INDUSTRY - SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

PROJECT REPORT

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1.INTRODUCTION

1.1 Project Overview

The smart fire management system includes a gas, flame, and temperature sensor to detect any environmental changes. The exhaust fans are turned on based on the temperature readings and the presence of any gases. If a flame is detected, the sprinklers will automatically activate. Emergency alerts are sent to the authorities and the Fire Station.

1.2 Purpose

- ➤ To provide a detect the status of the room using IoT devices
- ➤ To turn on sprinkler and exhaust fan when there is an accident
- ➤ To detect the flow of water
- ➤ To send and store the temperature status in a cloud storage
- ➤ To provide an easy management system on dashboard
- ➤ To provide an overview of what is happening to the user

2.LITERATURE SURVEY

2.1 Existing Problem

The situation is not ideal because fire management systems in homes and industries are not very reliable, efficient, or cost-effective, and lack advanced processing and features such as an automatic alert system for administrators and authorities. They are using older fire safety systems that cannot even activate the sprinkler system and do not communicate with one another properly to prevent false alarms. They also monitor the entire system using applications.

2.2 Reference

https://pdfs.semanticscholar.org/f3e7/a7c0cf2d448be592421045033506e845e6c2.pdf

https://www.mdpi.com/2224-2708/7/1/11

2.3 Problem Statement Definiton

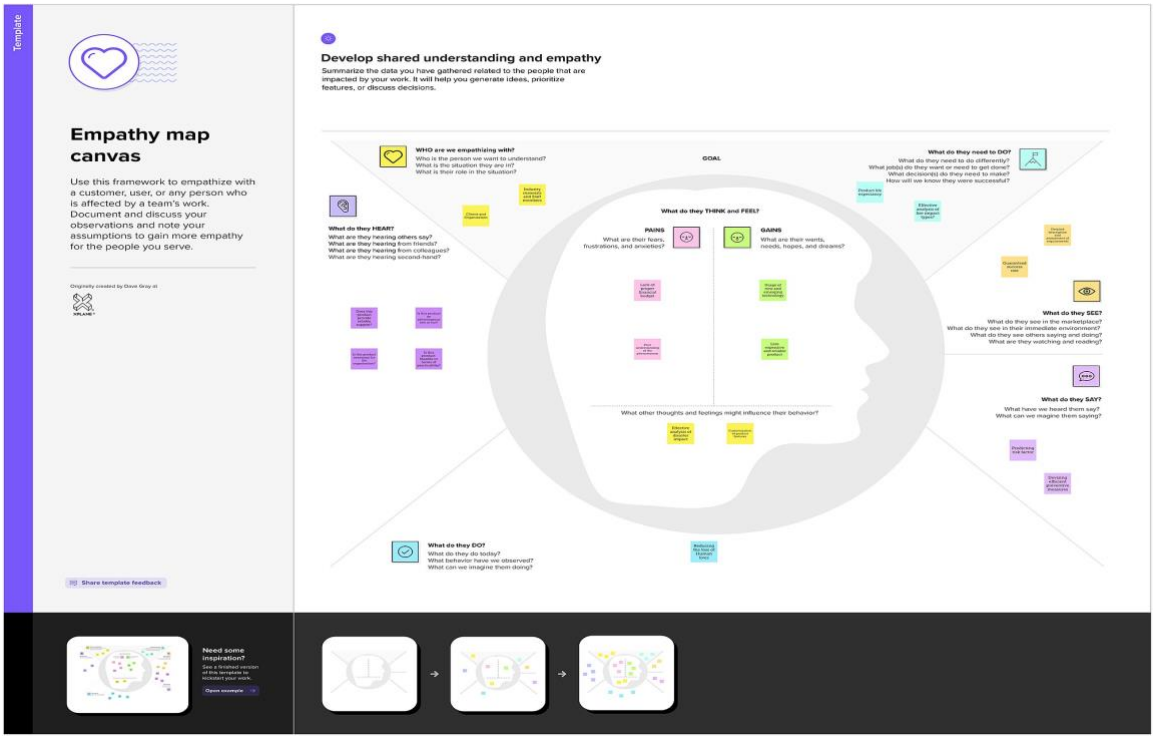
The fire management system in houses and industries is not very reliable, efficient, cost effective, and does not have any advanced processing and does not have any features like automatic alert system for admin and authorities and in many buildings there are using older fire safety system that cannot even activate the sprinkler system and all of them do not communicate with each other properly to prevent false alarms.

3.IDEATHON AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

- An empathy map is a simple, easy-to-understand visual that captures knowledge about a user's behaviors and attitudes.
- It is a useful tool for assisting teams in better understanding their users.
- Creating an effective solution necessitates understanding the true problem and the person experiencing it.

➤ The map-making exercise helps participants consider things from the user's perspective, including his or her goals and challenges.



3.2 Ideation and Brainstorming

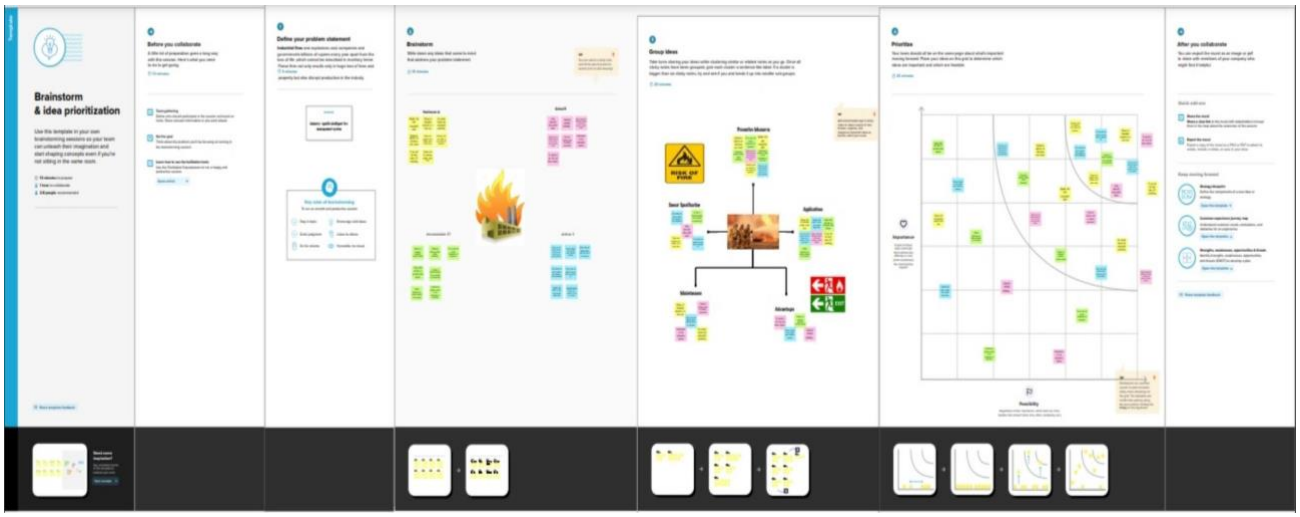
Step 1: Team Gathering, Collaboration and Select the Problem Statement

