# TABLE OF CONTENT

| S NO. | LIST OF FIGURE | PAGE NO. |
|---|---|---|

| S NO. | LIST OF TABLES | PAGE NO. |
|---|---|---|

# 1.INTRODUCTION

## 1.1 Project Overview

Fire Management System is designed to alert us to an emergency so that we can take action to protect ourselves, staff and the general public, Fire management system are found in Offices, Factories, and public buildings, they are a part of our everyday routine but are often overlooked until there is an emergency at which point, they might just save our lives. Whatever the method of detection is, if the alarm is triggered, sounders will operate to warn people in the building that there may be a fire and to evacuate.

The fire alarm system may also incorporate a remote signal system which could then alert the fire brigade via a central station. The 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.

## 1.2 Purpose

**#1 Detect Fire**

The fire alarm system is designed to detect fire in two main ways: smoke and heat. It should also have the capability of manual pull, in case a fire is observed before smoke or heat reaches the sensors of the system. Other systems are activated when movement in the sprinkler system is detected, indicating that the sprinklers are responding to a fire.

**#2 Alert Occupants**

When the fire management system detects smoke, heat, or gas, it alerts occupants of the building using both audible and visible alarms. These alarms will be bright, loud, obnoxious, and impossible to ignore, which help mobilize individuals to follow your evacuation plan. Using both types of alarms ensure that every person in the building is alerted.

**#3 Manage Risks**

The building's fire alarm system works in a third way to protect you: by reacting to potential risks using control measures. When the alarm is activated, some systems perform a set of tasks that help prevent fire and smoke from spreading as well as protect occupants, such as: automatically shutting doors in different zones, powering off ventilation and air conditioning, or redirecting elevators to bring cars to a designated level.

**#4 Notify Authorities**

The fourth purpose of your fire alarm system is to notify authorities. This ensures the fire department is en route as quickly as possible, so they can respond and extinguish the fire before it becomes an even bigger threat.

# 2.LITERATURE SURVEY

## 2.1 Existing problem

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 occupants 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, althoughinstallation 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 management system used the addressable detectors units besides using the wireless connection between the detector in zones as a slave units and the main control unit as the master unit. The system shall include a control panel, alarm initiating devices, notification appliances, and the accessory equipment necessary for a complete functioning fire management system. In the wireless fire alarm, individual units are powered by primary & secondary batteries for the communication.

## 2.2 References

**Paper 1:** A smart fire detection system using IoT technology
**Author :** Abdulsahib
**Publication:** International Journal of Electrical and Computer Engineering (IJECE).
**Published Year :** 2019

The fire detection systems proposed in the literature served fire stopping with no care of the responsiveness. Thus, this study considers the existing issues and build an efficient and effective fire detection system based on IoT technology, gas, temperature, and smoke sensors to collect the data accurately and rapidly. The continuous readings sent over WIFI modules to the central unit to analyze the data and trigger the water sprinkle. This system structure enhances the efficiency and effectiveness of fire detection. Moreover, using the Ubidots platform in this system made thedata exchange faster and reliable. However, this study's proposed approach obtained an average response of 5 seconds to detect the fire and alert the property owner.

Meanwhile, the water pump activated to suck water from the tank and release it into the water sprinkler to minimize the fire until the property owners and emergency services reached. Hence, the proposed system overcame the challenges of the issues of affordability, effectiveness, and responsiveness. The proposed system still needs further enhancements. Thus, one of the enhancement directions is integrating machine learning with the system to predict the potentiality of fire based on the collected data from different sources. Machine learning may help the operators find and overcome the vulnerabilities in their building to prevent fire instead of detection only.

**Paper 2 :**IoT-Based Intelligent Modeling of Smart Home Environment for Fire Prevention and Safety

**Author:** Rehman and Saeed F

**Publication:** Journal of Sensor and Actuator Networks
**Published Year :** 2018

The primary objective of the proposed work was to design an intelligent analysis of smart home for fire prevention. Two major flaws of the currently used systems are: (a) the fire prevention systems mostly use a single sensor for event detection but problems arise if the target sensor does not detect the event; (b) false alarms can be generated. Overall our proposed method provides a solution to these problems. We introduced an efficient technique to overcome these problems. We used multi-sensors for each region in smart homes.To reduce the false alarms, we used the GSM communication system. The purpose of GSM communication was to alert the user at the very initial time of the fire. Fire detection decisions were made by the main home sink connected with all the sensors wirelessly. The decision was made on the basis of the sensor's values or the user's response. We simulated fire in FDS that was designed by NIST, and the generated results of the simulation were analyzed by our proposed algorithm that we implemented in Visual Studio using C++ libraries programming language.

The simulators were installed on a machine with the following specification: Intel(R) Core(TM) i5-3570 CPU @ 3.40 GHz 3.80 GHz, and RAM 16 GB. The energy consumption of thedeployed sensors was also computed, and we noticed that it was within an acceptable limit. The results and other evaluations showed that our proposed work fulfills all the desired requirements.

**Paper 3 :** Evaluation of a wireless sensor network with low cost and low energy consumption for fire detection and monitoring

**Author :**Morandini, F. & Innocenti

**Publication:** Engineering Sciences [physics]/Reactive fluid environment.

**Published Year :** 2015

Wireless sensor networks (WSNs) may offer the opportunity to eliminate most of the extension cables and wires in digital systems, allowing operation far from any infrastructure. This opportunity coincides with a great increase in cost-effectiveness in an overall fire detection and monitoring system for vegetation or industrial configurations. Our purpose is to evaluate this opportunity. After presenting the three main technologies for wireless communications to non experts, we retained the ZigBee protocol for this study.

We then investigated whether the use of a WSN with this protocol is valuable for measuring heat quantities during a fire spreading over vegetation fuel beds. Experiments are performed under both lab scale indoor and real outdoor conditions. The method consists of comparing temperatures and radiant heat fluxes gained simultaneously by the wireless technology and a wired data acquisition system (WDAS). Delays due to the wireless radio communications are identified and explained. We also observe information loss for measurements performed in the fire front. Finally, we highlight that fires can be detected satisfactorily by WSN equipment in indoor and outdoor conditions. However, we also show that the measurement accuracy of the wired systems cannot be achieved by the present wireless technology, and we do not recommend,at the present time, its use for fire monitoring and mitigation.

**Paper 4 :**Fire Alarm System with location using IoT

**Author :** M. Venkatesh and M. Hemanth

**Publication:** International Journal of Scientific Research in Computer Science, Engineering and Information Technology.

**Published Year :** 2019

Fire management systems have become increasingly sophisticated and functionally more capable and reliable in recent years. They are designed to fulfil two general requirements: protection of property and assets and protection of life As a result of state and local codes, the life-safety aspect of fire protection has become a major factor in the last two decades. To solve the problems caused by the fires, several safety measures have been put in to place to reduce the number of fatalities and losses. So our idea is to develop a fire management system.

The primary purpose of fire alarm system is to provide an early warning of fire so that people can be evacuated from the fire-affected place and immediate action could be taken to control the fire. The system will have a GPS module , Flame sensor to detect the flame , Smoke sensor to detect the smoke , Buzzers and led to alert the environment and GSM or wifi to send the notification to authorities. In addition this system reduces the occurrence of false positives with time delay.

## 2.3 Problem Statement Definition

**Reference:**https://miro.com/templates/customer-problem-statement/

Creating a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.As it can be understood the frequency of tests plays an important role on the building fire safety assurance. It is expected that the higher the frequency, the sooner hidden failures are revealed. Thus, the solution relies on establishing a maintenance and test planning and to assure its accomplishment. All critical items of the fire safety systems

should be analyzed from the probability of failure and failure consequences point of view and must be tested and inspected to assure system's availability and successfully operation (reliability).

**PS - 1**


**PS – 2**


**PS – 3**


**PS – 4**

# 3.IDEATION & PROPOSED SOLUTION

## 3.1 Empathy Map Canvas

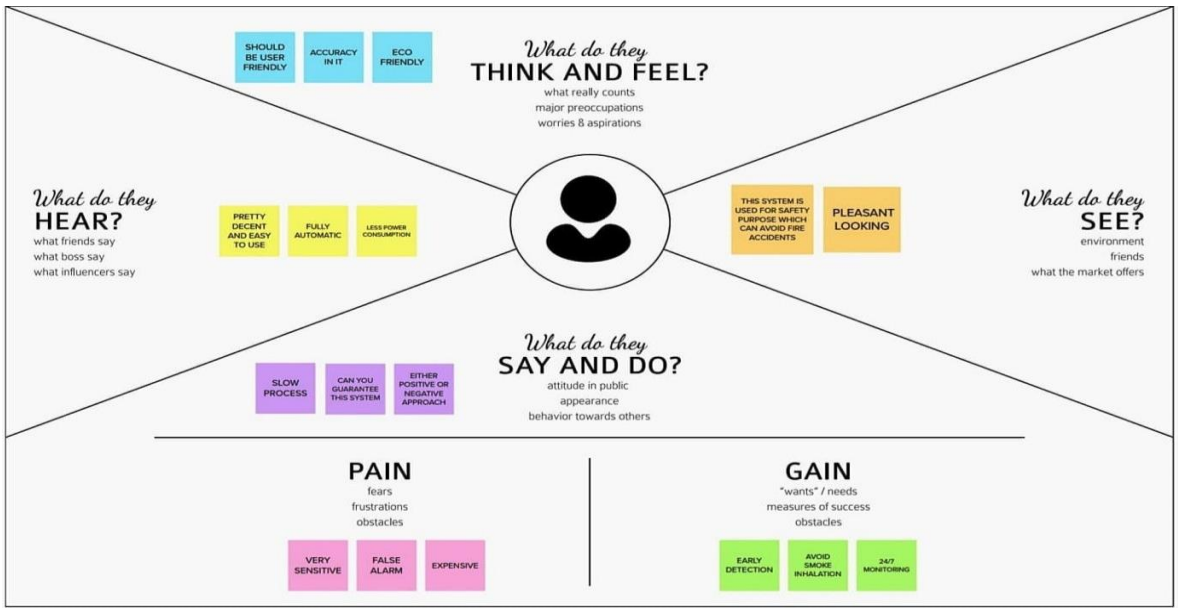



Figure.3.1 Empathy Map Canvas

Empathy map explains the how the implementation of the system is occurs and how effectively it identifies the Fire management system.

It explains the steps and procedures of the process and also about the benefits ans limitations of the system.

