PROJECT REPORT

INDUSTRY- SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

SUBMITTED BY

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

A properly designed, installed, operated, and maintained fire alarm system can reduce the losses associated with an unwanted fire in any building. These losses include property and, more importantly, human life. The primary motivation for fire alarm system requirements in building and fire codes is to provide early notification to building occupants so they can exit the building, and to notify the fire service so it can respond to the fire. In settings such as hospitals the fire alarm system provides notification to staff so they can respond to the fire emergency (as opposed to evacuating the building). This module will explain the basic features of fire alarm systems and the inspection of these systems. It should be noted that fire alarm systems also are called "protective signaling systems," especially in NFPA documents and in other codes and standards.

Under the rather broad heading of fire protection systems, this module will examine the main components of alerting, suppression, and containment features and systems. Consideration of these systems is a natural adjunct to a discussion of hazards and building construction features. The primary components we will examine are fire alarm systems, fire detection and notification systems, suppression agents and systems, water distribution systems, automatic sprinkler systems, standpipe and hose systems, and portable fire extinguishers. This module will cover a lot of basic material meant to provide the novice inspector a solid foundation on which to build.

1.2 PURPOSE

The primary purpose of a fire management system is to design, manage, plan and co-ordinate appropriate fire safety procedures to reduce the risks of fire and to ensure the safety of building occupants.

A complete fire management system ensures legal compliance and protection of lives and assets. Fire alarm systems are only effective if they can generate reliable and fast fire alerts with exact location of fire. There is a direct correlation between the amount of damage caused by fire and interventions time in various fire alarm systems. As the time of intervention decreases, the damage also decreases. Hence the

most important factor in a fire alarm system is the reaction or response time of fire alarm system, that is, the time between fire detection and extinguishing.

The earliest recorded examples of fire protection can be traced back to the Roman Empire and the catastrophic fires that started in Rome. As a result, Emperor Neron has adopted regulations that required fireproof material for walls and buildings restoration to be used. The second recorded case of adopting fire protection regulations occurred in the year 1666, after the Great fire of London, which destroyed more than 80% of the city. The fire of London spurred interest in the development of the first equipment for fire suppression in the form of hand pumps and fire hydrant installation for water supply.

CHAPTER 2

LITERATURE SURVEY

2.1 REFERENCES

PAPER 1:

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3724291

PAPER 2:

https://www.researchgate.net/publication/347130865_Smart_Fire_Alarm_System_Using_IOT

PAPER 3:

https://www.researchgate.net/publication/323627877_Design_and_Fabrication_of_an_Automatic_Sprinkler_Fire_Fighting_System

PAPER 4:

https://www.sciencedirect.com/science/article/abs/pii/S2352710222005848

2.2 PROBLEM STATEMENT DEFINITION

PAPER 1:

Sensor Based Smart Fire Detection and Fire Alarm System

Published year: November 3, 2020

Author name:

Rishika Yadav

Graphic Era Hill University, Dehradun, India

Poonam Rani

Graphic Era Hill University, Dehradun, India

Abstract

The use of different IoT devices for home automation has become very popular in recent years. Fire detection and avoidance of fire accidents is one of the necessary and important application of home automation using IoT. Traditional fire alarm system requires huge installation cost and labour. The proposed IOT based fire alarm system basically detects fire at an early stage, generates an automatic

alarm and notify the remote user or fire control station about the fire outbreak. This also tries to +extinguish the fire. The use of Arduino is proposed to sense the surroundings for occurrence of fire with the help of fire and gas sensor. The development of home fire alert system is built based on Arduino board. The fire is detected at an early stage and the system generates an alarm and sends SMS or call alerts to mobile numbers stored inside the Arduino program, via the GSM module. Simultaneously, a water sprayer producing device is switched on for the control of fire. This prototype system can help users to improve their safety standards with immediate response by preventing accidents. This will eventually allow both the lives and the properties from the disaster. The functions of each module and its implementation is described in detail.

PAPER 2:

Smart Fire Alarm System Using IOT

Published year: July 13,2020

Author name :

Ibrahim Majid Al Shereiqi

Middle East College, Muscat, Oman

Muham mad Sohail

Middle East College, Muscat, Oman

ABSTRACT:

The research paper proposes the “Smart Fire Alarm System Using IOT” in smart building by integrating IOT devices, including fire alarm devices (smoke and temperature detectors), Arduino and other complementary equipment. The idea of the research paper is when a fire occurs, the sensors will send a message to the security of the building and the official, and this massage includes location and time. The internet of things is predicted to provide businesses and people with better visibility and has the power to control 99% of environments and available objects that are at this time out of reach of the internet. So therefor, IOT make opportunity to people and businesses to be attached with the outside world even more than before that will achieve more meaningful work in higher levels. The traditional fire alarm system contains several types of devices each has a specific role in system operation to detect people and worn them through visual and audible devices if there is a fire, smoke, carbon monoxide or any other emergencies. This type of alarm can automatically have activated from heat and smoke

detector and it could be activated by manual fire alarms such us manual focal point or intake station. Alarms can come as a motorized bell; horns or wall-mounted speaker they can also be luminous sound for speakers that actually sound an alarm, and add an audio evacuation message that for example will warn people against using elevator.

PAPER 3:Design and Fabrication of an Automatic Sprinkler Fire Fighting SystemPublication year: 2015

Author name:

Abdalsalam Ahmed, Abdulsalam Mansor, and Abdulgani Albagul
Faculty of Electronic Technology Baniwald, Tripoli Road, Baniwalid, Libya

Abstract:

This paper attempts to integrate microcontrollers into smoke detector circuitry and other components for safety purpose. This can be achieved by placing some sensors and devices in the building. In the proposed system, a smoke detector upon senses smoke activates its alarm, sends a low voltage signal to microcontrollers. The microcontroller will activate the relays which are connected to other components to alert residents that one of the smoke detectors has sensed smoke by means of voice and flashing lights. At the same time, it will send signals to valves, air suckers and the water pump. The solenoid valve will operate the water pump which delivers water to the room through pipes installed inside the building to attack the fire. Meanwhile, the air sucker will suck the smoke from the room to prevent suffocation. The proposed design is aiming to have cost efficient system, compact design, easily expandable, simple to install and replaceable components.

Paper 4:

CloudFAS: Cloud-based building fire alarm system using Building Information Modelling

Published year: 2020

Authorname:

Xiaoping Zhou , HaoranLi , JiaWang , JichaoZhao , QingshengXie , LeiLi ,Jiayin Liu , Jun Yu

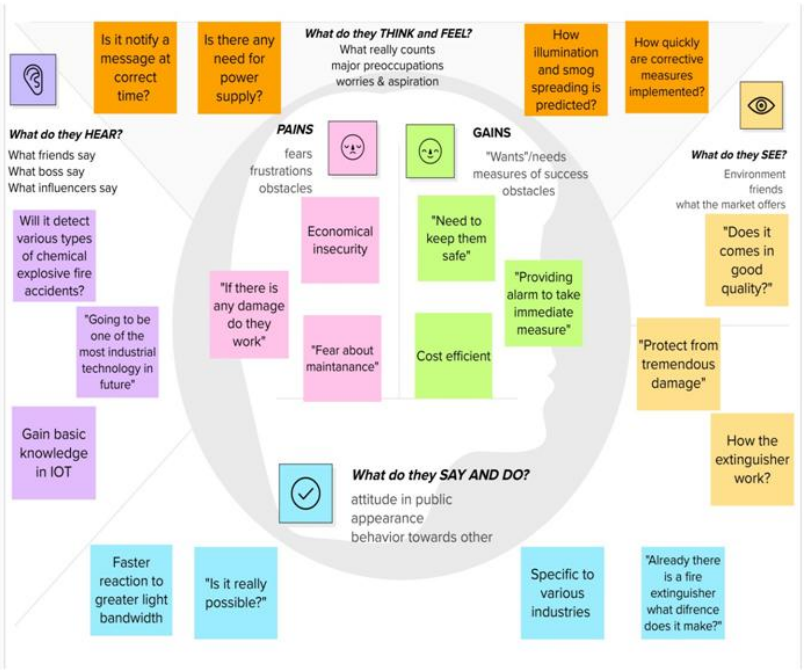
Abstract:

