Supermarket Crowd Management System using Arduino and ThingSpeak

Submitted in complete fulfilment of the course project of

ECE3051 – IoT Fundamentals

In

Bachelor of Technology

By

Rahul Kolay (19BEC0169)
Tanmay Mirdha (19BEC0368)
Swarnim Kulshreshtha (19BEC0449)
Neerukattu M. Naidu(19BEC0025)

Under the guidance of

Prof. Manimaran P.

VIT, Vellore

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INTRODUCTION

Our project, supermarket crowd management system aims to control and manage the gathering of people at crowded places, it warns people before hand so that the can follow social distancing.

- During this COVID situation, social distancing has become even more important.
- crowd management not only in shopping malls but any area where public gatherings happen is necessary.
- This idea will save a lot of time and money of people and will also reduce the fuel consumption in the region.
- Reduced traffic would also help emergency services to run smoothly.
- As there is already a shortage of staff members due to COVID, it will be easier for them to manage the crowd in the supermarket.

OBJECTIVE

To develop a solution to control the crowd in the supermarket at a given time by counting people in the market and sending an alert mail of the same in their Gmail account.

COMPONENTS USED

HARDWARE:

- INFRARED SENSORS
- ARDUINO UNO
- JUMPER WIRES
- BREAD BOARD

SOFTWARE:

- ARDUINO
- TINKERCAD
- THINGS SPEAK

THEORY

HARDWARE:

- IR SENSORS - An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment.

- ARDUINO UNO- Arduino Uno is a microcontroller which has 14 digital input/output pins 6 analog inputs, a 16 MHz quartz crystal, a

USB connection, a power jack and a reset button. It contains everything needed to support the microcontroller. We just need to simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
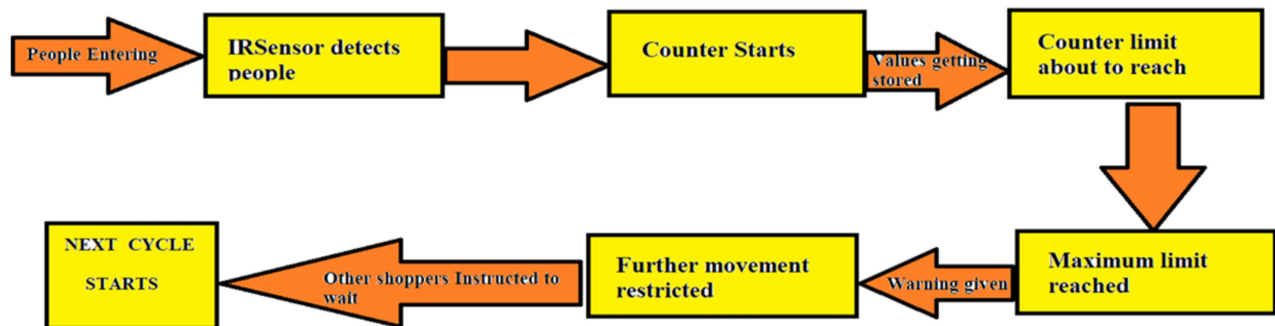
- BREAD BOARD- A breadboard is a rectangular plastic board with a bunch of tiny holes in it (that's why the name bread board). These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode).

SOFTWARE:

- ARDUINO IDE - The Arduino Integrated Development Environment is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

- TINKERCAD- Tinkercad is a free-of-charge, online 3D modeling program that runs in a web browser. It has become a popular platform for creating models for 3D printing as well as an entry-level introduction to constructive solid geometry in schools.

- THINGS SPEAK- ThingSpeak is an IoT analytics platform service that allows us to aggregate, visualize and analyze live data streams in the cloud. We can send data to ThingSpeak from our devices, create instant visualization of live data and send alerts.

BLOCK DIAGRAM

Based on our understanding, we have created a block diagram

People Entering → **IRSensor detects people** → **Counter Starts** → Values getting stored → **Counter limit about to reach** → **Maximum limit reached** → Warning given → **Further movement restricted** → Other shoppers Instructed to wait → **NEXT CYCLE STARTS**

WORKING PRINCIPLE

- In our device we have used two IR Sensors which have been placed side by side 3cm apart.
- This setup can be placed on the sidewall of a walk-through metal detector or the frame of a door.
- The device has two IR sensors one would be closer to the inside and the other to the outside.
- When a person walks in, first the IR sensor towards the outside will sense the person and then the IR sensor towards the inside, the device will register this as a person entering.
- When a person walks out, first the IR sensor towards the inside will send the person and then the IR sensor towards the outside, the device will register this as a person exiting.

