

# **INDUSTRY SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM**

**A PROJECT REPORT**

*Submitted by*

<b>DINESH A</b>	<b>19BEC202</b>
<b>JONES ALWYN J</b>	<b>19BEC204</b>
<b>PRAGADESH N R</b>	<b>19BEC212</b>
<b>SHRI KRISHNAA M</b>	<b>19BEC216</b>

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**COIMBATORE-641049**

**ANNA UNIVERSITY: CHENNAI 600025**

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## **ABSTRACT**

The primary purpose of fire alarm system is to provide an early warning of fire so that people can be evacuated & immediate action can be taken to stop or eliminate of the fire effect as soon as possible. Alarm can be triggered by using detectors or by manual call point (Remotely). To alert/evacuate the occupant's siren are used. With the Intelligent Building of the rapid development of technology applications, commercial fire alarm market demand growth, the key is to use the bus system intelligent distributed computer system fire alarm system, although installation in the system much easier than in the past, but still cannot meet the modern needs, the installation costs of equipment costs about 33% ~ 70. The suggested technique in Fire alarm system used the addressable detectors units besides using the wireless connection between the detector in zones as a slave unit and the main control unit as the master unit. The system shall include a python code, alarm initiating sensor, notification appliances, and the accessory equipment necessary for a complete functioning fire alarm system. In the IOT based fire alarm, individual units are powered by IBM Watson, IBM Cloud and Node Red for the communication.

## **CHAPTER -1**

### **INTRODUCTION**

#### **1.1 INTRODUCTION TO IOT:**

At present, safety is still attracting the attention of world. And in the all kinds of disaster, the fire occurrence frequency of fire is high rate and damages more. With the rapid development of science and technology, late-model fire monitor and alarm systems are merged new semiconductor technique and artificial intelligent theory Although traditional fire detect and alarm system may be satisfied either fire detection in a certain extent, there are some defects, such as uncertainty sensitivity of fire detector, deficiency ability in self-diagnosis and self-elimination which fire detection system is adopted in structure. There is some scarcity in trans port and communication fire signal in real system is not satisfied with fire detection in modern time. Intelligent fire detects and alarm control system is of fire signal detected, transmitted, processed and controlled system. And smoke fog, temperature, and flame of fire detect and al arm system is proposed based on IOT. Fire is very dangerous situation and it's very much necessary to monitor and give warning before anything unwanted happens. In many developing countries, houses do not come fitted with fire alar m system This results in fire being attended and leading to lot of loss of property, human and so also in developing countries like India we do not have strict laws pertaining to installation of Fire Alarm system So there is an urgent need towards developing an automated fire monitoring and warning system.

#### **1.2 SCOPE:**

- The future scope is regarding to minimize the problem of Fire Accidents and for reducing overall cost of other commercial Fire sensor products.
- Also, in order find the amount of temperature and humidity is sensed by the sensor and control action to take automatically to turn off the fire generated

#### **1.3. Project Overview:**

The main aim of smart fire management system includes a Gas sensor, Flame sensor and temperature sensors to detect any changes in the environment. Based on the temperature readings and if any Gases are present the exhaust fans are powered ON. If any flame is detected the sprinklers will be switched on automatically. Emergency alerts are notified to the authorities and Fire station.

**1.4. 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.

## **CHAPTER -2**

### **LITERATURE SURVEY :**

#### **2.1 INTRODUCTION:**

Internet of Things (IoT) is a concept and a paradigm that considers pervasive presence in the environment of a variety of things that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things to create new applications/services and reach common goal. A world where the real, digital and the virtual are converging to create smart environments that make energy, transport, cities and many other areas more intelligent. The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service.

#### **2.2 Sensor Layer**

The lowest layer is made up of smart objects integrated with sensors. The main function of this layer is to obtain the various types of static/ dynamic information of the real world through various types of sensors and to share with Internet access. The miniaturization of hardware has enabled powerful sensors to be produced in much smaller forms which are integrated into objects in the physical world. There are various types of sensors for different purposes. The sensors have the capacity to take measurements such as temperature, air quality, distance, movement and electricity. In some cases, they may also have a degree of memory, enabling them to record a certain number of measurements. A sensor can measure the physical property and convert it into signal that can be understood by an instrument.

#### **2.3 Gateways and Networks:**

A large volume of data will be produced by these sensors and this requires a robust and high performance wired or wireless network infrastructure as a transport medium. The network helps to distinguish each object that is interconnected in the physical world. Current networks, often tied with very different protocols, have been used to support machine-to-machine (M2M) networks and their applications. With demand needed to serve a wider range of IOT services and applications such as high-speed transactional services, contextaware applications, etc. multiple networks with various technologies and access protocols are needed to work with each other in a heterogeneous configuration. These networks can be in the form of a private, public or hybrid models and are built to support the communication requirements for latency, bandwidth or security.

## 2.4 Management Service Layer:

It renders the processing of information possible through analytics, security controls, process modeling and management of devices. One of the important features of the management service layer is the business and process rule engines. IOT brings connection and interaction of objects and systems together providing information in the form of events or contextual data such as temperature of goods, amount of fuel, current location and traffic data. Some of 14 these events require filtering or routing to post-processing systems such as capturing of periodic sensory data, while others require response to the immediate situations such as reacting to emergencies on patient's health conditions. Data management is the ability to manage data information flow. With data management in the management service layer, information can be accessed, integrated and controlled.

## 2.5 Application Layer:

It is at the top of the stack is responsible for delivery of various applications to different users in IoT. It consists of protocols that focus on process-to-process communication across an IP network and provides a firm communication interface and end-user services.

