# INDUSTRY – SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

## DOMAIN – INTERNET OF THINGS

## IBM – NALAIYATHIRAN

**PROJECT REPORT**


**TEAM ID:** PNT2022TMID46346

**FACULTY MENTOR:** KARTHICK. B

**INDUSTRY MENTOR:** SANTHOSHI

**TEAM MEMBERS:**

ELAYAKAVI P (TEAM LEADER)

ABDUR RAHMAN M

ASHA G

HEMALA B

MANIKANDAN R

PRAKASH T

HARIHARAN D

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# CHAPTER 1

# INTRODUCTION

In today's world we come across many fire accidents. Fire fighters need to risk their lives in saving fire victims and in extinguishing fire. In such situations they can get trapped in fire and lose their lives and also harmful gases produced due to accident causes breathing trouble and several health issues. Intelligent fire management system is used to detect fire and reduce the injuries deaths. This as well as increases the effectiveness of performing tasks.

Early detection of fire in the home or workplace is one of the important actions to prevent the mass fire and save many things. There are many methods to detect and estimate fire before it become huge. Detecting fire with gas sensor can grow the ability the detection performance and early alarm.

Industrial fire safety is primarily a management activity which is concerned with ReducingControlling& Eliminating fire accident from the industries or industrial units. It is the set of practices intended to reduce the destruction caused by fire. Also, it measures include those that are intended to prevent ignition of an uncontrolled fire, and those that are used to limit the development and effects of a fire after it starts.

## 1.1 PROJECT OVERVIEW

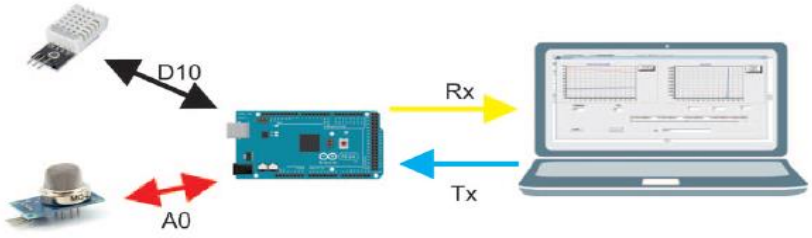



*Fig 1. Design of fire symptoms detection*

a) To prevent fire accidents in the plant by reducing the fire hazard to minimum.
b) To eliminate fire accident caused work stoppage and lost production.

c) To achieve lower workmen's compensation, insurance rates and reduce all other direct and indirect costs of fire accidents.
d) To prevent loss of life, permanent disability and the loss of income of worker by eliminating causes of fire accidents.
e) To evaluate employee's confidence by promoting safe work place and good working condition.
f) To educate all members of the organization in continuous state of safety mindless and to make supervision competent and intensely safety minded.so as to reduce casualties and economic losses.
g) The main overviews of this project are,
    i. Monitoring the temperature and humidity using sensors.
    ii. Fire detection.
    iii. Alert the users through email.
    iv. Do safety measures.
    v. Live monitoring using web and mobile application

## 1.2 PURPOSE

Fire safety reduces the risk of injury and industrial damage that fires can cause. Developing and implementing fire safety protocols in the workplace is not only required by law but it is crucial to everyone's safety that may be in the industrial during a fire emergency. To reduce the destruction caused by fire. Fire safety measures include those that are intended to prevent the ignition of an uncontrolled fire and those that are used to limit the development and effects of a fire after it starts.

# CHAPTER 2
# LITERATURE SURVEY

Jia Jiang proposed the fire data acquisition and transmission by the way of ZigBee wireless sensor network as the bottom, if made a warning by background intelligent fire analysis system. Then finally the application scheme made an effective control for fire through triggering will corresponding fire joint action equipment by a scientific fire emergency decision system [1]. In that the root cause for the fire will have to be analyzed and prevent from the fire before it is triggered. Through this hazardous fire accidents should be avoided and many lives can be saved [2].

To identify the application of narrowband Internet of Things (NB-IoT) technology for the field on fire protection could fundamentally enhance the combat capability of fire fighting forces, In these analyses and introduces an intelligent fire-fighting system based on the new industry standard, and a smoke-fire detection and alarm device based on the Internet of Things (IoT) platform and Nb-IoT technology. It will also put forward corresponding solutions to the problem of smoke fire, such as the value, advantages and future expectations of the solution [3].

In this system, a few advancements have been implemented in order to help the students in various aspects by using multiple and distinct Arduino devices. However, an android application is developed to facilitate the security officer in order to identify the car information that are involved in the accident that might be occur in the university parking area [4].

In this system aim to be notify the users on the detection of flame with the help of a flame sensor so that the person can take action accordingly. With the help of Internet of Things (IoT) paradigm, the fire detection system will be developed using Raspberry-Pi that makes use of flame sensor and

Google cloud-based messaging service (GCM) for sending an alert message to the users. Therefore, the outcome of this device helps people in taking necessary precautions in the home welfare (Mitul Sheth, Anand Trivedi, 2020) [5]. We have designed a cheap Internet of Things based system which enables the early detection of house fire and gas leaks. We had to simulating a scenario where we detect the rising possibility of house fire in the kitchen environment, by measuring temperature and the gases concentration.

To identify the communication process and reduce the number of sent packets from the measuring node to the system gateway, when we applied time series forecasting approach based on moving average prediction scheme (MarjanRalevski and Biljana Risteska Stojkoska,2019) [6].

## 2.1 EXISTING PROBLEM

Fromtraditional system, a few advancements have been implemented in order to help the people in various aspects by using multiple and distinct Arduino devices. However, an android application is developed to facilitate the security officer in order to identify the car information that are involved in the accident that might be occur in the university parking area.

The objective of implementing fire management system is to overcome the drawback of traditional firefighting systems. The proposed systemgathers sensor data to identify the fire and also send early alert to emergency users.

## 2.2 REFERENCES

[1] Jia Jiang, Zhe Gao, Huanhuan Shem, changsheng Wang, “Research on The Fire Warning Program of Cotton Warehousing Based on IoT Technology”, International Conference on Logistics, Informatics and Service Sciences (LISS),IEEE,2015.

[2] N.Savitha, S.Malathi, “A Survey on Fire Safety Measures for Industry Safety Using IOT”, International Conference on Communication and Electronics Systems (ICCES),IEEE,2018.

[3] Tianxiang, Ping Hou, “Application of NB-IoT in Intelligent Fire Protection System”, International Conference on virtual Reality and Intelligent Systems (ICVRIS), IEEE,2019.

[4] Anis Farihan Mat Raffel, Nur Syafiqah Awang, Nur Shamsiah Abdul Rahman, Nor SaradatulAkmarZulkfli, “Internet of Things (IoT) Based Fire Alert Monitoring System for Car Parking”,International Conference on Eectrical and Electronics Engineering (ICEEE),IEEE,2020.

[5] Mitul Sheth, Anand Trivedi, Krishna Suchak, Kumar parmar, Deval Jetpariya, “Inventive Fire Detection utilizing Raspberry Pi for New Age Home of Smart Cities”, Third International Conference on Smart Systems and Inventive Technology (ICSSIT),IEEE,2020.

[6] MarjanRalevski, Biljana RisteskaStojkoska, “IoT based System for detection of gas leakage and house fire in smart kitchen environments”,27thTelecommunicationsForum (TELFOR), IEEE,2019.

## 2.3 PROBLEM STATEMENT DEFINITION

The proposed systemgathers sensor data from multiple sensor types that are sensitiveto measuring various components emitted from fires.Then, the collected sensor data are displayed the web ui and mobile application for real-time monitoring and detects the outbreak of fires at an earlystagewith lowfalse alarms.

The sensordata collectedby the newly developed sensing system periodically and experimentalresults conducted by the proposed fire detection algorithmshow the effectiveness of the proposed fire detection system.