Building fires are a common urban disaster. The emergence of high-rise, large-scale and inner-complex buildings bring new challenges for fire safety and triggers new demand to upgrade traditional building fire alarm system (FAS). Different from current studies by deploying enormous smart fire sensors to replace FAS, this study addresses this issue from a novel perspective and proposes a cloud-based FAS using Building Information Modelling (BIM) on top of FAS, termed CloudFAS. Firstly, the

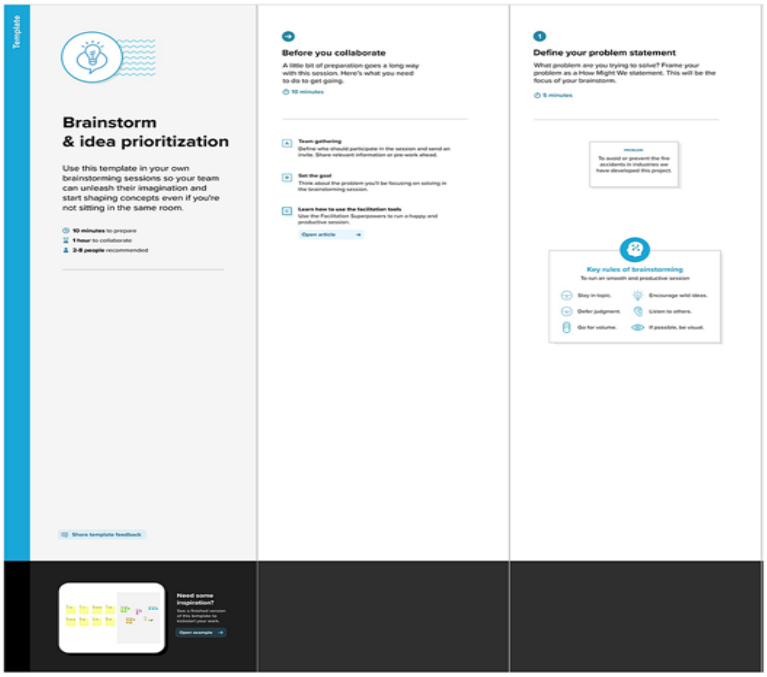
system framework and the software architecture are designed. Secondly, two key technologies are presented to address two unresolved technical issues: private fire alarm data sharing and alignment of fire sensors with the BIM model. A cloud gateway for fire sensors is developed to address the first problem by capturing the fire alarm data from the fire alarm control unit through the IEEE 1824 standard. Noticing that the fire sensor locations are listed in a sensor installation spreadsheet using natural language, termed as sensor location table (SLT). A natural language processing (NLP)-based sensor-BIM alignment algorithm is proposed to automatically match fire sensors with the BIM model through SLT, which enables to display fire sensor statuses in proper places in the 3D BIM model. Finally, a concrete case study from the China Construction Library is presented, which verifies the effectiveness of our proposed CloudFAS. Our CloudFAS is built on top of traditional FAS. If the fire alarm control unit follows the IEEE 1824 standard and an SLT is available, then CloudFAS can upgrade the traditional FAS in existing buildings effortlessly with its BIM model. Moreover, the cloud gateway for fire sensors contributes to addressing the private data sharing problem using IEEE 1824 standard, and the NLP-based sensor-BIM alignment algorithm can promote the adoption of BMI in the building operation phase.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

⏱ 10 minutes

GOWRI SHANGARI E

Flame detector will detect the presence of a flame or fire.

If any flame detected the sprinklers will be switched on automatically.

It should not sprinkle water unless there is fire.

The temperature should be recorded continuously

The communication between the user and IOT need to be simple

SINDHUJA B

Gas sensor will detect the presence of a gas incase of any gas leakage

It wil note it in the cloud for future needs

Based on the temperature readings, if any gas detected the exhaust fan gets power ON.

The system must provide accurate data

False data recording may cause error in future analysis.

VIJAYALAKSHMI K

Temperature sensor will detect the atmosphere temperature.

Based on the python script logics the exhaust fan gets powered ON.

Alert message can be send through SMS.

It will alarm incase if there is fire.

AHALYA PREETHI R

24*7 water service should be maintained for sprinkler

focus the water on fire inorder to avoid wastage of water

making this system user-friendly is more important.

The access should be easy.

SNEGA ROOPA M

Alert should be sent to fire station as soon as possible.

The location of place in danger due to fire will be shared along with the alert to the fire station.

configuration of IOT device and cloud is important

The IOT components should accomodate the step by step process without any kind of delay.

3

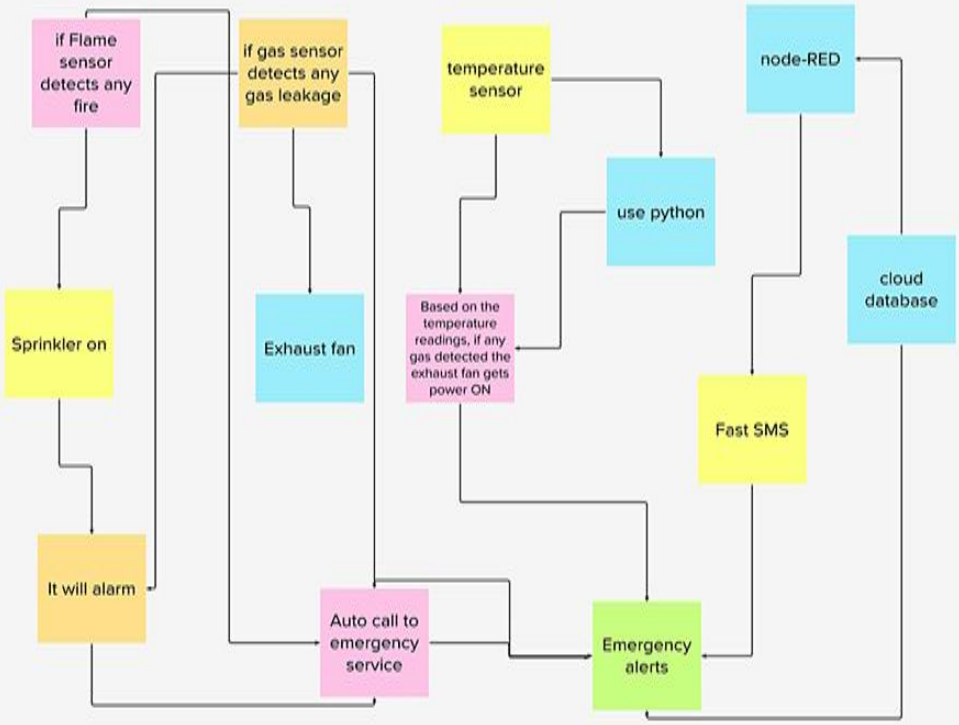
Group ideas

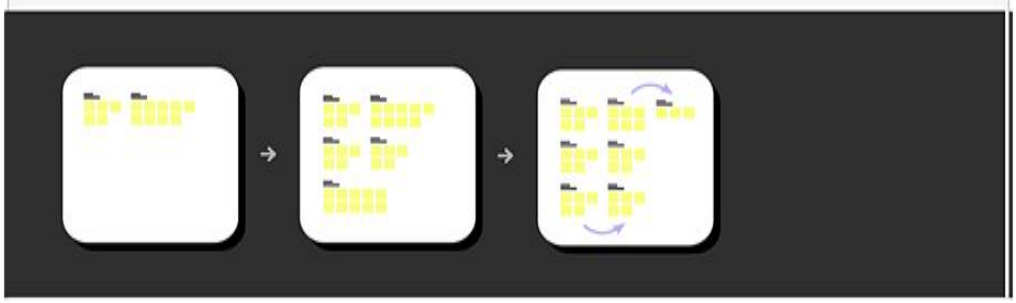
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.