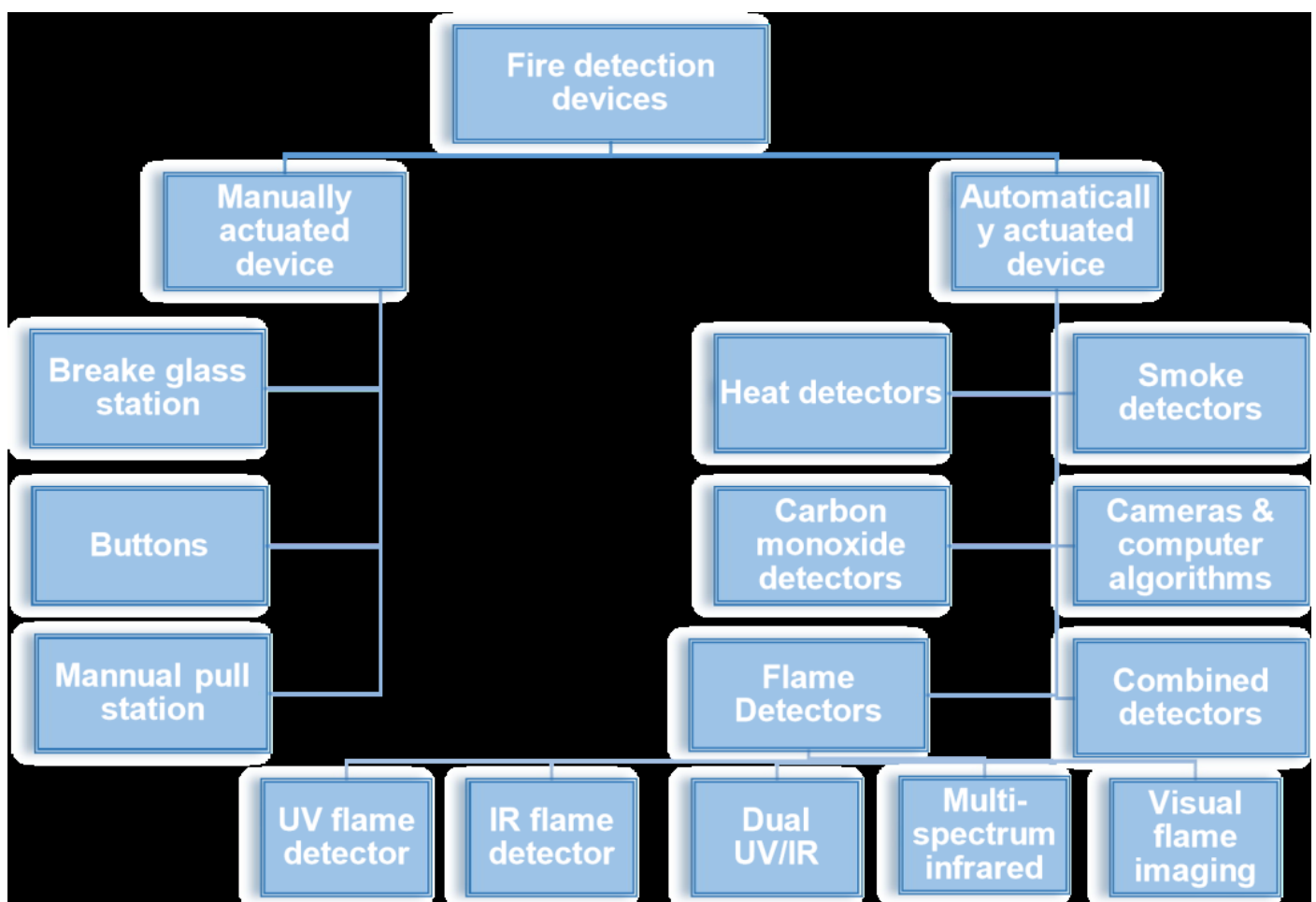


Fig. 2.2 Fire detection devices

process-to-process communication across an IP network and provides a firm communication interface and end-user services. Manually actuated devices are located near the exits and in many cases look like the red button on the wall. Somebody should push the button in a risk of a fire. But it will be late when somebody will push the button after he will see the flame[4]. Modern automatically actuated fire alarms are used to detect fire at the earliest possible stage. They were produced for working 24 hours per day without any human intervention. Fire detection sensors are divided into smoke sensors, flame sensors, heat sensors, carbon monoxide sensors and also cameras operated by computer algorithms. As a rule fire detection sensors trigger at a critical value. There are point fire detectors, linear and sampling fire detectors. Point fire detectors take sample in that place where they are installed. The linear one consists of elements which look like cameras. They are installed in front of each other on the opposite walls of the room and based on laser technologies. This type of detectors can operate in large spaces up to the 100 meters long. Sampling fire detectors are the kind of smoke detectors which can be located in the ventilation system or another place and it takes the samples of the air at specified predetermined intervals.

PAPER TITLE	AUTHOR	OBJECTIVE/OUTCOME
A Survey of Fire Safety Measures for Industry Safety Using IOT	N. Savitha; S. Malathi 2019	In the system the fire safety practices is going to implement for the fire crackers industry. In that the root cause for the fire is to be analyzed and prevent from the fire before it is triggered. Through this hazardous fire accidents can be avoided and many lives can be saved.
Design of Distributed Factory Fire Alarm Systems	Li Liu ;Yanke C I ; Haosong chen 2020	The Distributed plant fire alarm system can quickly detect the fire and issues an alarm to reduce the damage caused by the fire. The fire alarm system is a control system that integrates signal detection,transmission , processing and control .It mainly complete the basic function of Fire ,smoke and temperature module monitoring fire.
A Microcontrollerbased Fire Protection System for the Safety of Industries in Bangladesh	Md. Saiam Dept. of Electrical and Electronic Engineering, Khulna University of Engineering & Technology, Khulna, Bangladesh 2021	The affected area is also triggered by the fire extinguishing equipment. At the same time, it also notifies the manager and the nearby fire station via SMS. This paper presents a simulation and practical arrangement of the system to demonstrate how it can be implemented as a fire prevention equipment.
Safety Robot for Flammable Gas and Fire Detection using Multisensor Technology	Sandeep Prabhakaran; Mathan N	In case of fire accidents, the robot alerts the workstation and sends a mail to the firefighting department with the location read from the GPS module. As the robot works as an autonomous system, it does not need to be controlled remotely. Hence this robot is based on the line following mechanism, it is quite easy to install and can cover a large area efficiently.

Computer Vision Based Industrial and Forest Fire Detection Using Support Vector Machine (SVM)	Md. Abdur Rahman; Sayed Tanimun Hasan; Mohammed Abdul Kader 2022	The real-life situations and from the internet. This SVM pipeline model shows the maximum accuracy is 93.33%. The system can fulfill the precision and detect faster realtime fire detection. It's forest and industrial application will aid in the early detection of fires, as well as emergency management, and so immensely contribute to loss prevention.
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## 2.7 Existing Problem:

It was found that the value of absorption coefficient along the flame axis depended on the fuel flow velocity, and a sharp decrease emerged at 5 mm/s. Based on [81], Bouhafid [82,83] employed laboratory-scale oil pool fire, further investigated the absorption coefficient profile in the flames. The flame radiation fraction is an important parameter quantifying its radiation loss and impact on the surroundings.

## 2.8 References:

- 1 <https://www.researchgate.net>
- 2 <https://www.wikipedia.org>
- 3 <https://www.rapidonline.com>
- 4 <https://www.schematics.com>
- 5 <https://www.batteryuniversity.com>

## 2.9 Problem statement definition :

A problem statement is a concise description of the problem or issues a project seeks to address. The problem statement identifies the current state, the desired future state and any gaps between the two. A problem statement is an important communication tool that can help ensure everyone working on a project knows what the problem they need to address is and why the project is important.