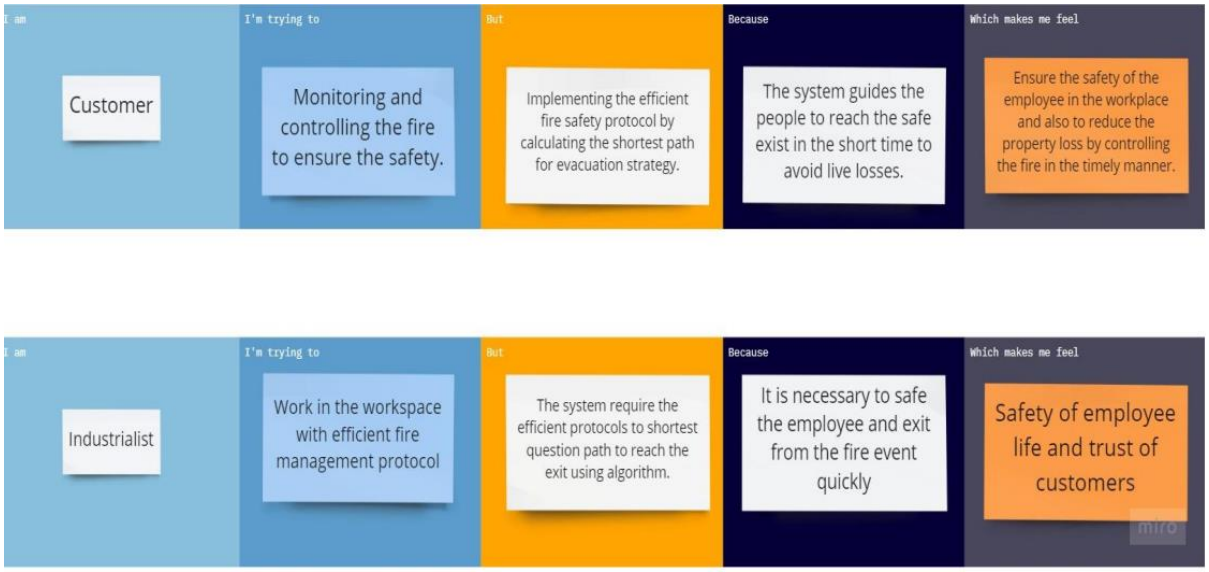



*Fig 2.Problem statement proposed solution*

**TABLE 1:**

| **Problem Statement (PS)** | **I am** | **I'm trying to** | **But** | **Because** | **Which makes me feel** |
|---|---|---|---|---|---|
| Detecting the fire incident in the industry. | A Customer | Monitoring and controlling the fire to ensure the safety. | Implementing the efficient fire safety protocol by calculating the shortest path for evacuation strategy. | The system guides the people to reach the safe exist in the short time to avoid live losses | Ensure the safety of the employee in the workplace and also to reduce the property loss by controlling the fire |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | in the timely manner. |
| Monitor and controlling the fire in the earlier stage to prevent the risk of losses. | An Industrialist | Work in the workspace with efficient fire management protocol. | The system requires the efficient protocols to detect the probability of fire detection and make control measures once break out | It is necessary to safe the employee and exit from the fire event quickly by early identification of fire. | Safety of employee life and trust of customers |