Team was gathered in mural app for collaboration

The team members are

- Kousika Shree
- Guru Manickam
- Kavin Kumar
- Lalitha Shri

Step 2: Brainstorm, Idea Listing and Grouping



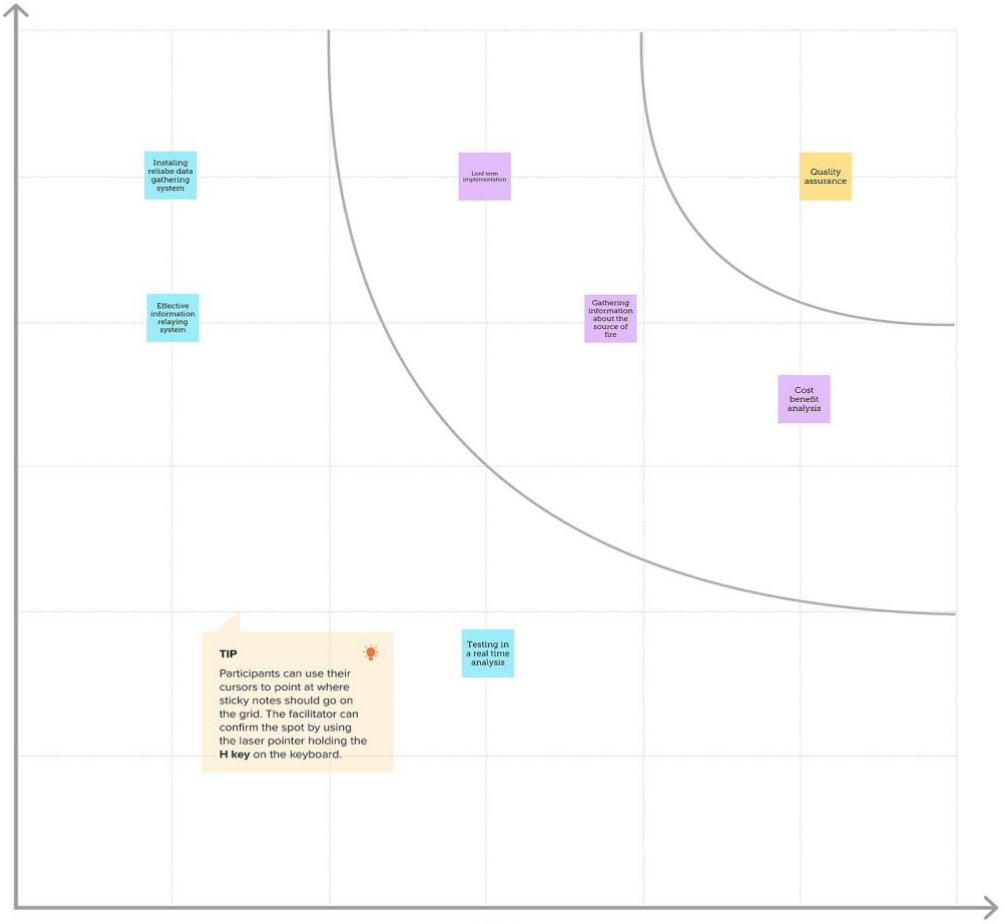
Step3: Idea Prioritization

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

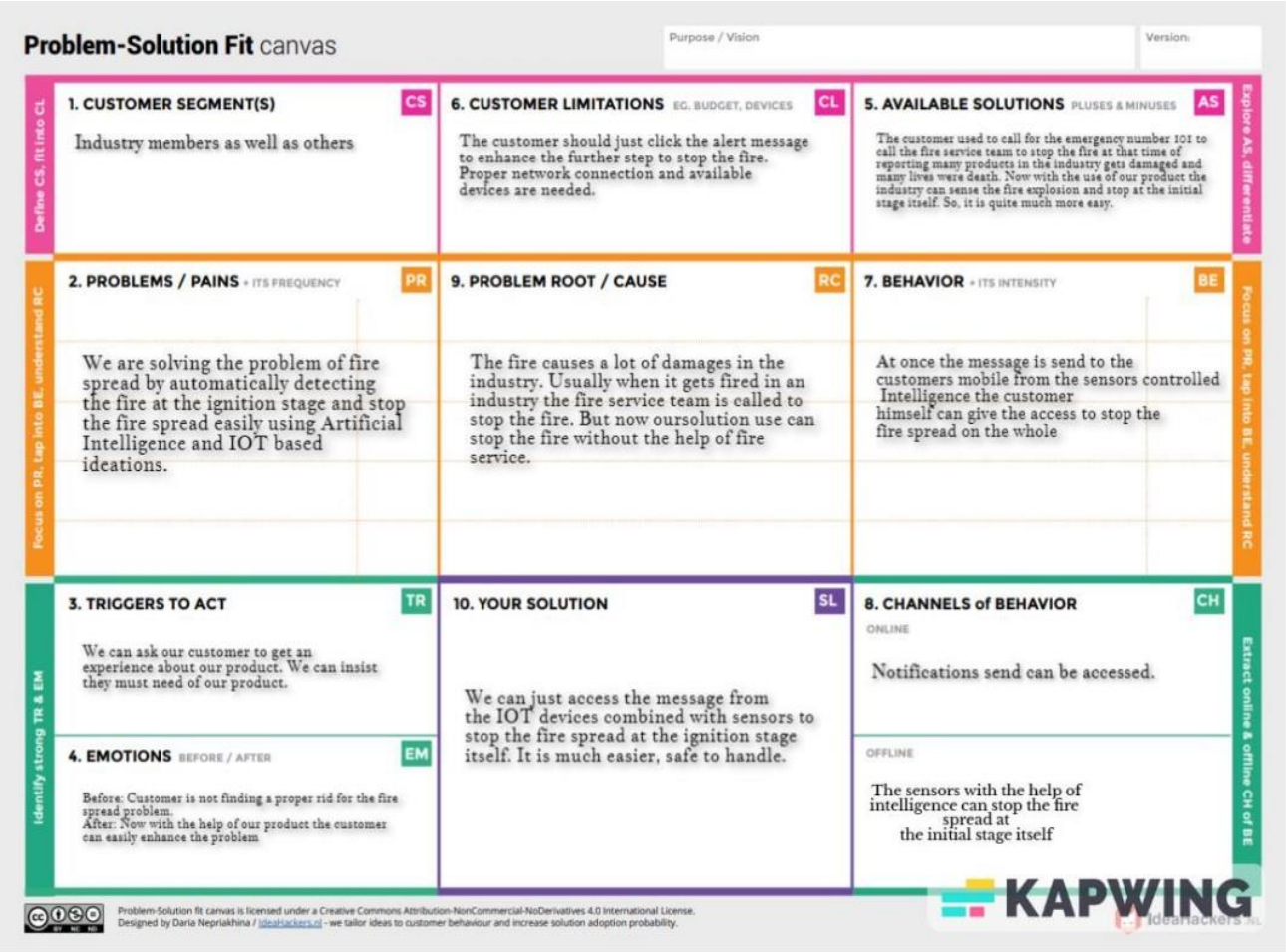
Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