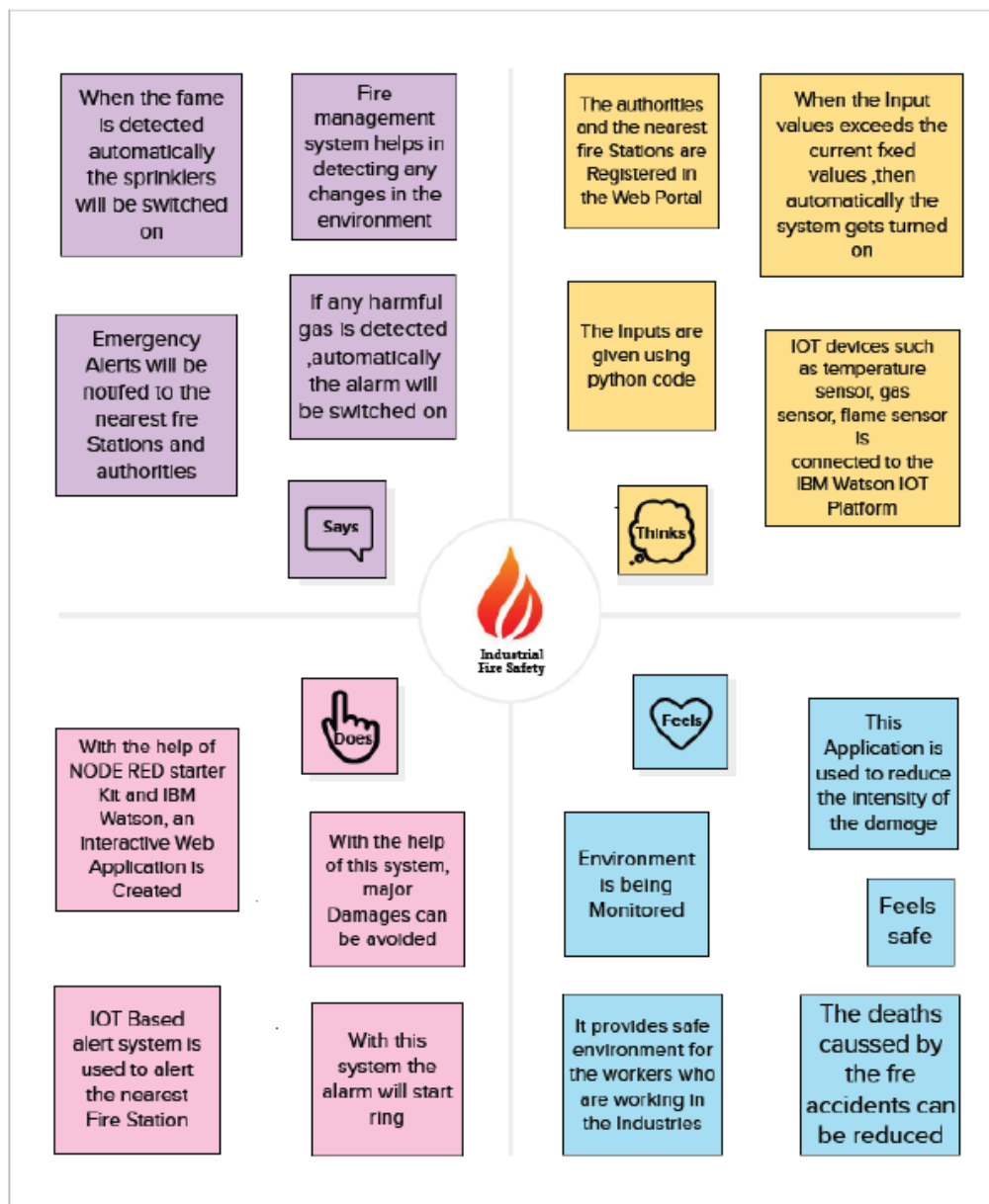


## CHAPTER – 3

### IDEATION & PROPOSED SOLUTION

Ideation is the creative process of generating new ideas, which can be accomplished through a variety of ideation techniques, such as brainstorming and prototyping. If done right, ideation is what helps founders and executives determine the right problem to solve and how to solve it. proposed solution should relate the current situation to a desired result and describe the benefits that will accrue when the desired result is achieved. So, begin your proposed solution by briefly describing this desired result.

#### 3.1 Empathy Map Canvas:



**Fig. 3.1 Empathy Map Canvas**

### 3.2 Proposed Solution

S.No.	Parameter	Description
1	Problem Statement (Problem to be solved)	Industry Specific Fire Management System
2	Idea / Solution description	This Project helps the industries in monitoring the leakage of fire in several locations , the sensors like flame/temperature sensors will be integrated to monitor the fire leakage.
3	Novelty / Uniqueness	Fire Explotion /fire leakage location send to the management.
4	Social Impact / Customer Satisfaction	The industrial admin /management can prevent before the accident through the fire leakage monitoring System.
5	Business Model (Revenue Model)	Efficiency of cost High security
6	Scalability of the Solution	High Scalability

Table 3.1 Proposed Solution

### 3.3 Ideation & Brainstorming:

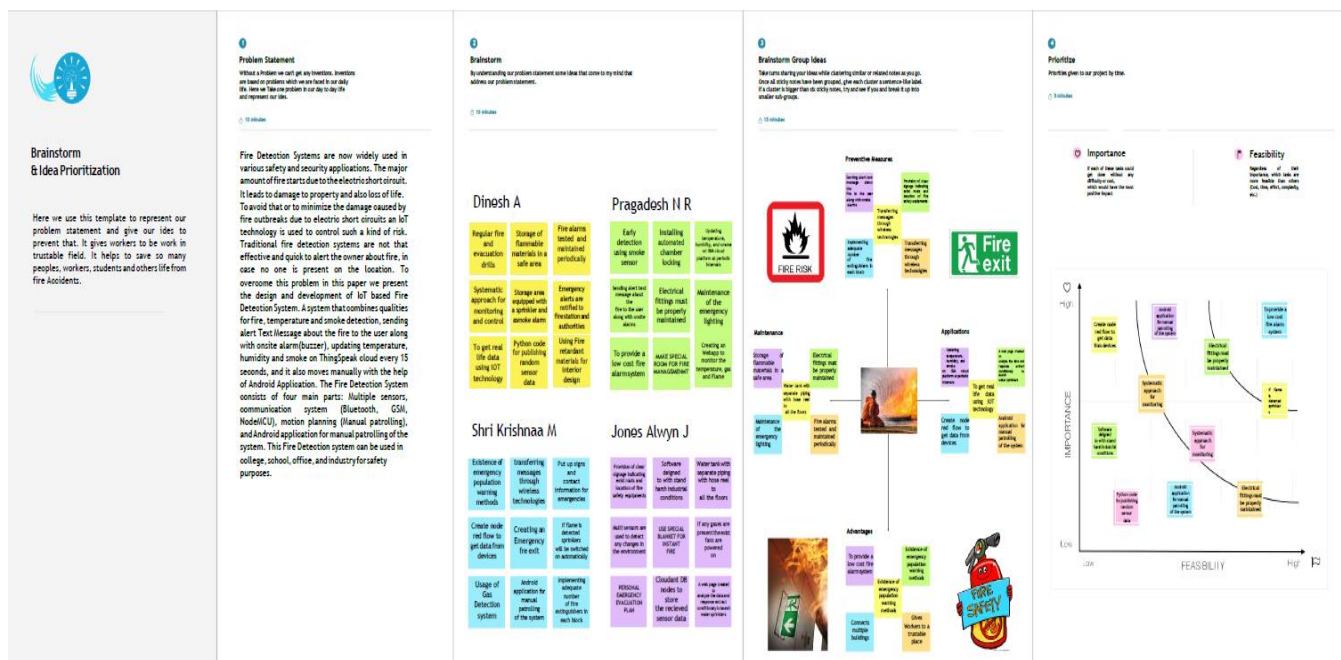


Fig. 3.2 Ideation & Brainstorming

### 3.4 Problem Solution fit:

Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> <b>CS</b>  Economic Value of Customer	<b>6. CUSTOMER CONSTRAINTS</b> <b>CC</b>  The Priority, Frequency and Minimum Space Between, visit.	<b>5. AVAILABLE SOLUTIONS</b> <b>AS</b>  <ul style="list-style-type: none"><li>➤ Fire Alarms Systems</li><li>➤ Fire Suppression Systems</li><li>➤ Fire Extinguishers.</li></ul>	Explore AS, differentiate
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> <b>J&amp;P</b>  <ul style="list-style-type: none"><li>➤ Harmful Fire Detection</li><li>➤ Burns</li><li>➤ Destruction of Industries</li><li>➤ Decode station</li></ul>	<b>9. PROBLEM ROOT CAUSE</b> <b>RC</b>  <ul style="list-style-type: none"><li>➤ Heat</li><li>➤ Fuel</li><li>➤ Oxygen</li></ul>	<b>7. BEHAVIOUR</b> <b>BE</b>  <ul style="list-style-type: none"><li>➤ Fire Stations</li><li>➤ Intimate management</li><li>➤ Emergency vehicles</li><li>➤ Road Network Components</li></ul>	
Identify strong TR & EM	<b>3. TRIGGERS</b> <b>TR</b>  <ul style="list-style-type: none"><li>➤ Efficient</li><li>➤ Candles</li><li>➤ Lightning.</li></ul>	<b>10. YOUR SOLUTION</b> <b>SL</b>  <ul style="list-style-type: none"><li>➤ Proper Disposal</li><li>➤ Regular Maintenance</li><li>➤ Clean Environment</li></ul>	<b>8. CHANNELS OF BEHAVIOUR</b> <b>CH</b>  <b>8.1 ONLINE</b> Intimate the management of Fire Station and Emergency number  <b>8.2 OFFLINE</b> Remove the Fire Burn Things	Identify strong TR & EM
	<b>4. EMOTIONS: BEFORE / AFTER</b> <b>EM</b>  <u>BEFORE:</u> Detection of Fires.  <u>AFTER:</u> To secure the Objects or Things .			