# CHAPTER 3

# IDEATION & PROPOSED SOLUTION

## 3.1EMPATHY MAP CANVAS

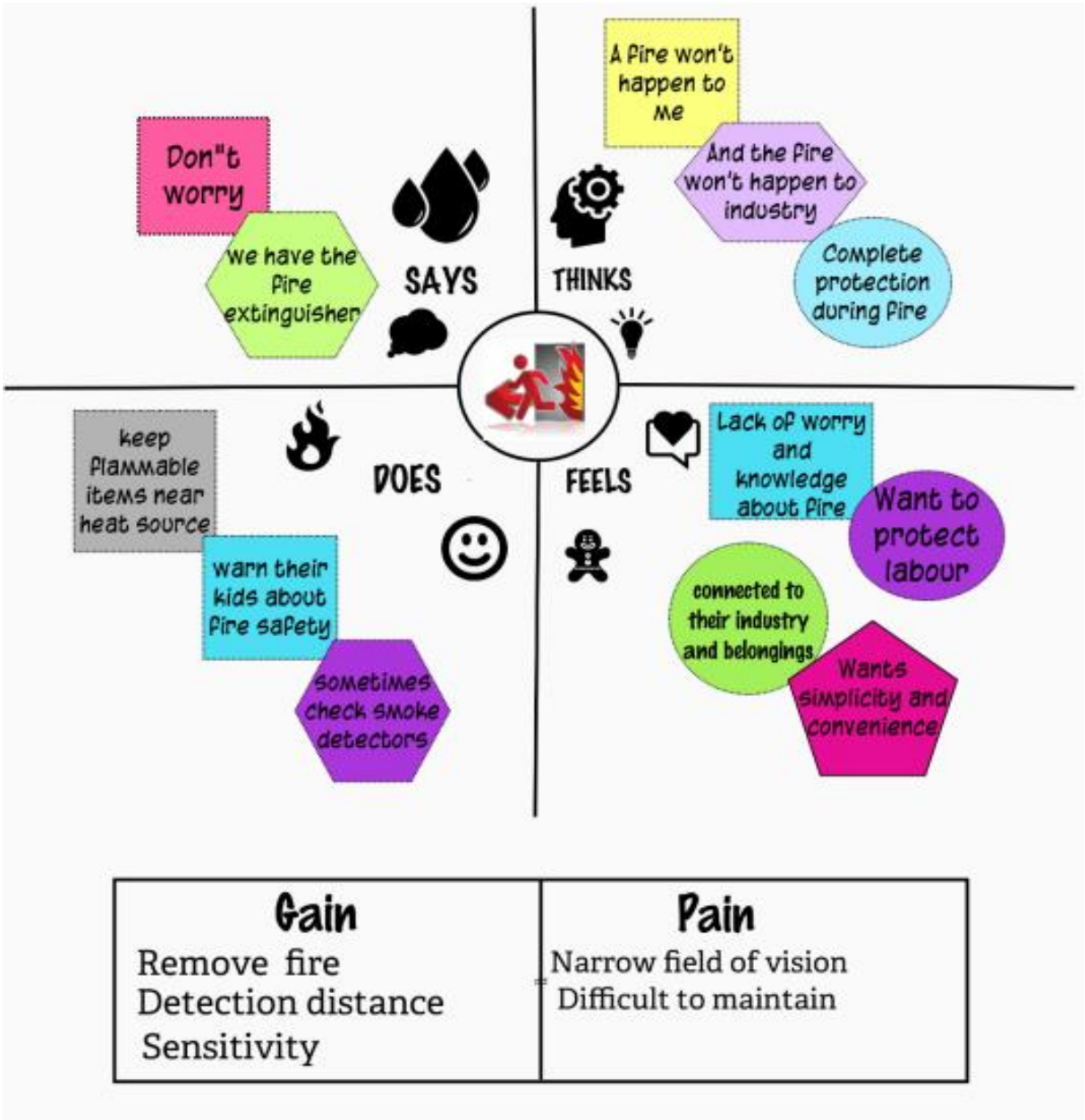



*Fig 3.Empathy map*

## 3.2IDEATION & BRAINSTORMING

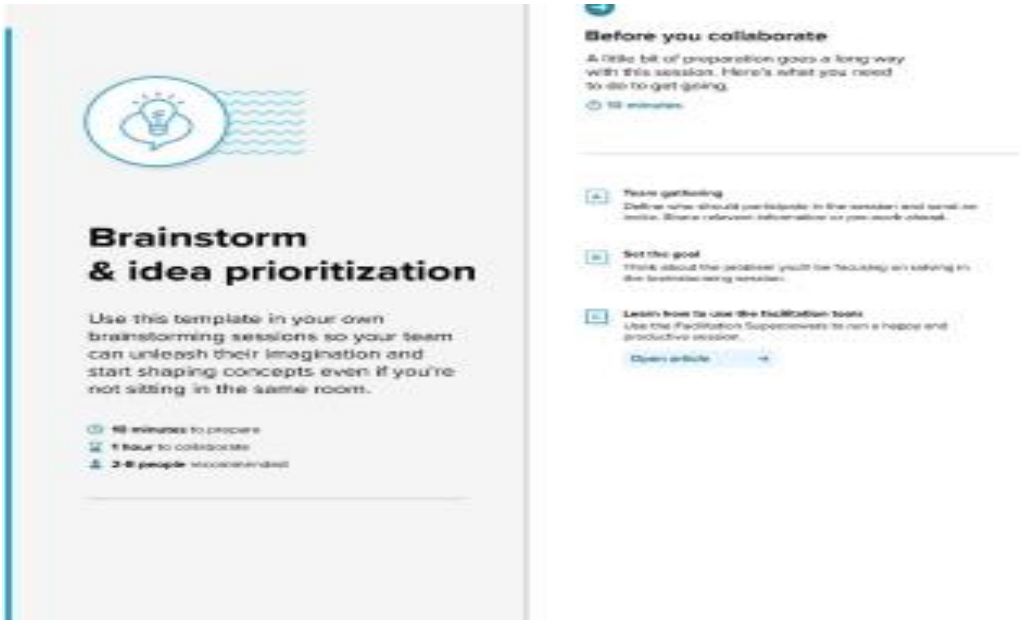



*Fig 4.Brainstorm & idea prioritization*


*Fig 5.Brainstorm*

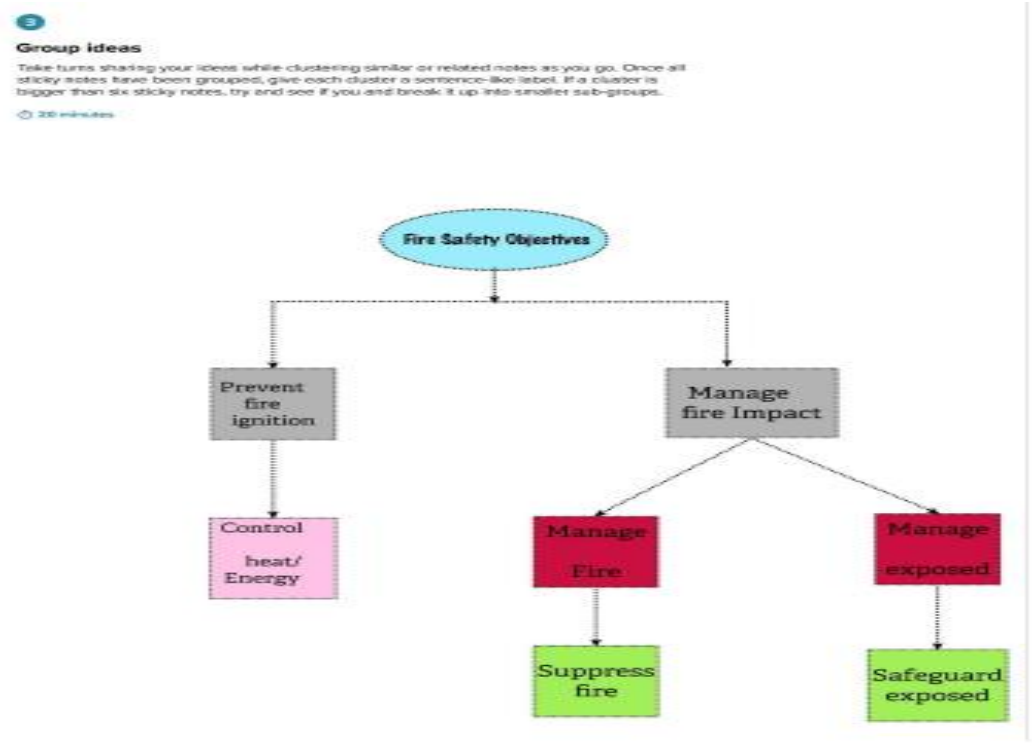



*Fig 6.Group ideas*

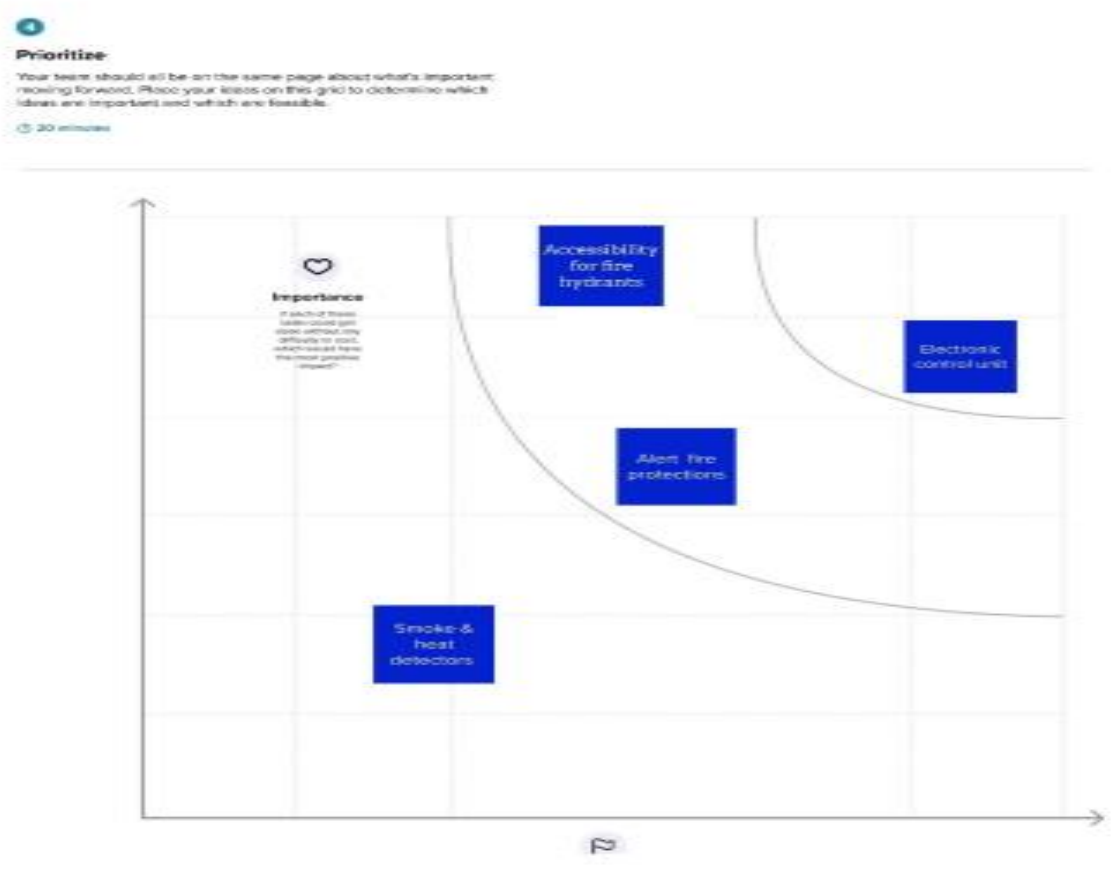



*Fig 7.Prioritize*

## 3.3PROPOSED SOLUTION

**TABLE 2**

| S.No | Parameter | Description |
|---|---|---|
| 1 | Problem Statement (Problem to be solved) | Fire is one of the main concerns when looking at potential risks to buildings. Developing and implementing fire safety protocols in the workplace is needed to reduce the risk of injury to employees and customers, and to protect against losing customers' trust. The complexity and variability of the internal environment of public buildings prompt to think about how to protect people in fire and quickly reach the safe area. |
| 2 | Idea / Solution description | Industry specific fire management system is implemented by integrating different types of sensors to detect the fire. When the fire breaks out it will send the alert message to the nearby fire station through cloud. |

| | | |
|---|---|---|
| 3 | Novelty / Uniqueness | Designing display/Audio system to help the earlyidentification of fire. And automatically share the alert the respective user and do control measure |
| 4 | Social Impact / Customer Satisfaction | The System can help guide the people to identify the fire from the building real-time, so as to reduce causalities and economic losses. |
| 5 | Business Model (Revenue Model) | This model may guarantee people to escape the fire and reach the safe are smoothly. |
| 6 | Scalability of the Solution | The system is completely expandable and it can be installed in various node of the building |