3.3 Proposed Solution

S No	Parameter	Description
1.	Problem Statement (Problem to be solved)	To improve the safety management system in industries. Improving the safety management system against the fire incidents in industries.
2.	Idea / Solution description	To implement the fire safety management in industry based on IOT using Arduino uno board with fire detection and fire extinguisher system. And using some sensors (Humidity sensor, Flame sensor, smoke sensor) with GPS tracking system.
3.	Novelty / Uniqueness	An integrated system of temperature monitoring, gas monitoring, fire detection automatically fire extinguisher with accuracy of information about locations and response through SMS notification and call.
4.	Social Impact / Customer Satisfaction	It early prevents the accident cost by fire in industries. Nearby locations so maximum extend more accurate reliability Compatibility design integrated system
5.	Business Model (Revenue Model)	This product can be utilized by an industry. This can be thought of as a productive and helpful item as industries great many current rescuing people and machine from the fire accident.
6.	Scalability of the Solution	It is trying to execute this technique as we need to introduce an Arduino gadget which was modified with an Arduino that takes received signals from sensors. Easily operatable and can be maintained. Required low time for maintain. Cost is reasonable value

3.4 Proposed Solution Fit



4.REQUIREMENT ANALYSIS

4.1 Functional Requirements

A functional requirement defines a system or component's function, where a function is

- ➤ Defined as a specification of behavior between inputs and outputs
- ➤ It defines "what the software system should do"
- ➤ Defined at the component level
- ➤ Usually simple to define
- ➤ Aids in testing the software's functionality

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	• Registration through Form • Registration through mobile number
FR-2	User Confirmation	• Confirmation via message • Confirmation via call
FR-3	User Login	Login through site or App using respective username and password
FR-4	User Upload	Client ought to be able to upload the information
FR-5	Fire Detection Monitoring	The sensors located will monitor the industry 24/7 and keeps updating the end user.
FR-6	Location notification	Location of fire will be sent to the fire department through alarm or message

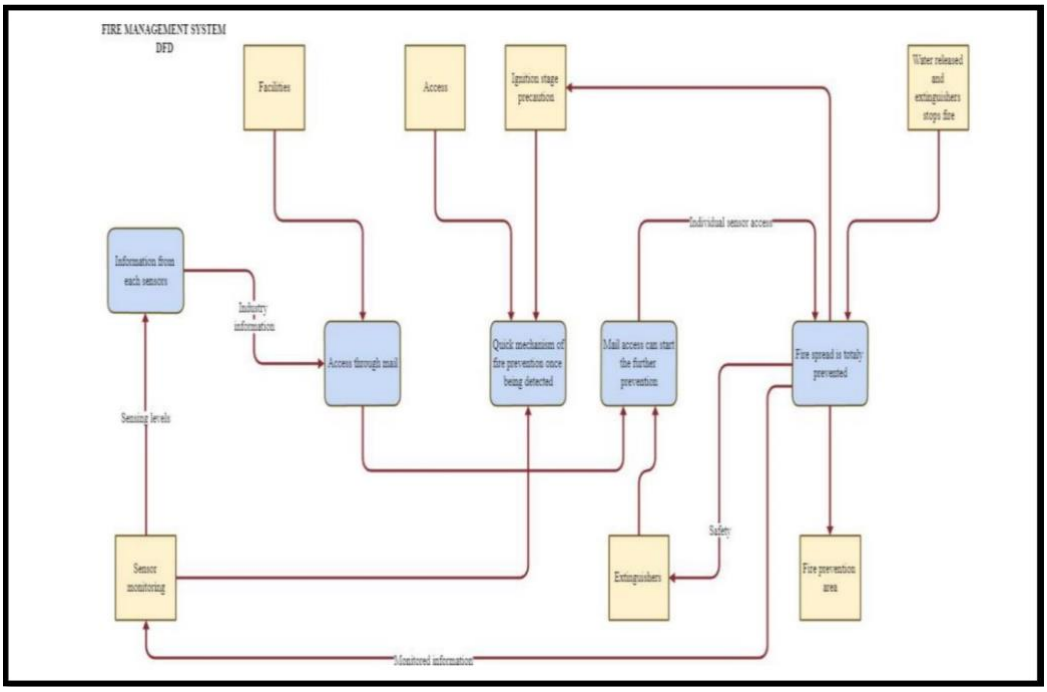
4.2 Non - Functional Requirements

- ➤ A non-functional requirement defines a software system's quality attribute.
- ➤ It limits "How should the software system fulfill the functional requirements?"
- ➤ It is not required Applied to the entire system
- ➤ Usually more difficult to define
- ➤ Aids in the verification of software performance

FR . No	Non - Functional Requirement	Description
NFR-1	Usability	● It is the simple and Economic ● Easy to use
NFR-2	Security	● The software remains resilient in the face of attacks ● The Web application is highly secured
NFR-3	Reliability	● Response timer will be faster ● It has high Reliability ● The application runs accurately
NFR-4	Performance	If Fire detected it will be immediately notified through the web application, and it also maintain track periodically.
NFR-5	Availability	We will be Monitoring the Industry by day and Night (24/7). In case of Fire detected we willbe intimating the management rapidly.

