PROJECT REPORT

PROJECT TITLE	INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM
TEAM ID	PNT2022TMID14369

1.INTRODUCTION

1.1 Project overview

The three main risks for the process industry are fire, explosion, and hazardous leakage, with fire being the most frequent one. The need for automatic intelligent fire alarm systems in residential and commercial buildings has increased due to an increase in fire incidences and property loss. An intelligent fire alarm system is made expressly to offer benefits including pinpointing the location of the fire, finding any wiring issues, and ensuring simpler maintenance. To detect any changes in the environment, this system has temperature, flame, and gas sensors. The exhaust fans are turned on based on the temperature readings and whether any gases are present. The sprinklers will be turned on automatically if any flame is found. The authorities and the Fire station are notified of emergency notifications. Additionally, these contemporary intelligent fire alarm systems are capable of recognising false alarms and are more sensitive than the traditional models.

1.2 Purpose

The main goal of a fire alarm system is to give people advance notice of a fire so they can escape and take swift action to minimise the effects of the fire as soon as possible.

2.LITERATURE SURVEY

2.1 Existing problem

Traditionally, fire monitoring systems have only used a single sensor, such as smoke or flame. These single sensor systems cannot distinguish between real and fake fire presence. Relying on a single sensor all day and running the risk of false alarms results in energy inefficiency and environmental harm. We require a system that is capable of accurately detecting fire as well as an intelligent solution. To improve the functionality of existing single sensor systems, the smart fire management system includes a temperature sensor, a flame sensor, and a gas sensor. This system also requires a good network with separate smart devices connected to various panels.

2.2 References

[1] N N Mahzan, N I M Enzai, N M Zin and K S S K M Noh, ”Design of an Arduino-based home fire alarm system with gSM module”, 1st International conference on green and Sustainable computing (ICoGeS), 2017.

[2] ZHANG Ying-Cong, YU Jing, “Study on the Fire IOT Development Strategy”, Shenyang Fire Research Institute --Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling, US: ANSI/FMRC, pp. FM3260-2004.

[3] Public Security, Shenyang 110034, China Shenyang Institute of Engineering, Shenyang 110136, China, 2019. Liu Yunhong Qi Meini,"The Design of Building Fire Monitoring System Based on ZigBee-WiFi Networks", Eighth International Conference on Measuring Technology and Mechatronics Automation, IEEE, 2016, pp-733-735