## 3.4 PROBLEM SOLUTION FIT

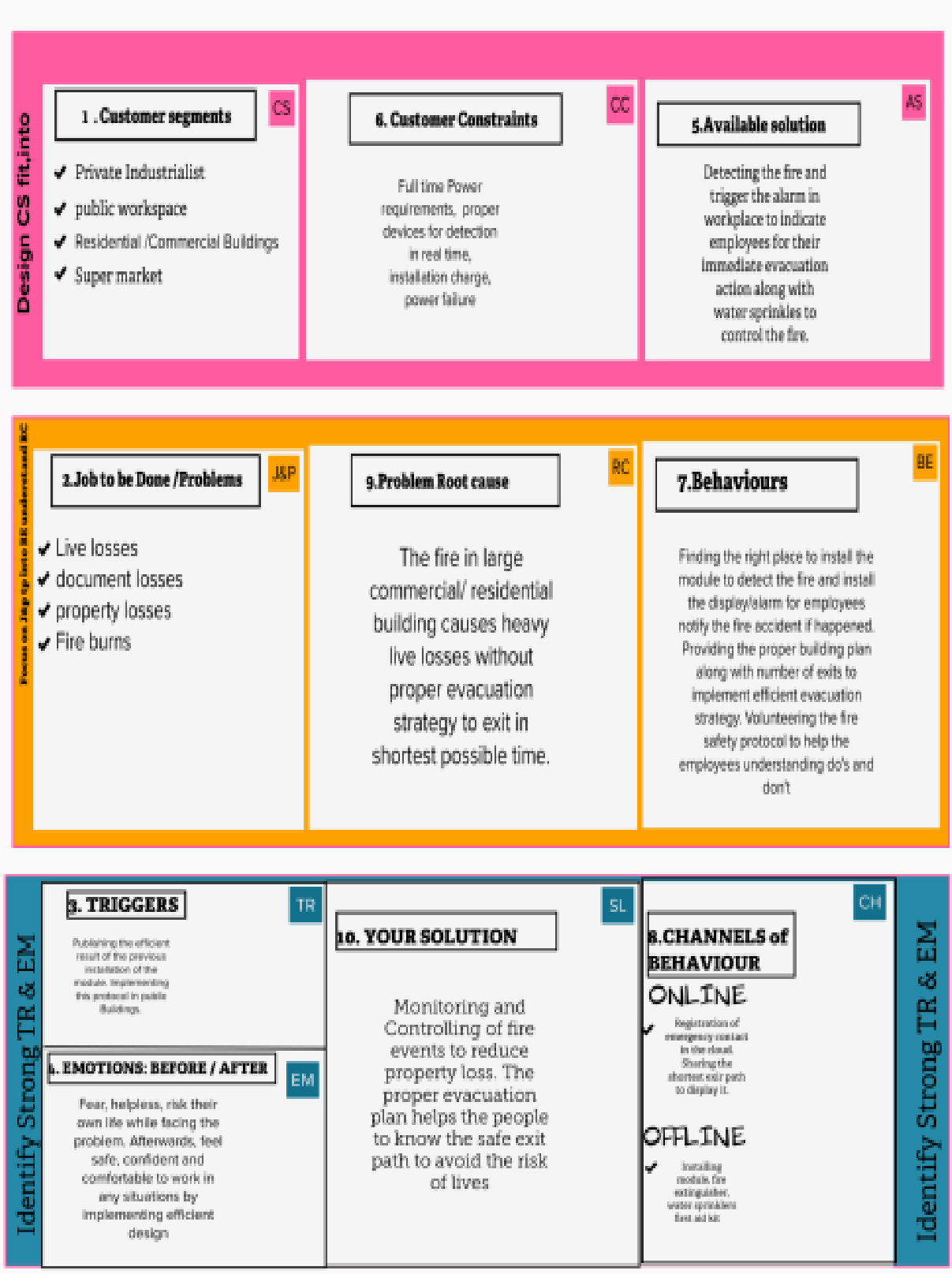



*Fig 8.Problem solution fit*

# CHAPTER 4

# REQUIREMENT ANALYSIS

## 4.1 FUNCTIONAL REQUIREMENTS

**TABLE 3 -Functionalrequirementsoftheproposedsolution.**

| **FRNo.** | **FunctionalRequirement (Epic)** | **SubRequirement (Story/Sub-Task)** |
|---|---|---|
| FR-1 | UserRegistration | • Registration through Form.<br>• Registration through mobile number.<br>• Registration through Gmail. |
| FR-2 | UserConfirmation | • Verification via Email.<br>• Verification via OTP. |
| FR-3 | UserLogin | Login through website or App using the respective user name and password. |
| FR-4 | UserAccess | Access the app requirements. |
| FR-5 | UserUpload | User should be able to up load the data. |
| FR-6 | UserSolution | Data report should be generated and delivered to user for every 24hours. |
| FR-7 | UserDataSync | API interface toincrease to in voice system. |
| FR-8 | Location notification | Location of fire will be sent to the fire department through alarm or message. |

## 4.2 NON - FUNCTIONAL REQUIREMENTS

**TABLE 4 - Non-Functionalrequirementsofthepproposedsolution.**

| FR No. | Non-FunctionalRequirement | Description |
|---|---|---|
| NFR -1 | **Usability** | Usability requirements includes languagebarriers and localization tasks. Usability can beassessedby Efficiencyofuse. |
| NFR -2 | **Security** | Accesspermissionsfortheparticularsyst eminformation may only be changed by thesystem'sdataadministrator. |
| NFR -3 | **Reliability** | Thedatabaseupdateprocessmustrollbackall relatedupdateswhenanyupdatefails. |
| NFR -4 | **Performance** | Thefront-pageloadtimemustbenomorethan2 seconds for users that access the websiteusingaVoLTEmobileconnection. |
| NFR-5 | **Scalability** | We can increase scalability by adding memory, servers, or disk space. On the other hand, we can compress data, use optimizing algorithms. |
| NFR-6 | **Availability** | New module deployment must not impact front page, product pages, and check out pages availability and mustn't take longer than one hour. |