**Table 3.2 Problem Solution Fit**

## CHAPTER – 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

**Table 4.1 Functional requirements**

#### 4.2 Non-Functional requirement:

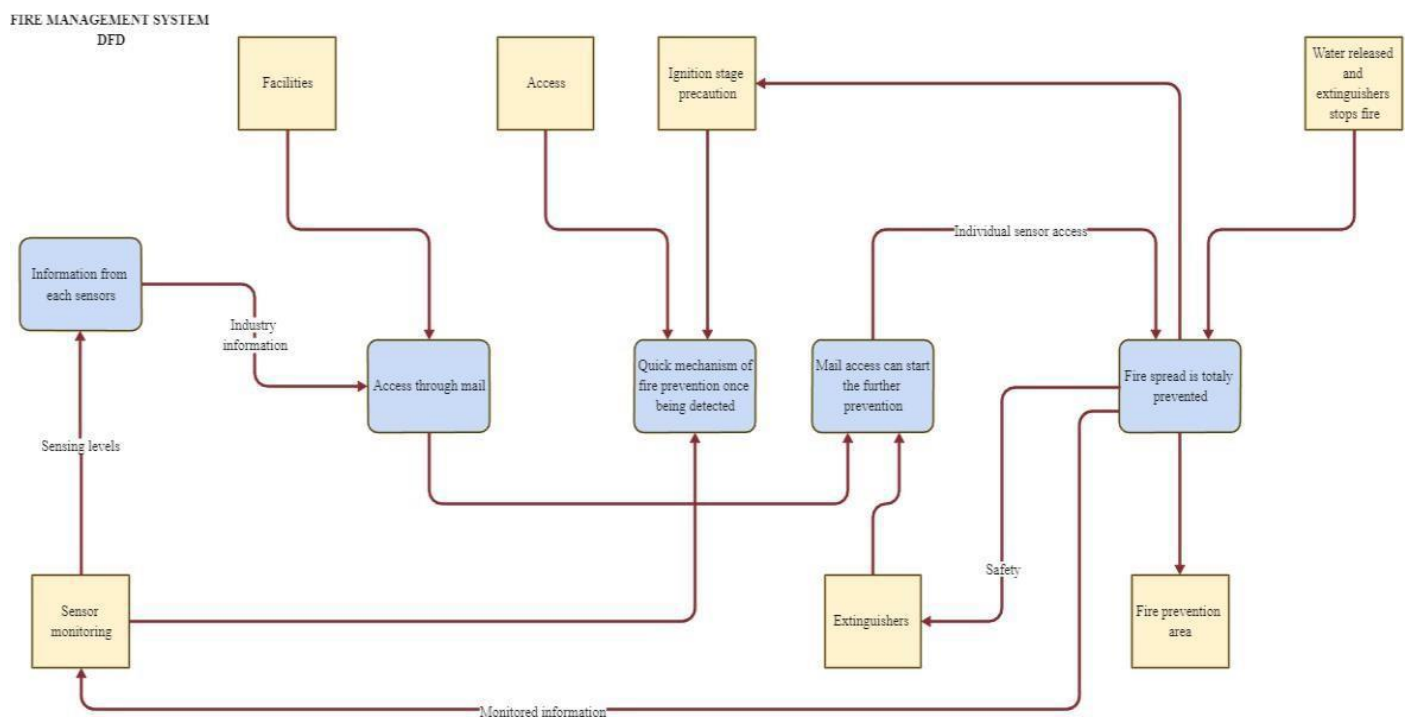
FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	Usability requirements includes language barriers and localization tasks. Usability can be assessed by Efficiency of use.
NFR-2	<b>Security</b>	Access permissions for the particular system information may only be changed by the system's data administrator.
NFR-3	<b>Reliability</b>	The database update process must roll back all related updates when any update fails.
NFR-4	<b>Performance</b>	The front-page load time must be no more than 2 seconds for users that access the website using an VoLTE mobile connection.
NFR-5	<b>Availability</b>	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	<b>Scalability</b>	We can increase scalability by adding memory, servers, or disk space. On the other hand, we can compress data, use optimizing algorithms.

**Table 4.2 Non-Functional requirements**

## PROJECT DESIGN

Processes are something that are often overlooked in our industry, but are absolutely essential for a number of reasons. They help you create a repeatable template for a winning formula. They help your team understand how to move through a project in the correct way.

### 5.1 Data Flow Diagram:



### Fig. 5.1 Data Flow Diagram

## 5.2 Solution & Technical Architecture:

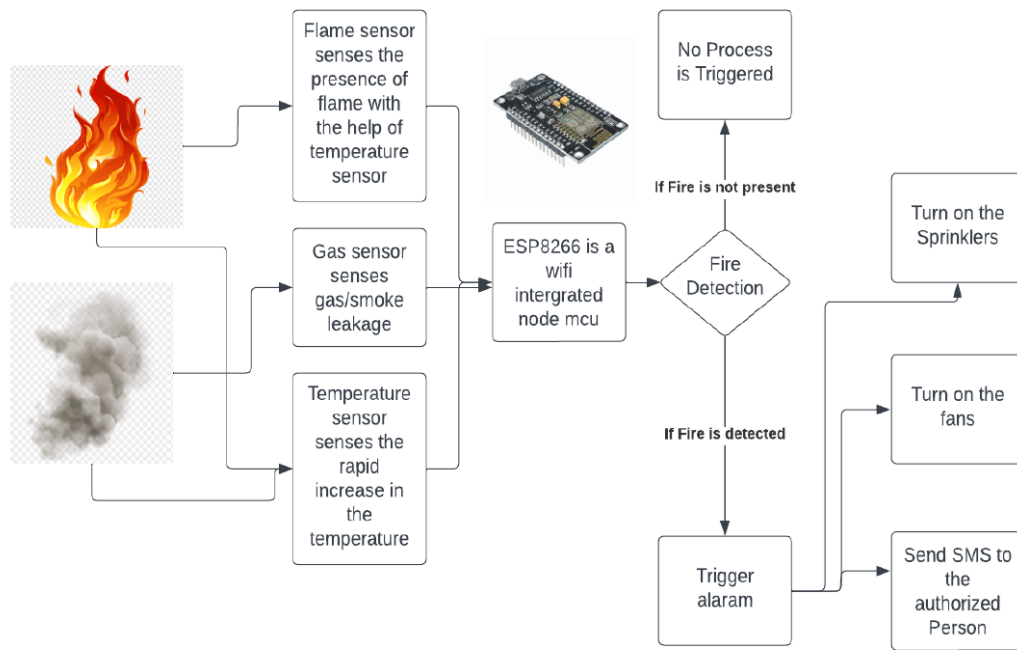


Fig. 5.2 Solution & Technical Architecture.