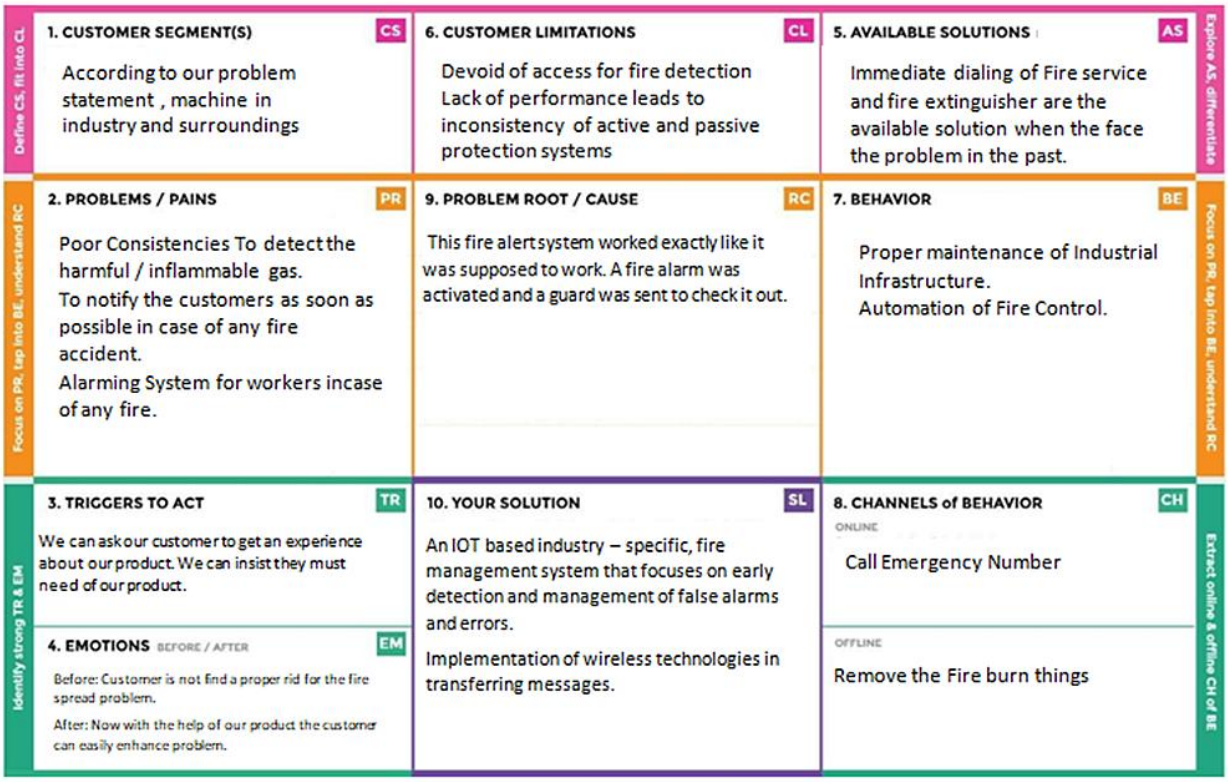


3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To improve the fire safety management system in industries.
2.	Idea / Solution description	Sense the temperature, flame & gas in the room periodically. If it exceeds the threshold ring alarm and sprinkle water and notify the user.

3.	Novelty / Uniqueness	An integrated system of temperature monitering, gas monitering, fire detection and automatic sprinklers to obtain the accurate information about locations and response through SMS notification and call.
4.	Social Impact / Customer Satisfaction	User friendly and low cost. Early detection of fire will help the industries and workers to evacuate before the fire takes over the buildings.
5.	Business Model (Revenue Model)	The product can be made compact, cost efficient and easily installable so that all the small scale to large scale industries can afford to buy the product which creates profit and increases the sale.
6.	Scalability of the Solution	This is complete system makes it easily expandable and business efficient for the fire detection, with the significant cost.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

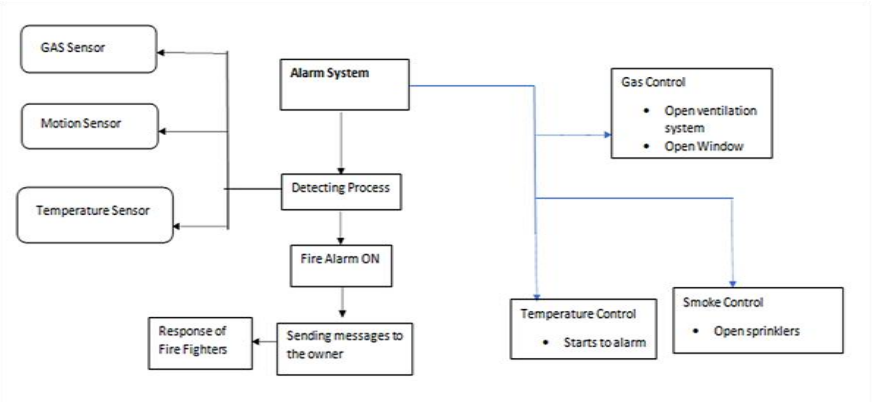
4.1 FUNCTIONAL REQUIREMENTS

FR	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registrationthrough Mobile Number
FR-2	User Confirmation	Confirmation via Message Confirmation via Call
FR-3	User Login	Login through siteor app usingrespective username and password
FR-4	User Upload	Client ought to be ableto upload the information
FR-5	Fire Detection Monitoring	The sensors located will monitor theindustry 24/7 and keeps updating the end user.
FR-6	Location Notification	Location of firewill be sent to the fire department through alarmor message

4.2 NON-FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It is simple and economic Easy to use
NFR-2	**Security**	Software remains securedin the face of attacks
NFR-3	**Reliability**	Response timer will be faster igh Reliability The application runs accurately
NFR-4	**Performance**	If Fire detected it will be immediately notified the web application ,andit also maintain track periodically.
NFR-5	**Availability**	Availability of thesystems for institutions ,restaurants andother public places.
NFR-6	**Scalability**	It accommodates easy modification forvarious requirements

5. PROJECT DESIGN
5.1 DATA FLOW DIAGRAMS



5.2 SOLUTION & TECHNICAL ARCHITECTURE

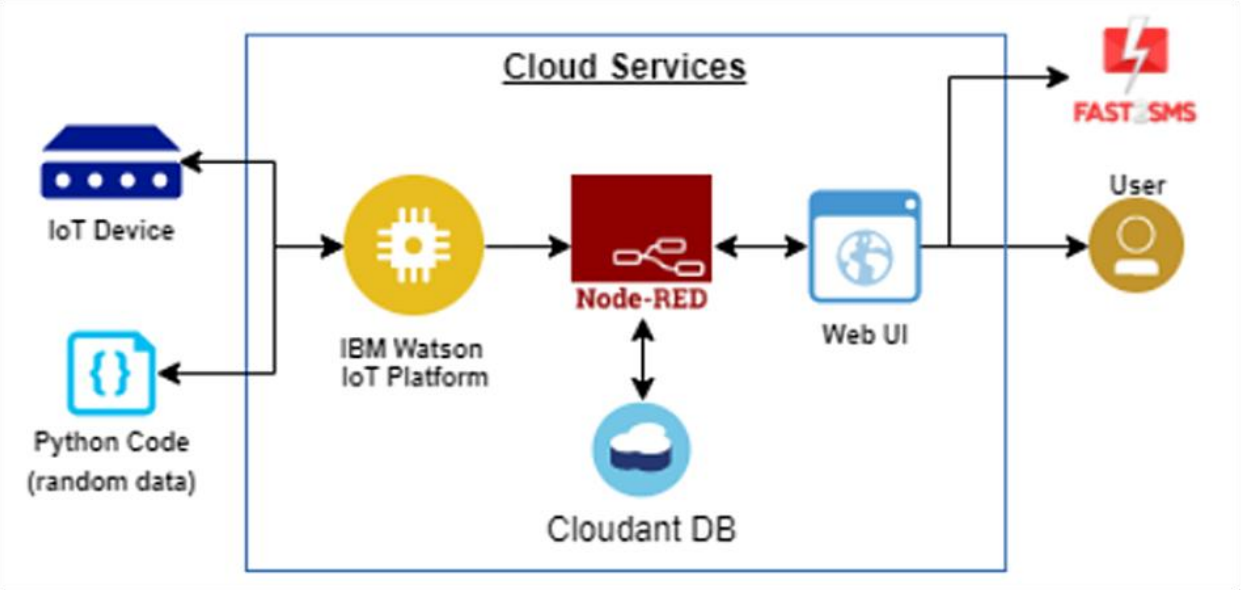


Table-1: Components&Technologies:

S.No	Component	Description	Technology
1.	UserInterface	WebUI,Node-RED, MITapp	IBM IoT Platform, de red,IBMCloud
2.	ApplicationLogic-1	CreateIbmWatsonIoTplatformandcreaten ervice	IbmWatson,ibmcloud ce,ibmnode-red
3.	ApplicationLogic-2	Develop python script to publish and subscribe oTPlatform	python
4.	ApplicationLogic-3	Buildawebapplicationusing node-redservice	IBMNode-red
5.	Database	DataType, Configurationsetc.	MySQL
6.	CloudDatabase	DatabaseServiceonCloud	IBMDB2, IBMCloudant
7.	FileStorage	Developingmobileapplicationtostoreandreceiveth informationandtoreactaccordingly	WebUI,python
8.	ExternalAPI-1	UsingthisIBMfiremanagementAPIwecantrack the temperature of the incident placeand efire hadbeen attacked.	IBMfiremanagementAPI
9.	ExternalAPI-2	Using this IBM Sensorsit detects thefire, gasleaks,temperatureandprovides ationofsprinklersto web UI	IBMSensors
10.	MachineLearningModel	Using this we can derive the cognitionmodel	ObjectRecognitionModel
11.	Infrastructure(Server/Clou	Application Deployment on Local System/ oudServerConfiguration	IBMcloudant, Platform

Table-2:ApplicationCharacteristics:

S.No	Characteristics	Description	Technology
1.	Open-SourceFrameworks	MIT appInventor	MIT License
2.	SecurityImplementations	IBMServices	Encryptions,IBMControls
3.	ScalableArchitecture	sensor-IoTCloudbasedarchitecture	cloudcomputingand AI
4.	Availability	Mobile,laptop, desktop	MIT app
5.	Performance	DetectstheFire,gasleak,temperature	sensors

5.3 USER STORIES

User Type	Functional Requirement(Epic)	User Story	User Story / Task	Acceptance	Priority	Release
Customer ıser)	Registration	USN-1	As a user, I can or the application ıg my email, l, and confirming vord.	I can access ınt /dashboard	High	Sprint-1
		USN-2	As a user, I .ve tion emailonce gistered for the on	I can receive tionemail onfirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & edashboard ebook Login	Low	Sprint-2
		USN-4	As a user, I can or the onthrough		Medium	Sprint-1

	Login	USN-5	As a user, I nto the on byentering password		High	Sprint-1
	Dashboard					
Customer (Webuser)						
Customer Care e						
Administrator						

6. PROJECT PLANNING & SCHEDULE

6.1 SPRINT PLANNING & ESTIMATION

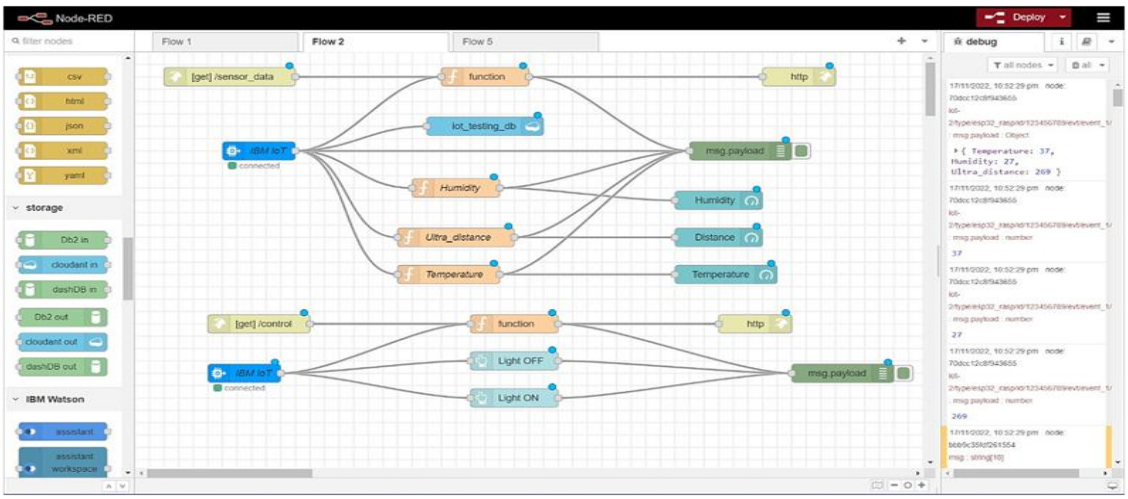
Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, andconfirming my password.	2	High	Sindhuja B
Sprint-2	Registration	USN-2	As a user,I will receive confirmation email once I have registered for the application	3	Medium	Ahalya Preethi R
Sprint-3	Registration	USN-3	As a user, I can register for the application through gmail	1	Low	Snega Roopa M
Sprint-2	Registration	USN-4	As a user, I can register for the application through Gmail	1	High	Gowri Shangari E