# CHAPTER 5
# PROJECT DESIGN

## 5.1 DATA FLOW DIAGRAMS

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

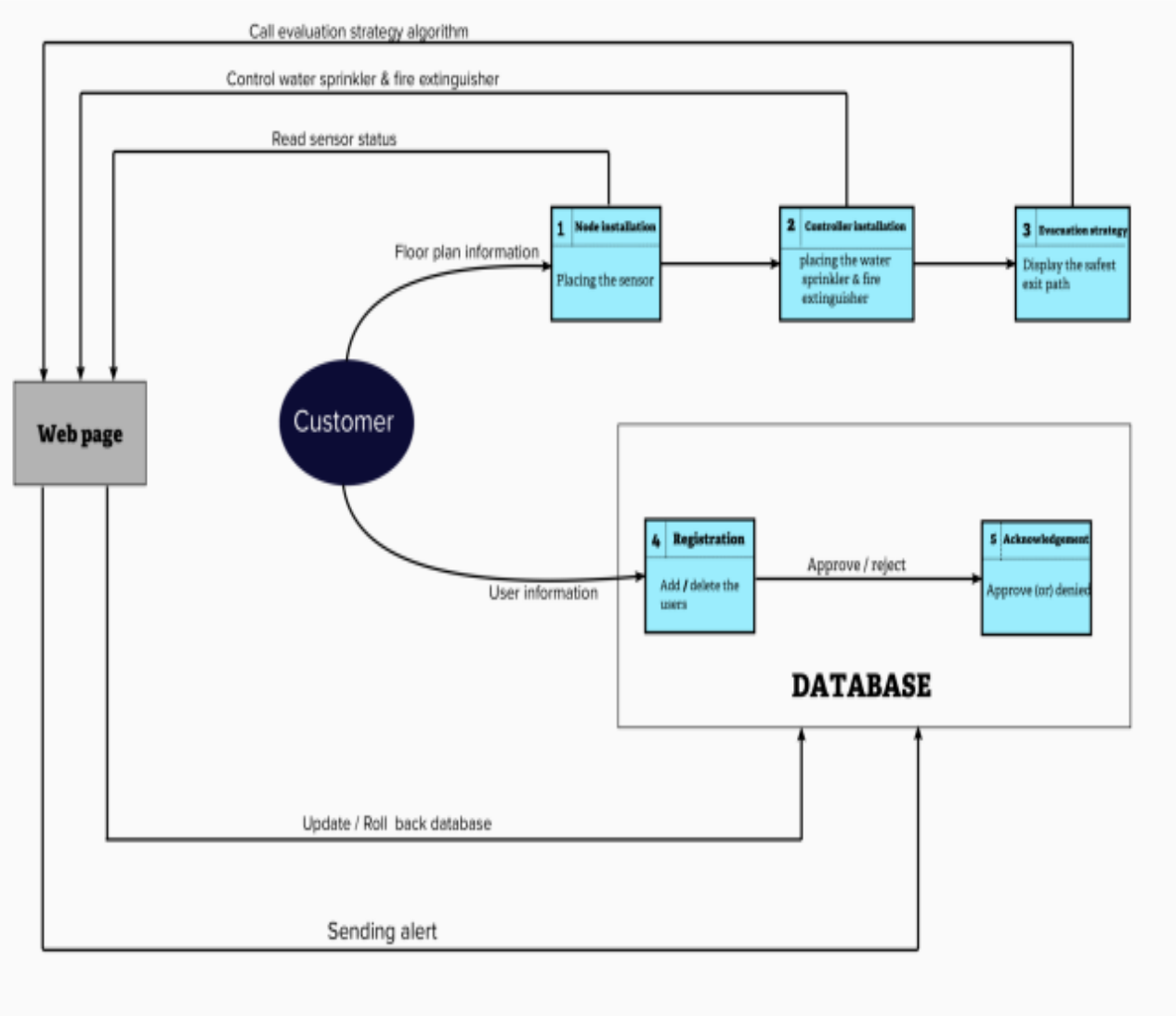



*Fig 9.Data flow diagram*

**TABLE 5**

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (Mobile user) | Floor plan update | USN-1 | Design the web application with installed sensor, water sprinkler as per floor plan | I can access my account / dashboard | High | Sprint 1 |
| | Registration | USN-2 | As a user, I can register the application by entering email, password and confirm it | I can receive confirmation email & click confirm | High | Sprint 1 |
| | Login | USN-3 | As a user login to web application with registered mail and password. | I can register & access the dashboard with Facebook Login | High | Sprint 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Dashboard | USN-4 | Go to live dashboard to view node status. | I can see the live status | High | Sprint 1 |
| Admin | storage | USN-5 | As an admin, I can add the emergency contact | | High | Sprint 2 |
| | | USN-6 | Can able to delete/modify the data | | Medium | Sprint 2 |
| | Acknowledgement | USN-7 | Approve/Denied by sending acknowledgement to respective user | | Low | Sprint 4 |
| Customer Care Executive | Action | USN-8 | Display the temperature Reading | I can see the live status about temperature | High | Sprint 2 |
| | | USN-9 | Display the humidity reading | I can see the live status about humidity | High | Sprint 2 |
| | | USN-10 | As a user, I can able to detect the fire. | | Medium | Sprint 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | USN-11 | As a user, I can able to control the fire using water sprinkler. | | Medium | Sprint 3 |
| | Sharing alert | USN-12 | Sending message alert to emergency contact. | | High | Sprint 3 |
| | | USN-13 | Track the status of message | I can see the live status about humidity | Low | Sprint 3 |
| | Floor path | USN-14 | As a user, I can display the details via mobile application | | High | Sprint 4 |

## 5.2 SOLUTION & TECHNICAL ARCHITECTURE

Industry-Specific Intelligent Fire Management System is a process involves – monitoring and controlling of fire in workplace.

i. Detecting the fire event using different sensors by integrating various parameters like temperature, humidity, gas etc.,
ii. Registering the users and fire controlling service in the cloud database
iii. Once the fire detects, the alert will send to all user through cloud service

iv. Indicating the fire in workplace by using buzzer and controlled by using fire extinguisher and water sprinklers