## 3.2 Ideation & Brainstorming

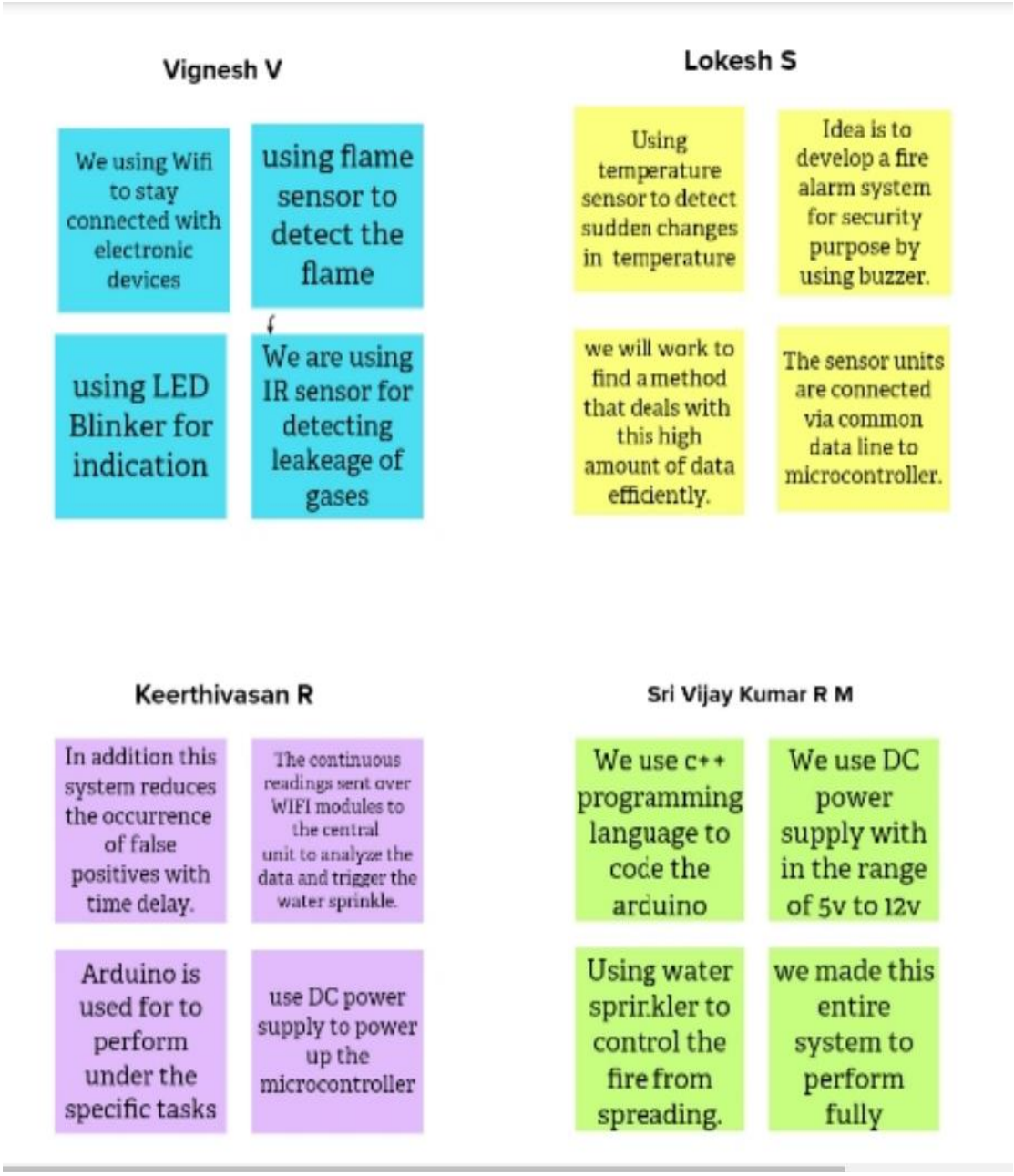



Figure.3.2.1 Ideation & Brainstroming

## Idea Prioritization

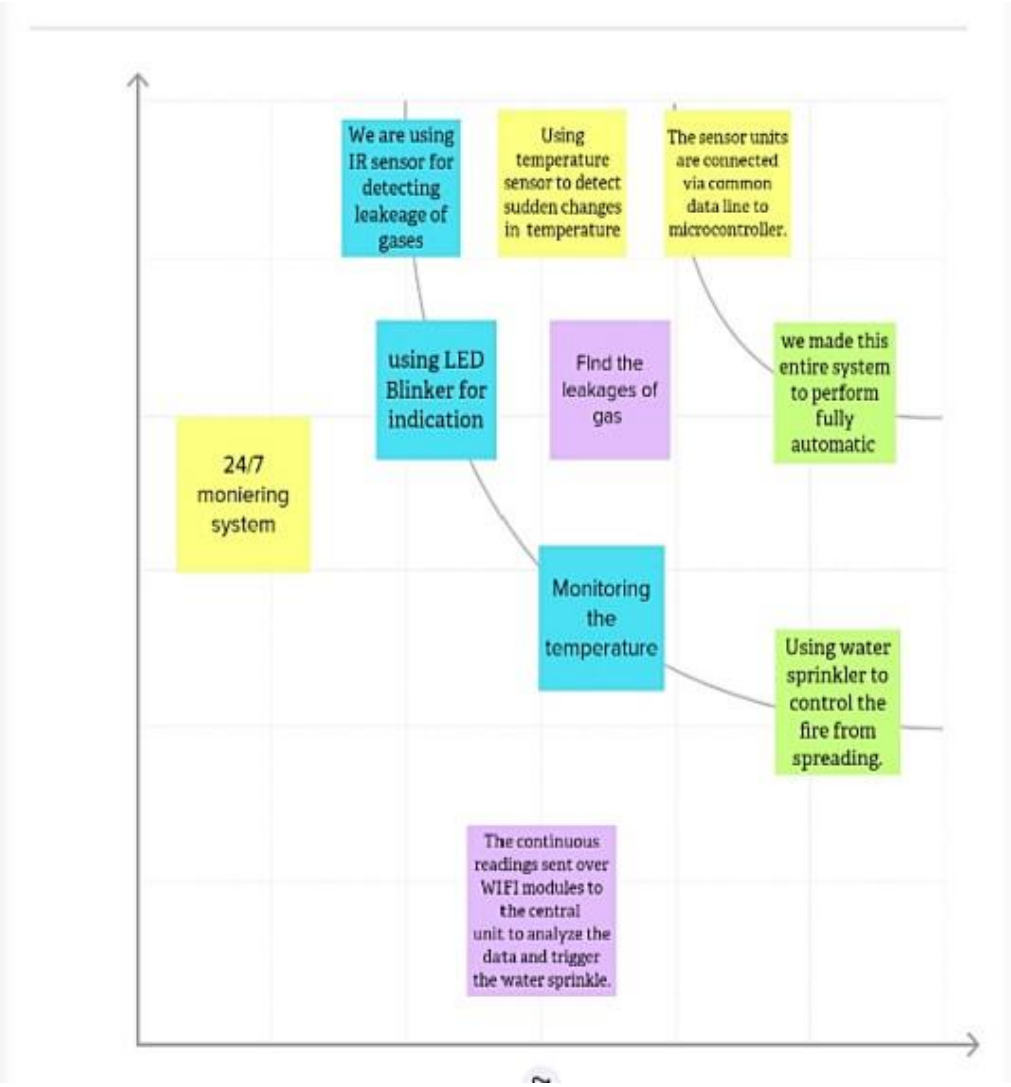



Figure.3.2.2 Idea Prioritization

Ideation and Brainstorm explains the step by step procedures of the system and overview of the entire process.

## 3.3 Proposed Solution

| S.No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | The existing fire alarm system on market nowadays is too complex in terms of its design and structure.Since the system is too complex,it needs regular maintenance to be carried out to make sure the system operates well. |
| 2. | Idea / Solution description | To avoid the impact of fire.We as a team proposing a solution as fire management system.After installation of a system.The customer will safe from fire,if fire is exist.By the alarm,sprinklers and the alart messages end to the user by the fast sms or email. |
| 3. | Novelty / Uniqueness | Effective fire detection system eliminates damage by ensuring that a fire can be prevented before it even starts. A fire detector may also have a direct connection to an alarm monitoring center. |
| 4. | Social Impact / Customer Satisfaction | They help warn and keep customer safe and reduce the amount of destruction to a building. |
| 5. | Business Model (Revenue Model) | The main drawback of the fire management system, to save customer from fire moreover prevented by method. |
| 6. | Scalability of the Solution | Fire detection systems increase response times ,as they are able to alert the correct people in order to extinguish the fire. This thus reduces the amount of damage to the property. Fire detection systems can be connected to sprinklers that will automatically respond when a fire is detected. |

Table.3.3 Proposed Solution

## 3.4 Problem Solution fit

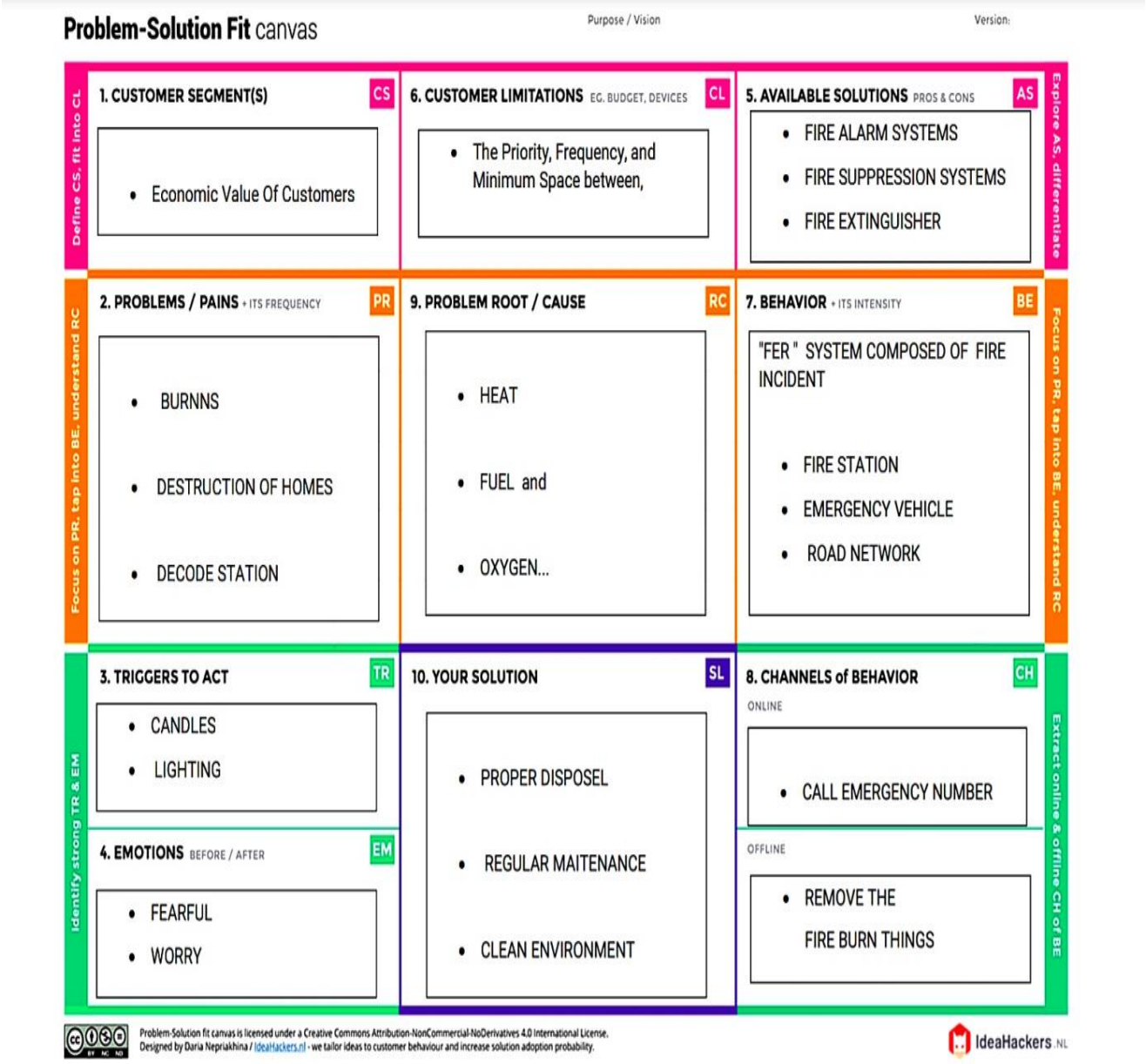



Figure.3.4 Problem Solution fit

Problem solution fit explains the problems and issues faced by the customers , issues may be happened due to some reasons like irregular maintanance and lack of awareness and etc.

It provides the possible way to minimize the issues and also provides the solutions for those problems.It also conveys the emotions of the customers before they using this system and after they using this system.

# 4.REQUIREMENT ANALYSIS

## 4.1 Functional requirement

Following are thefunctional requirements of the proposedsolution.