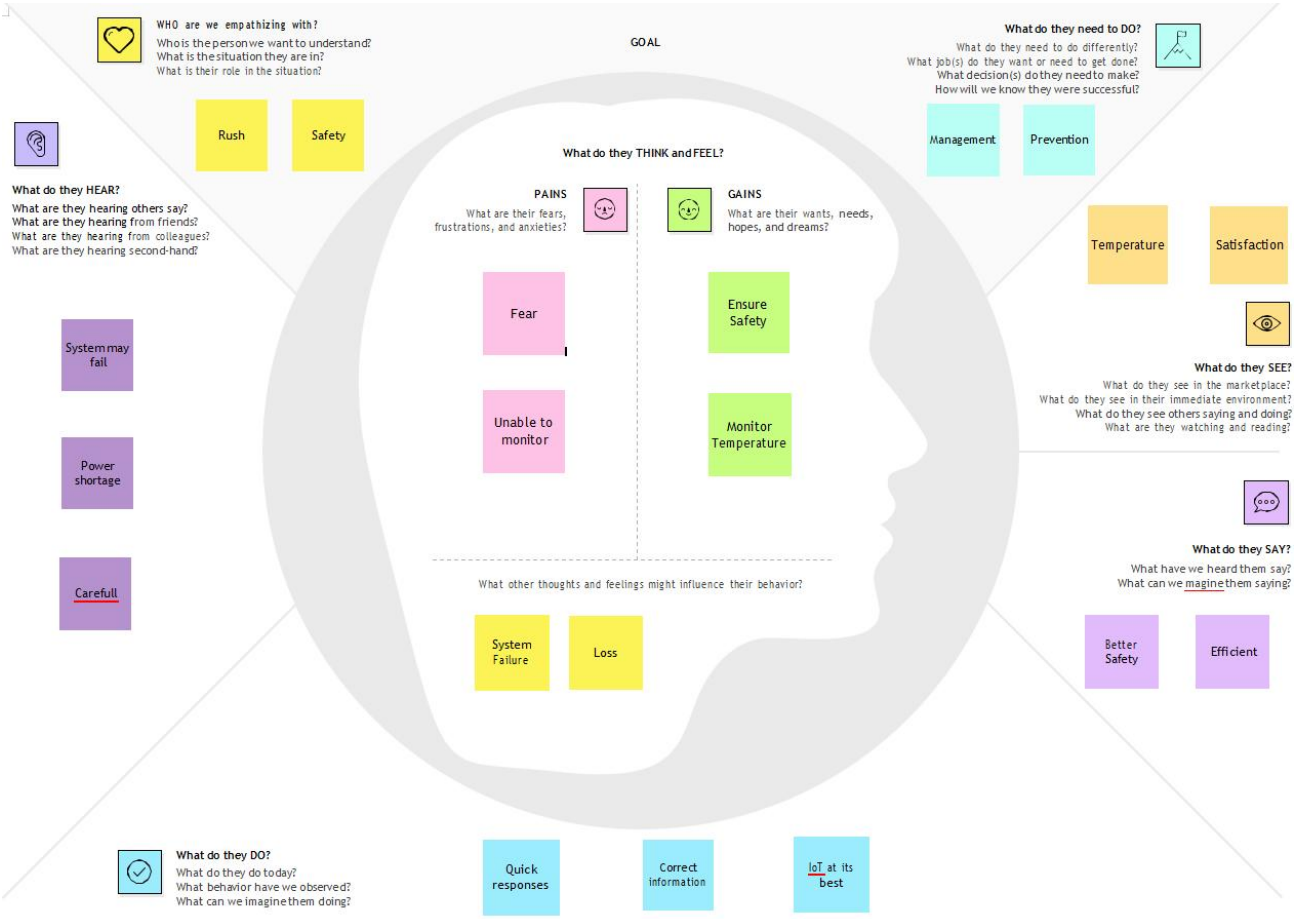
[4] R.A. Sowah, A.R. Ofoli, S.N. Krakani, S.Y. Fiawoo, hardware Design and Web-Based Communication Modules of a Real-Time multisensor Fire Detection and Notification System Using Fuzzy Logic, IEEE Transactions on Industry Applications, 53 (2016) 559-566.