v. Provide the safety measure by controlling fire

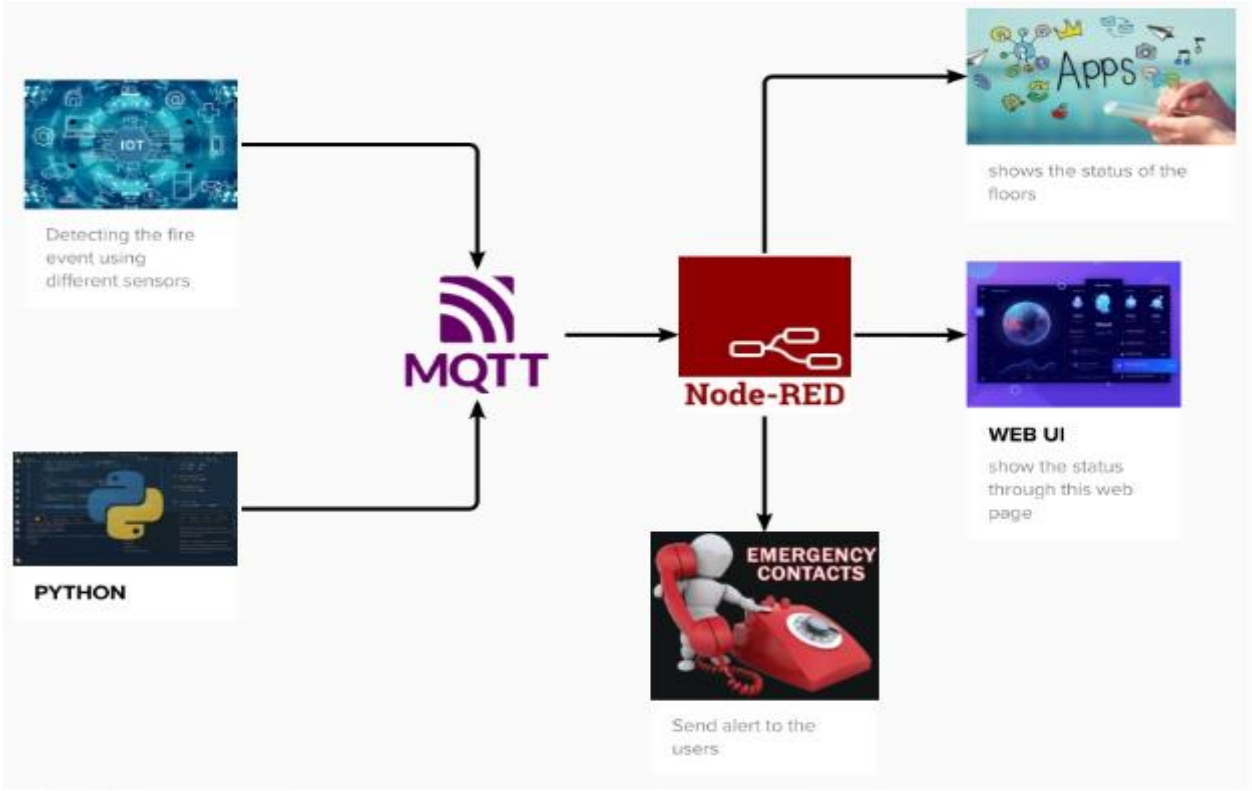



*Fig 10. Architecture and data flow of the IOT based Fire Management System*

# CHAPTER 6

# PROJECT PLANNING & SCHEDULING

## 6.1 SPRINT PLANNING & ESTIMATION

### TABLE 6

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story point | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Floor plan update | USN-1 | Design the web application with installed sensor, water sprinkler as per floor plan. | 3 | high | Elayakavi P<br>Hariharan D<br>Manikandan R |
| Sprint-1 | Registration | USN-2 | As a user, I can register the application by entering email, password and confirm it | 1 | high | Abdurrahman M<br>Manikandan R<br>Prakash T |
| Sprint-1 | Login | USN-3 | As a user login to web application with registered mail and password. | 1 | High | Abdurrahman M<br>Asha G<br>Hemala B |
| Sprint-1 | Dashboard | USN-4 | Go to live dashboard to view node status. | 2 | High | Hemala B<br>Prakash T |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Elayakavi P |
| Sprint-2 | Storage | USN-5 | As an admin, I can add the emergency contact | 3 | High | Elayakavi P<br>Manikandan R<br>Hariharan D |
| Sprint-2 | | USN-6 | Can able to delete/modify the data | 1 | Medium | Prakash T<br>Asha G<br>Hemala B |
| Sprint-4 | Acknowledge-ment | USN-7 | Approve/Denied by sending acknowledgement to respective user | 2 | Low | Hariharan D<br>Abdurrahman M<br>Asha G |
| Sprint-2 | Action | USN-8 | Display the temperature Reading | 2 | High | Elayakavi p<br>Hemala B<br>Asha G |
| Sprint-2 | | USN-9 | Display the humidity reading | 2 | High | Abdurrahman M<br>Hariharan D<br>Manikandan R |
| Sprint-2 | | USN-10 | As a user, I can able to detect the | 1 | Medium | Asha G |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | fire | | | Prakash T<br><br>Elayakavi P |
| Sprint-3 | | USN-11 | As a user, I can able to detect the fire | 3 | Medium | Hemala B<br><br>Manikandan R<br><br>Prakash T |
| Sprint-3 | Sharing alert | USN-12 | Sending message alert to emergency contact. | 3 | High | Manikandan R<br><br>Abdurrahman M<br><br>Hemala B |
| Sprint-3 | | USN-13 | Track the status of message | 2 | Low | Prakash T<br><br>Asha G<br><br>Hariharan D |
| Sprint-4 | Floor path | USN-14 | As a user, I can display the details via mobile application | 4 | High | Elayakavi P<br><br>Abdurrahman M<br><br>Hariharan D |

## 6.2 SPRINT DELIVERY SCHEDULE

**TABLE 7**

| 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 | 4 Days | 04 Nov 2022 | 07 Nov 2022 | 20 | 07 Nov 2022 |
| Sprint – 2 | 20 | 4 Days | 08 Nov 2022 | 11 Nov 2022 | 20 | 11 Nov 2022 |
| Sprint – 3 | 20 | 4 Days | 12 Nov 2022 | 15 Nov 2022 | 20 | 15 Nov 2022 |
| Sprint - 4 | 20 | 4 Days | 16 Nov 2022 | 19 Nov 2022 | 20 | 19 Nov 2022 |

**Velocity:**

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{\text{Velocity}}{\text{Sprint Duration}} = \frac{20}{4} = 5$$

**Burndown Chart:**

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum.

However, burn down charts can be applied to any project containing measurable progress over time.