ARDUINO PROGRAM

1. Program for Infrared Sensors and reading number of person entering and keeping a record:-

```
int total=0;
int i=3;
void setup()
{
 pinMode(8,INPUT);
 pinMode(9,INPUT);
 Serial.begin(9600);
}
void show()
{
 Serial.print(total);
}
void loop()
{
 if(digitalRead(9)==LOW)
 {
 Serial.print("\nPerson Entered, Number of people in the market: ");
 total++;
 show();
 digitalWrite(i,HIGH);
 i++;
 delay(500);
 }
 else if(digitalRead(8)==LOW)
 {
 Serial.print("\nPerson Exited, Number of people in the market: ");
```

```
  total--;
  i--;
 digitalWrite(i,LOW);
 show();
 delay(1000); }}
```

2.Tinkercad Arduino Program using ESP8266 module for sending data's to Thing Speak Channel:-

```
//Make sure to subscribe Technomekanics:)
String ssid    = "Simulator Wifi";  // SSID to connect to
String password = ""; // Our virtual wifi has no password
String host    = "api.thingspeak.com"; // Open Weather Map API
const int httpPort   = 80;
String                              url                              =
"/update?api_key=GNUBGDUQUL2OG1HG&field1=";
 int setupESP8266(void) {
 // Start our ESP8266 Serial Communication
 Serial.begin(115200);        // Serial connection over USB to
computer
 Serial.println("AT");     // Serial connection on Tx / Rx port to
ESP8266
 delay(10);       // Wait a little for the ESP to respond
 if (!Serial.find("OK")) return 1;

 // Connect to 123D Circuits Simulator Wifi
 Serial.println("AT+CWJAP=\"" + ssid + "\",\"" + password +
"\"");
 delay(10);       // Wait a little for the ESP to respond
```

```cpp
  if (!Serial.find("OK")) return 2;

  // Open TCP connection to the host:
  Serial.println("AT+CIPSTART=\"TCP\",\"" + host + "\"," + httpPort);
  delay(50);      // Wait a little for the ESP to respond
  if (!Serial.find("OK")) return 3;

  return 0;
}

void anydata(void) {

  int temp = map(analogRead(A0),20,358,-40,125);

  // Construct our HTTP call
  String httpPacket = "GET " + url + String(temp) + " HTTP/1.1\r\nHost: " + host + "\r\n\r\n";
  int length = httpPacket.length();

  // Send our message length
  Serial.print("AT+CIPSEND=");
  Serial.println(length);
  delay(10); // Wait a little for the ESP to respond if (!Serial.find(">")) return -1;

  // Send our http request
  Serial.print(httpPacket);
  delay(10); // Wait a little for the ESP to respond
  if (!Serial.find("SEND OK\r\n")) return;
```

```
    }

    void setup() {

      setupESP8266();

    }

    void loop() {

     anydata();

      delay(10000);
    }
```

3.ThingSpeak MATLAB Program to trigger alert in E-Mail:-

% Store the channel ID for the moisture sensor channel.
channelID = 1584257;

% Provide the ThingSpeak alerts API key. All alerts API keys start with TAK.
alertApiKey = 'TAK5HGJ2FU4HRF5DGKXT4';