2.3 Problem Statement Definition

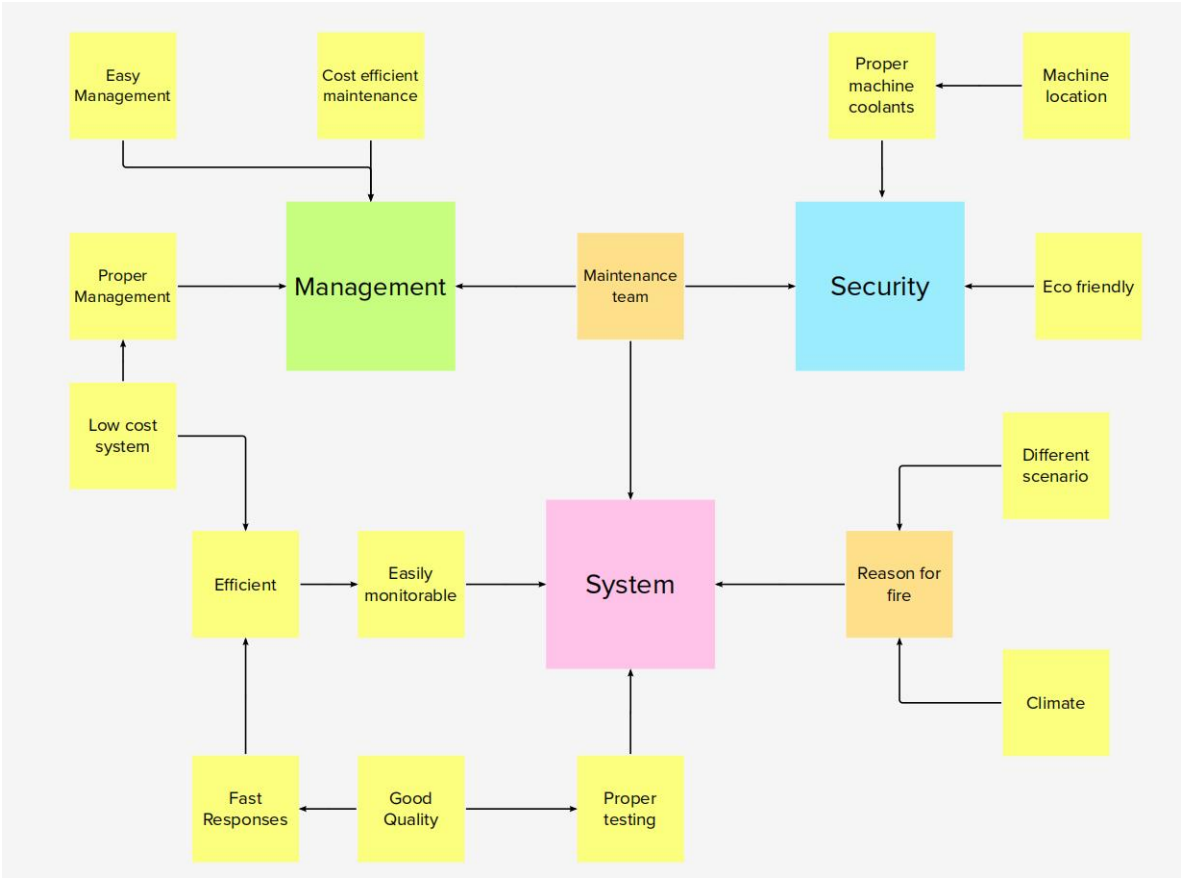
Industry-Specific Systems for managing fires intelligently are intended to prevent industrial fires caused by gas leaks and flame.