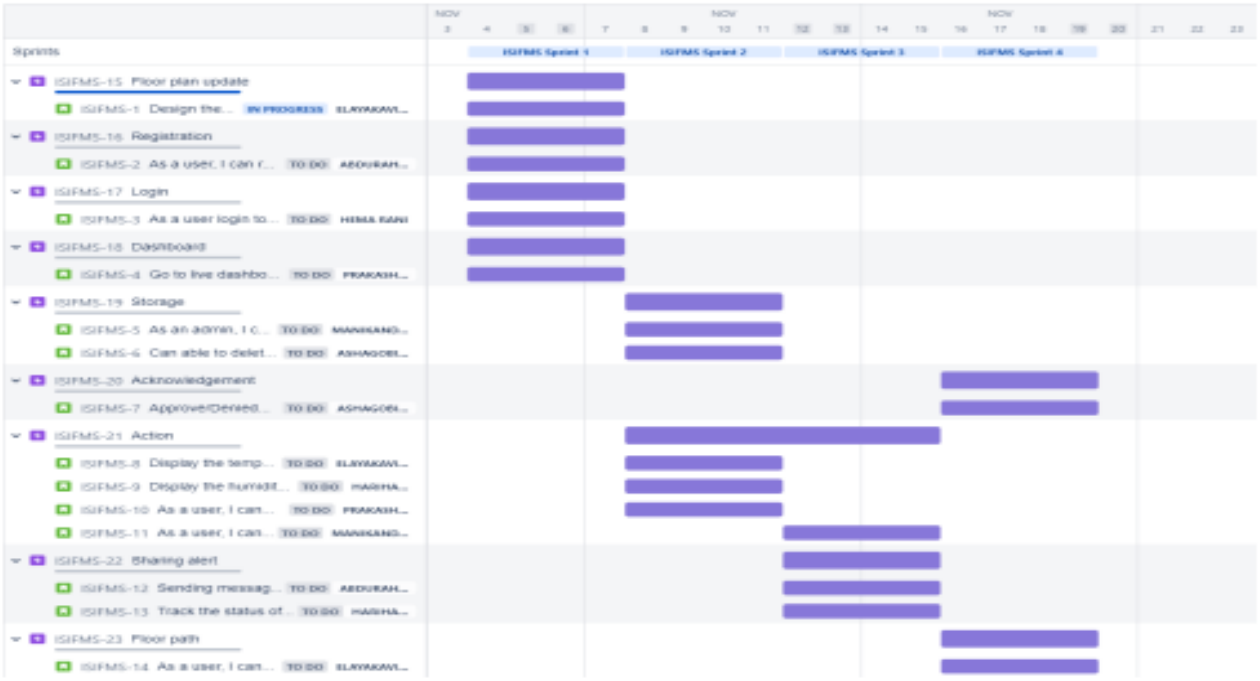


*Fig 11.Sprint delivery*

## 6.3 REPORTS FROM JIRA

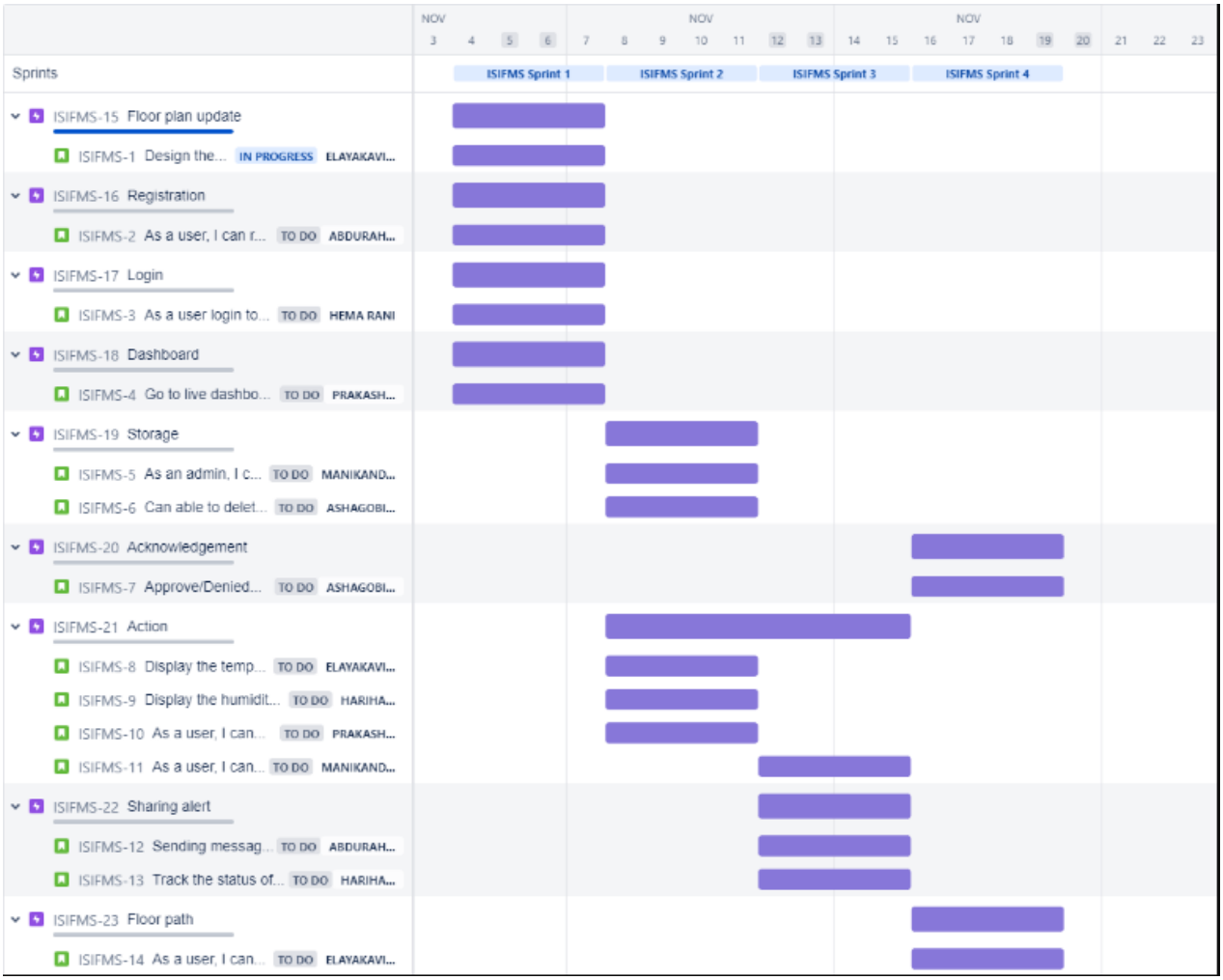



*Fig 12.Reports from JIRA*

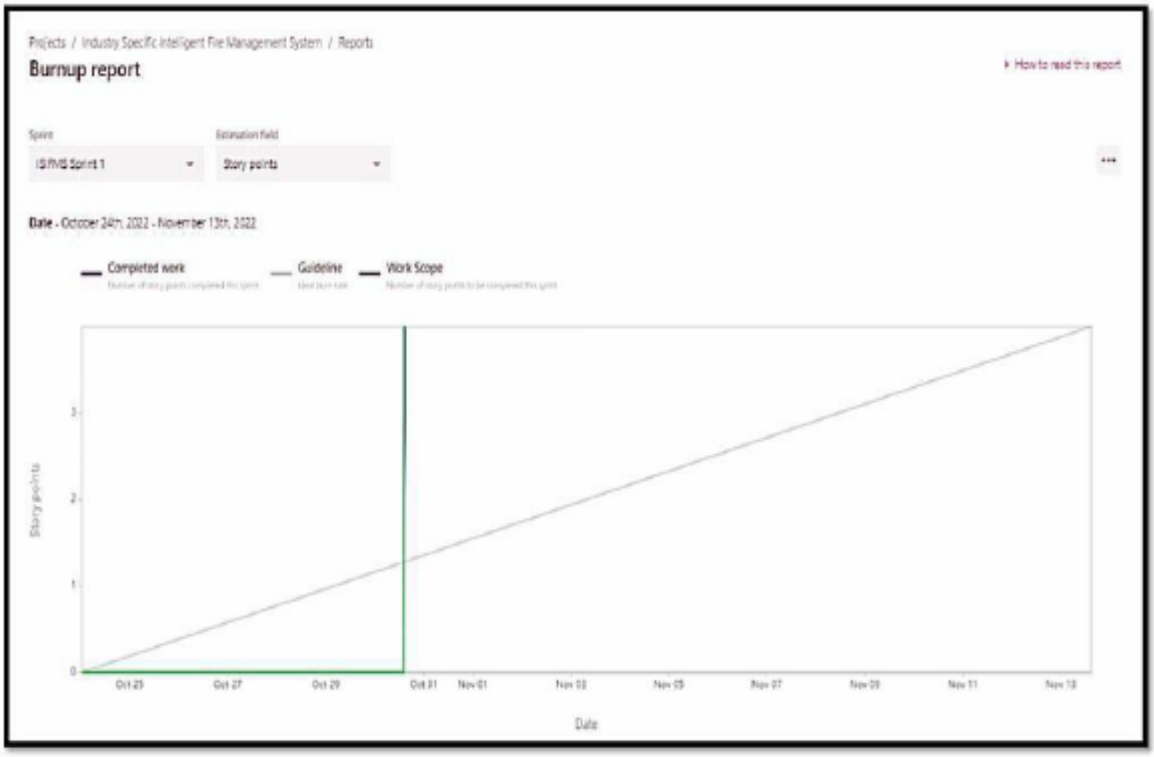



*Fig 13.Burnup report*

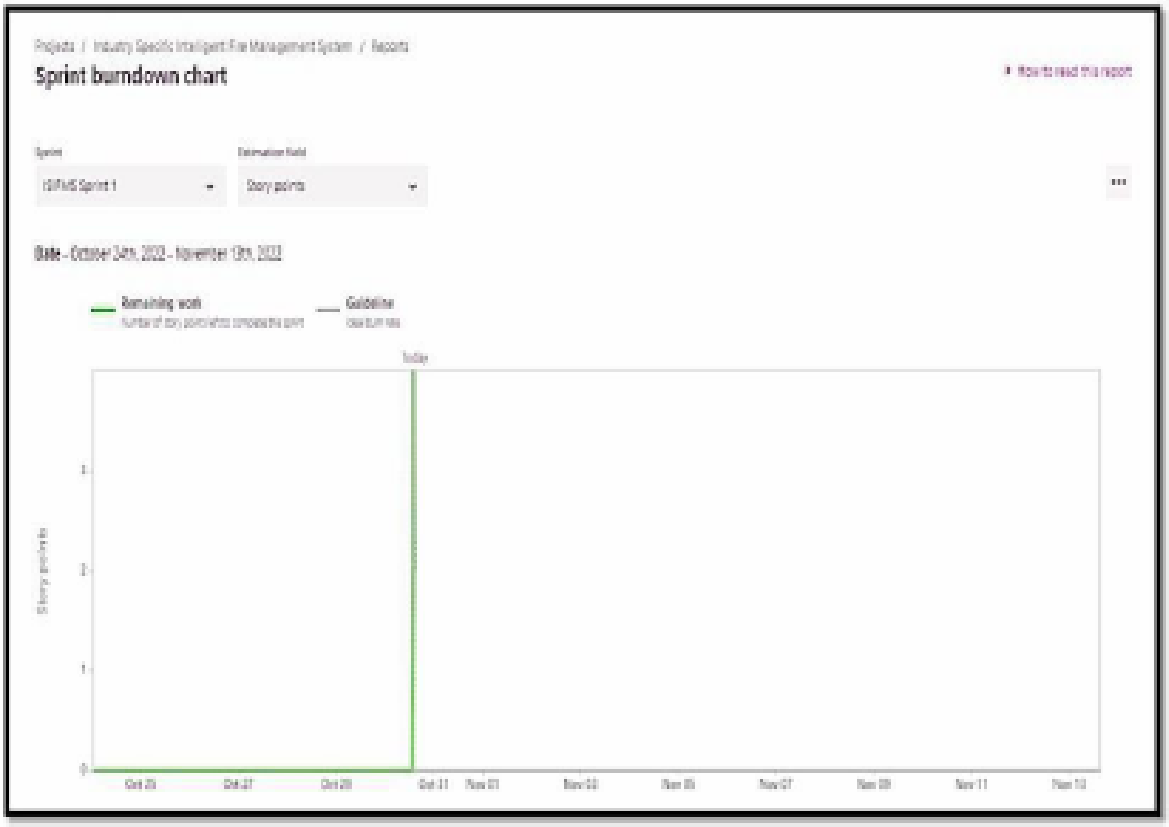



*Fig 14.Sprint Chart*

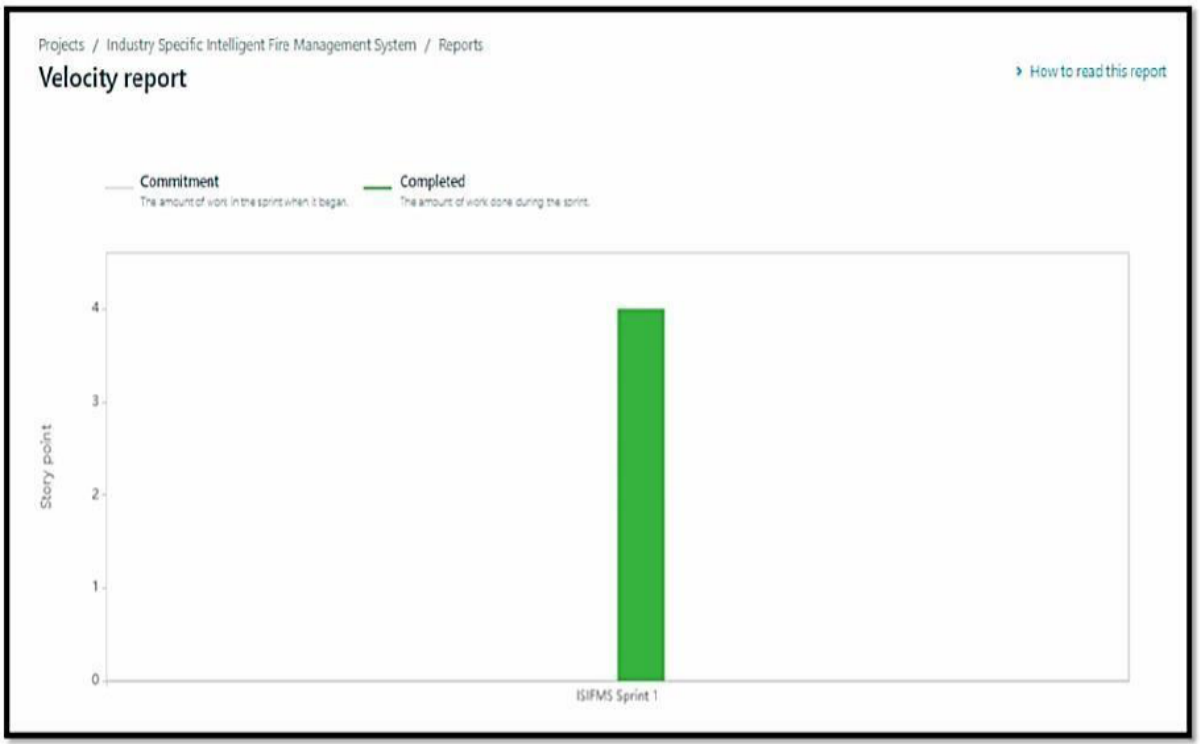



*Fig 15.Velocity Report*