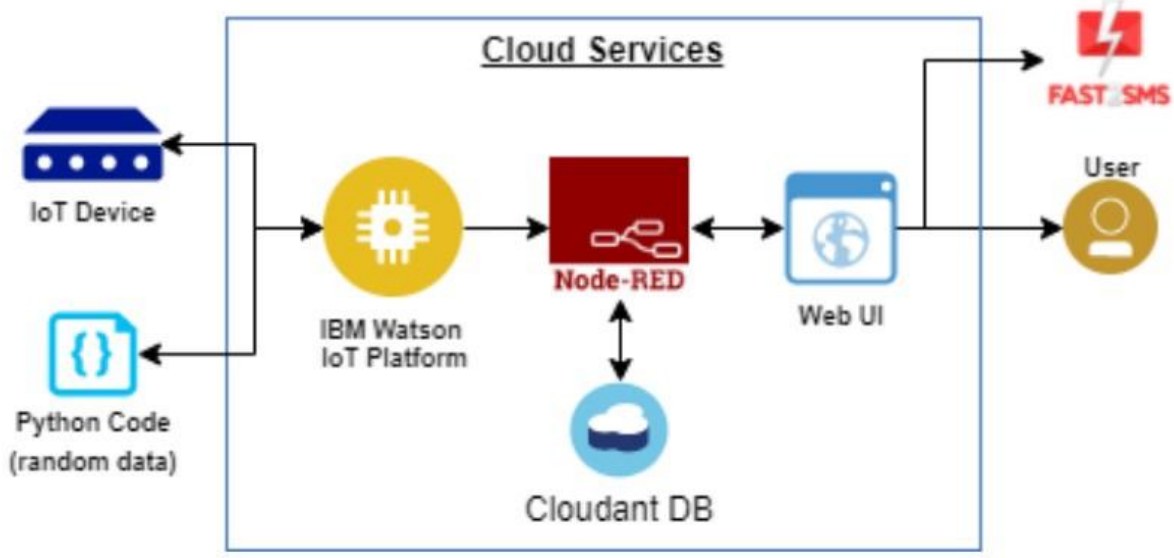
5.PROJECT DESIGN

5.1 Data flow Diagram

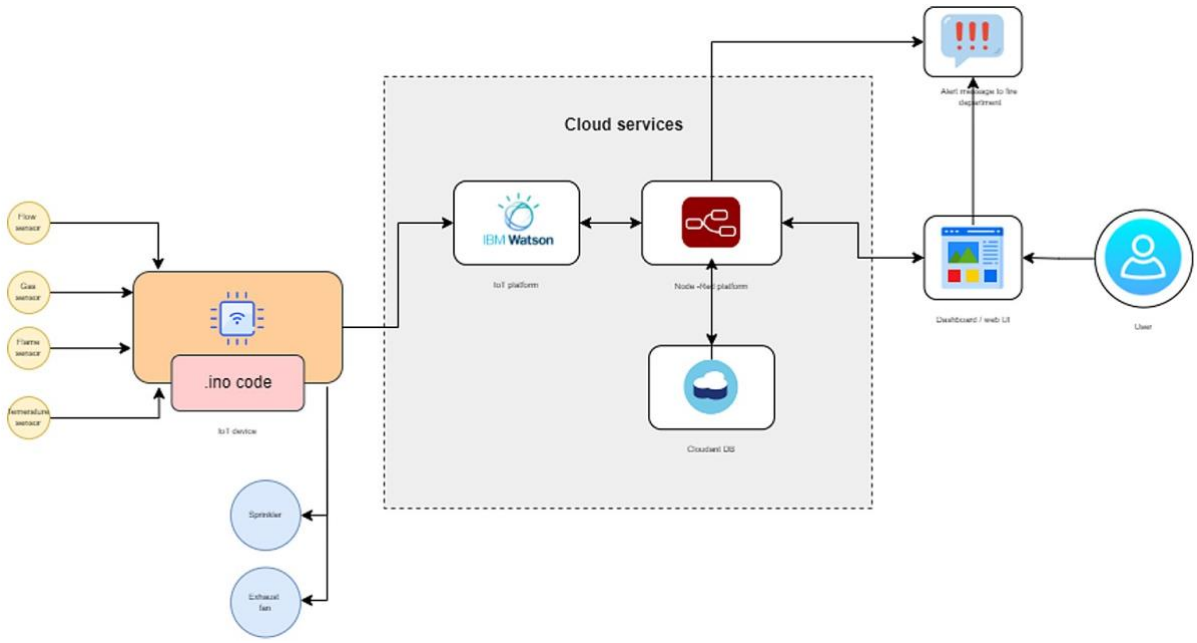


5.2 Solution and Technical Architecture

Solution Architecture



Technical Architecture



5.3 User Stories

User Type	Functional Requirement	User Story Number	User Story/Task	Acceptance Criteria	Priority	Release
Customers (Mobile user, web user, care executive, Administrator)	Registration	USN - 1	As a user, I can register for the application by entering my mail, password, and confirming my password	I can access my account/ dashboard	High	Sprint - 1
		USN - 2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint - 1
	Dashboard	USN - 3	As a user, I can register for the application through internet	I can register & access the dashboard with Internet login	Low	Sprint - 2
		USN - 4	As a user, I can register for the application through Gmail	I can confirm the registration in Gmail	Medium	Sprint - 1
	Login	USN - 5	As a user, I can log into the application by entering email & password	I can login with my ID & password	High	Sprint - 1

6.PROJECT DESIGN AND PLANNING

6.1 Sprint Planning and Estimation

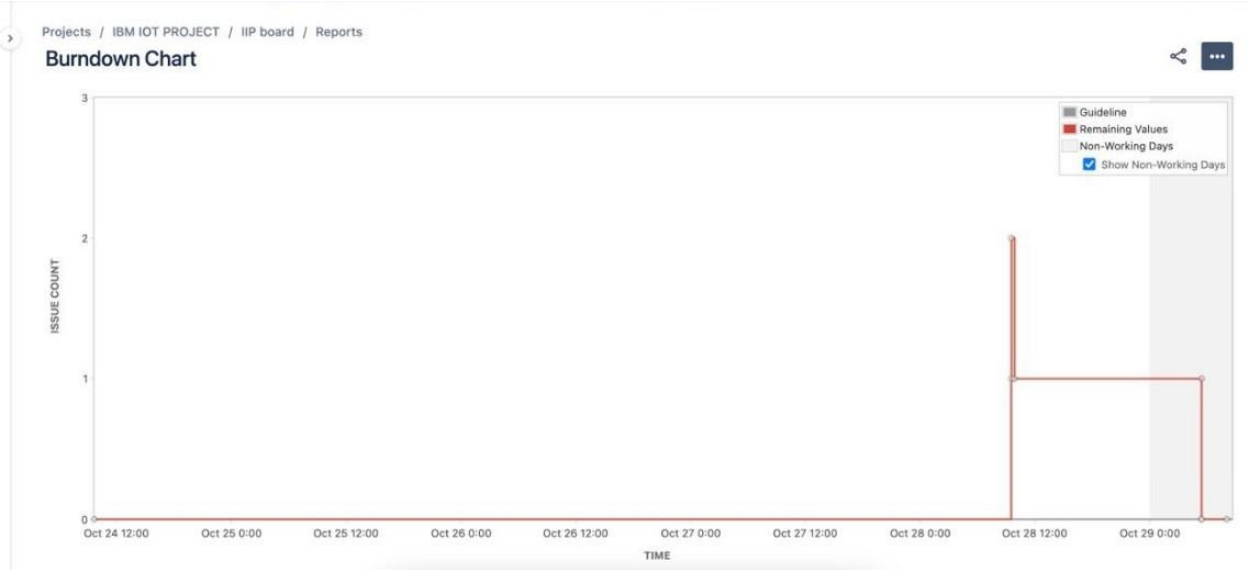
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Hariharan A Gohul R
Sprint-1	User Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Jeevanandam KT
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password	1	High	Hariharan A
Sprint-2	Sensor	USN-4	In industry, sensor sense the fire and smoke.	2	High	Hariharan A Joshva V
Sprint-2	Actuators	USN-5	If the sensor detected the fire, next step is extinguishing the fire with the help of Sprinkler.	2	High	Hariharan A Gohul R
Sprint-3	Cloud	USN-6	All the values are stored in the cloud database.	2	High	Gohul R Joshva V
Sprint-4	Siren	USN-7	If the fire is detected, employee should Evacuate by the intimation by Siren/Buzzer.	2	High	Jeevanandam KT
Sprint-4	Event management	USN-8	Notification message will be sent to the fire Department, proprietor.	2	High	Gohul R