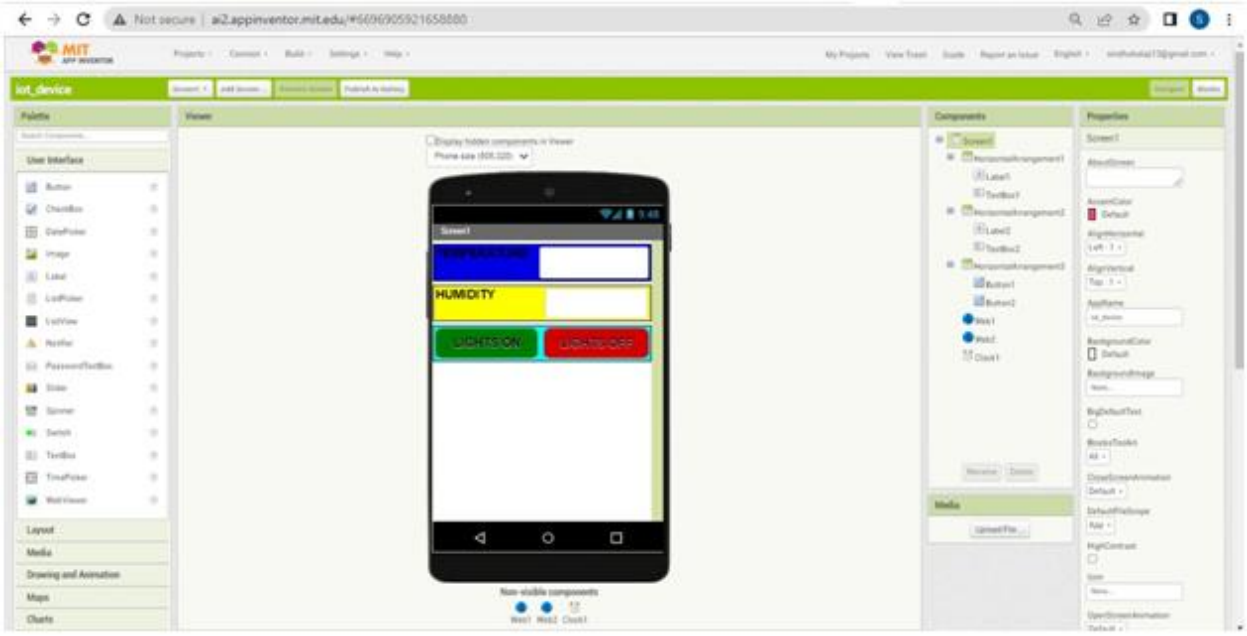
6.2 SPRINT DELIVERY SCHEDULE

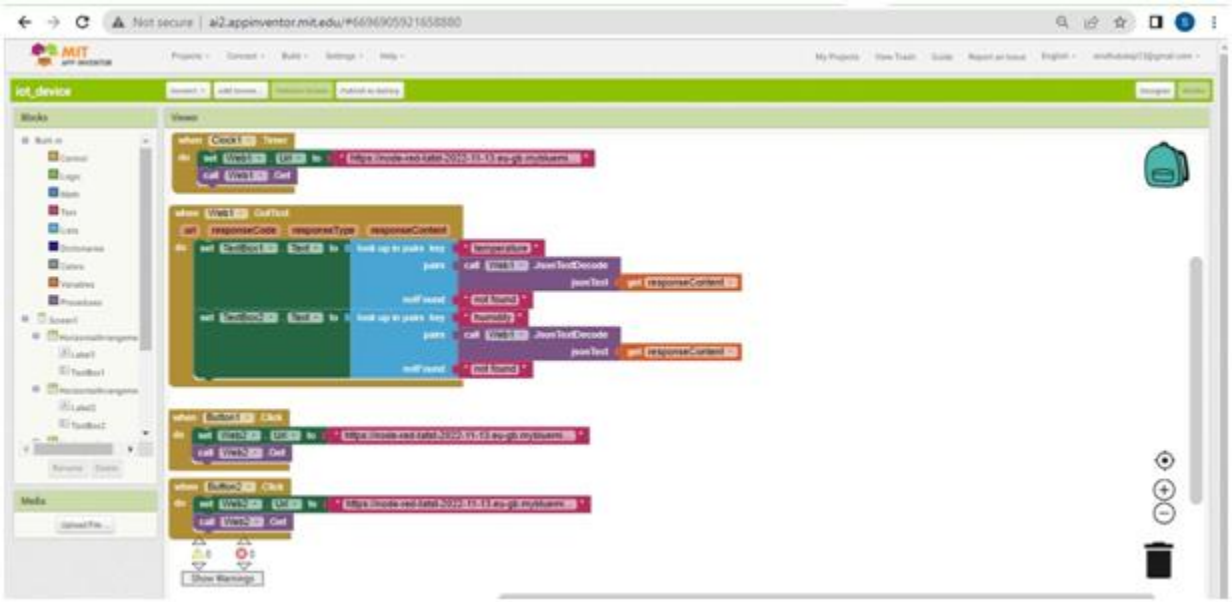
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned EndDate)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	12Nov 2022	17 Nov 2022	20	18 Nov 2022
Sprint-2	20	6 Days	12Nov 2022	17 Nov 2022	20	18 Nov 2022
Sprint-3	20	6 Days	12Nov 2022	17 Nov 2022	20	18 Nov 2022
Sprint-4	20	6 Days	12Nov 2022	17 Nov 2022	20	18 Nov 2022

7. CODING & SOLUTIONING

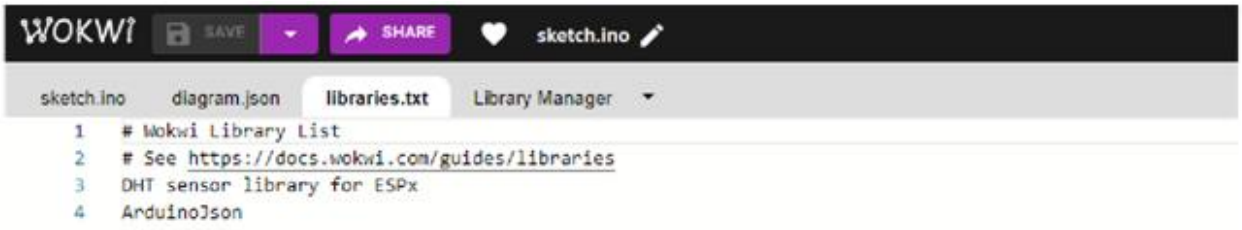
7.1 FEATURE 1

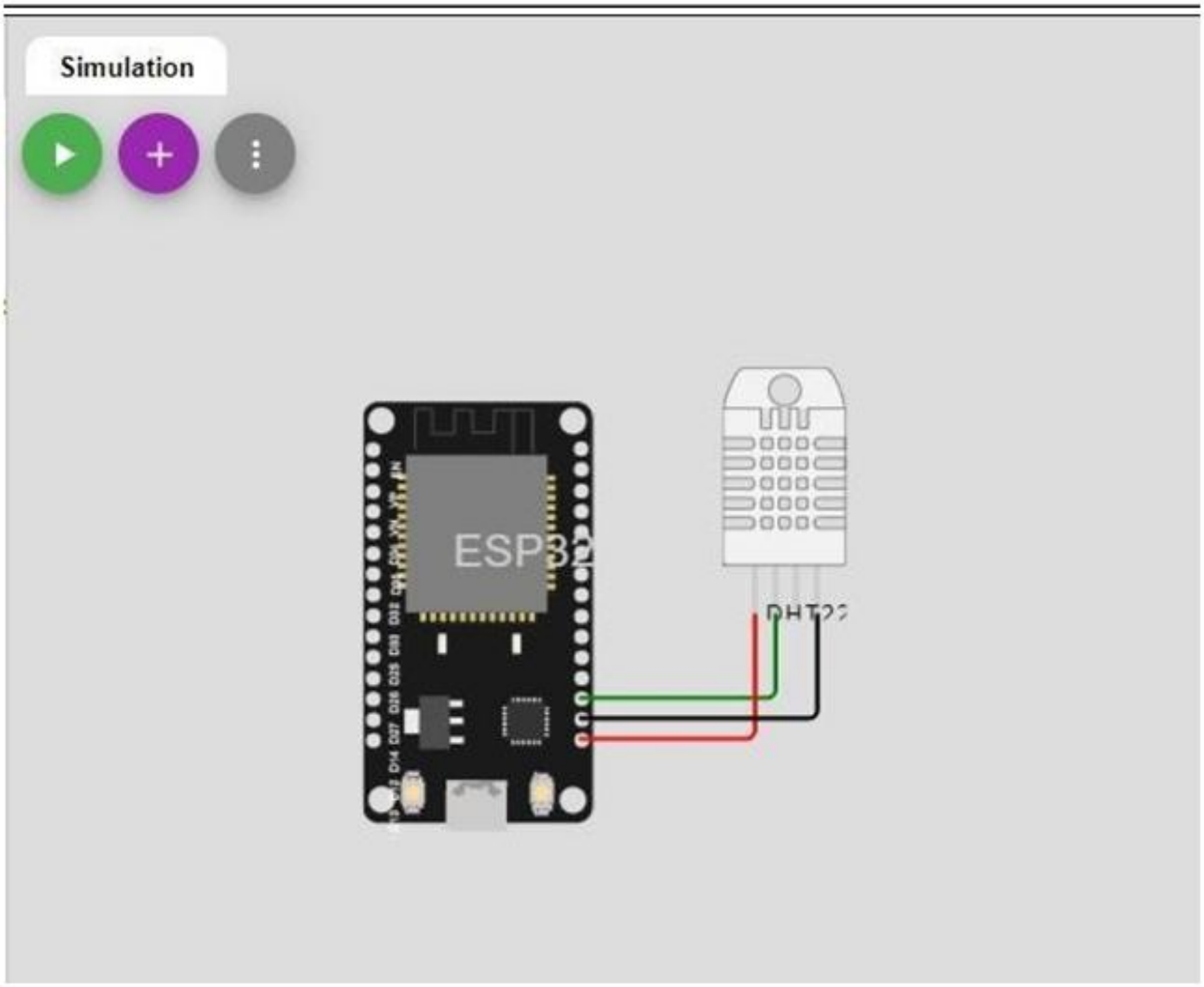



Not secure | ai2.appinventor.mit.edu/#6696905921658880
iot_device
Palette
Viewer
Components
Properties
HUMIDITY
LIGHTS ON
LIGHTS OFF


Not secure | ai2.appinventor.mit.edu/#6696905921658880
iot_device
Blocks
Viewer
Media

7.2 Feature 2


WOKWI
SAVE
SHARE
sketch.ino
sketch.ino
diagram.json
libraries.txt
Library Manager
1 # Wokwi Library List
2 # See https://docs.wokwi.com/guides/libraries
3 DHT sensor library for ESPx
4 ArduinoJson