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



Rithik

Reason for fire

Easy Management

Low cost system

Eco friendly

Kumar

Proper Management

Good Quality

Fast Responses

Climate

Ritthik Raj

Efficient

Proper testing

Easily monitorable

Different scenario

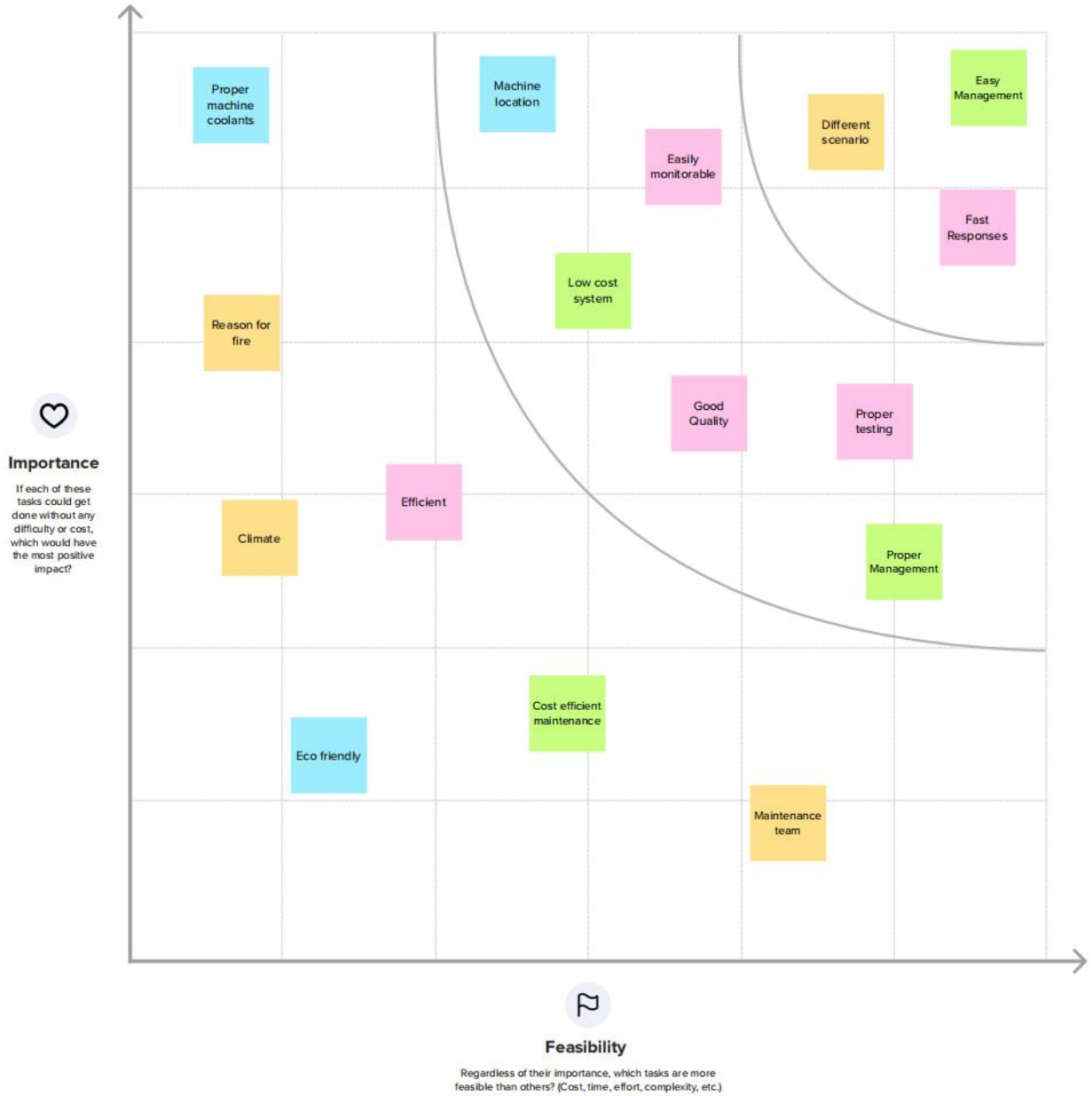
Rithika

Cost efficient maintenance

Proper machine coolants

Maintenance team

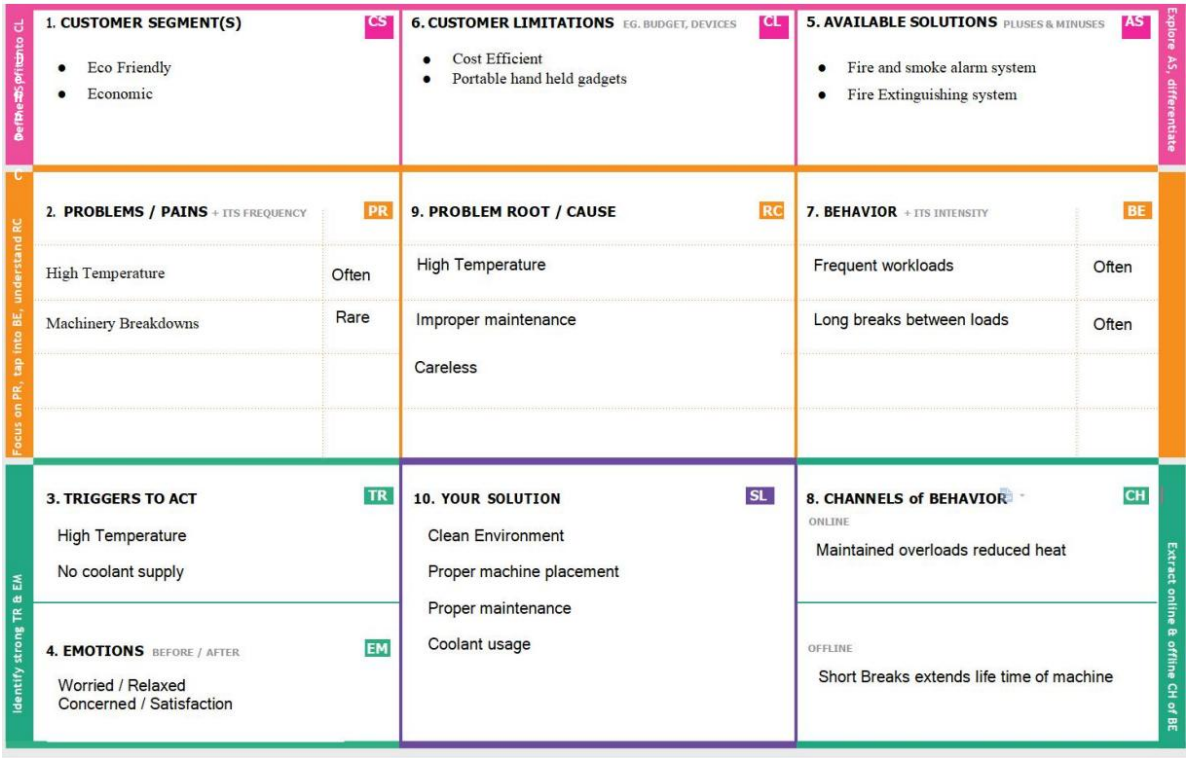
Machine location


Proper machine coolants
Machine location
Easy Management
Different scenario
Easily monitorable
Fast Responses
Low cost system
Reason for fire
Good Quality
Proper testing
Efficient
Climate
Proper Management
Cost efficient maintenance
Eco friendly
Maintenance team
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)	Many industries face fire related problems and accidents. To prevent these accidents and to manage temperature we need a fire management system.
2.	Idea / Solution description	The idea is to detect high temperature and smoke. And the temperature is reduced by maintaining room humidity and suppressing fire in-case of any accident