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story/ Sub-Task) |
|---|---|---|
| FR-1 | **User Visibility** | Emergency alerts through Fast SMS. |
| FR-2 | **User Reception** | The data like amount of temperature, smoke contentand gas levels are received via SMS. |
| FR-3 | **Prediction Understanding** | Based on the data, the user understands that if any of the data is above the threshold value, then there is a fire burst. |
| FR-4 | **User Action** | In case of fire bursts, the user needs to take actions like find the escape route, evacuate the workers and take necessary actions to control the fire. |

Table.4.1Functional requirements

## 4.2 Non-Functional requirements

Following are thenon-functional requirements of the proposedsolution.

| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | It ought to have the option to caution inhabitants of the structure the utilization of every perceptible and apparent alert. |
| NFR-2 | **Security** | It ought to be utilized to guarantee the insurance of both important properties, as well as human existence. |
| NFR-3 | **Reliability** | It might have a capacity to recognize the smoke accurately and doesn't give a false caution or signal. |

| | | |
|---|---|---|
| NFR-4 | **Performance** | It ought to have Programmed fire sprinklers combined with identification which distinguishes the flames, yet in addition smother the flames in the underlying stage itself. |
| NFR-5 | **Availability** | It could be accessible for day in and day out hours so it tends to be useful for individuals. |
| NFR-6 | **Scalability** | The sensors and boards utilized in this framework ought to have the option to effortlessly change overhaul concurring to change and need in requirements |

Table.4.2 Non-Functional requirements

# 5.PROJECT DESIGN

## 5.1 Data Flow Diagrams

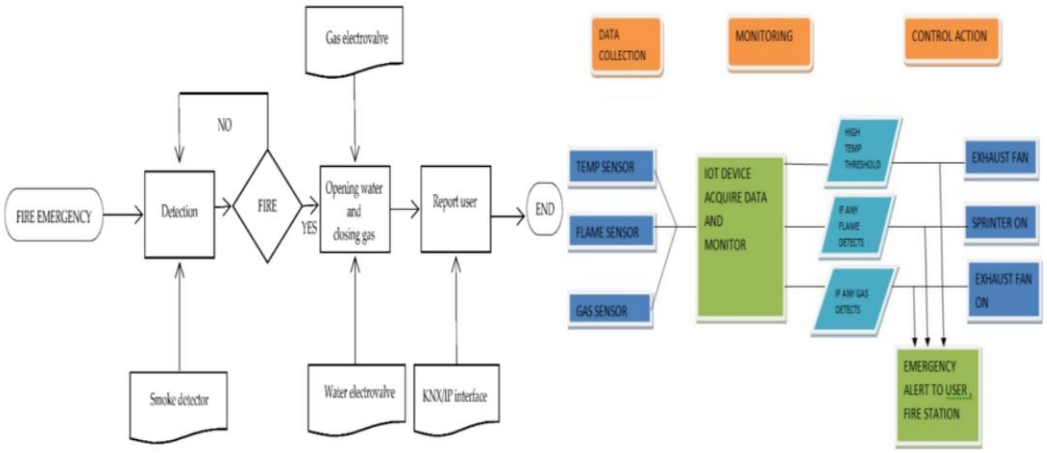



Figure.5.1 Data Flow Diagrams

Data Flow Daigrams are the diagramatical representation of the Fire management system process.It contains the entire process from intial part to final part.

## 5.2 Solution & Technical Architecture

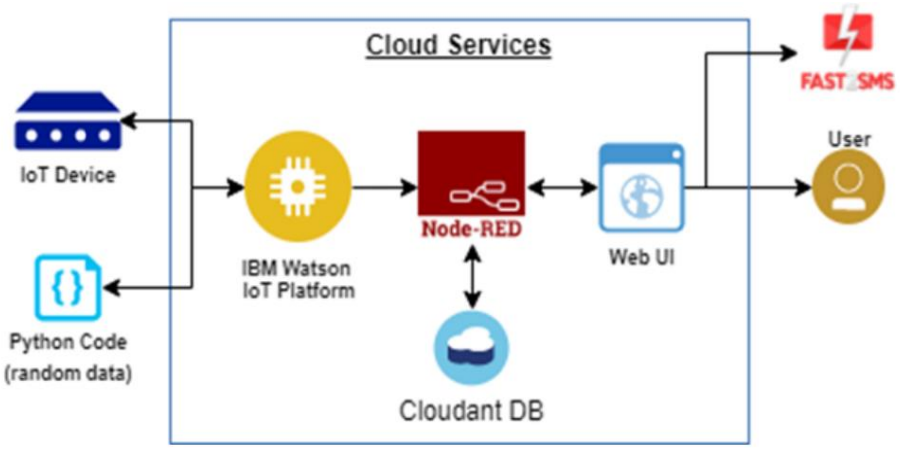



Figure.5.2 Solution & Technical Architecture

**Table-1 : Components & Technologies:**

| S.No | Component | Description | Technology |
|---|---|---|---|
| 1. | User Interface | Web UI, Node-RED, MIT app Inventor | IBM IoT Platform, IBM Node RED, IBM Cloud |
| 2. | Application Logic-1 | Create IBM Watson IoT Platform and create NodeRED service | IBM Watson,IBM Node-RED, IBM Cloud ant service |
| 3. | Application Logic-2 | Describe logic for a process in the application and build a web application using node-red service | IBM Node-red |
| 4. | Application Logic-3 | Develop python script to subscribe publish and to IBM IoT Platform | Python |
| 5. | Database | Data Type, Configurations etc. | MySQL, NoSQL |
| 6. | Cloud Database | Database Service on Cloud | IBM DB2, IBM Cloudant |
| 7. | File Storage | Mobile application is developed for storing and receiving the sensor information | Web UI |

| | | | |
|---|---|---|---|
| 8. | External API-1 | IBM sensors are used to detect the fire, temperature , smoke in the environment and provides the activation of water sprinklers in web ui | IBM Sensors |
| 9. | External API-2 | IBM Fire management API is used to detect the fire in one place | IBM fire management system API |
| 10. | Machine Learning Model | Using this model we can be able to recognize objects | Object Recognition Model |
| 11. | Infrastructure (Server / Cloud) | Cloud Server Configuration | IBM Cloudant, IBM IoT Platform |

Table.5.2.1 Components & Technologies

**Table-2: Application Characteristics:**

| S.No | Characteristics | Description | Technology |
|---|---|---|---|
| 1. | Open-Source Frameworks | MIT App Inventor | MIT license. |
| 2. | Security Implementation | IBM Services | Encryptions, IBM Controls. |
| 3. | Scalable Architecture | Sensor-IoT Cloud based Architecture | AI and Cloud computing. |
| 4. | Availability | Mobile phones, Desktop and Laptop | MIT App Inventor. |
| 5. | Performance | Design consideration for the performance of the application (number of requests per sec, use Cache, use of CDN's) etc. | Sensor. |

Table.5.2.2 Application Characteristics

Solution and Technical architecture includes the requirements of the system and components like software, tools, algorithms used in this system.

## 5.3 User Stories

| User Type | Functional Requirement (Epic) | User Story Number | User Story/ Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (Mobileuser) | Registration | USN-1 | As a user,I can download the application | I can view the complete data sent by the hardware | High | Sprint-1 |
| Customer (Mobileuser) | Registration | USN-2 | As a user,I can register for the application by entering my mobile number,email, password. | I can access my profile | High | Sprint-1 |
| Customer (Mobileuser) | Registration | USN-3 | As a user,I will receive confirmation email or otp to sms once I have registered for the application | I can receive confirmation email or otp click confirm | High | Sprint-1 |
| Customer (Mobileuser) | Login | USN-4 | As a user,I can login to the application by enetering email and password | I can access my profile and dashboard | High | Sprint-2 |
| Customer (webuser) | Actions | USN-5 | As a user,I can View Temperature Readings | I can view the data by hardware | Medi um | Sprint-2 |
| Customer (webuser) | Actions | USN-6 | As a user,I can view any flameis detected in the place | I can view the data by hardware | High | Sprint-2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Customer (webuser) | Actions | USN-7 | As a user,I will have on and off button or operates prinklers | The actions are taken by the user based on flame detected data | Medi um | Sprint-3 |
| Customer (webuser) | Actions | USN-8 | As a user,I will have on and off button for operate exhaust fan. | The actions are taken by the user based on temperature and level of gas content data | Medi um | Sprint-3 |
| Administrator | Storage | USN-9 | As a Administrator I can store the data in cloud database. | The entire data's are stored in cloud database | High | Sprint-4 |

# 6.PROJECT PLANNING & SCHEDULING

## 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 download the application | 5 | High | Vignesh V |
| Sprint-1 | Registration | USN-2 | As a user, I can register for the application by entering my mobile number, email, password. | 5 | High | Vignesh V |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sprint-1 | Registration | USN-3 | As a user, I will receive confirmation email or otp to sms once I have registered for the application | 4 | High | Vignesh V |
| Sprint-2 | Login | USN-4 | As a user, I can log into the application by entering email and password. | 5 | High | Sri Vijay Kumar R M |
| Sprint-2 | View | USN-5 | As a user, I can View Temperature Readings. | 2 | Medium | Sri Vijay Kumar R M |
| Sprint-2 | View | USN-6 | As a user, I can view any flame is detected in the place. | 4 | High | Lokesh S |
| Sprint-3 | Actions | USN-7 | As a user, I will have on and off button for operate sprinklers. | 1 | Medium | Keerthivasan R |
| Sprint-3 | Actions | USN-8 | As a user, I will have on and off button for operate exhaust fan. | 2 | Medium | Keerthivasan R |
| Sprint-3 | Management | USN-9 | As a Administrator I can store the data in cloud database. | 5 | High | Keerthivasan R |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sprint-4 | Testing | USN-10 | As a tester , I can check whether the sensors are working properly. | 5 | High | Sri Vijay Kumar R M |
| Sprint-4 | Testing | USN-11 | As a tester I can check whether the sprinklers are working well. | 5 | High | Lokesh S |
| Sprint-4 | Testing | USN-12 | As a tester I can get the appropriate readings of the Temperature. | 5 | High | Lokesh S |

Table.6.1.1 Sprint Planning & Estimation

| **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 | 14 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | | |
| Sprint-2 | 11 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | | |
| Sprint-3 | 08 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | | |
| Sprint-4 | 15 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | | |

Table.6.1.2 Project Tracker, Velocity & Burndown Chart

## **Velocity** :

Average Velocity (AV)= 8/4= 2

## Burndown Chart :

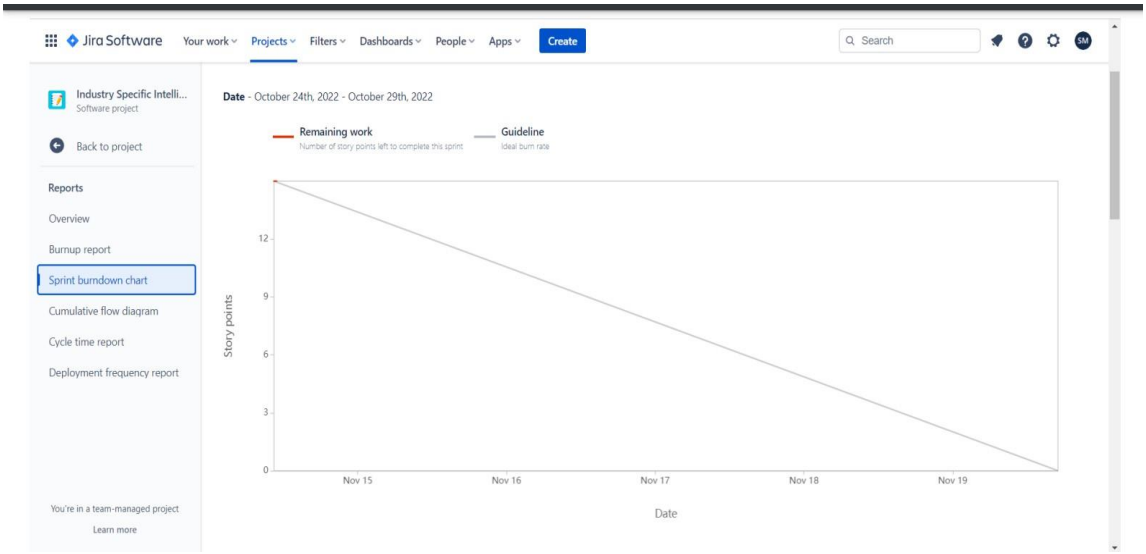
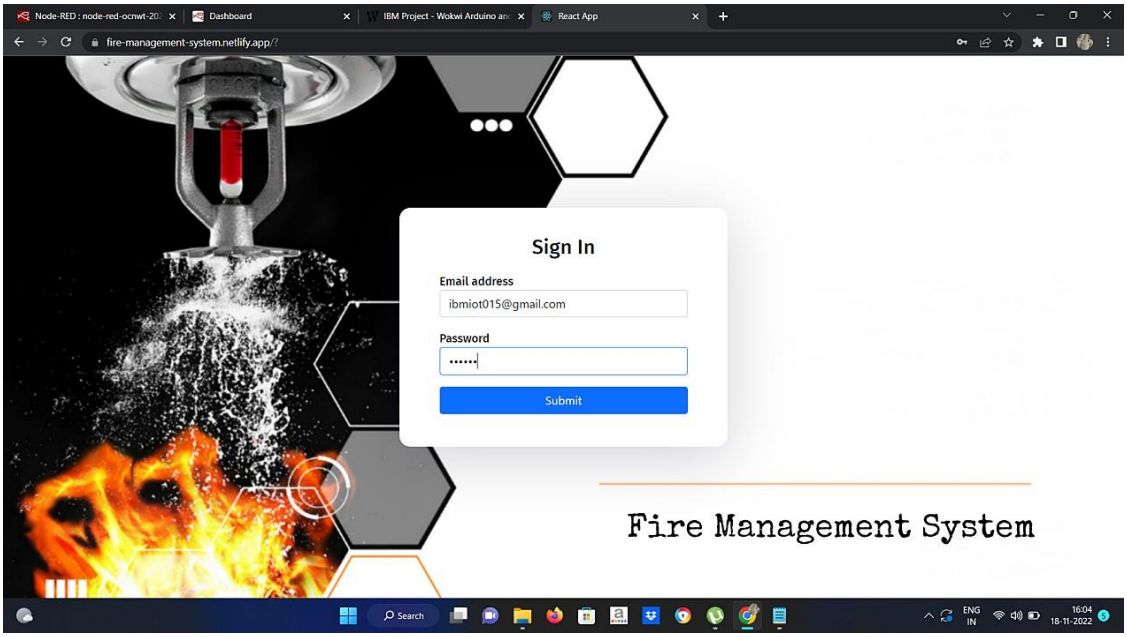