Simulation
ESP32
DHT22

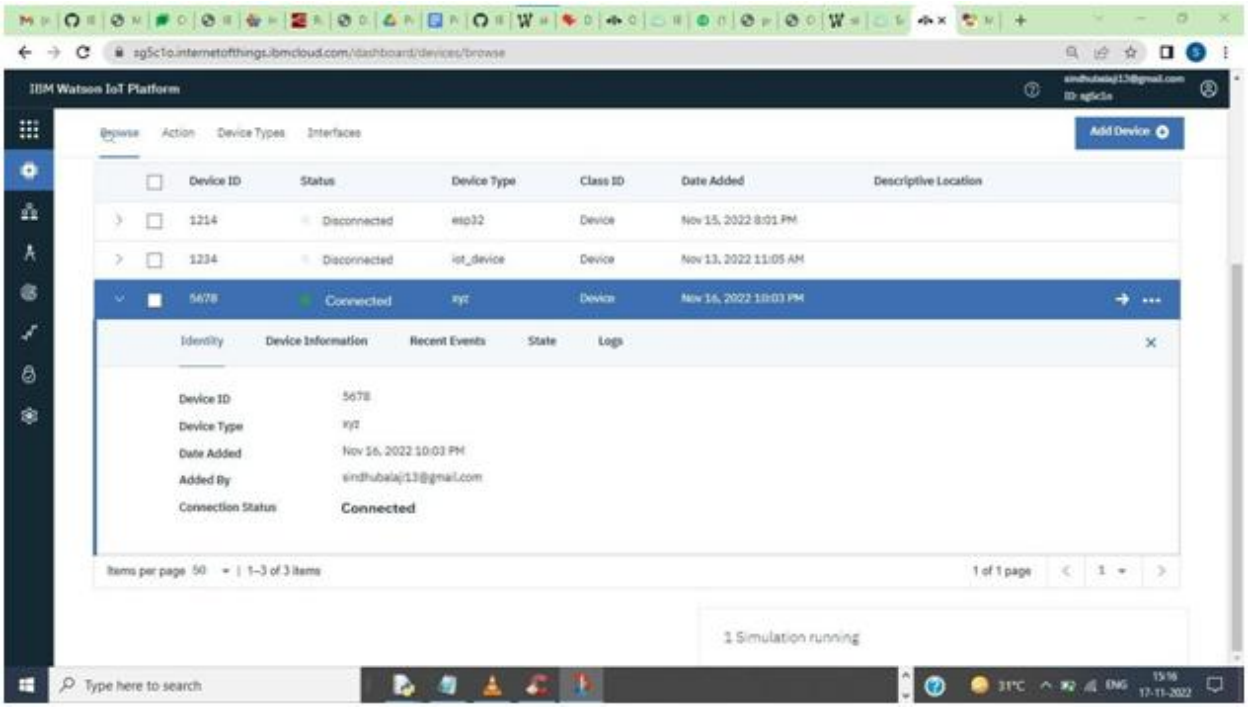
CODE:

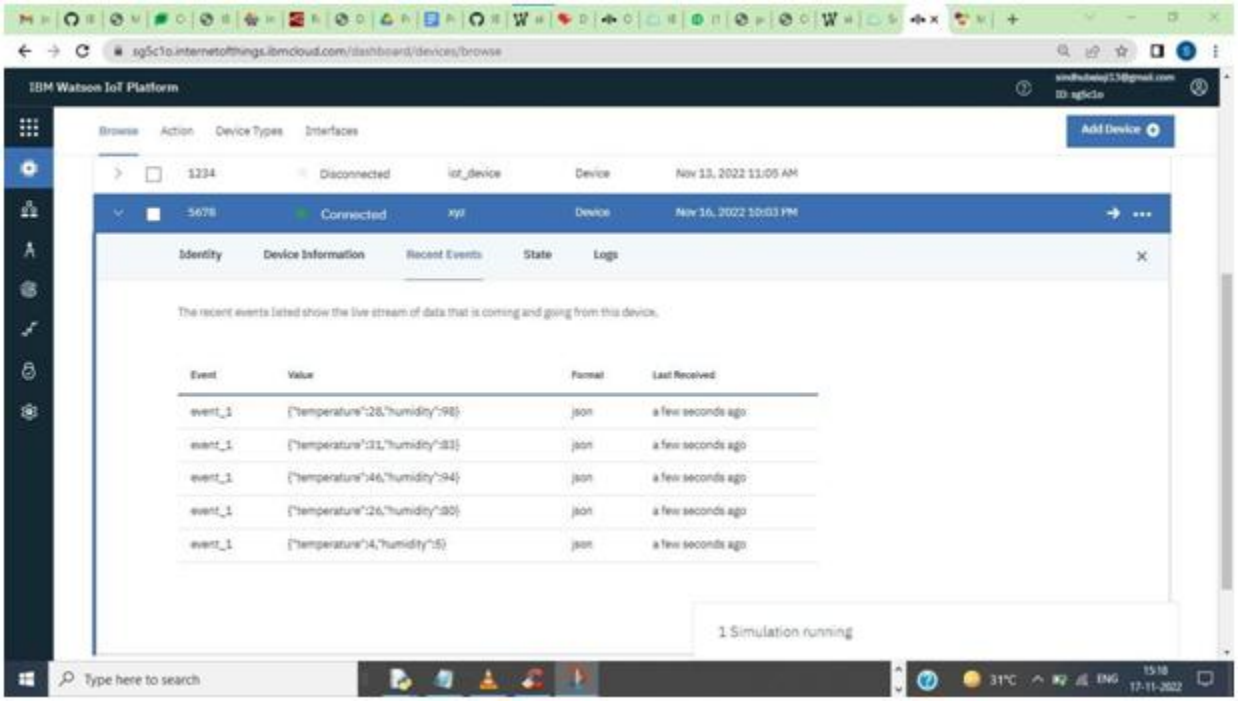
```
#include "DHTesp.h" #include <cstdlib> #include<time.h>

const int DHT_PIN = 15;

bool is_exhaust_fan_on = false; bool is_sprinkler_on = false;
float temperature = 0; int gas_ppm = 0;


int flame = 0; int flow = 0;

String flame_status = ""; String accident_status = ""; String sprinkler_status = "";

DHTesp dhtSensor;


void setup() {
Serial.begin(99900);

/**** sensor pin setups ****/ dhtSensor.setup(DHT_PIN, DHTesp::DHT22);
//if real gas sensor is used make sure the senor is heated up for acurate readings
/*
- Here random values for readings and stdout were used to show the working of the devices as physical
or simulated devices are not available.

*/
}

void loop() {

TempAndHumidity data = dhtSensor.getTempAndHumidity();

//setting a random seedsrand(time(0));

//initial variable activities like declaring , assigning temperature = data.temperature;
gas_ppm = rand()%1000;
int flamereading = rand()%1024;
flame = map(flamereading,0,1024,0,1024);
int flamerange = map(flamereading,0,1024,0,3); int flow = ((rand()%100)>50?1:0);

//set a flame status based on how close it is.....
switch (flamerange) {
case 2:    // A fire closer than 1.5 feet away. flame_status = "Close Fire";
break;
case 1:    // A fire between 1-3 feet away. flame_status = "Distant Fire";
break;
```

```
case 0:    // No fire detected. flame_status = "No Fire"; break;
}

//toggle the fan according to gas in ppm in the room if(gas_ppm > 100){
is_exhaust_fan_on = true;
}
else{
is_exhaust_fan_on = false;
}

//find the accident status 'cause fake alert may be caused by some mischief activities

if(temperature < 40 && flamerange ==2){ accident_status = "need auditing";
is_sprinkler_on = false;
}
else if(temperature < 40 && flamerange ==0){ accident_status = "nothing found";
is_sprinkler_on = false;
}
else if(temperature > 50 && flamerange == 1){ is_sprinkler_on = true;
accident_status = "moderate";
}
else if(temperature > 55 && flamerange == 2){ is_sprinkler_on = true;
accident_status = "severe";
}else{
is_sprinkler_on = false; accident_status = "nil";
}


//send the sprinkler status if(is_sprinkler_on){
if(flow){
sprinkler_status = "working";
}
else{
sprinkler_status = "not working";
}
}
else if(is_sprinkler_on == false){ sprinkler_status = "now it shouldn't";
}
else{
sprinkler_status = "something's wrong";
```

```
}

//Obivously the output.It is like json format 'cause it will help us for future sprints
String out = "{\n\t\"senor_values\":{"; out+="\n\t\t\"gas_ppm\":"+String(gas_ppm)+",";

out+="\n\t\t\"temperature\":"+String(temperature,2)+",";out+="\n\t\t\"flame\":"+String(fl
ame)+","; out+="\n\t\t\"flow\":"+String(flow)+",\n\t}"; out+="\n\t\"output\":{";

out+="\n\t\t\"is_exhaust_fan_on\":"+String((is_exhaust_fan_on)?"true": "false")+",";

out+="\n\t\t\"is_sprinkler_on\":"+String((is_sprinkler_on)?"true":"fal se")+",";
out+="\n\t}"; out+="\n\t\"messages\":{";
out+="\n\t\t\"fire_status\":"+flame_status+",";
out+="\n\t\t\"flow_status\":"+sprinkler_status+",";
out+="\n\t\t\"accident_status\":"+accident_status+",";out+="\n\t}";
out+="\n}";
Serial.println(out);

delay(1000);
}
```