% Set the address for the HTTTP call

```
alertUrl="https://api.thingspeak.com/alerts/send";

% webwrite uses weboptions to add required headers.  Alerts needs a
ThingSpeak-Alerts-API-Key header.
options = weboptions("HeaderFields", ["ThingSpeak-Alerts-API-Key",
alertApiKey ]);

% Set the email subject.
alertSubject = sprintf("SuperMarket Crowd Information");

% Read the recent data.
headcounts = thingSpeakRead(channelID,'NumDays',30,'Fields',1);

% Check to make sure the data was read correctly from the channel.
if isempty(headcounts)
   alertBody = ' SuperMarket is Empty ';
else
   % Calculate a 10% threshold value based on recent data.


   % Get the most recent point in the array of moisture data.
   lastValue = headcounts(end);

   % Set the outgoing message
   if (lastValue<=50)
      alertBody = 'SuperMarket is,';
   elseif (lastValue>50)
      alertBody = 'SuperMarket is OverCrowded';
   end
end
```

```
 % Catch errors so the MATLAB code does not disable a TimeControl if
it fails
try
   webwrite(alertUrl , "body", alertBody, "subject", alertSubject,
options);
catch someException
   fprintf("Failed to send alert: %s\n", someException.message);
end
```
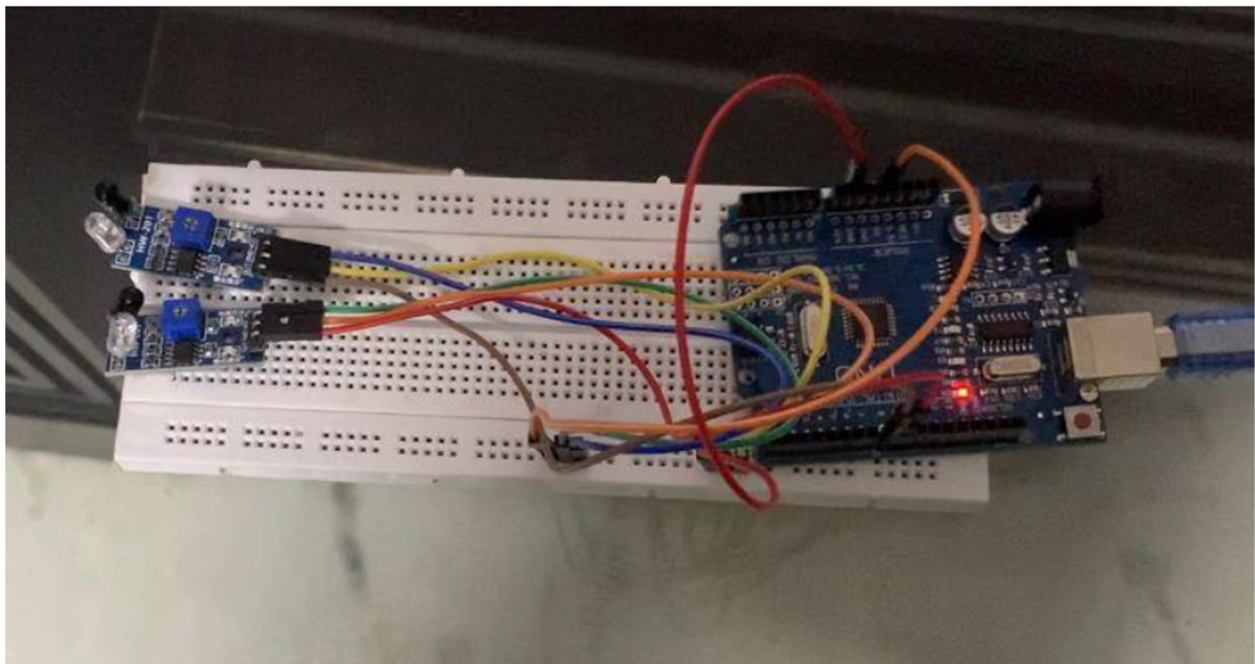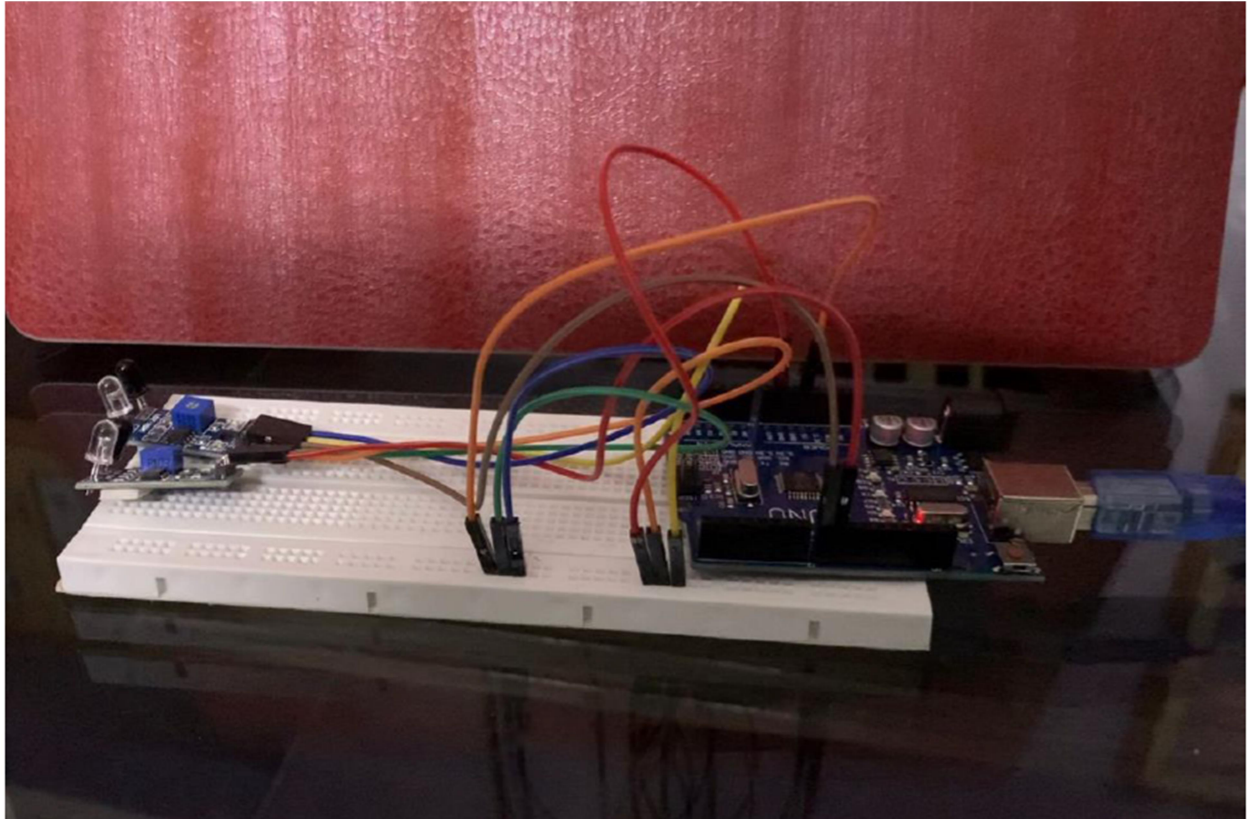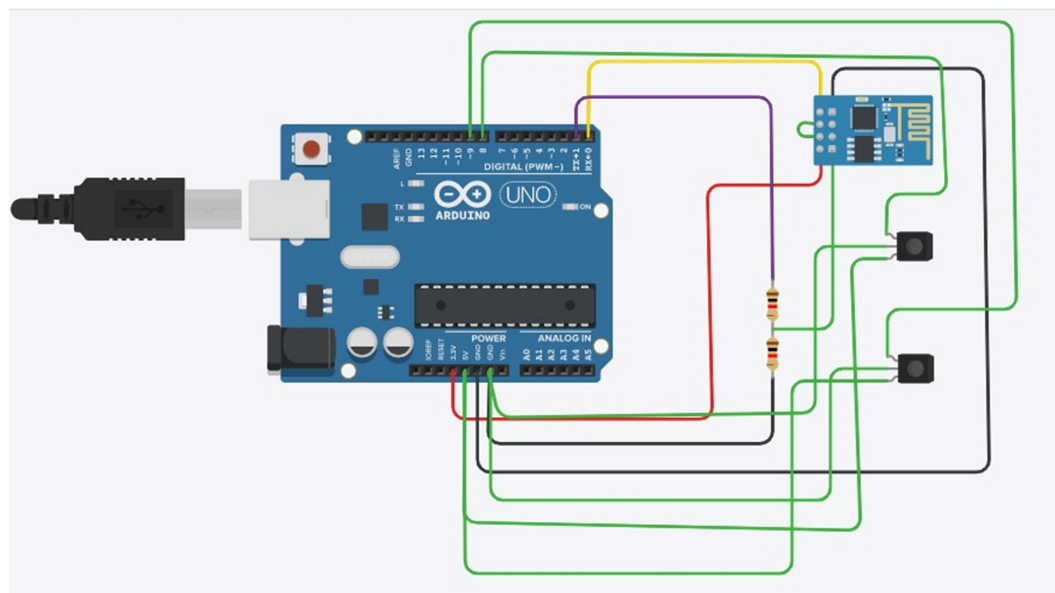
⇨ **As the number of headcounts increases the threshold values, it
will generate an email alert**.