Figure.6.1.2 Burndown Chart

## 6.2 SPRINT DELIVERY SCHEDULE

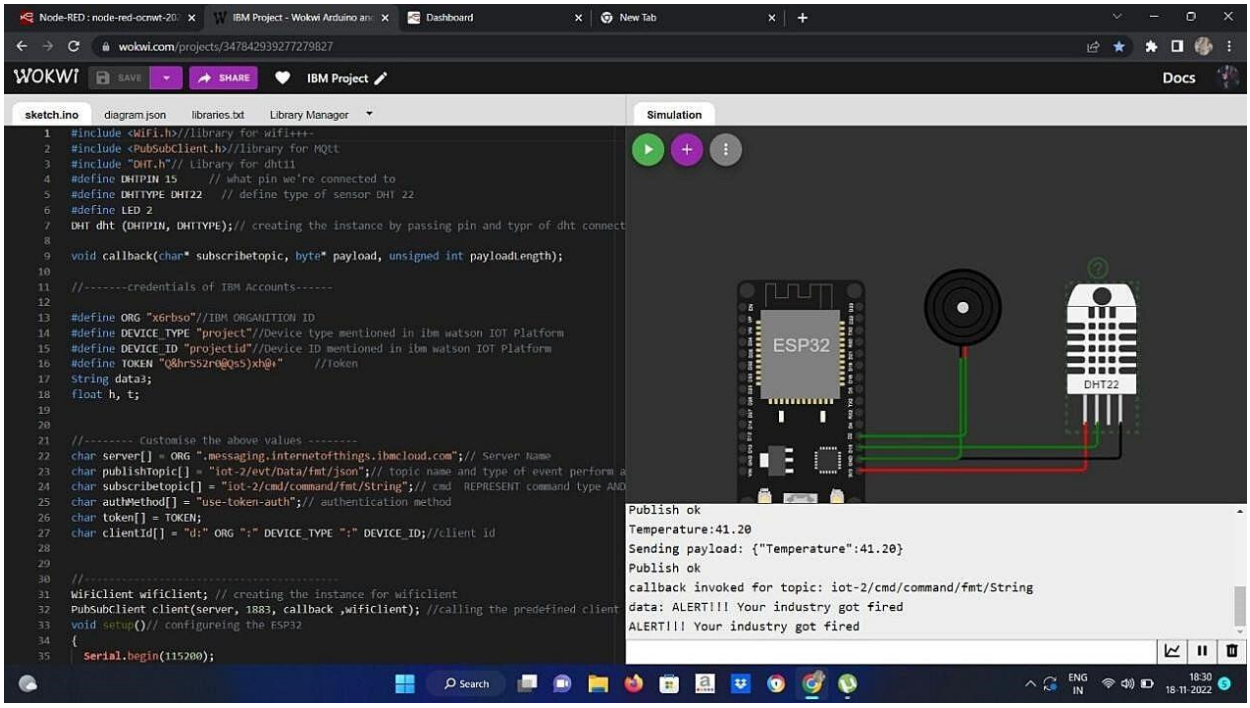
## SPRINT 1:

**TASKS:**UI Login page



## SPRINT 2:

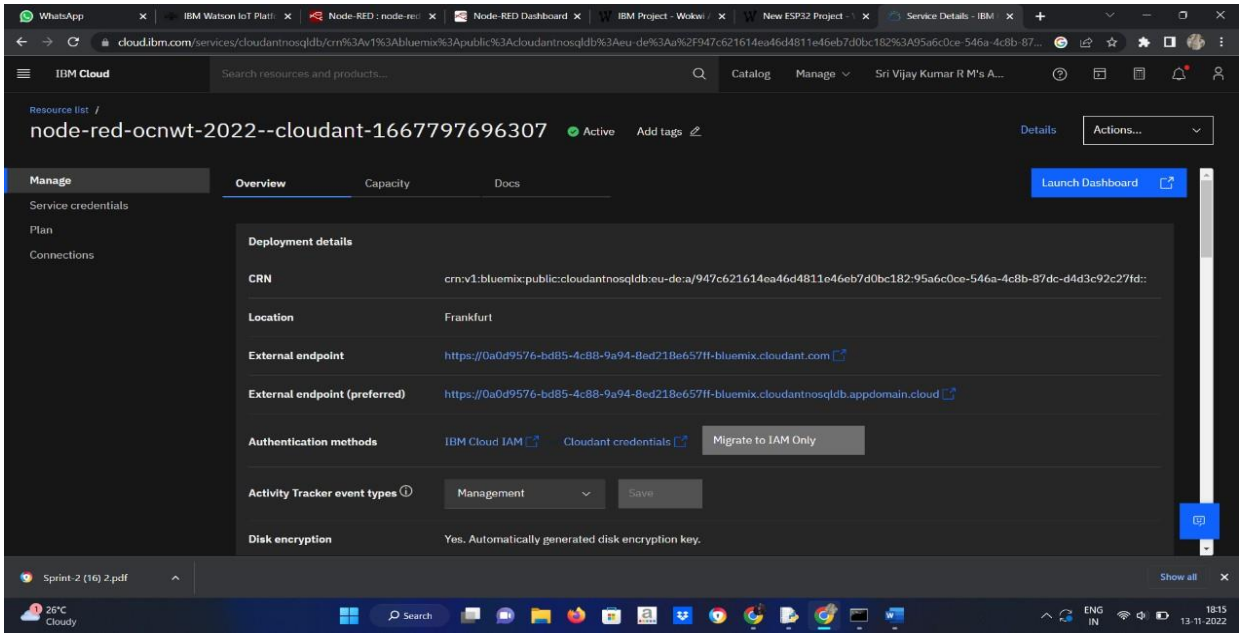
**TASKS:** Temperature Sensor Readings.