7.3 DATABASE SCHEMA





8. TESTING

8.1 TEST CASES

SL.NO	INPUT	OUTPUT	RESULT
01.	Gas:933 Temperature:59.30 Flame:207	Exhaust fan on:TRUE Sprinklers:OFF	Passed
02.	Gas:437 Temperature:59.30 Flame:693	Exhaust fan on:TRUE Sprinklers:OFF	Passed
03.	Gas:218 Temperature:59.30 Flame:369	Exhaust fan on:TRUE Sprinklers:ON	Passed
04.	Gas:2503 Temperature:59.30Flame:531	Exhaust fan on:TRUE Sprinklers:ON	Passed
05.	Gas:437 Temperature:59.30 Flame:693	Exhaust fan on:TRUE Sprinklers:ON	Passed

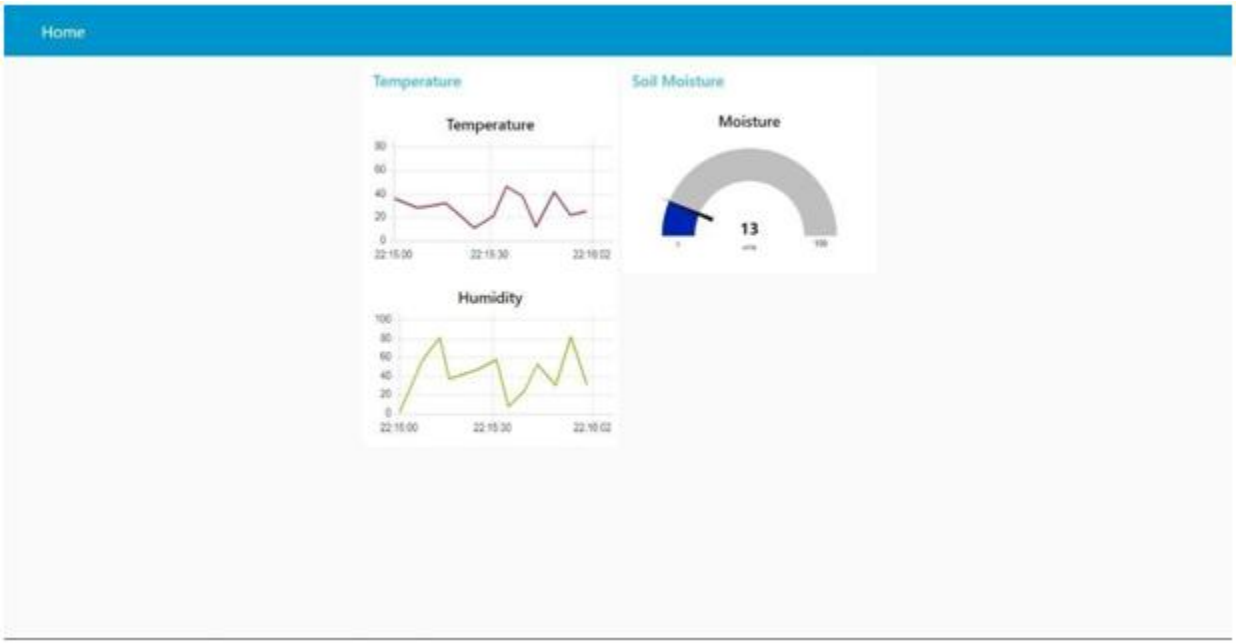
06.	Gas:722 Temperature:59.30 Flame:855	Exhaust fan on:TRUE Sprinklers:ON	Passed
07.	Gas:7 Temperature:59.30 Flame:1017	Exhaust fan on:FALSE Sprinklers:ON	Passed
08.	Gas:941 Temperature:59.30 Flame:155	Exhaust fan on:TRUE Sprinklers:OFF	Passed
09.	Gas:226 Temperature: 59.30 Flame:317	Exhaust fan on:TRUE Sprinklers:OFF	Passed
10.	Gas:511 Temperature:59.30 Flame:479	Exhaust fan on:TRUE Sprinklers:ON	Passed
11.	Gas:444 Temperature:59.30 Flame:641	Exhaust fan on:TRUE Sprinklers:ON	Passed

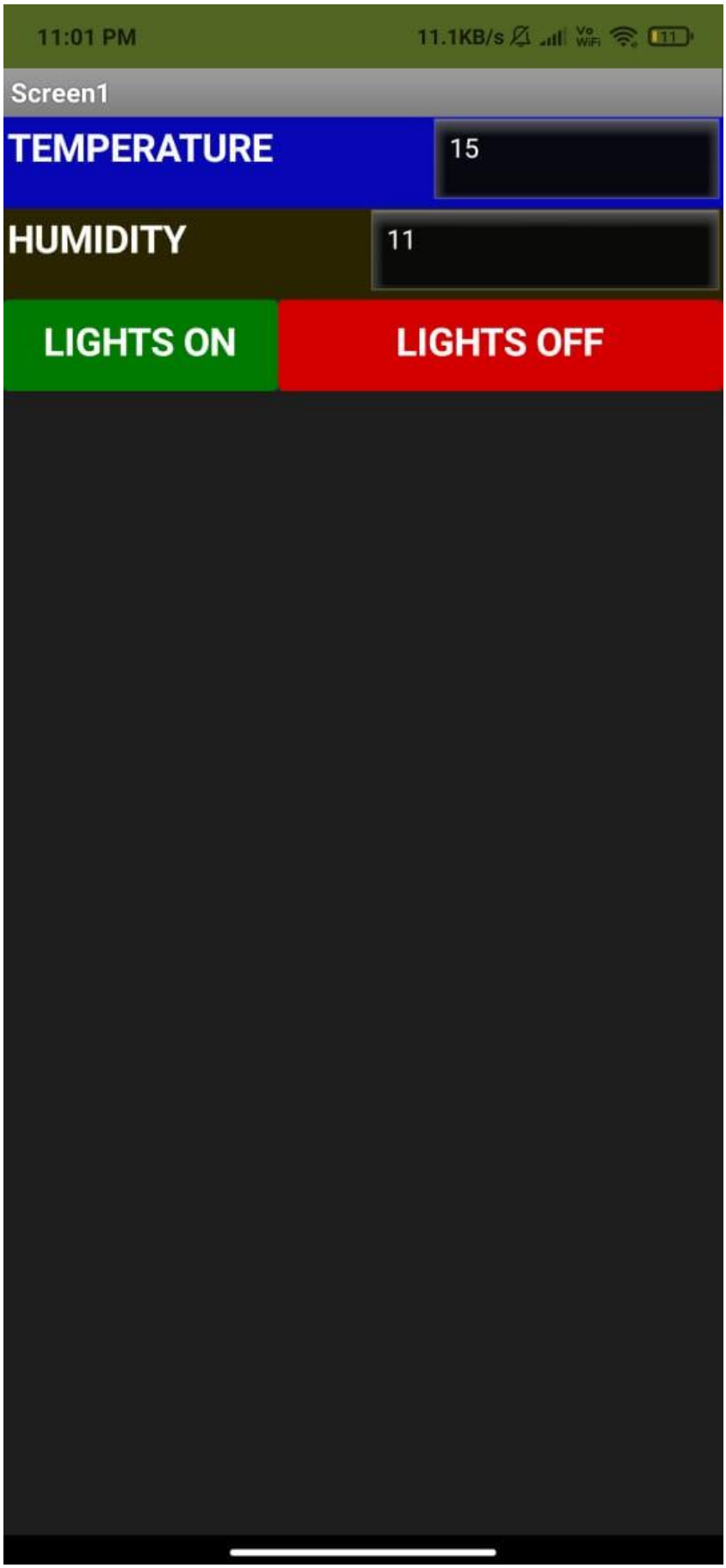
8.2 USER ACCEPTANCE TESTING

```
#IBM Watson IOT platform
import wiotp.sdk.device
import time
import random
myConfig={
    "identity": {
        "orgId":"sg5c1o",
        "typeId":"xyz",
        "deviceId":"5678"
        },
    "auth": {
        "token":"567891011"
        }
    }
def myCommandCallback(cmd):
    print("Message received from IBM IOT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    client=wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=none)
    client.connect()
    while True:
        temp=random.randint(-20,125)
        hum=random.randint(0,100)
        myData={'temperature':temp,'humidity':hum}
        client.publishEvent(eventId="status",msgFormat="json",data=myData,qos=0,onPublish=None)
        print("Published data Successfully: %s", mydata)
        client.commandCallback=myCommandCallback
        time.sleep(2)
        client.disconnect()
```