3.	Novelty / Uniqueness	Detects the fire even before it starts. Easy Management and efficient work flow.
4.	Social Impact / Customer Satisfaction	Fearless work hours for industry employees. Reduce the amount of destruction. To warn everyone if there is some caution.
5.	Business Model (Revenue Model)	The successful launch of the system will be great impact and leads to new revolution
6.	Scalability of the Solution	It helps in reducing destruction of machine, prevents loss of life, reduces expenditure, easy maintenance.

3.4 Problem Solution Fit



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

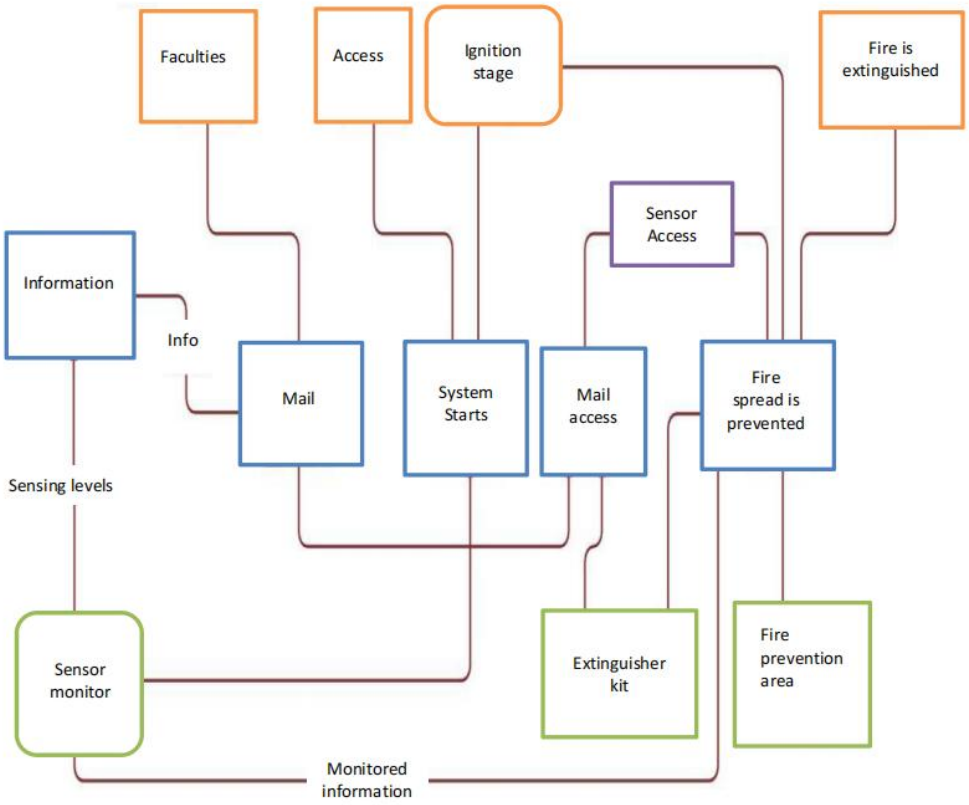
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through website or application Registration through Social medias Registration through LinkedIN
FR-2	User Confirmation	Verification via Email or OTP
FR-3	User Login	Login through website or App using the respective username and password
FR-4	User Access	Access the app requirements
FR-5	User Upload	User should be able to upload the data
FR-6	User Solution	Data report should be generated and delivered to user for every 24 hours
FR-7	User Data Sync	API interface to increase to invoice system