## 5.3 Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application Web UI and Mobile App	NodeRed
2.	Application Logic-1	Logic for a process in the IoT Device to sense	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson Assistant
4.	Cloud Database	Database Service on Cloud	IBM Cloudant DB
5.	External API-1	Purpose of External API used in the application	IBM Weather API
6.	Infrastructure (Server / Cloud)	Application Deployment on Cloud Server Configuration	Cloud Foundry.

Table 5.1 Components & Technology

#### 5.4 Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Python
2.	Security Implementations	List all the security / access controls implemented,use of firewalls etc.	Use API Gateway and Internet Gateway as firewall Protection
3.	Scalable Architecture	Every Cloud Services are hosted separately andmake is scalable separately	Public and Private Gateway
4.	Availability	Application is hosted on two regions for availability	London and Frankfurt Region Data Centres are used
5.	Performance	Used Content Delivery Network and API gatewayto scale millions of users and IoT Devices as well	IBM CDN and IBM API Gateway are used

**Table 5.2 Application Characteristics**



## 5.5 User Stories:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 1	Objective	USN-1	As a system, the fire sensor should detect the fire	8	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 1	Features	USN-2	As a system, the fire sensor value should be displayed in a LCD screen	2	Low	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 1	Features	USN-3	As a system, as soon as the detected fire reaches the threshold level, the red color LED should be turned ON	5	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 1	Features	USN-4	As a system, as soon as the detected fire reaches the threshold level, the siren should be turned ON	5	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 2	Features	USN-5	As a system, the fire alarm should detect automatically when the fire accident is held	5	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 2	Features	USN-6	As a system, it will indicate the fire accident in the LCD screen	5	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 2	Data transfer	USN-7	As a program, it should retrieve the API key of the IBM cloud to send the details of the system	5	Low	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 2	Data transfer	USN -8	As a cloud system, it should send the data of the sensor values to the IBM cloud	5	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 3	Data transfer	USN-9	As a cloud system, the IBM cloud should send the data to Node-red	5	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 3	Data transfer	USN-10	As a cloud system, the Node Red should Process the data from IBM cloud	4	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 3	Data Transfer	USN-11	As a cloud system, the IBM Node Red should send the data to the dashboard	3	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 3	Dashboard	USN-12	As a user, I can access the dashboard and make use of available resources	4	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 3	Focus	USN-13	As a system, the dashboard must display the sensor data real-time in a webpage	4	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 4	Data transfer	USN-14	As a cloud system, the Node Red must send data to MIT app through API key	3	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 4	Data transfer	USN-15	As an application, the MIT app should receive the data from Node-Red in the backend and do necessary processes.	5	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 4	Focus	USN-16	As an application, it should display the details of the temperature level and other detail to the user through the frontend of the MIT app.	8	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 4	Focus	USN-17	As an application, it should display the notification when the fire is detected in the smoke sensor, to the user through the notification	4	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M



## CHAPTER – 6

### PROJECT PLANNING & SCHEDULING

The definition of a sprint is a dedicated period of time in which a set amount of work will be completed on a project. It's part of the agile methodology, and an Agile project will be broken down into a number of sprints, each sprint taking the project closer to completion.

#### 6.1 Project Planning Phase:

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.

#### 6.2 Product Backlog, Sprint Schedule, and Estimation (USN 1-5):

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 1	Objective	USN-1	As a system, the fire sensor should detect the fire	8	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 1	Features	USN-2	As a system, the fire sensor value should be displayed in a LCD screen	2	Low	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 1	Features	USN-3	As a system, as soon as the detected fire reaches the threshold level, the red color LED should be turned ON	5	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 1	Features	USN-4	As a system, as soon as the detected fire reaches the threshold level, the siren should be turned ON	5	High	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 2	Features	USN-5	As a system, the fire alarm should detect automatically when the fire accident is held	5	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M

**Table 6.1 Product Backlog, Sprint Schedule, and Estimation (USN 1-5)**

### 6.3 Product Backlog, Sprint Schedule, and Estimation (USN 6-11):

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 2	Features	USN-6	As a system, it will indicate the fire accident in the LCD screen	5	Medium	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
Sprint 2	Data transfer	USN-7	As a program, it should retrieve the API key of the IBM cloud to send the details of the system	5	Low	Dinesh A Jones Alwyn J Pragadesh N R Shri Krishnaa M
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**Table 6.2 Product Backlog, Sprint Schedule, and Estimation (USN 6-11)**

### 6.4 Sprint Delivery Schedule:

#### Project Tracker, Velocity & Burndown Chart:

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	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

**Table 6.3 Project Tracker, Velocity & Burndown Chart**

## CHAPTER – 7

### CODING & SOLUTIONING

#### 7.1 Feature 1 (coding and result):

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQTT
#include "DHT.h"// Library for dht11
#define DHTPIN 15      // what pin we're connected to
#define DHTTYPE DHT22  // define type of sensor DHT 11
#define LED 2
#define BUZZER 4
#define EXFAN1 13
#define EXFAN2 14
#define SPRKLR 12

#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C LCD = LiquidCrystal_I2C(0x27, 20, 4);

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 "pol6f4"//IBM ORGANITION ID
#define DEVICE_TYPE "ESP-32IoT"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "100100C40A24"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "EnuF+Tgx40@Y!wJWsQ" //Token
String data3;
float h, t, s,f,fan1=0,fan2=0,spr=0;

//----- Customise the above values -----
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform
and format in which data to be send
char subscribetopic[] = "iot-2/cmd/command/fmt/String";// cmd REPRESENT command type AND
COMMAND IS TEST OF FORMAT STRING
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client 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();
  pinMode(LED,OUTPUT);
  pinMode(BUZZER,OUTPUT);
  pinMode(EXFAN1,OUTPUT);
  pinMode(EXFAN2,OUTPUT);
  digitalWrite(LED,LOW);
  digitalWrite(BUZZER,LOW);
  digitalWrite(EXFAN1,LOW);
  digitalWrite(EXFAN2,LOW);
  pinMode(SPRKLR,OUTPUT);
  digitalWrite(SPRKLR,LOW);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
  LCD.init();
  LCD.backlight();
  LCD.setCursor(0, 0);
  LCD.print("Connecting to ");
  LCD.setCursor(0, 1);
  LCD.print("WiFi ");
  delay(1000);
  LCD.clear();
}
```

```
void loop()// Recursive Function
```

```
{
  LCD.setCursor(0,2);
  LCD.print("Smoke: ");
  LCD.setCursor(0, 0);
  LCD.print("Temp: ");
  LCD.setCursor(14, 0);
  LCD.print("C");
  LCD.setCursor(0, 1);
  LCD.print("Humid: ");
  LCD.setCursor(14, 1);
  LCD.print("%");
  h = dht.readHumidity();
  t = dht.readTemperature();
  s = random(0,900);
  f = random(0,255);
  if (s>400)
  {
    Serial.print("Smoke: ");
    Serial.println("Detected");
  }
}
```