6.2 Sprint Delivery Schedule

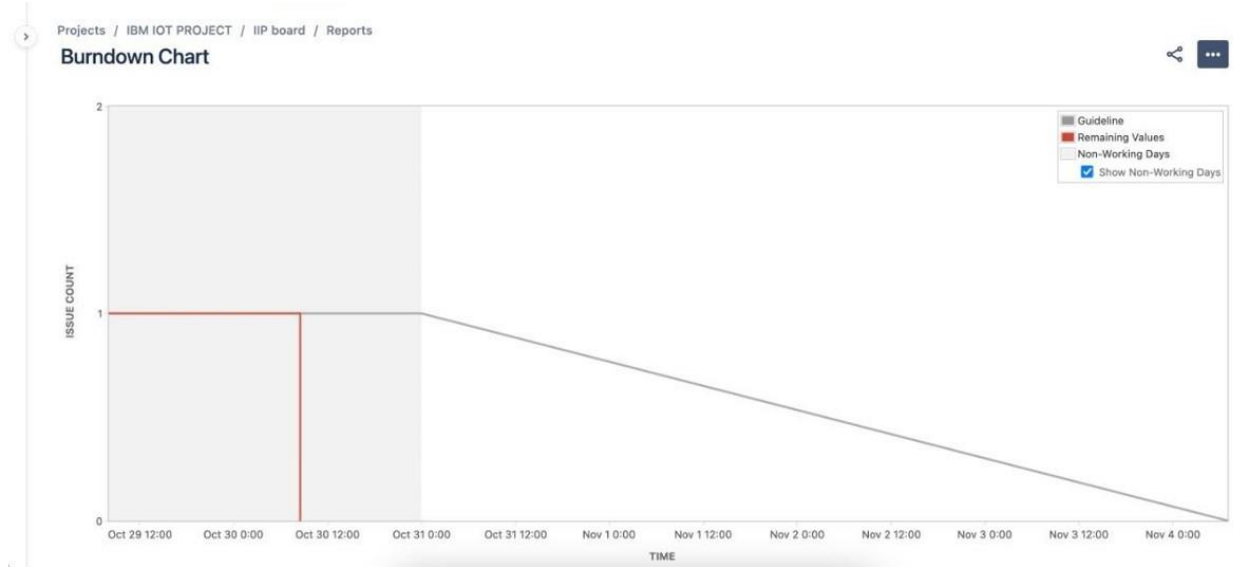
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	30	30 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	49	06 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	50	07 Nov 2022

6.3 Reports from JIRA

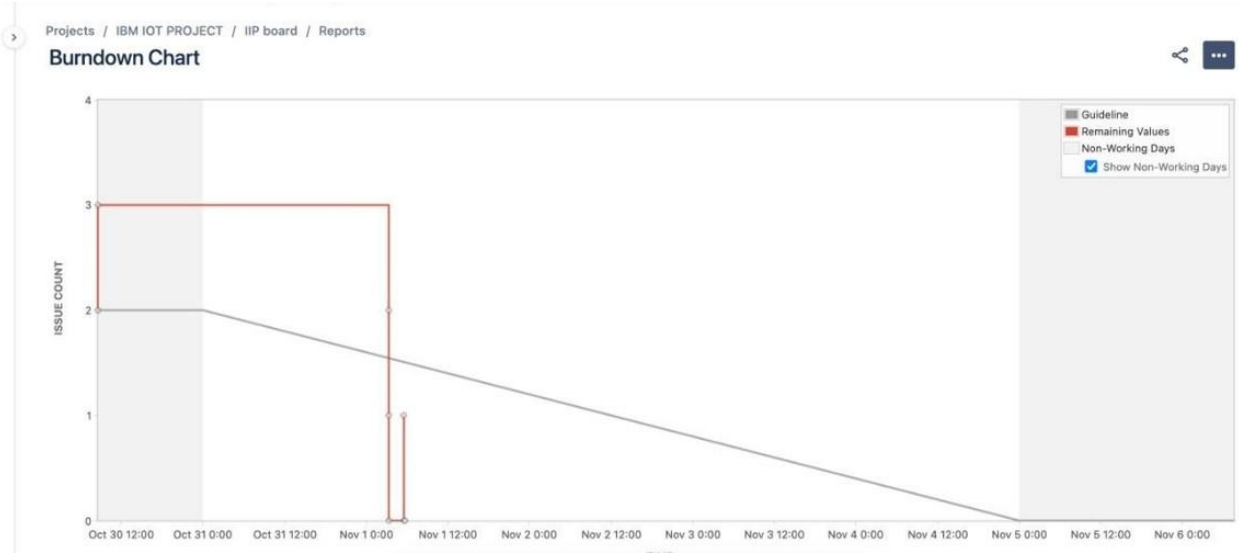
Sprint 1



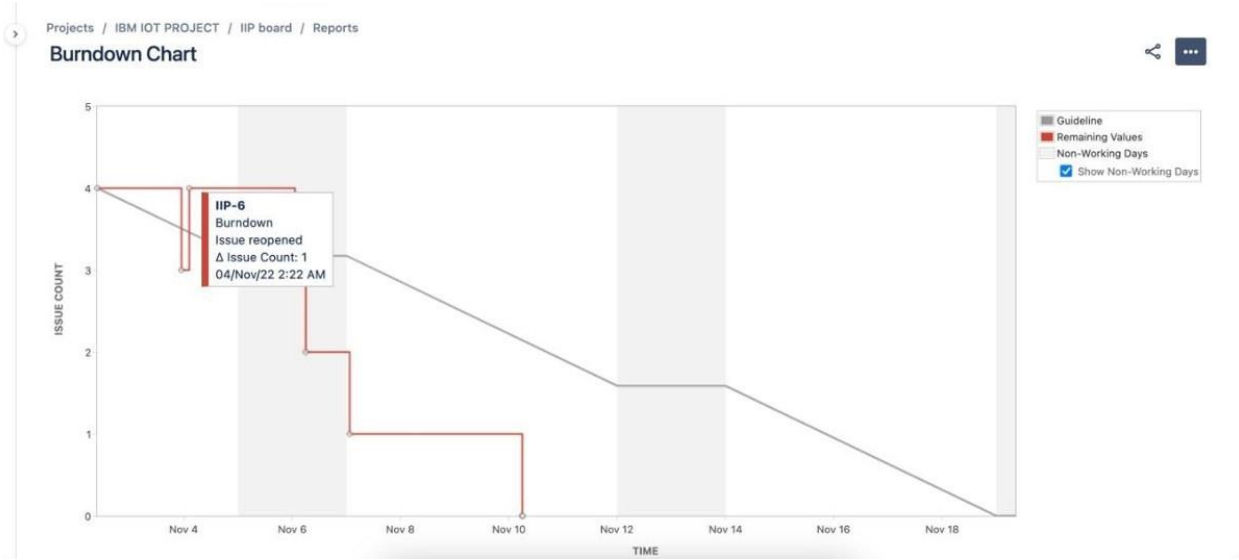
Sprint 2



Sprint 3



Sprint 4



7.CODING & SOLUTIONING

Feature 1: False Alarm Checking

```
if(temp < 45 ) {  if(flame > 650 ) {
accidentstatus = "Need
Auditing";  if(canfanoperate)
isfanon = true;  else isfanon =
false;  issprinkon = false;
}

else if(flame <= 10)
{

accidentstatus = "nothing
happened";  isfanon = false;
issprinkon = false;
} }
else if(temp >= 45 && temp <= 55 )
{
if(flame <=650 && flame >100      )
{ if(cansprinkoperate)
issprinkon = true; else
issprinkon = false;
accidentstatus = "moderate";
if(gas > 160 && canfanoperate )
{ isfanon =
true; } else{
isfanon = false;
} }
else if(flame <= 100 && flame > 10)
{

if(cansprinkoperate)
issprinkon = true;
else issprinkon =
false;  isfanon =
false;
 accidentstatus = "moderate";
} }
```

```
else if(temp > 55){ if(flame > 650){
gas = 500 + rand()%500;
accidentstatus = "severe";
if(cansprinkoperate) issprinkon =
true; else issprinkon = false;
if(canfanoperate) isfanon = true;
else isfanon = false; }
else if(flame < 650 && flame > 400 )
{  gas = 300 +
rand()%500;
accidentstatus =
"severe";
if(cansprinkoperate)
issprinkon = true; else
issprinkon = false;
if(canfanoperate)
isfanon = true; else
isfanon = false;
} }
else {
accidentstatus = "Need moderate Auditing";
isfanon = false;
issprinkon = false; }
if(issprinkon){ if(flow) {
sprinkstatus = "working";
} else
{
sprinkstatus = "not working";
}
}
else if(!issprinkon)
{  sprinkstatus =
"ready";
} else { sprinkstatus = "something's
wrong";
 }
```