4.2 Non-Functional requirement

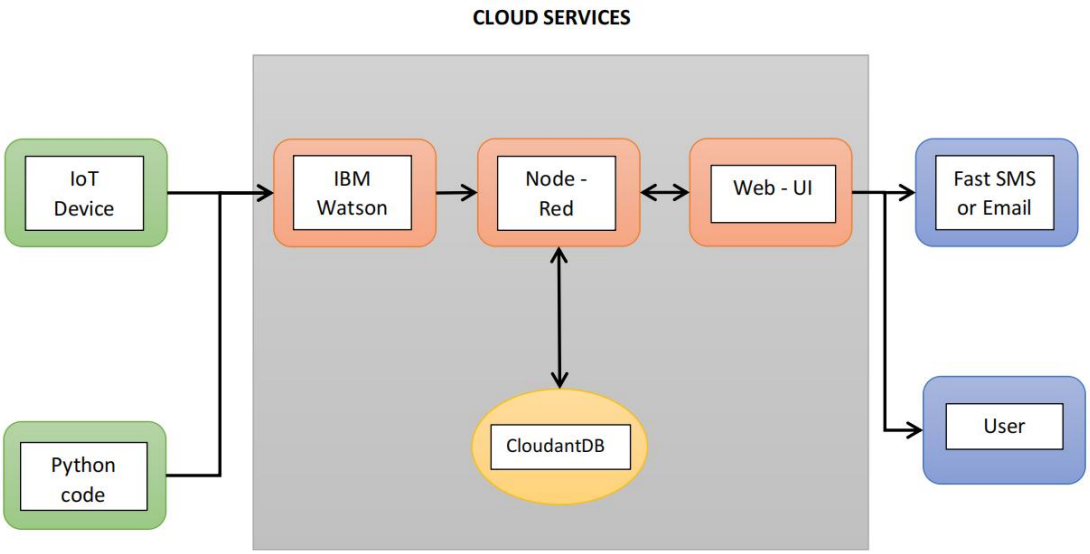
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Usability requirements includes language barriers and localization tasks. Usability can be assessed by Efficiency of use.
NFR-2	**Security**	Access permissions for the particular system information may only be changed by the system' s data administrator.
NFR-3	**Reliability**	The database update process must roll back all related updates when any update fails.
NFR-4	**Performance**	The front-page load time must be no more than 4 seconds for users that access the website using an VoLTE mobile connection.
NFR-5	**Availability**	New module deployment must not impact front page, product pages, and check out pages availability and mustn't take longer than one hour.
NFR-6	**Scalability**	We can increase scalability by adding memory, servers, or disk space. On the other hand, we can compress data, use optimizing algorithms.

