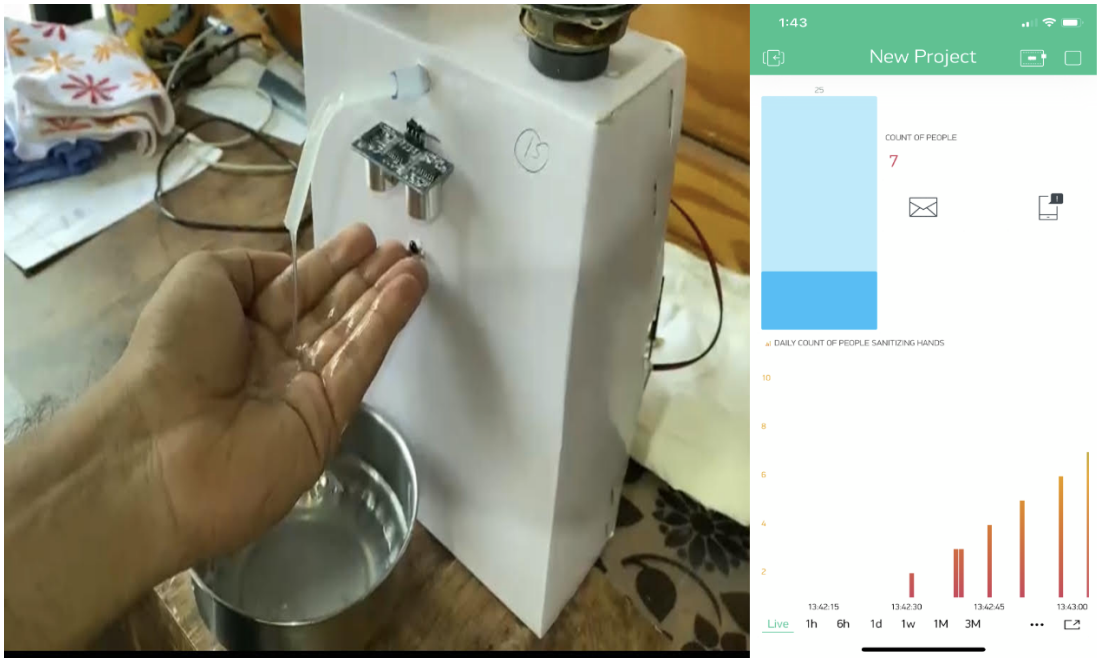

Figure 27: Experimental result (d)

As the 10^{th} person finishes and 11^{th} person start sanitizing his hands the fluid level detector interface with blynk app shows **25 %** filled and the counter shows **11 which indicates eleven person has sanitize thier hands** and superchart is shown to indicate log records of people sanitizing thier hands daily.after sanitizng the speakers also says **thank you for sanitizing your hands and have a nice day!.as soon as the voice stops we get an email and mobile notification for refilling sanitizer bottle.**

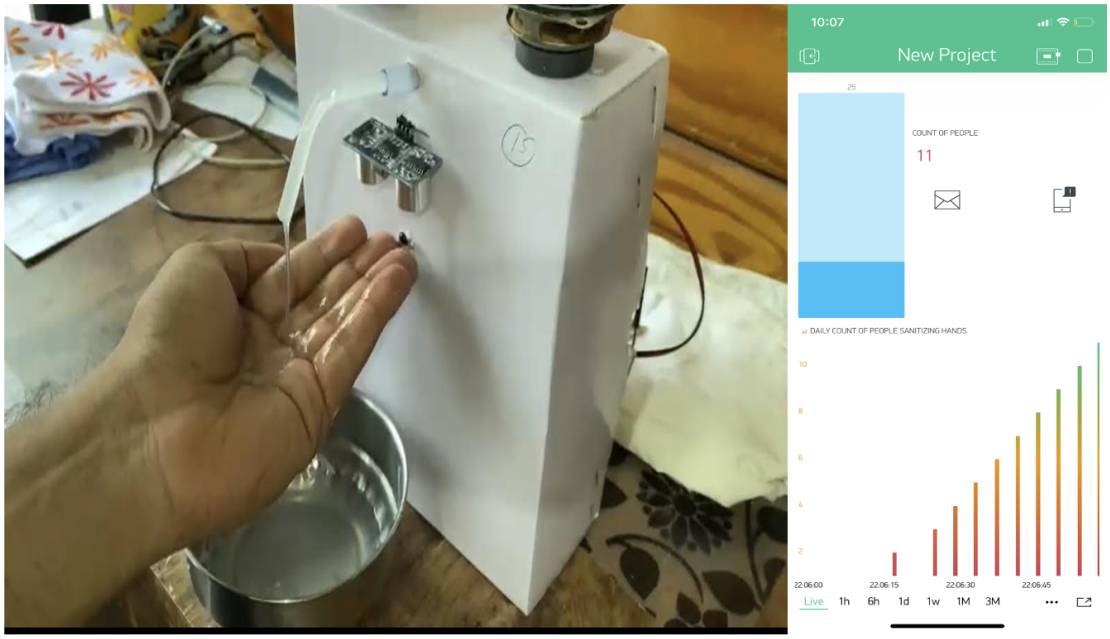

Figure 28: Experimental result (e)

As soon as the 10^{th} person finishes sanitizing his hands which means sanitizer bottle is left with very less amount of sanitizer in it so an **mobile notification is send in blynk app** to **remind the person to refill the sanitizer bottle.**