Explanation

➤ This set of code checks the false alarms and sets the current status

➤ It also handles the permission management of whether a device will work or not

Feature 2

```
void PublishData(float temp, int gas ,int flame ,int flow,bool
isfanon,bool issprinkon)
{

mqttconnect();

String payload = "{\"temp\":";
payload += temp; payload +=
"," "\"gas\":";  payload +=
gas; payload += ","
"\"flame\":";  payload +=
flame;
payload += "," "\"flow\":";

payload += ((flow)?"true":"false");

payload += "," "\"isfanon\":";

payload += ((isfanon)?"true":"false");
payload += "," "\"issprinkon\":"; payload
+= ((issprinkon)?"true":"false");  payload
+= "," "\"cansentalert\":"; payload +=
((cansentalert)?"true":"false");  payload
+= "," "\"accidentstatus\":";  payload +=
"\""+accidentstatus+"\"";  payload += ","
"\"sprinkstatus\":"; payload +=
"\""+sprinkstatus+"\"";  payload += "}";

if (client.publish(publishTopic, (char*) payload.c_str()))
{  Serial.println("Publish ok");// if it sucessfully upload data on
the
}  else
{
Serial.println("Publish failed");
```

```
}
}
```

Explanation

➤ It sends the data to IBM Watson Platform

Feature 3

```
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)

{

Serial.print("callback invoked for topic: ");
Serial.println(subscribetopic); for (int i = 0;
i < payloadLength; i++)
{  data3 +=
(char)payload[i];
}

Serial.println("data: "+ data3);

const char *s =(char*) data3.c_str();
double pincode = 0;
if(mjson_get_number(s, strlen(s), "$.pin", &pincode)){
if(((int)pincode)==137153){ const char *buf; int len;




if (mjson_find(s, strlen(s), "$.command", &buf, &len))

{

String command(buf,len);  if(command=="\"cantfan\""){
canfanoperate = !canfanoperate;
```

```
}

else if(command=="\"cantsprink\""){ cansprinkoperate = !cansprinkoperate;
}else if(command=="\"sentalert\""){ resetcooldown();
}
}
}
 } data3="";
}
```

Explanation

- ➤ The user's action is received as a command and stored in a buffer
- ➤ The event in the device is performed in accordance with the command
- ➤ It searches for a secret encrypted pin to perform that event

8.TESTING

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
Sensor_OO1	Functional	Microcontroller	Sensor data is properly taken	The connections to the circuit	1.Open the simulator in wokwi.	Random values generated ,	Get the values and print it in the	Working as	Pass		N		Akshaya
Sensor_OO2	Functional	Microcontroller	Sensor data is parsed as json	The microcontroller should	1.Open the simulator in wokwi.	Random values generated ,	Get the values and print it in the	Working as	Pass		N		Karthick
Work_001	Functional	Microcontroller	To check for fake alarm	The sensor values are taken	1.Simulate the device(do a practical	Random values generated ,	Accident status is properly updated	Working as	Pass		N		Ajin
Work_002	Functional	Microcontroller and	The data should be sent to IBM	The device setup is completed	1.Start the simulation in wokwi.	Random values generated ,	The values are shown in recent	Working as	Pass		N		Akshaya
Work_OO3	Functional	Node-red	The data should be sent to	The necessary packages	1.Login to node red editor	values got from the iot	The debug area should show the	Working as	Pass		N		Yoonus
Work_OO4	Functional	Node-red	Verify that the json data is parsed	A configured node-red with	1.Login to node red editor	values got from the iot	the debug menu shows the output	Working as	Pass		N		Yoonus
Database_001	Storage	Cloudant	The received data is stored in database in a key value pair	The node red is connected with cloudant node	1.login to cloudant dashboard. 2.create new database. 3. connect the database with node red and then give the database name in required field	values got from the iot device	After sending the data the data is stored in cloudant	Working as expected	Pass		N		Karthick
SMS_001	API	sms API	The sms is sent when there is fire alert	The node red should be configured to send a post request	1.Simualte the fire in the simulator(if real hardware is used real fire is used). 2.or click the sent alert button in	"Fire alert at xyz industries Hurry" And the trigger inputs	sms receiving to the given phonenum	Working as expected	Pass		N		Ajin
Work_005	Functional	UI	Even at times of emergency sometimes manual control is required	the dashboard interaction elements is connected to the node-red	1. in the dashboard enter the correct pin 2.click the action to be done	The action by user	manual command system works only	Working as expected	Pass		N		yoonus
Auth_001	Functional	UI	Verify that the correct pin is entered	text filed is given in dashboard to enter pin	1.The correct pin is entered 2.then necessary action is required	1234	command is sent successfull	working as expected	Pass		N		Akshaya
Auth_002	Functional	UI	Verify that it handles when wrong pin is entered	text filed is given in dashboard to enter pin	1.The correct pin is entered 2.then necessary action is required	141324 63363 1 001 fds	Show a message that the entered pin is wrong	Working as expected	Pass		N		Karthick
SMS_002	Functional	Microcontroller	Verify that the message is not sent continuously when there is fire it sends a message then waits for 10 minutes even after that if the fire exists it sends again	the sms funtionality should be implemented	1.Simulate a fire accident scenario 2.or click the send alert button on the dashboard 3.wait for the message to be sent	the event is simulated or triggered	The service should not spam continuous messages to authorities as fire won't be down within fraction of seconds	Working as expected	Pass		N		Ajin

8.2UAT

Defect Analysis

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	0	2	1	12
External	0	0	1	0	1
Fixed	19	24	25	14	82
Not Reproduced	0	0	2	0	2
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	28	24	30	15	97

Test Case Analysis

Section	Total Cases	Not Tested	Fail	Pass
Client Application	4	0	0	4
Security	2	0	0	2
Exception Reporting	11	0	0	11
Final Report Output	5	0	0	5

9.RESULTS

9.1 Performance Metrics

CPU Usage:

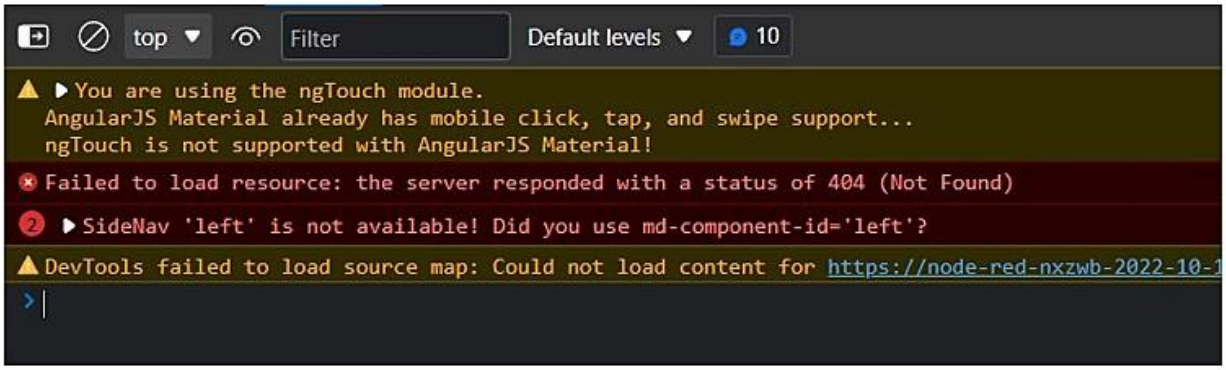
The micro version of C++ makes the most efficient use of the CPU. The program runs in O(1) time for each loop, ignoring the network and communication. To improve communication with MQTT, the program sleeps every 1 second. Because the program runs in O(1) time and the compiler optimizes it during compilation, there is less CPU load per cycle. The following instructions are stored on the stack memory and can be popped after execution.