5.PROJECT DESIGN

5.1 Data Flow Diagram



5.2 Solution Architecture



4.3 User Stories

User Type	Functional requirement	User story number	User story/task	Acceptance criteria	Priority	Release
Customer (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 and password	High	Sprint-1

6. PROJECT PLANNING &SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Resources Initialization	Create and initialize accounts in various public APIs like Open Weather Map API.	1	LOW	Rithik Rithik raj Rithika Kumar
Sprint-1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location.	1	MEDIUM	Rithik Rithik raj Rithika Kumar
Sprint-2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it can be accessed from anywhere	2	MEDIUM	Rithik Rithik raj Rithika Kumar
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the cloud functions and provide inputs to the same.	2	HIGH	Rithik Rithik raj Rithika Kumar
Sprint-4	UI/UX Optimization & Debugging	Optimize all the shortcomings and provide better user experience.	2	LOW	Rithik Rithik raj Rithika Kumar

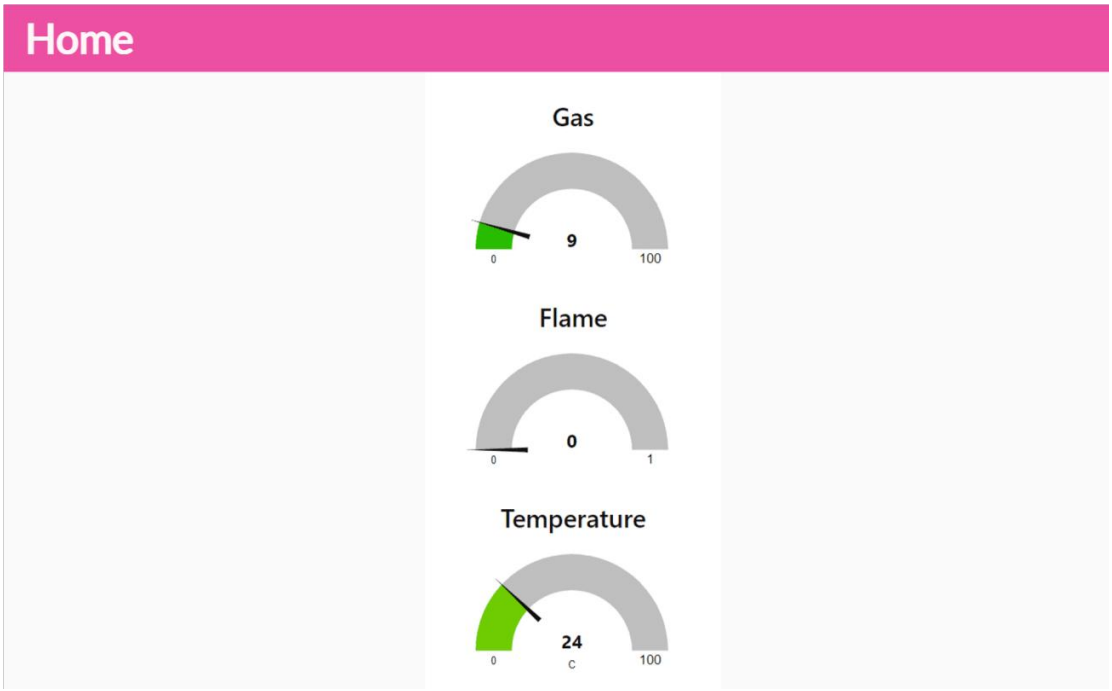
7. CODING & SOLUTION

7.1 Features

- IoT device
- IBM Watson Platform
- Node red
- Cloudant DB
- Web UI
- MIT App Inventor
- Python code
- Wokwi

8. TESTING AND RESULTS

8.1 Test Cases



9. ADVANTAGES

- Reduced installation cost.
- They monitor 24/7.
- Improved security in homes, industries and Offices.
- It pin points location of the fire.

10. DISADVANTAGES

- Heat detectors are not considered as life saving devices because they are sensitive only to heat.
- High battery or current consumption will need for these detectors.
- Control pannel may need to be replaced if it becomes damaged.

11. CONCLUSION

This gas leakage device has several industrial uses in addition to home security. In the past, industrial and residential fires and gas leaks have caused extensive damage and losses. If the right steps are not taken promptly, gas leaks and fire outbreaks can expand rapidly and cause considerably greater loss of life and property. So, in this case, we suggested a system that alerts us to gas and fire breakouts and identifies them so that the appropriate steps may be done to manage them.