## SPRINT 3:

**TASKS:** Cloudantdb, Buttons & Node Red.

### Cloudantdb:



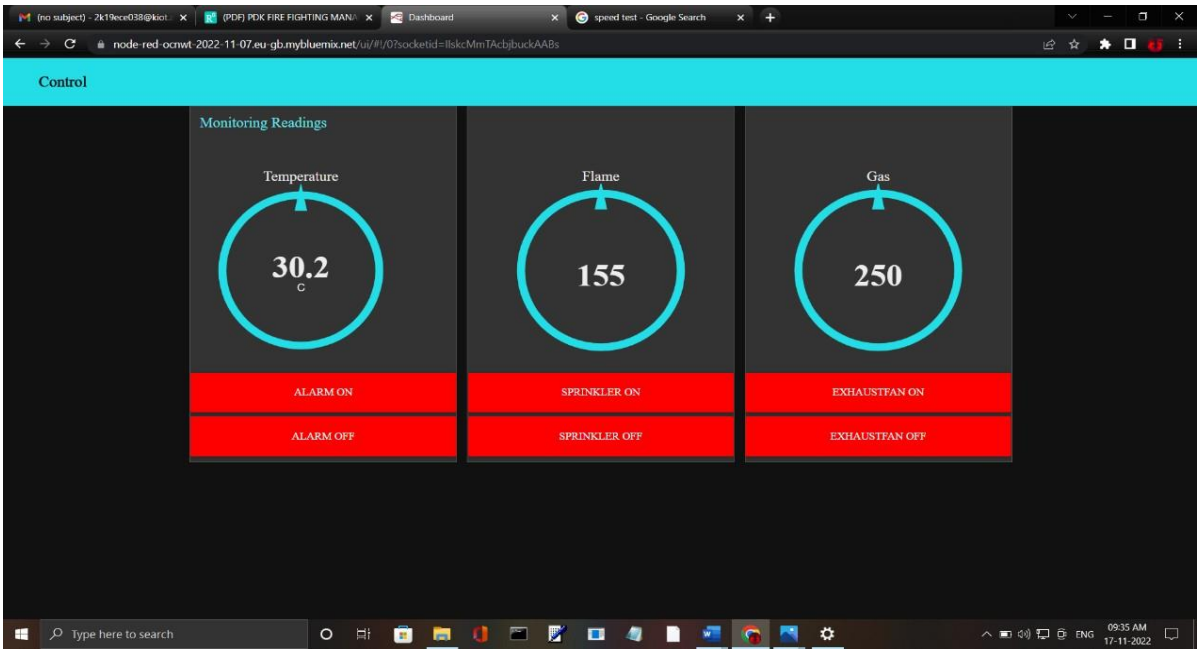

**Buttons:**

1.Sprinklerson

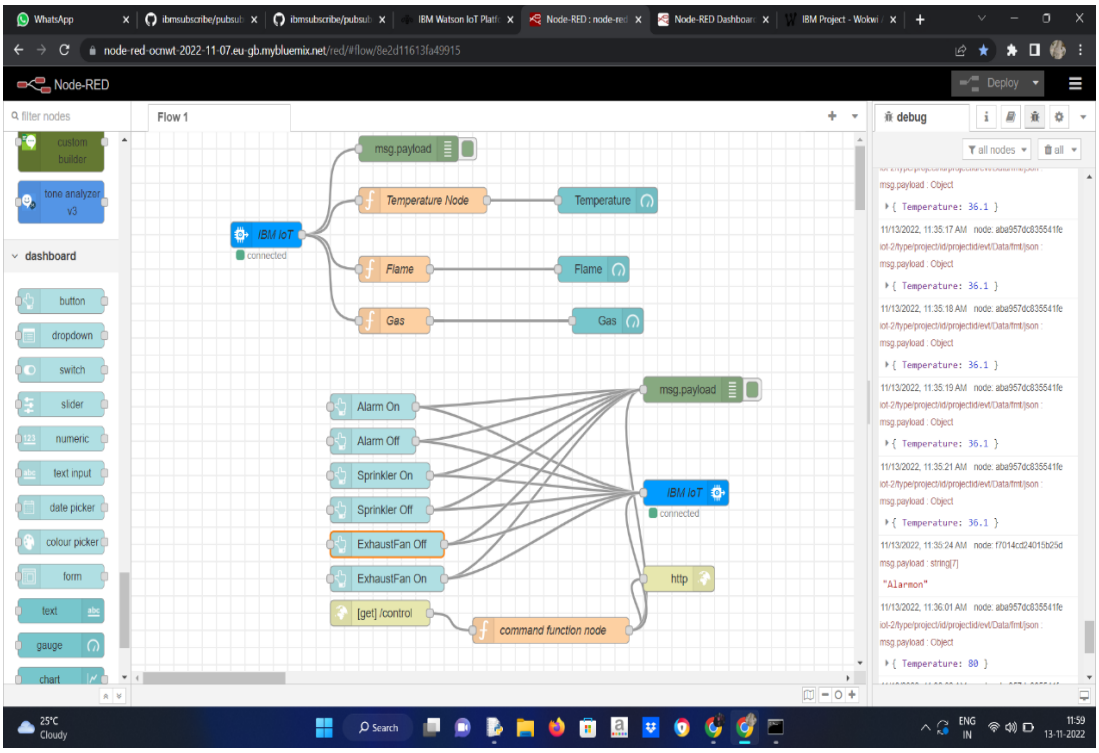
2.Sprinklersoff

3.Exhaustfanon

4.Exhaustfanoff



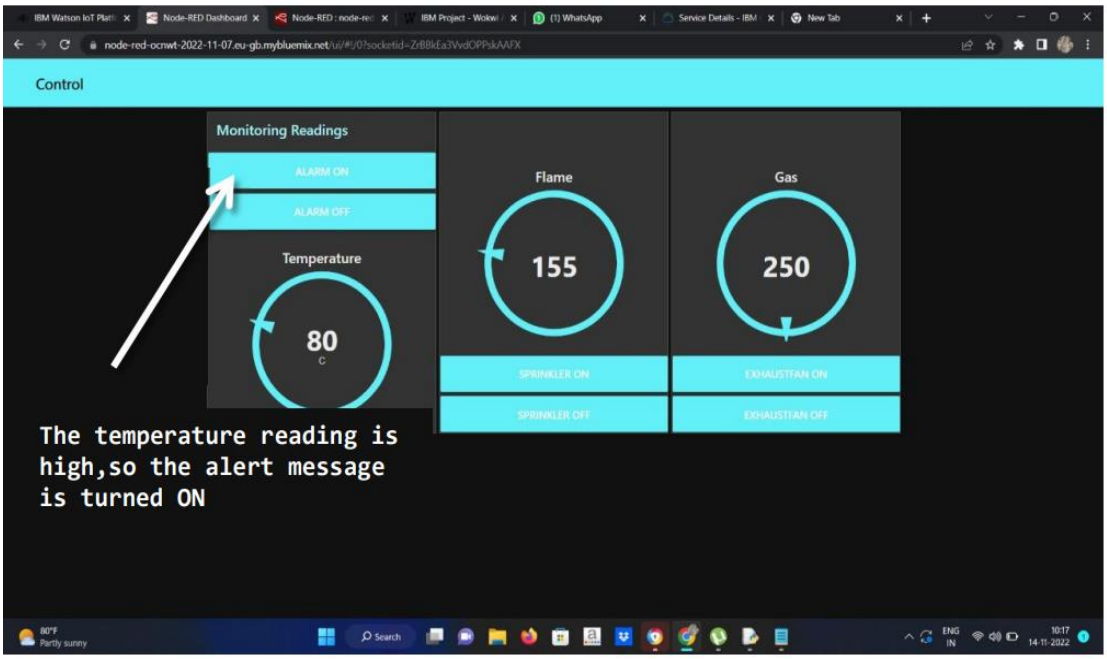
## Node Red:

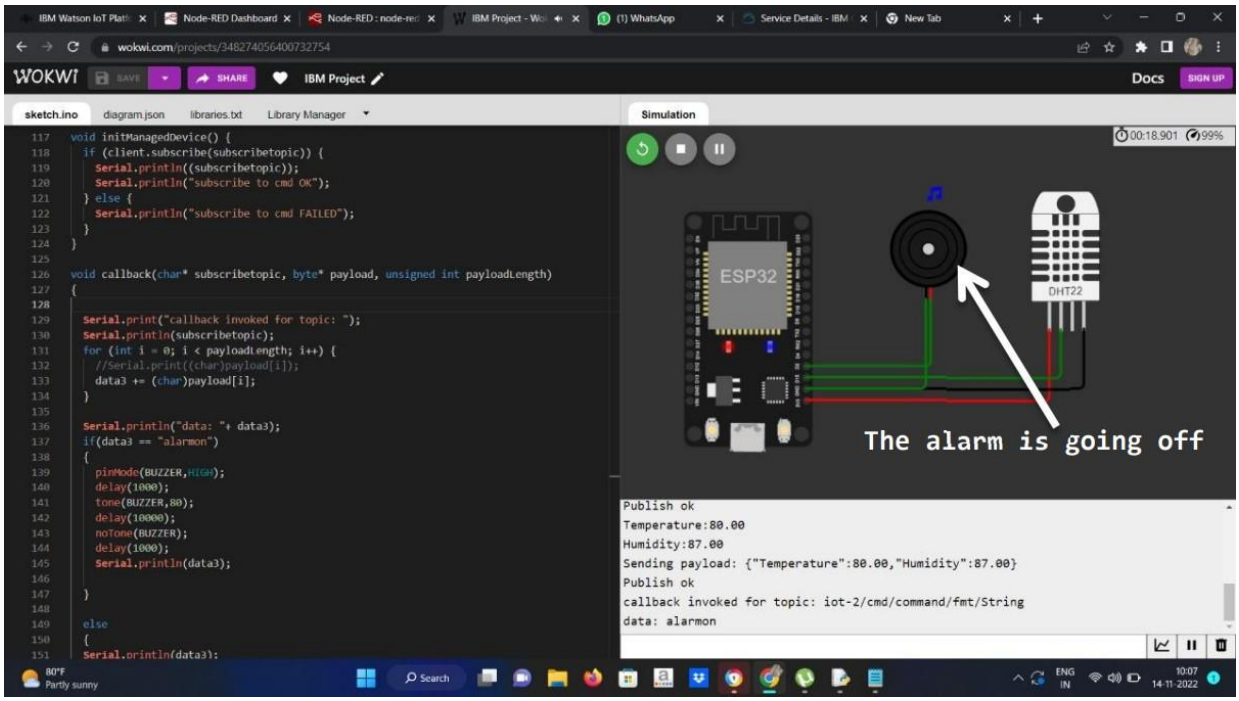



## SPRINT 4:

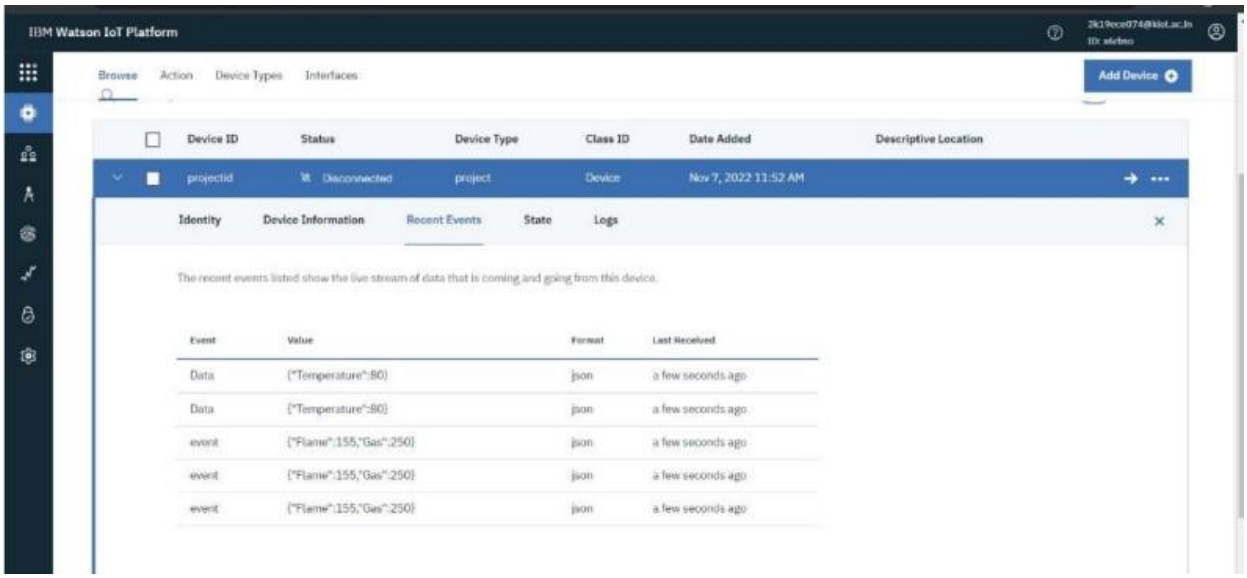
# TESTING

## Temperature sensor:



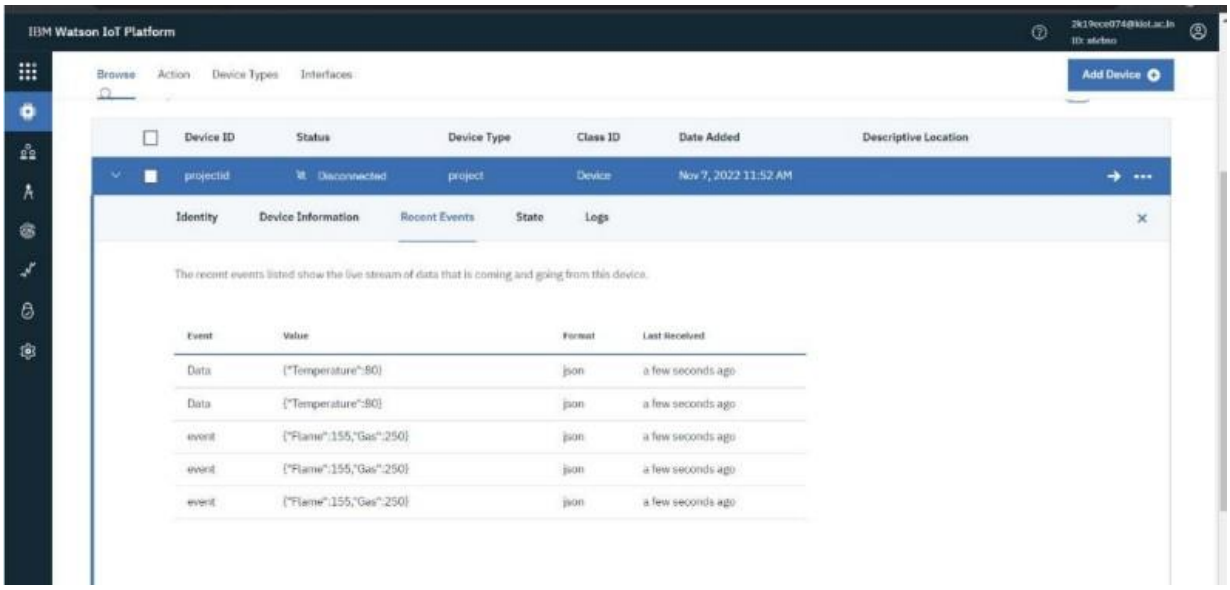

WOKWI
IBM Project
sketch.ino
diagram.json
libraries.txt
Library Manager
Simulation
ESP32
DHT22
The alarm is going off
Publish ok
Temperature:80.00
Humidity:87.00
Sending payload: {"Temperature":80.00,"Humidity":87.00}
Publish ok
callback invoked for topic: iot-2/cmd/command/fmt/String
data: alarmon

## IBM Cloud :

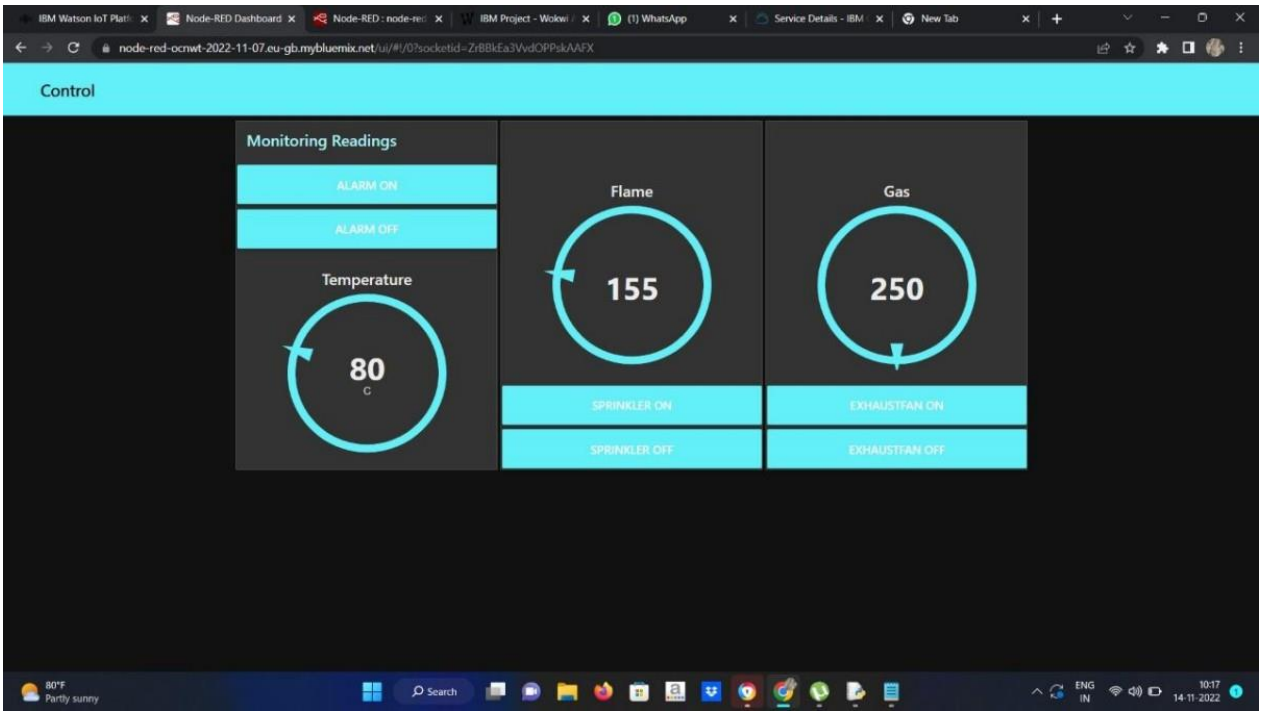

IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Add Device
Device ID
Status
Device Type
Class ID
Date Added
Descriptive Location
projectid
Disconnected
project
Device
Nov 7, 2022 11:52 AM
Identity
Device Information
Recent Events
State
Logs
Event
Value
Format
Last Received
Data
{"Temperature":80}
json
a few seconds ago
event
{"Flame":155,"Gas":250}