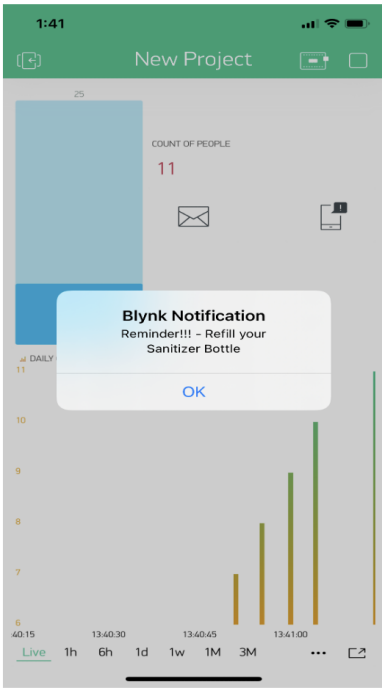

Figure 29: Experimental result :- Mobile Reminder Notification

As soon as the 10^{th} person finishes sanitizing his hands which means sanitizer bottle is left with very less amount of sanitizer in it so an **email notification is send in blynk app** to **remind the person to refill the sanitizer bottle.**

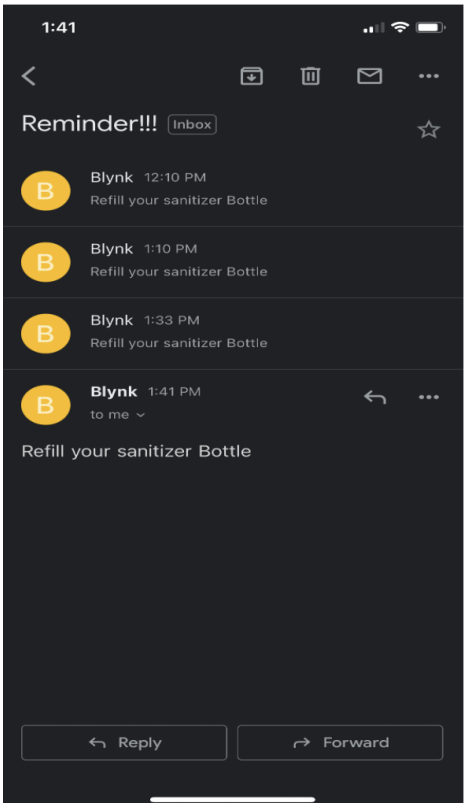

Figure 30: Experimental result :- Email Reminder Notification

FEATURES ACCURACY

The hardware design of automatic hand sanitizer dispenser shown in the figure 1 represents, the way ultrasonic and IR sensor are been mount in the box to gives very well accuracy to whole system. the product gives **96-98 %** of accuracy for automatic hand sanitizer dispenser. For reminding people for sanitizing thier hands and giving thankyou note after sanitizing hands the product can give accuracy upto **45 %**. for email and mobile notification reminders for refilling sanitizer bottle and monitoring live fluid level detection indicator the product can give accuracy upto **91-93 %**.and also for log record of people sanitizing thier hands daily to track covid appropriate behaviour amongs the people it can give accuracy upto **81-85%**. So the overall accuracy of the system with all the features included in the product can give the accuracy upto **83-85 %**.each featuresś accuracy is Shown below in the table as well.

SR NO	FEATURES	ACCURACY (%)
1	Automatic hand sanitizer dispenser	93 to 95 %
2	Reminding people for sanitizing hands	45 %
3	Fluid Level detection	91 %
4	Mobile and email reminder for bottle refilling	93 %
5	Log records of people using Dispenser	81 %
	Overall Accuracy of the system	79 to 82 %

Figure 31: Experimental result:-Accuracy of each features

SCOPE

1. This product can be used in hospital, public location, school, colleges, Airports, hotels restaurants, shopping malls, banks etc for sanitizing hands.
2. It reminds people using speakers so people entering the premises can sanitize thier hands and it also gives thank-you for sanitizing your hands feedback once person finished sanitizing hands.
3. It gives email and mobile notification reminder for refilling the sanitizer bottle and also we can monitor live fluid level detection indicator(i.e the amount of sanitizer fluid present in the bottle) on mobile app.
4. Also we can have a log record of people sanitizing thier hands daily to track how many people sanitize thier hands and it can be used to take surveys about how much people are aware and taking precautions about covid appropriate behaviour.

CONCLUSION

Hand sanitizers usually operate by squirting sanitizer liquid when one presses a pump with one's hand. Some hand sanitizers on the market are automatically pumped. However, sanitizer containers and pump devices are designed to be compatible only between products produced by the same manufacturer.To address this problem, we have designed an automatic hand sanitizer system that is compatible with various containers. With the proposed device, it is possible to avoid many people coming into contact with the pump handle, thus preventing fomite viral transmission and making the use of hand sanitizer much more convenient.

The features associated with hand sanitizer dispenser are it reminds people for sanitizing hands and also gives thankyou feedback for using it. It gives email and mobile notification reminder for refilling the sanitizer bottle and also we can track live fluid level detection indicator(i.e the amount of sanitizer fluid present in the bottle).Also we can have a log record of people sanitizing thier hands daily to track how many people sanitize thier hands and it can be used to take surveys about how much people are aware and taking precautions about covid appropriate behaviour.

The product can be kept at entrance gates of society, schools, colleges or any commercial building.The product was tested for 24 hour operation for more than a week and is working fine. It helped to reduce the contact for getting sanitizer and also reduce man power employed to spray sanitizer with a spray bottle.Moreover, the system squirts a certain amount of hand sanitizer at all times, making it easy to manage refills and replacement.It reduces the risk of community transmission of the virus.

ACKNOWLEDGEMENT

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[2] https://www.hackster.io/tunirdas/automation-to-prevent-spread-of-covid-19-using-bolt-iot-56b5b0

[3] https://www.youtube.com/watch?v=D5oB9GbCf0It=3s

[4] https://www.youtube.com/watch?v=F28Znry0qcw