12. FUTURE SCOPE

The function of smoke detectors and alarms is evolving from simple smoke detection to combination detectors and multicriteria detectors. The identification of more combustion byproducts, such as carbon monoxide, carbon dioxide, sulphur dioxide, and nitrogen dioxide, in addition to heat and particulate matter, will be possible in the future with multicriteria detection. Within the next ten years, video image detection (VID), which enables the isolation and detection of the picture of smoke or flame from within a room or place using analytics, will become more widely used. The VID system would also be capable of detecting the presence of a person inside the area and, through interaction with the notification appliances, would be able to give an evacuation route.

13. APPENDIX

13.1 Source Code

```
#include <WiFi.h>
#include <Wire.h>
#include <SPI.h>
#include "ThingSpeak.h"
#include <WiFiClient.h>


unsigned long myChannelNumber = 2;
const char * myWriteAPIKey = "25V40ZAPI6KIZFGY";
int LED_PIN = 32;
const int mq2 = 4;
int value = 0;
int flame_sensor_pin = 10;
lame_pin = HIGH;
char ssid[] = "NALAIYA";
char pass[]= "NALAIYATHIRAN";
WiFiClient client;
```

```
#define PIN_LM35 39
#define ADC_VREF_mV 3300.0
#define ADC_RESOLUTION 4096.0
#define RELAY_PIN 17
#define RELAY_PIN1 27


void setup(){
Serial.begin(115200);
pinMode(RELAY_PIN, OUTPUT);
pinMode(RELAY_PIN1, OUTPUT);
Serial.print("Connecting to ");
Serial.println(ssid);
WiFi.begin(ssid, pass);
int wifi_ctr = 0;
while (WiFi.status() != WL_CONNECTED){
delay(1000); Serial.print(".");
}
Serial.println("WiFi connected");
ThingSpeak.begin(client);
pinMode(LED_PIN, OUTPUT);
pinMode(mq2, INPUT);
pinMode ( flame_sensor_pin , INPUT );
pinMode(BUZZER_PIN, OUTPUT);
}


void temperature(){
int adcVal = analogRead(PIN_LM35);
float milliVolt = adcVal * (ADC_VREF_mV / ADC_RESOLUTION);
float tempC = milliVolt / 10;
Serial.print("Temperature: ");
Serial.print(tempC);
Serial.print("°C");
if(tempC > 60){
Serial.println("Alert");
digitalWrite(BUZZER_PIN, HIGH);
}
else{
digitalWrite(BUZZER_PIN, LOW);
}
int x = ThingSpeak.writeField(myChannelNumber,1, tempC, myWriteAPIKey);
}


void GasSensors(){
int gassensorAnalogmq2 = analogRead(mq2);
Serial.print("mq2 Gas Sensor: ");
Serial.print(gassensorAnalogmq2);
Serial.print("\t");
Serial.print("\t");
Serial.print("\t");
if (gassensorAnalogmq2 > 1500){
Serial.println("mq2Gas");
Serial.println("Alert");
digitalWrite(RELAY_PIN1, HIGH);
}
else{
Serial.println("No mq2Gas");
digitalWrite(RELAY_PIN1, LOW);
delay(100);
}
int a = ThingSpeak.writeField(myChannelNumber,4, gassensorAnalogmq2, myWriteAPIKey);
}
```

```
void flamesensor(){
flame_pin = digitalRead( flame_sensor_pin );
if (flame_pin == LOW ){
Serial.println ( " ALERT: FLAME IS DETECTED" );
digitalWrite (BUZZER_PIN,HIGH ) ;
}
else{
Serial.println ( " NO FLAME DETECTED " );
digitalWrite (BUZZER_PIN , LOW );
}
int value = digitalRead(flame_sensor_pin);
if (value ==LOW) {
Serial.print("FLAME");
digitalWrite(RELAY_PIN, HIGH);
} else {
Serial.print("NO FLAME");
digitalWrite(RELAY_PIN, LOW);
}
}



void loop() {
temperature();
GasSensors();
flamesensor();
}
```