## Flame and Gas Sensor :

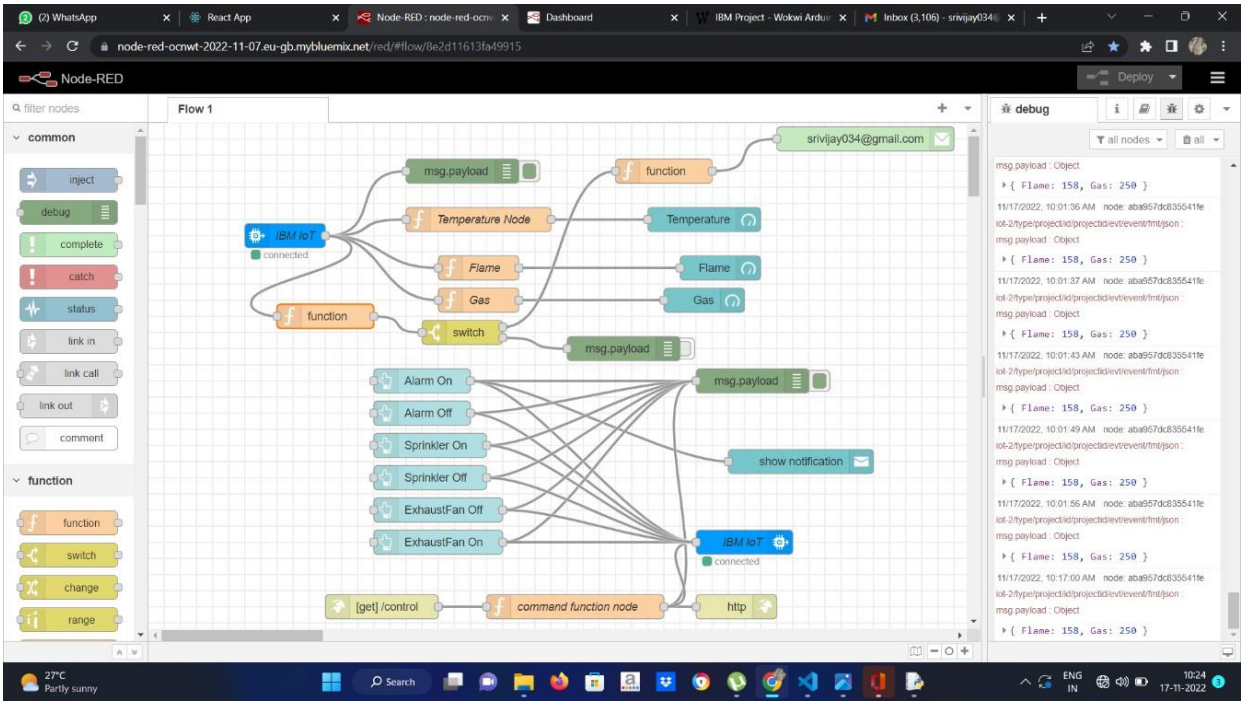
## IBM Cloud :



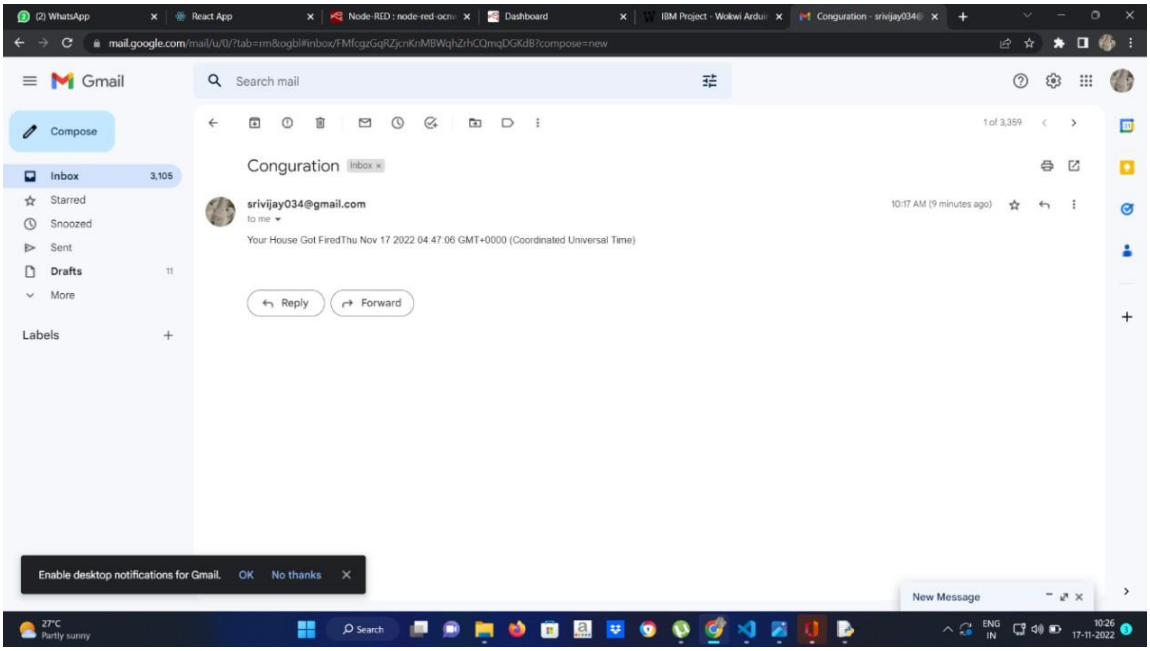

## The Alarm , sprinkler and exhaust fan working as per the instruction.


Control
Monitoring Readings
ALARM ON
ALARM OFF
Temperature
80
C
Flame
155
Gas
250
SPRINKLER ON
SPRINKLER OFF
EXHAUSTFAN ON
EXHAUSTFAN OFF

## Node Red:


Node-RED
Flow 1
common
function
inject
debug
complete
catch
status
link in
link call
link out
comment
function
switch
change
range
msg.payload
Temperature Node
Flame
Gas
function
switch
IBM IoT
connected
srivijay034@gmail.com
Temperature
Flame
Gas
msg.payload
Alarm On
Alarm Off
Sprinkler On
Sprinkler Off
ExhaustFan Off
ExhaustFan On
show notification
IBM IoT
connected
[get] /control
command function node
http
debug

## Email Alert:


Gmail
Search mail
Compose
Inbox 3,105
Starred
Snoozed
Sent
Drafts 11
More
Labels
Conguration Inbox
srivijay034@gmail.com
to me
10:17 AM (9 minutes ago)
Your House Got FiredThu Nov 17 2022 04:47:06 GMT+0000 (Coordinated Universal Time)
Reply
Forward
Enable desktop notifications for Gmail.
OK
No thanks
New Message

## 6.3 Reports from JIRA

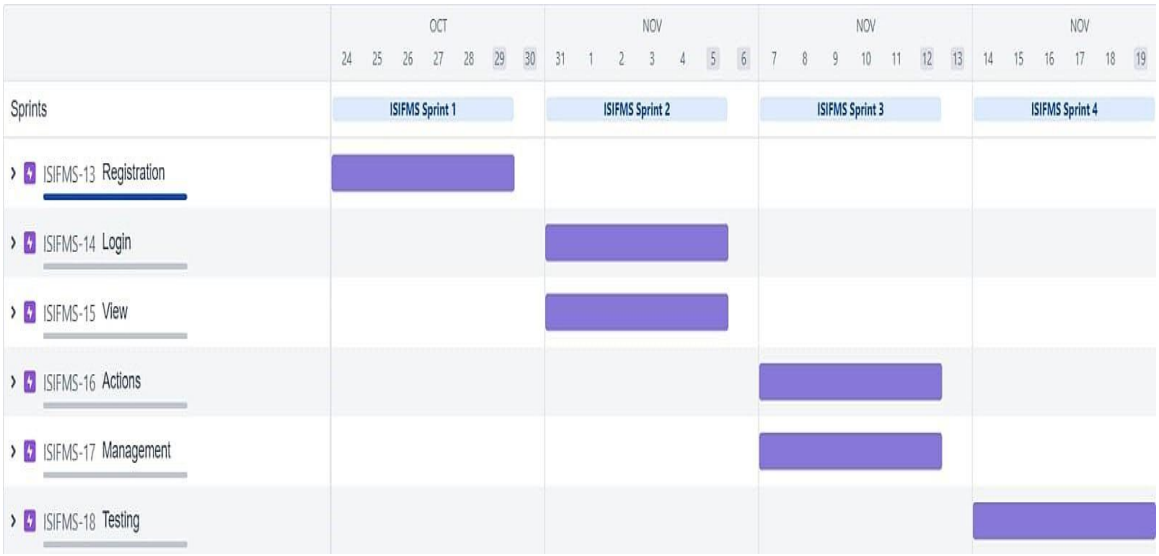



Figure.6.3 Reports from JIRA

# 7. CODING & SOLUTIONING

## 7.1 Feature 1

```
import React, { Component } from 'react'
export default class Login extends Component {
constructor(props) {
    super(props);
    this.state = { password: '', email: '', isButton: true };
  }
  handleChangePassword = (event) => {
    this.setState({ password: event.target.value });
  }
  handleChangeEmail = (event) => {
    this.setState({ email: event.target.value });
  }
  onClickEvent = () =>{
    if(this.state.email !== "ibmiot015@gmail.com" || this.state.password !==
"iotibm"){
      alert("Email id or password is incorrect")
    }}
  render() {
    return (
      <form>
        <h3>Sign In</h3>
        <div className="mb-3">
          <label>Email address</label>
          <input
            type="email"
            className="form-control"
```

```
          placeholder="Enter email"
          value={this.state.email}
          onChange={this.handleChangeEmail}
        />
      </div>
      <div className="mb-3">
        <label>Password</label>
        <input
          type="password"
          className="form-control"
          placeholder="Enter password"
          value={this.state.password}
          onChange={this.handleChangePassword}
        />
      </div>
      <div className="d-grid">{
        (this.state.email === "ibmiot015@gmail.com" && this.state.password ===
"iotibm") ?
          <a
            className="btn btn-primary"
            href="https://node-red-ocnwt-2022-11-07.eu-gb.mybluemix.net/ui"
            target="_self"
            rel="noopener noreferrer"
            onClick={this.onClickEvent}
          >
            submit
          </a>
          :
          <button type="submit" className="btn btn-primary"
onClick={this.onClickEvent}>
          Submit
```

```
          </button>
        }
      </div>
    </form>
  )
 }
}
```

## 7.2 Feature 2:

```
msg.payload1=msg.payload.Temperature
msg.payload2=msg.payload.Flame
msg.payload3=msg.payload.Gas
if((msg.payload1>=70) | (msg.payload2>=156) | (msg.payload3>=251)){
   msg.payload=1;
   return msg;
}
else {
    msg.payload=0;
    return msg;
}
```

# 8.TESTING

## 8.1 Test Cases

| Test case ID | Feature Type | Component | Test Scenario |
|---|---|---|---|
| Frontend_TC_OO1 | Dashboard UI | Home page | User login |
| Backend_TC_OO2 | UI Configuration | Node Red Editor | UI should get the details from the userto storein database |
| Readings_TC_OO3 | Sensors | Wokwi, Python 3.7.3 | Find readings to generate the alert messages |
| Datebase_TC_OO4 | Cloudant Database | IBM Cloudant DB | Verifying the details |

**Figure 8.1.1 Test case**

| Steps To Execute | Test Data | Expected Result | Status | Executed by |
|---|---|---|---|---|
| 1.Login using Industry mail and password | https://fire-management-system.netlify.app/? | User account homepage | Pass | Sri Vijay Kumar R M |
| 1.Web UI Configuration 2.to turn ON the sprinkles And exhaust fan | https://fire-management-system.netlify.app/? | Process the information which shown in the readings. | Pass | Lokesh S |
| 1.To check whether the abnormal Temperatre ,flame and gas levels. | https://wokwi.com/projects/347842939277279827 | Accurate Readings | Pass | Vignesh V |
| 1.Alert messages. 2.Go to Cloudant dashboard | https://0a0d9576-bd85-4c88-9a94-8ed218e657ff-bluemix.cloudant.com | Sensor Readings should store in database document | Pass | Keerthivasan R |

Table.8.1.2 Test Report

## 8.2 User Acceptance Testing

The purpose of this document is to briefly explain the test coverage and open issues of the wokwi,Node-Red,python 3.7.3, UI Dashboard of project at the time of the release to User Acceptance Testing (UAT).