9.RESULTS

9.1 PERFORMANCE METRICS


Home
Temperature
Temperature
80
60
40
20
0
22:15:00
22:15:30
22:16:02
Humidity
100
80
60
40
20
0
22:15:00
22:15:30
22:16:02
Soil Moisture
Moisture
13


11:01 PM
11.1KB/s
Screen1
TEMPERATURE
15
HUMIDITY
11
LIGHTS ON
LIGHTS OFF

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

1. Sprinkler systems are automatic and respond at all times. Fire control is therefore rapid and no human intervention is needed.
2. Sprinkler systems are fitted with water flow 'gong' alarms and will alert occupants /guards of a developing fire.Significantly less heat and smoke is generated if the fire is extinguished at inception – this is what sprinklers are designed to do.Property damage is reduced.
3. A well-designed system will control a fire and fire/water damage will generally be localised.Occupants and fire fighters are exposed to much less danger if the fire is kept in check by a sprinkler system.
4. Savings on insurance premiums because sprinkler controlled fires are in the overall majority of instances less damaging than fires that are not kept in check by sprinklers.
5. Sprinkler controlled fires reduces the demand for security as it minimises intrusion opportunities.Sprinkler systems use significantly less fire water than hydrants, hydraulic hose reels or the fire brigade.

DISADVANTAGES:

1. The one thing most fire alarm system inspectors caution against with wireless systems is having to replace the battery. The system is essentially useless if the batteries aren't charged, since it won't work properly. There is a bit of a burden to homeowners or business owners to always remember to keep the batteries fresh so the system operates properly when you need it most.
2. A couple other disadvantages fire alarm system inspectors point out is wireless systems have limited range and don't have centralized monitoring. Range can be a problem for large offices or homes, since a weak wireless connection may cause the system to not operate reliably. Wireless fire alarm systems also don't connect directly to the telephone lines, which are linked to the fire departments, so the response to an emergency could be slower as a result.

11.CONCLUSION

There is a general agreement over the fire and protection segments that at 220,000 for every annum the degrees of bogus and undesirable alarms radiating from fire alarm and discovery frameworks is excessively high. Bogus and undesirable alarms squander fire and salvage administration assets; cause superfluous and costly interruption to end-clients which can bring about the
loss of trust in frameworks and has seen a few frameworks turned off. As fire alarm and identifications frameworks are so firmly inserted into the clearing
systems and strategies created to meet the necessities of Building Regulations and Fire Safety Law their utilization is far reaching and there are entrenched outsider accreditation plans for producers and installers. The item measures and testing systems anyway stay quiet on the reasons for bogus alarms.

12.FUTURE SCOPE

The scope of the fire safety systems market includes the type of safety system with fire detectors and suppressors, such as gas, foam, and detectors. The increasing focus of the government bodies on

implementing fire safety equipment across various industries, such as chemical and petrochemical, oil and gas, pharmaceutical, aerospace, and defense, has led to the growth of the market studied.

13.APPENDIX

Source Code :

```
#include "DHTesp.h"
#include <cstdlib>
 #include<time.h>

const int DHT_PIN = 15;

bool is_exhaust_fan_on = false; bool is_sprinkler_on = false;
float temperature = 0; int gas_ppm = 0;


int flame = 0; int flow = 0;

String flame_status = ""; String accident_status = ""; String sprinkler_status = "";

DHTesp dhtSensor;


void setup() {
Serial.begin(99900);

/**** sensor pin setups ****/ dhtSensor.setup(DHT_PIN, DHTesp::DHT22);
//if real gas sensor is used make sure the senor is heated up for acurate readings
/*
- Here random values for readings and stdout were used to show the working of the devices as physical or simulated devices are not available.

*/
}

void loop() {

TempAndHumidity data = dhtSensor.getTempAndHumidity();

//setting a random seedsrand(time(0));

//initial variable activities like declaring , assigning temperature = data.temperature;
gas_ppm = rand()%1000;
int flamereading = rand()%1024;
flame = map(flamereading,0,1024,0,1024);
int flamerange = map(flamereading,0,1024,0,3); int flow = ((rand()%100)>50?1:0);
```

```
//set a flame status based on how close it is.....
switch (flamerange) {
case 2:    // A fire closer than 1.5 feet away. flame_status = "Close Fire";
break;
case 1:    // A fire between 1-3 feet away. flame_status = "Distant Fire";
break;
case 0:    // No fire detected. flame_status = "No Fire"; break;
}

//toggle the fan according to gas in ppm in the room if(gas_ppm > 100){
is_exhaust_fan_on = true;
}
else{
is_exhaust_fan_on = false;
}

//find the accident status 'cause fake alert may be caused by some mischief activities

if(temperature < 40 && flamerange ==2){ accident_status = "need auditing"; is_sprinkler_on = false;
}
else if(temperature < 40 && flamerange ==0){ accident_status = "nothing found"; is_sprinkler_on =
false;
}
else if(temperature > 50 && flamerange == 1){ is_sprinkler_on = true;
accident_status = "moderate";
}
else if(temperature > 55 && flamerange == 2){ is_sprinkler_on = true;
accident_status = "severe";
}else{
is_sprinkler_on = false; accident_status = "nil";
}


//send the sprinkler status if(is_sprinkler_on){
if(flow){
sprinkler_status = "working";
}
else{
sprinkler_status = "not working";
}
}
else if(is_sprinkler_on == false){ sprinkler_status = "now it shouldn't";
}
else{
sprinkler_status = "something's wrong";
}
```

```
//Obivously the output.It is like json format 'cause it will help us for future sprints
String out = "{\n\t\"senor_values\":{"; out+="\n\t\t\"gas_ppm\":"+String(gas_ppm)+",";

out+="\n\t\t\"temperature\":"+String(temperature,2)+",";
out+="\n\t\t\"flame\":"+String(flame)+","; out+="\n\t\t\"flow\":"+String(flow)+",\n\t}";
out+="\n\t\"output\":{";

out+="\n\t\t\"is_exhaust_fan_on\":"+String((is_exhaust_fan_on)?"true": "false")+",";

out+="\n\t\t\"is_sprinkler_on\":"+String((is_sprinkler_on)?"true":"fal se")+",";
out+="\n\t}"; out+="\n\t\"messages\":{";
out+="\n\t\t\"fire_status\":"+flame_status+","; out+="\n\t\t\"flow_status\":"+sprinkler_status+",";
out+="\n\t\t\"accident_status\":"+accident_status+",";out+="\n\t}";
out+="\n}";
Serial.println(out);

delay(1000);
}
```

GITHUB LINK : https://github.com/IBM-EPBL/IBM-Project-29733-1660129016