Memory Usage:

The sensor values and networking data are saved in the ESP32's sram. It's a lot of information because the ESP32 only has 520 KB of memory. To save memory and ensure optimal program execution, the exact addresses for each memory cycle are overwritten with new values.

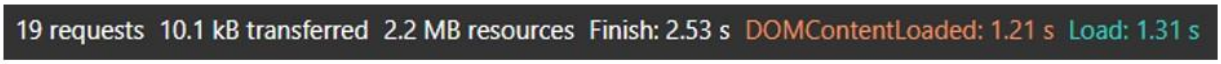
Error Rates:

The error rates are very low because the backend and dashboard are handled with node-red. Exceptions are handled properly so that the system's usability is not affected.

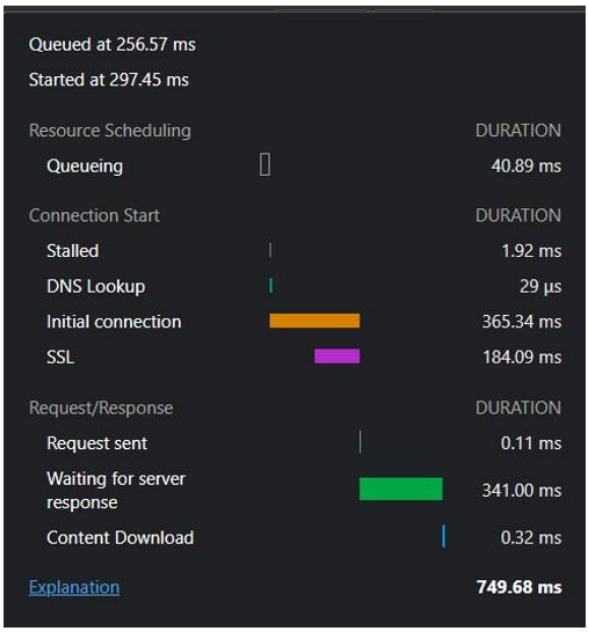


Latency and Respose Time:

The DOM handling of the received data is optimal and latency is low .After the DOM is loaded the entire site is loaded to the browser.



In addition, the server responds quickly. The average response time is acceptable.

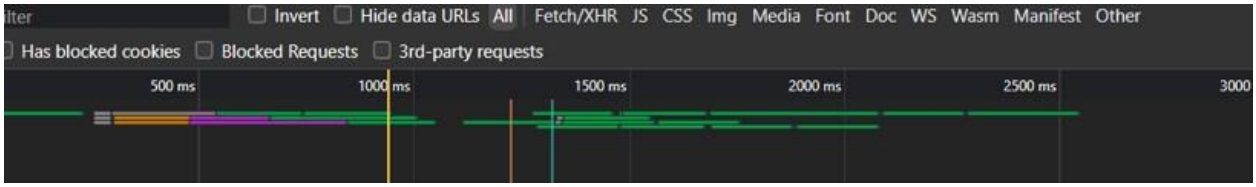


For the data sent from the IoT Device (considering the sleep of one second from the IoT), the response is much faster. We can see the delay caused by the sleep function.

The average time is well over optimal value

Average Time = (5ms + 2600ms)/2

= 1302.5



Garbage Collection:

The Node framework handles garbage collection on the server side. C++ does not have garbage collection features in IoT devices. However, in this case, it is not necessary because the memory will be used again to store the data. There is no allocation of any dangling pointers or poorly handled address space.

10.ADVANTAGES & DISADVANTAGES

Advantages:

- ➤ Active detection of gas leaks and fire outbreaks
- ➤ SMS alerting of administrators and fire authorities
- ➤ Turning on/off sprinklers and exhaust fans automatically
- ➤ To manually turn on/off sprinklers and exhaust fans, as well as send SMS alerts, authentication is required
- ➤ It detects false fire outbreaks automatically, reducing unnecessary panic
- ➤ We can confirm that the sprinkler system is functioning properly by using flow sensors

- ➤ A dashboard can display the status of any device
- ➤ The dashboard can be viewed by users via a web application
- ➤ The dashboard can be viewed by users via a web application

Disadvantages:

- ➤ Always require an internet connection [only to send the SMS alert]
- ➤ If the physical device fails, the entire operation fails
- ➤ Because a large amount of data is stored in the cloud database every second, a large database is required

11.CONCLUSION

So we conclude that, our problem premise is solved using IoT devices by developing a smart management system that solves many inherent problems in traditional fire management systems, such as actively monitoring for fire breakouts and gas leakage and sending SMS alerts to administrators and fire authorities.

12.FUTURE SCOPE

The existing devices can be modified to work in various specialized environments, as well as scaled to house use to large labs [Because fire accidents can cause significant loss of human lives in homes to large industries], as well as used in public places and vehicles.

13.APPENDIX

ESP32 - Microcontroller:

The ESP32 is a low-cost, low-power system-on-a-chip microcontroller family with integrated Wi-Fi and dual-mode Bluetooth.

- Memory: 320 KiB SRAM
- CPU: Tensilica Xtensa LX6 Microprocessor @ 160 or 240 MHz
- Power: 3.3 VDC
- Manufacturer: Espressif Systems
- Predecessor: ESP8266

Sensors:

DHT22 - Temperature & Humidity Sensor:

The DHT22 is a simple and inexpensive digital temperature and humidity sensor. It measures the surrounding air with a capacitive humidity sensor and a thermistor and outputs a digital signal on the data pin (no analog input pins needed).

Flow Sensors:

A flow sensor (also known as a "flow meter") is an electronic device that measures or controls the flow rate of liquids and gases through pipes and tubes.

MQ5 - Gas Sensor:

Gas sensors (also referred to as gas detectors) are electronic devices that detect and identify various types of gasses. They are frequently used to detect toxic or explosive gases as well as to measure gas concentration.

Flame Sensor:

A flame-sensor is a type of detector that is intended to detect and respond to the occurrence of a fire or flame. The response to flame detection can be affected by its fitting.