**Data Analysis:**

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 4 | 3 | 2 | 1 | 10 |
| Duplicate | 0 | 0 | 1 | 1 | 2 |
| External | 4 | 3 | 0 | 1 | 8 |
| Fixed | 7 | 3 | 3 | 12 | 25 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 0 | 1 | 1 |
| Won't Fix | 0 | 0 | 0 | 1 | 1 |
| Totals | 15 | 9 | 7 | 17 | 48 |

This report shows the number of test cases that have passed, failed, and untested

**Test case Analysis:**

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| Login | 4 | 0 | 0 | 4 |
| Wokwi | 13 | 0 | 0 | 13 |
| Python 3.7.3 | 8 | 0 | 0 | 8 |
| Node-Red | 5 | 0 | 0 | 5 |
| UI Dashboard | 3 | 0 | 0 | 3 |
| Final Report Output | 7 | 0 | 0 | 7 |

# 9. RESULT

## 9.1 Performance Metrics

## Temperature Sensor:

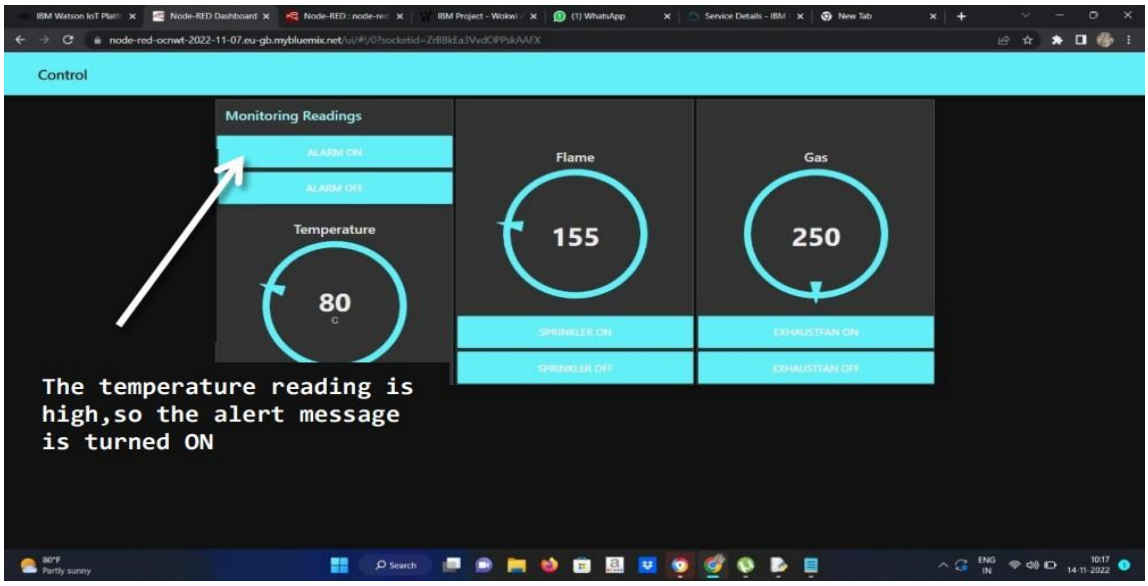



Figure.9.1.1 Temperature sensor Reading

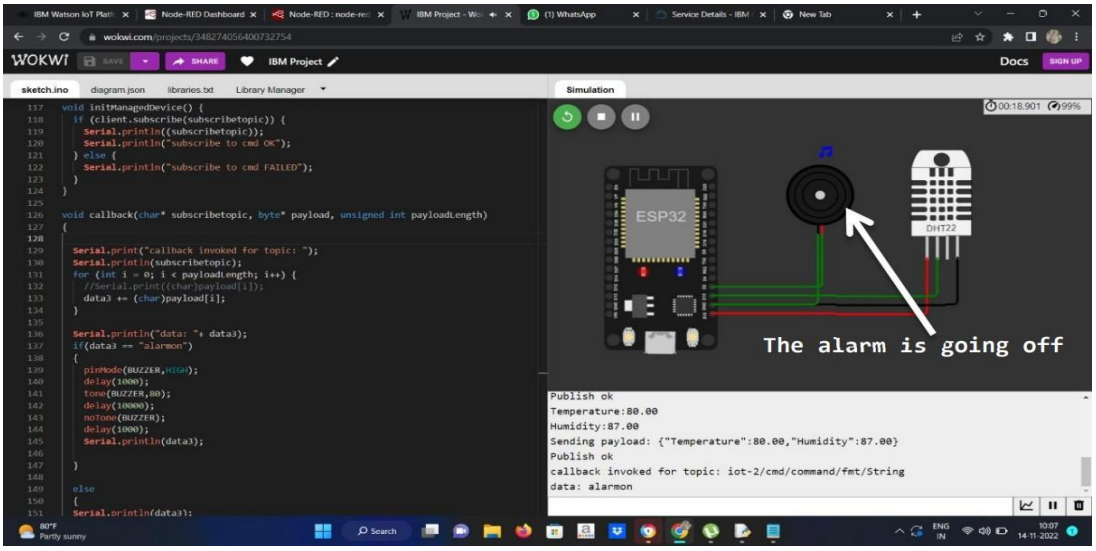



Figure.9.1.2 Alarm indication

## IBM Cloud:

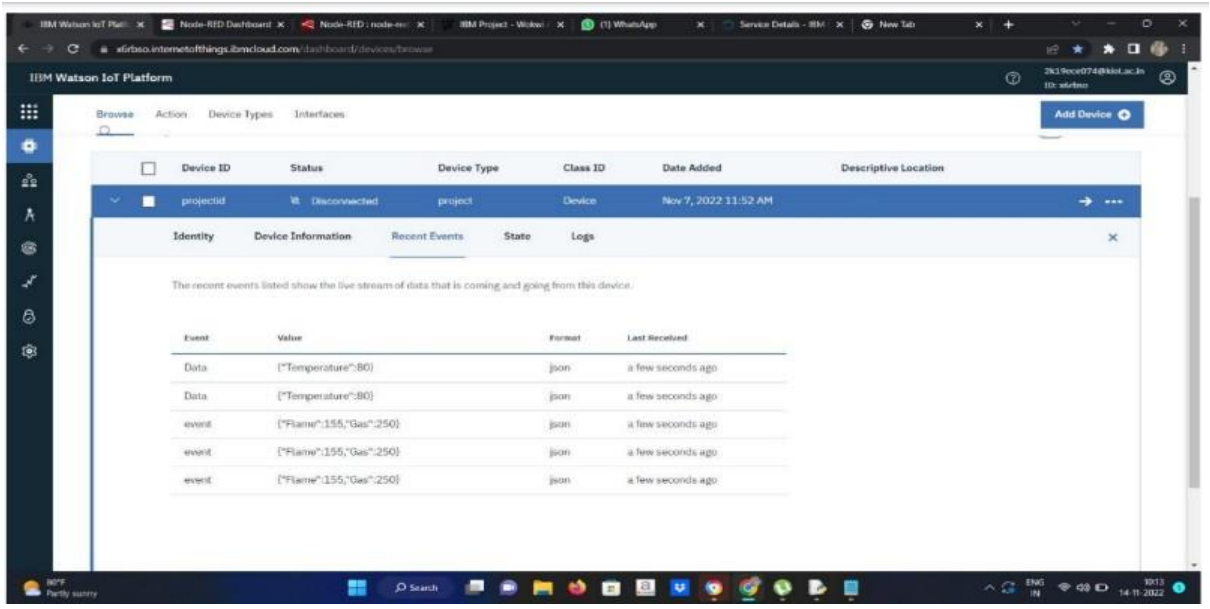



Figure.9.1.3 Cloud Readings

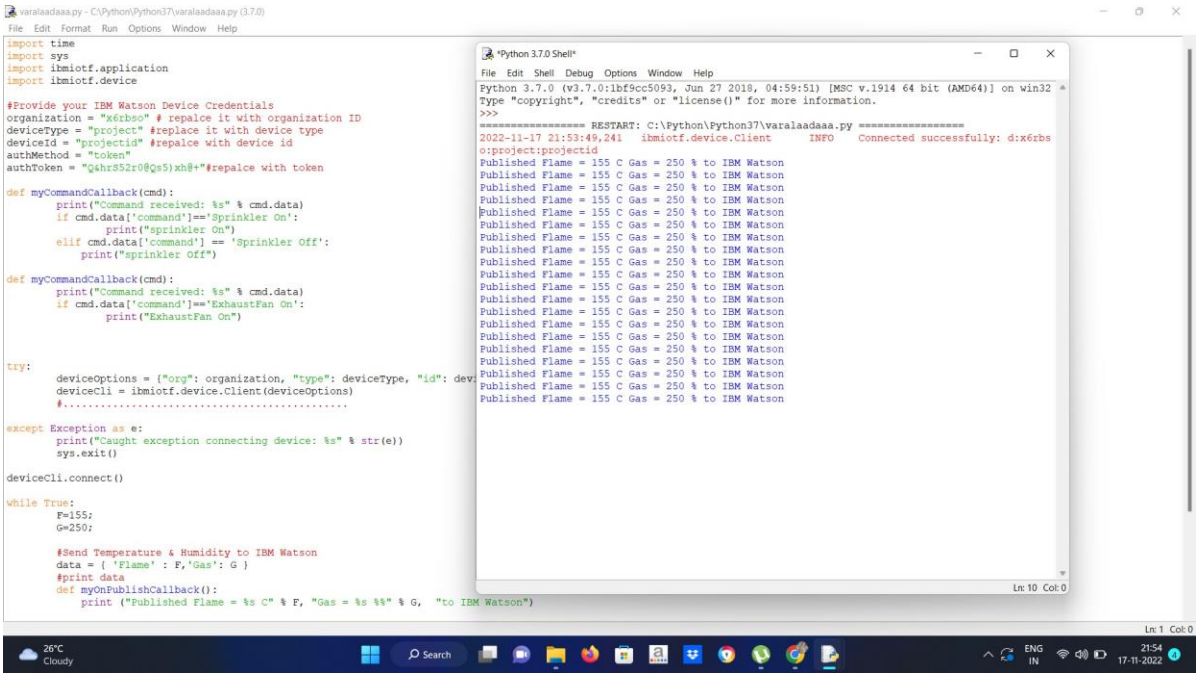



Figure.9.2.1 Output for Flame and Gas sensor

## IBM Cloud:

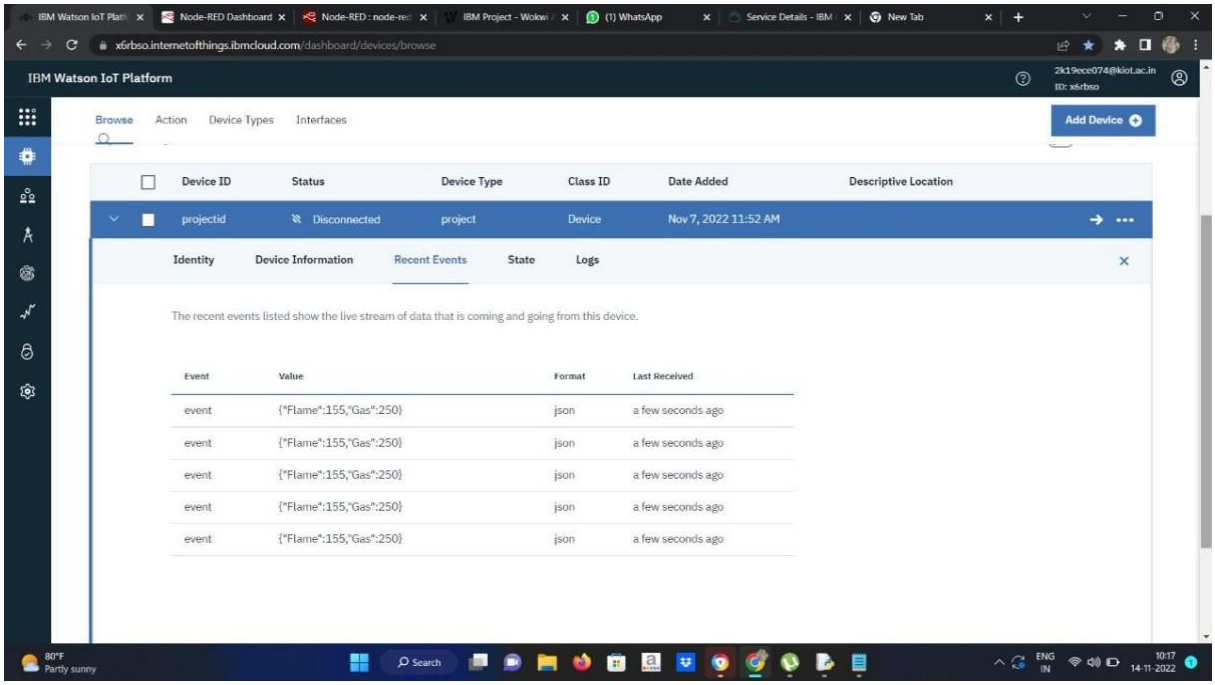



Figure.9.2.2 Cloud Readings

**The Alarm , sprinkler and exhaust fan working as per the instruction.**

## Node Red:

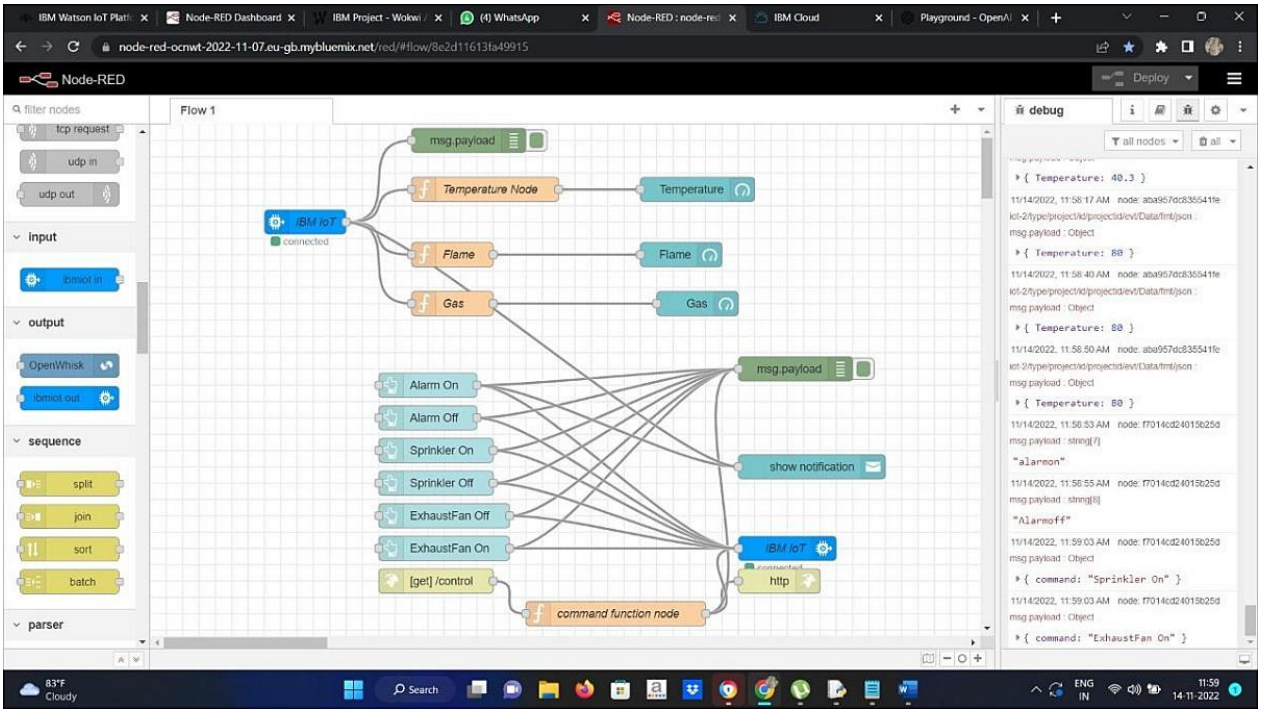



Figure 9.2.3 Node Red

# 10. ADVANTAGES & DISADVANTAGES

## Advantages :

1. The main advantage and function of a fire alarm system is to ensure ultimate safety.
2. They help warn and keep people safe and reduce the amount of destruction to a building.
3. This is probably the major reason as to why a business will install a fire detection system.

## Disadvantages :

1. Temperature sensor-Nonlinearity, limited support for temperature range, current source needed, fragile, self heating etc
2. Maintenance. Systems need to be tested annually and parts replaced as they break or age.
3. Insurance companies often give significant discounts for fire insurance when a monitored, maintained alarm is present and operational.
4. However, they can be costly to install and maintain, because they need more maintenance and testing.
5. False Alarms. Many municipalities charge a fee for responding to a false alarm when it was preventable (like when servicing the system).

# 11.CONCLUSION

In conclusion it is important to have a fire protection system in place as a part of abuilding's safety plan. Without a fire protection system, the lives of those who are inside thebuilding are placed at a high risk in the event an emergency. The systems recommended for uselike the fire alarm systems, sprinkler systems, fire pumps, and smoke control systems use someamount of actions to notify of the fire and smoke conditions, help slow the growth of the fire orto help put out the fire altogether. The plan that is recommended follows the guidelines providedby NFPA and if they are put into use the City of Washington Distribution Warehouse will be asafe place to work and in case of a fire the building will include protections that will result inminimum loss.

# 12.FUTURE SCOPE

In future this project can be implemented in various places like buildings, schools, colleges, hospitals, etc… Fire detection technologies have been slow to evolve compared to rapidly advancing smart devices. Understandably, global companies focus their efforts on developing high-return products, especially ones that connect consumers with popular trends. While fire alarms aren't exactly at the forefront of social advancement, innovative companies are developing new methods of approaching fire and gas-related threats.

# 13.APPENDIX

## 13.1 Source Code

### TEMPERATURE SENSOR CODE:

```
#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 22
#define LED 2
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 "x6rbso"//IBM ORGANITION ID
#define DEVICE_TYPE "project"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "projectid"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "Q&hrS52r0@Qs5)xh@+"     //Token
String data3;
float h, t;
//-------- 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);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
}

void loop()// Recursive Function
{
  t = dht.readTemperature();
 Serial.print("Temperature:");
 Serial.println(t);
 PublishData(t);
  delay(1000);
  if (!client.loop()) {
    mqttconnect();
  }
}
/.....retrieving to Cloud ..... /
void PublishData(float temp) {