```

digitalWrite(BUZZER,HIGH);
  LCD.setCursor(7, 2);
LCD.print("YES");
LCD.setCursor(0, 3);
LCD.print("WARNING!FIREACCIDENT");
digitalWrite(EXFAN1,HIGH);
digitalWrite(EXFAN2,HIGH);
  fan1=1;
  fan2=1;
}
else{
  Serial.print("Smoke: ");
  Serial.println("Not Detected");
  digitalWrite(BUZZER,LOW);
  LCD.setCursor(7, 2);
  LCD.print(" NO");
  LCD.setCursor(0, 3);
  LCD.print("                ");
  digitalWrite(EXFAN1,LOW);
  digitalWrite(EXFAN2,LOW);
  fan1=0;
  fan2=0;
}
if(f>80)
{
  Serial.print("Flame: ");
  Serial.println("Detected");
  spr=1;
  digitalWrite(SPRKLR,HIGH);
}
else
{
  Serial.print("Flame: ");
  Serial.println("nOT Detected");
  spr=0;
  digitalWrite(SPRKLR,LOW);
}
Serial.print("temp:");
Serial.println(t);
LCD.setCursor(7, 0);
LCD.print(t);
Serial.print("Humid:");
Serial.println(h);
LCD.setCursor(7, 1);
LCD.print(h);

PublishData(t, h, s,fan1,fan2,spr);
delay(1000);
if (!client.loop()) {
  mqttconnect();
}
}

```

```

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

void PublishData(float temp, float humid, float smoke, float fan1, float fan2, float spr) {
    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 += "," " \"Humid\":";
    payload += humid;
    payload += "," " \"Smoke\":";
    payload += smoke;
    payload += "," " \"F1STATUS\":";
    payload += fan1;
    payload += "," " \"F2STATUS\":";
    payload += fan2;
    payload += "," " \"SPRKLR\":";
    payload += spr;
    payload += "}";

    Serial.print("Sending payload: ");
    Serial.println(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();
    }
}

```

```

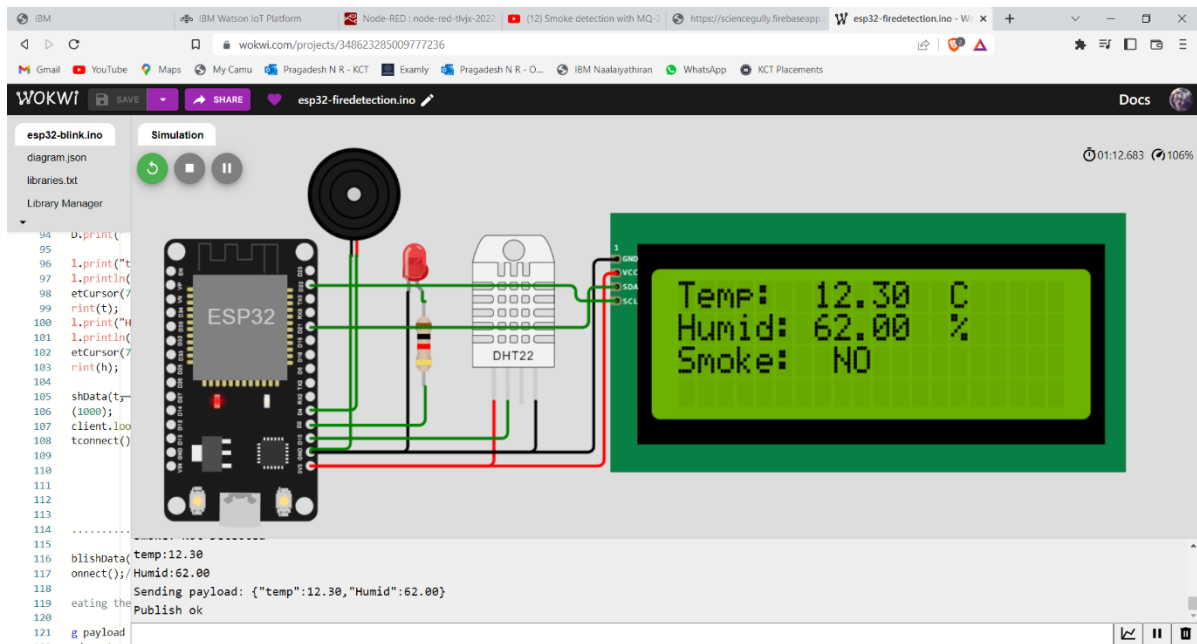
}
void wificonnect() //function defination for wificonnect
{
    Serial.println();
    Serial.print("Connecting to ");

    WiFi.begin("Wokwi-GUEST", "", 6); //passing the wifi credentials to establish the
connection
    while (WiFi.status() != WL_CONNECTED) {
        delay(500);
        Serial.print(".");
    }
    Serial.println("");
    Serial.println("WiFi connected");
    LCD.setCursor(0, 0);
    LCD.print("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");
    }
}

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++) {
        //Serial.print((char)payload[i]);
        data3 += (char)payload[i];
    }
    Serial.println("data: "+ data3);
    if(data3=="lighton")
    {
        Serial.println(data3);
        digitalWrite(LED,HIGH);
    }
    else
    {
        Serial.println(data3);
        digitalWrite(LED,LOW);
    }
    data3="";
}