HARDWARE CIRCUIT

SOFTWARE CIRCUIT

VIDEO DEMONSTRATION
## (YOU TUBE LINK)
https://youtu.be/j6xrYPHZd5Q

GPS FUNCTIONALITY

- A GPS module is connected with the Arduino board. The Google Maps API Keys are generated through Google Console. The API Keys are fed into the GPS module which is connected to the Arduino Board.
- ThingSpeak is used to send the message, for this Arduino ThingSpeak is imported to the Arduino.
- After simulation of the Arduino Code, the message is sent via ThingSpeak stating "The Super Market is overcrowded. If you are planning to visit here, kindly to avoid overcrowding and also traffic congestion outside the Market.

OUTPUT SCREENSHOTS

- **ThingSpeak**
⇨ The left diagram showing the number of person in the supermarket at any particular time.
⇨ The right diagram is the location of the SuperMarket.
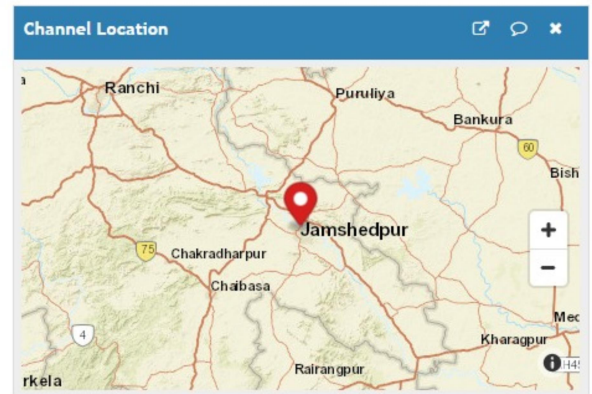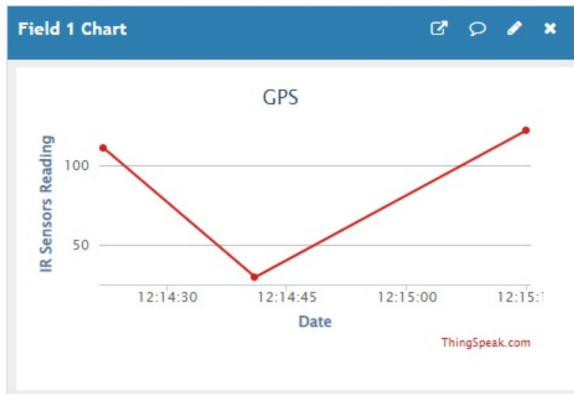
• Mail Alert
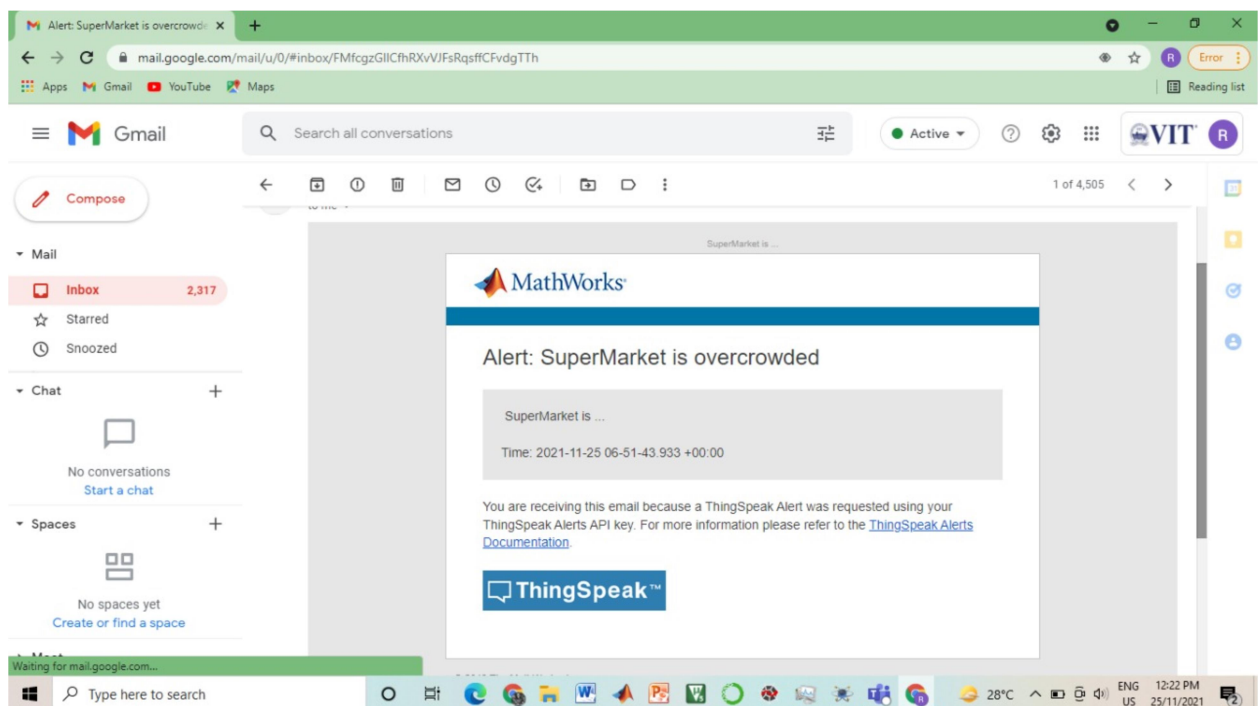
APPLICATIONS

- Attendance System.
- Automated Car parking system.
- Driver-less trains.
- In amusement park for restricting people going for a ride at a time.
- Supply chain (e.g., biscuit factory where counter operations are needed).

REFERENCES

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