Source Code:

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHT.h"// Library for dht11
#include <cstdlib> #include
<time.h>
#include <mjson.h>
#define DHTPIN 15         // what pin we're connected to
#define DHTTYPE DHT22                    // define type of sensor DHT 11
DHT dht (DHTPIN, DHTTYPE);  // creating the instance by passing pin and typr of dht connected



void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);

//-------credentials of IBM Accounts------

#define ORG "fvs923"

#define DEVICE_TYPE "zenabc"
#define DEVICE_ID "221"
#define TOKEN "12345678"

String data3 = "";
```

```
String accidentstatus ="";
String sprinkstatus = "";
float temp =0; bool
isfanon = false;

 bool issprinkon = false; bool
cansprinkoperate = true;
bool canfanoperate = true;
bool cansentalert = false;  int
gas = 0; int flame = 0;  int
flow = 0;
long int cooldown= 600;

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/data/fmt/json"; char
subscribetopic[] = "iot-2/cmd/command/fmt/String";  char
authMethod[] = "use-token-auth"; char token[] = TOKEN;

char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;

//-------------------------------------------

WiFiClient wifiClient; // creating the instance for wificlient

PubSubClient client(server, 1883, callback ,wifiClient);    //calling the predefined client id by passing
parameter like server id,portand wificredential

void setup()// configureing the ESP32

{
```

```
Serial.begin(115200); dht.begin();
//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.

*/ delay(10);
Serial.println();  wificonnect();
mqttconnect();
}

void loop()

{

temp = dht.readTemperature();

//setting a random seed (only for random values not in real life scenarios)

srand(time(0));

//initial variable activities like declaring , assigning gas = rand()%400;

int flamereading = rand()%1024;

flame = map(flamereading,0,1024,0,1024);
int flow = ((rand()%100)>50?1:0);   //find the accident status 'cause fake alert may be caused by some
mischief activities
```

```
if(temp < 45 ){ if(flame > 650 ){ accidentstatus
= "Need Auditing";
 if(canfanoperate)
isfanon = true; else
isfanon = false;
issprinkon = false;
}

else if(flame <= 10){

accidentstatus = "nothing
happened";  isfanon = false;
issprinkon = false;

}



}else if(temp >= 45 && temp <= 55 )
{
 if(flame <=650 && flame >100 )
{

if(cansprinkoperate)

issprinkon = true; else issprinkon
= false;  accidentstatus =
"moderate";  if(gas > 160 &&
canfanoperate )
{ isfanon =
true;
```

```
}

else{

isfanon = false;

}

} else if(flame <= 100 && flame > 10)
{  if(cansprinkoperate)
issprinkon = true; else
issprinkon = false;
isfanon = false;
accidentstatus =
"moderate";
} } else if(temp >
55) {
 if(flame > 650) { gas =
500 + rand()%500;

accidentstatus =
"severe";
if(cansprinkoperate)
issprinkon = true; else
issprinkon = false;
if(canfanoperate) isfanon
= true; else isfanon =
false;

}

else if(flame < 650 && flame > 400 )
```

```
{

 gas = 300 + rand()%500;
accidentstatus =
"severe";
if(cansprinkoperate)
issprinkon = true; else
issprinkon = false;
if(canfanoperate) isfanon
= true;  else isfanon =
false;
}

}

else {

accidentstatus = "Need moderate Auditing";
 isfanon = false; issprinkon
= false;

}

if(issprinkon){ if(flow) {
sprinkstatus = "working";

}

else{

sprinkstatus = "not working";
```

```
}

}

else if(!issprinkon) {
sprinkstatus =
"ready";
}

else {

sprinkstatus = "something's wrong";
}

PublishData(temp,gas,flame,flow,isfanon,issprinkon);

//a cooldown period is set as the values and situations are random in real life sceanarios the time can be
reduced or neclected

if(accidentstatus=="severe" && cooldown >= 600)
{
 cooldown = 0;
sendalert();

PublishData(temp,gas,flame,flow,isfanon,issprinkon);
 cansentalert = false;
}

if(cooldown > 999999)
{

cooldown = 601;
```

```
}

delay(1000);

++cooldown;

if (!client.loop())
{  mqttconnect();
}

}
/*.....retrieving to
Cloud. */

void PublishData(float temp, int gas ,int flame ,int flow,bool isfanon,bool issprinkon) {

mqttconnect();   //function call for connecting to ibm

/*

creating the String in in form JSon to update the data to ibm cloud

*/

String payload = "{\"temp\":";  payload += temp; payload
+= "," "\"gas\":"; payload += gas; payload += ","
"\"flame\":";  payload += flame; payload += ","
"\"flow\":"; payload += ((flow)?"true":"false"); payload
+= "," "\"isfanon\":"; payload +=
((isfanon)?"true":"false");  payload += ","
"\"issprinkon\":"; payload +=
```

```
((issprinkon)?"true":"false");  payload += ","
"\"cansentalert\":"; payload +=
((cansentalert)?"true":"false");  payload += ","
"\"accidentstatus\":";  payload +=
"\""+accidentstatus+"\"";  payload += ","
"\"sprinkstatus\":"; payload += "\""+sprinkstatus+"\"";
payload += "}"; if (client.publish(publishTopic, (char*)
payload.c_str())) { Serial.println("Publish ok");     // if it
sucessfully upload data on the cloud then it will print
publish ok in Serial monitor or else it will print publish
failed

} else {

Serial.println("Publish failed");

}

}

void mqttconnect() {

if (!client.connected())
{
Serial.print("Reconnecting client to ");
Serial.println(server); while
(!!!client.connect(clientId, authMethod, token))
{
Serial.print("."); delay(500);

}
```

```
initManagedDevice();
Serial.println();
}

}

void wificonnect()     //function defination for wificonnect

{
Serial.println();  Serial.print("Connecting to
");  WiFi.begin("Wokwi-GUEST", "", 6);
while (WiFi.status() != WL_CONNECTED)
{  delay(100);

Serial.print(".");

}

Serial.println("");
 Serial.println("WiFi connected");
Serial.println("IP address: ");  Serial.println(WiFi.localIP());
}

void initManagedDevice() {

if (client.subscribe(subscribetopic))
{
Serial.println((subscribetopic));
Serial.println("subscribe to cmd OK");
} else {

Serial.println("subscribe to cmd FAILED");
```

```
}

}

//handles commands from user side

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)

{

Serial.print("callback invoked for topic: ");
Serial.println(subscribetopic); for (int i = 0;
i < payloadLength; i++)
{  data3 +=
(char)payload[i];
}

Serial.println("data: "+ data3);
const char *s =(char*) data3.c_str();
double pincode = 0;
if(mjson_get_number(s, strlen(s), "$.pin", &pincode))
{  if(((int)pincode)==137153)
{
const char *buf; int len; if (mjson_find(s, strlen(s), "$.command", &buf,
&len))    // And print it

{

String command(buf,len);
 if(command=="\"cantfan\""){
//this works when there is gas sensor reads high value and if there should be a
```

```
//manual trigger else it will be automate canfanoperate = !canfanoperate;
}

else if(command=="\"cantsprink\"")
{  cansprinkoperate =
!cansprinkoperate; }else
if(command=="\"sentalert\""){

//this works when there is accident status is severe and if there should be a

//manual trigger else it will be automate resetcooldown();
}

}

}

}

data3="";

}

void resetcooldown()
{
cooldown = 0;
}

//sent alert request to node-red void sendalert(){
cansentalert = true; cooldown = 0;
}
```

Github Link:https://github.com/IBM-EPBL/IBM-Project-8413-1658918524

Demo Video:https://drive.google.com/file/d/1WnSDQq28qHXvek7utk4oQ_mB1fOc3QbV/view?usp=drivesdk