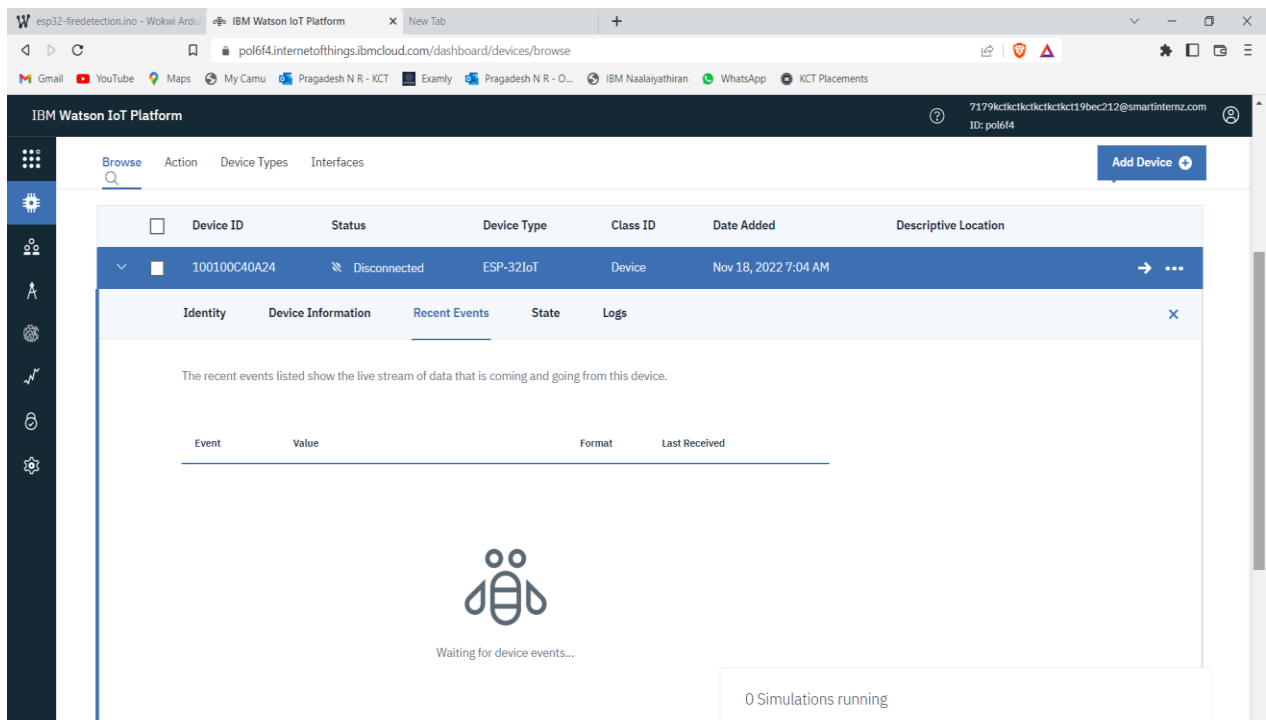
```



**Fig. 7.1 Coding Interface**

## 7.2 Feature 2

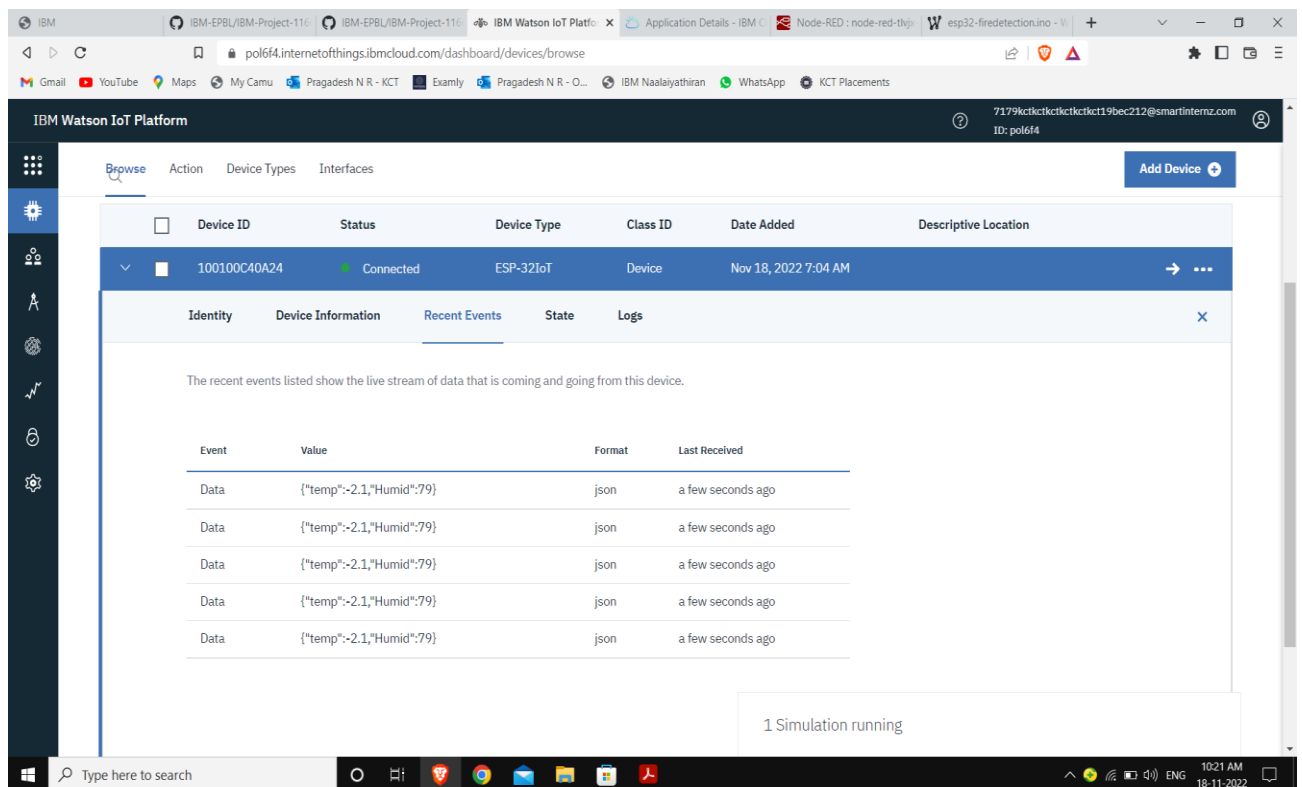
### Watson IOT Platform



**Fig. 7.2 Watson IOT Platform**

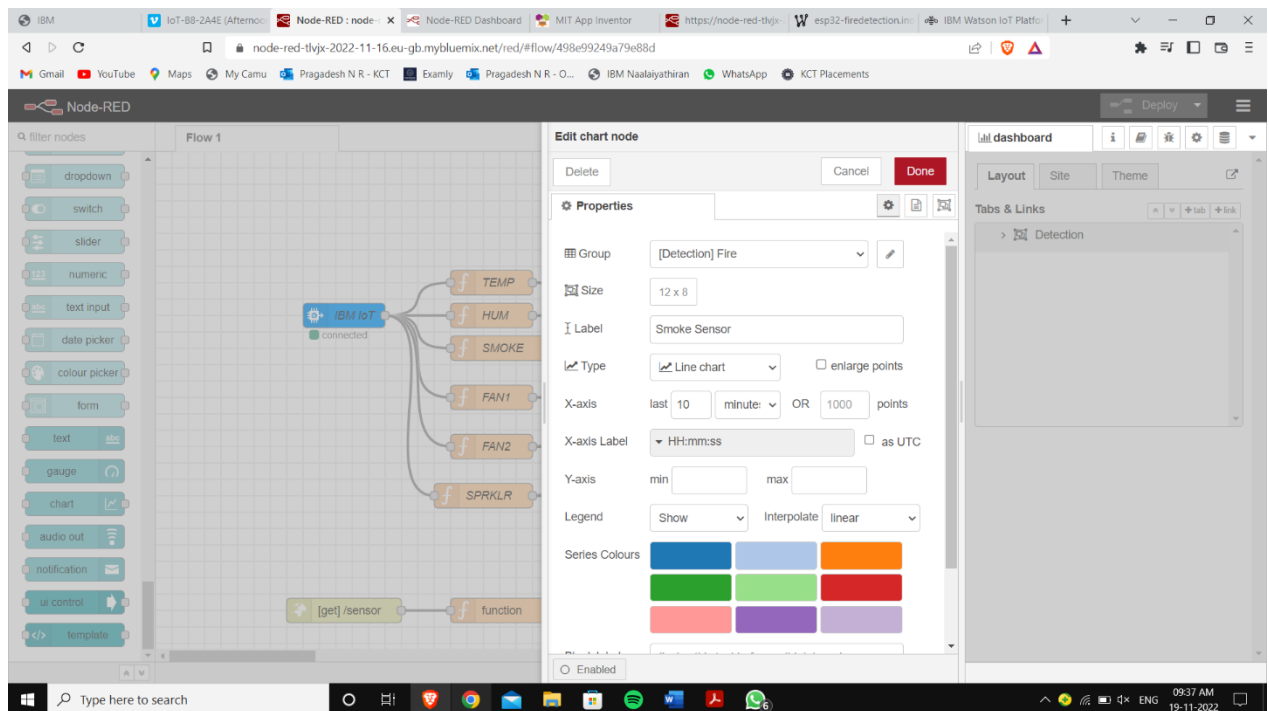


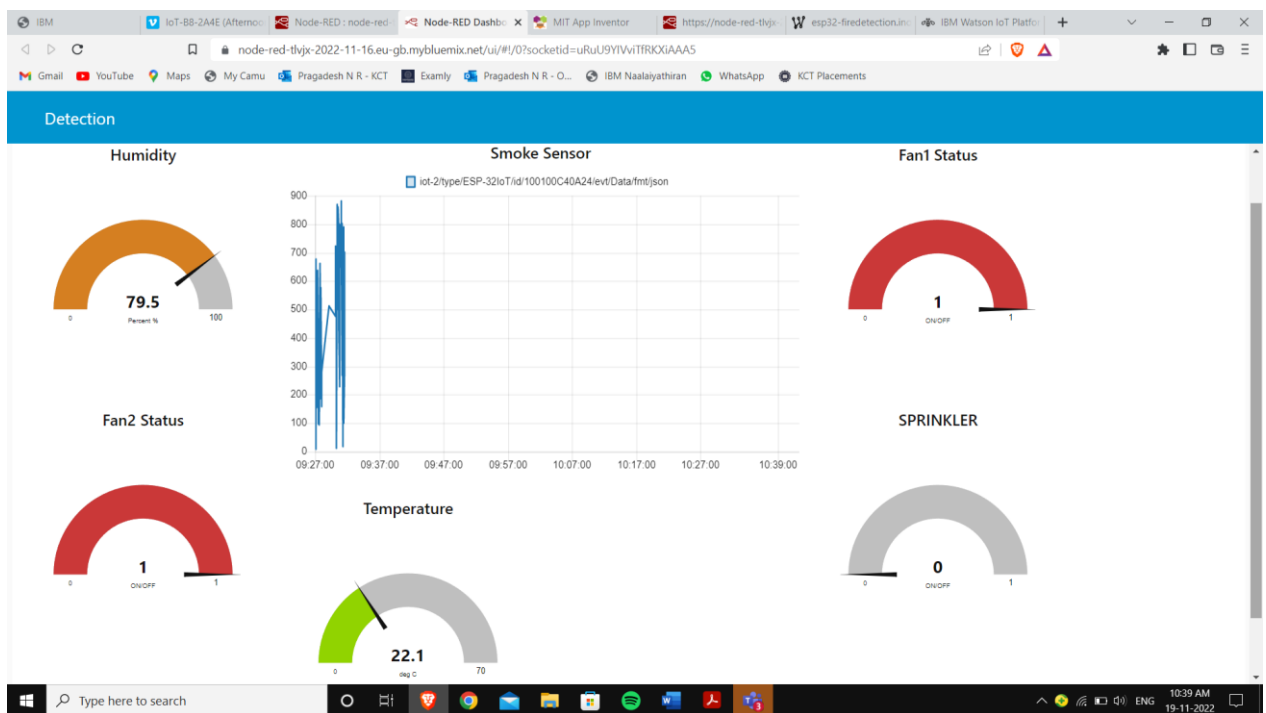
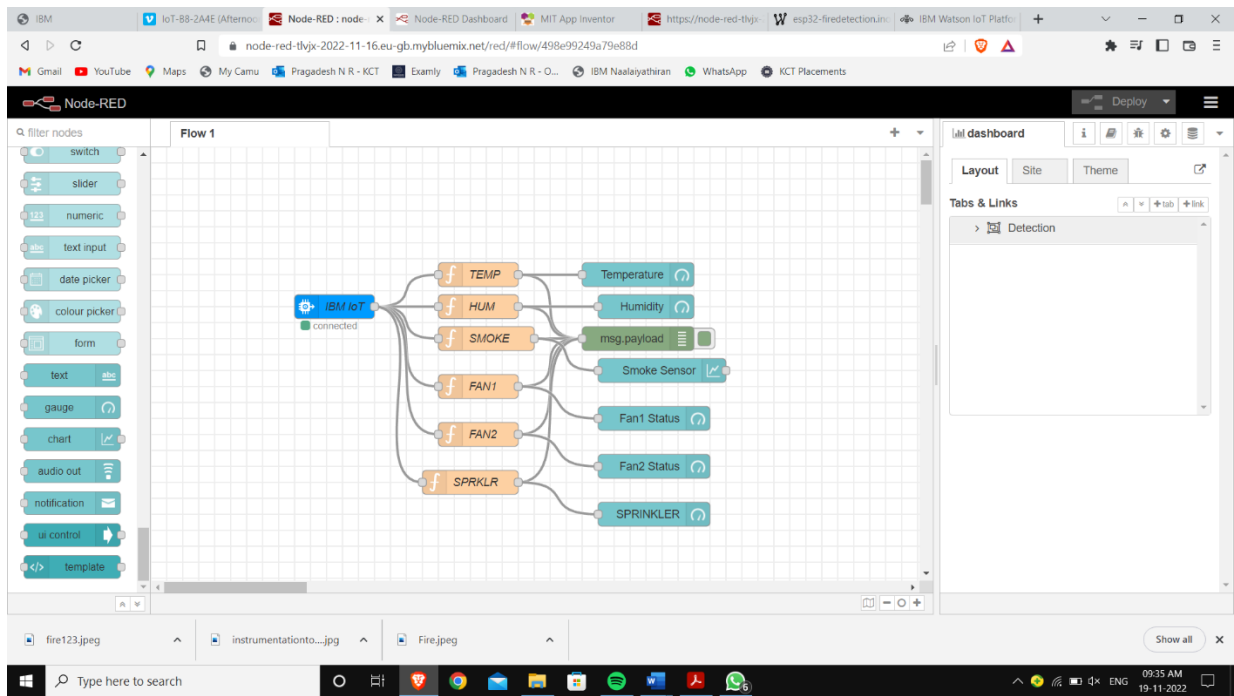
## Watson(output)



**Fig. 7.3 Watson Output**

## 7.3 Feature 3 (Node-Red)





**Node Red Dashboard**

## **CHAPTER – 8**

### **RESULTS**

#### **9.1 Performance Metrics:**

Fire safety differs from many areas measured because success results in the absence of an outcome (fires, injuries, property damage, business disruption, etc) rather than a presence. As such, measuring fire safety is not easy and there are no simple answers to achieve this. The key to effective selection and measurement of fire safety performance indicators is the quality of the performance standards and specifications that have been established. Performance indicators for reviewing overall performance can then be developed based on active and reactive measures that include: assessment of the degree of compliance with fire safety system requirements identification of areas where the fire safety system is absent or inadequate assessment of the achievement of specific objectives and plans within organizational policies and codes of practice fire and near miss data accompanied by analysis of immediate and underlying causes, trends and common features. In other words, the performance indicators should be answering questions in relation to where the organization stands in terms of aims and objectives and risk control, along with the effectiveness, reliability, efficiency and proportionality of the management system. Indicators should also be able to indicate whether performance is getting better or worse and how well the organizational culture is supporting implementation.

## **CHAPTER -9**

### **Advantages & Disadvantages**

#### **10.1 Advantages:**

- Cost effective for larger applications.
- The location of a fire condition is detected and recorded at each individual device, identifying exactly where the fire is occurring. This will improve response time for emergency responders.
- Lower ongoing service cost, because when a device goes into trouble (i.e. needs cleaning, repair or replacement), the panel will tell you the exact location of the device needing service.
- Online capabilities: New intelligent panels have the capability to provide detailed online notification of alarm/trouble/supervisory events.

#### **10.2 Disadvantages:**

- Cost, not as competitively priced for smaller applications.
- Typically with an intelligent panel, your peripheral devices (i.e. smoke detectors, etc...) tend to be more expensive than conventional devices.
- This panel is computer like and at times there maybe issues caused by the firmware (panel software). However, this is not common and the advantages of intelligent panel far outweigh any of these firmware issues.

## **CHAPTER – 10**

### **CONCLUSION**

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.