```

```
  mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update the data to ibm cloud
*/
  String payload = "{\"Temperature\":";
  payload += temp;
  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(1000);
    }
     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(1000);
    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");
  }
}
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=="ALERT!!! Your industry got fired")
  {
```

```
  Serial.println(data3);
  pinMode(LED,HIGH);
  tone(LED,67);
  delay(20000);
  }
  else
  {
Serial.println(data3);
pinMode(LED,LOW);
noTone(LED);
  }
data3="";
}
```

**LIBRARIES:**

```
{
  "version": 1,
  "author": "SRI VIJAY KUMAR R M",
  "editor": "wokwi",
  "parts": [
    { "type": "wokwi-esp32-devkit-v1", "id": "esp", "top": -11.62, "left": -130.71,
"attrs": {} },
    {
      "type": "wokwi-dht22",
      "id": "dht1",
      "top": -7.14,
      "left": 141.83,
```

```
      "attrs": { "temperature": "73.5", "humidity": "43" }
    },
    {
      "type": "wokwi-buzzer",
      "id": "bz1",
      "top": -27.23,
      "left": 23.94,
      "attrs": { "volume": "0.1" }
    }
  ],
  "connections": [
    [ "esp:TX0", "$serialMonitor:RX", "", [] ],
    [ "esp:RX0", "$serialMonitor:TX", "", [] ],
    [ "dht1:VCC", "esp:3V3", "red", [ "v0" ] ],
    [ "dht1:SDA", "esp:D15", "green", [ "v0" ] ],
    [ "dht1:GND", "esp:GND.1", "black", [ "v0" ] ],
    [ "bz1:2", "esp:D2", "green", [ "v0" ] ],
    [ "bz1:1", "esp:GND.1", "green", [ "v0" ] ]
  ]
}
```

**GAS AND FLAME SENSOR:**

—

```
import time
import sys
import ibmiotf.application
import ibmiotf.device

#Provide your IBM Watson Device Credentials
organization = "x6rbso" # repalce it with organization ID
```

```
deviceType = "project" #replace it with device type
deviceId = "projectid" #repalce with device id
authMethod = "token"
authToken = "Q&hrS52r0@Qs5)xh@+"#repalce with token

def myCommandCallback(cmd):
        print("Command received: %s" % cmd.data)
        if cmd.data['command']=='Sprinkler On':
                print("sprinkler On")
        elif cmd.data['command'] == 'Sprinkler Off':
           print("sprinkler Off")

def myCommandCallback(cmd):
        print("Command received: %s" % cmd.data)
        if cmd.data['command']=='ExhaustFan On':
                print("ExhaustFan On")



try:
        deviceOptions = {"org": organization, "type": deviceType, "id": deviceId,
"auth-method": authMethod, "auth-token": authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
        #.....................................

except Exception as e:
        print("Caught exception connecting device: %s" % str(e))
        sys.exit()

deviceCli.connect()
while True:
```

```
        F=80;
        G=78;
        #Send Temperature & Humidity to IBM Watson
        data = { 'Flame' : F,'Gas': G }
        #print data
        def myOnPublishCallback():
            print ("Published Flame = %s C" % F, "Gas = %s %%" % G,  "to IBM
Watson")
        success = deviceCli.publishEvent("event", "json", data, qos=0,
on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(60)
        deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
```

## Wokwi :

**Temperature sensor:**

**https://wokwi.com/projects/347842939277279827**

## Python 3.7.3:

**Gas and flame sensor:**

**https://drive.google.com/file/d/1UsonBmemG663_Rs00Z8zd4c6OuM9NYDk/view?usp=share_link**

## NODE RED :

**https://node-red-ocnwt-2022-11-07.eu-gb.mybluemix.net/red/#flow/8e2d11613fa49915**

## 13.2 GitHub & Project Demo Link

**GitHub:**

https://github.com/IBM-EPBL/IBM-Project-41334-1660641326

**Project Demonstration Video:**

https://youtu.be/iZQyFWfr8Q8

# 14.REFERENCE

**[1]** Abdulsahib,A smart fire detection system using IoT technology. "International Journal of Electrical and Computer Engineering (IJECE)", 2019.

**[ 2 ]**Rehman and Saeed F,IoT-Based Intelligent Modeling of Smart Home Environment for Fire Prevention and Safety "Journal of Sensor and Actuator Networks",2018.

**[3 ]** Morandini, F. & Innocenti,Evaluation of a wireless sensor network with low cost and low energy consumption for fire detection and monitoring**"**Engineering Sciences [physics]/Reactive fluid environment",2015.

**[ 4 ]** M. Venkatesh and M. Hemanth Fire Alarm System with location using IoT, " International Journal of Scientific Research in Computer Science, Engineering and Information Technology",2019.