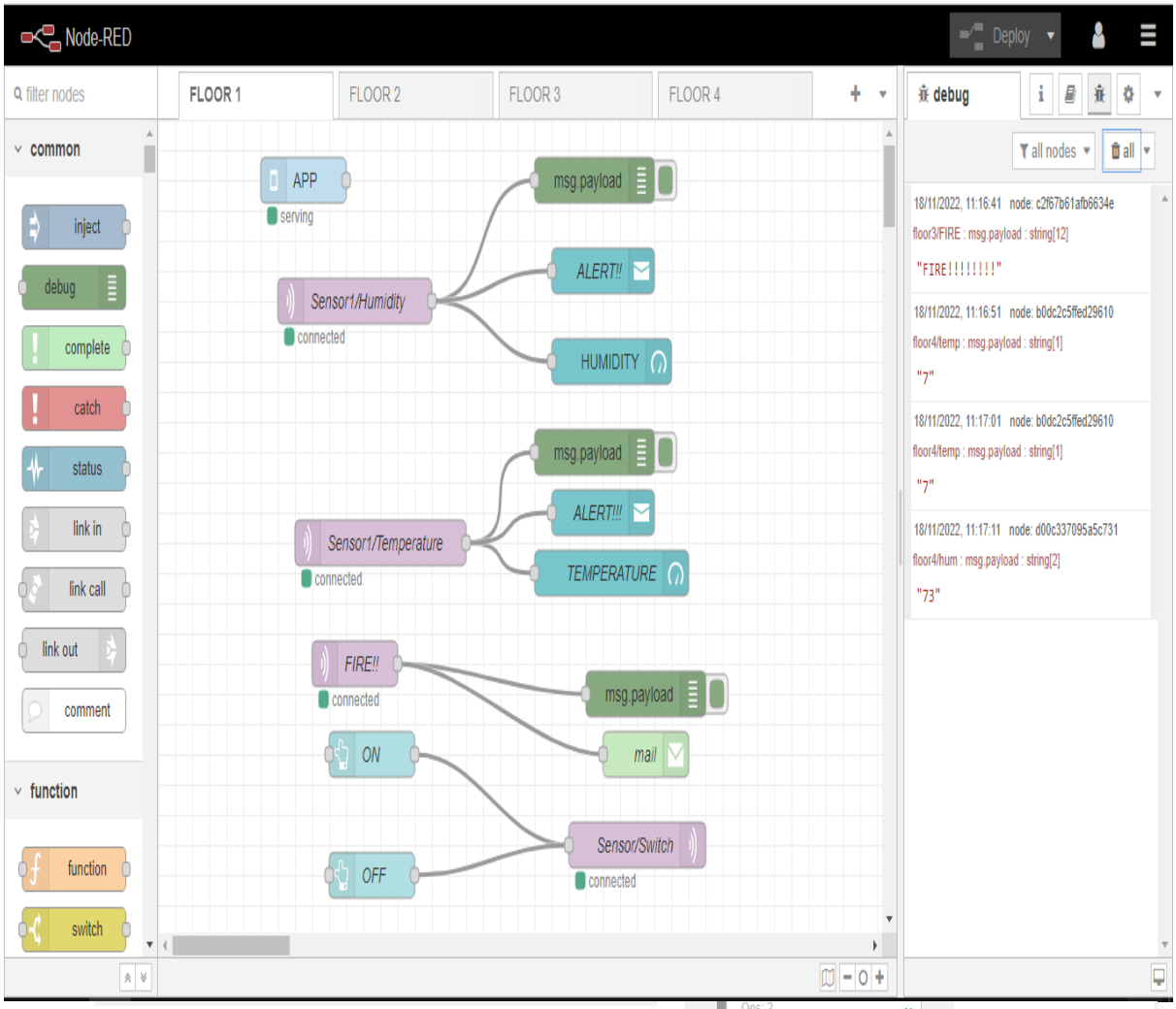
# CHAPTER 7
# CODEING & SOLUTIONING

## 7.1 PYTHON CODE:

i. Collect the data from sensor or generating random data as sensor from all floors
ii. Finding the fire condition based on sensor data
iii. Send the Sensor data to MQTT periodically
iv. Send the status whether fire happens or not to MQTT for all installed floors

## 7.2 NODE RED:

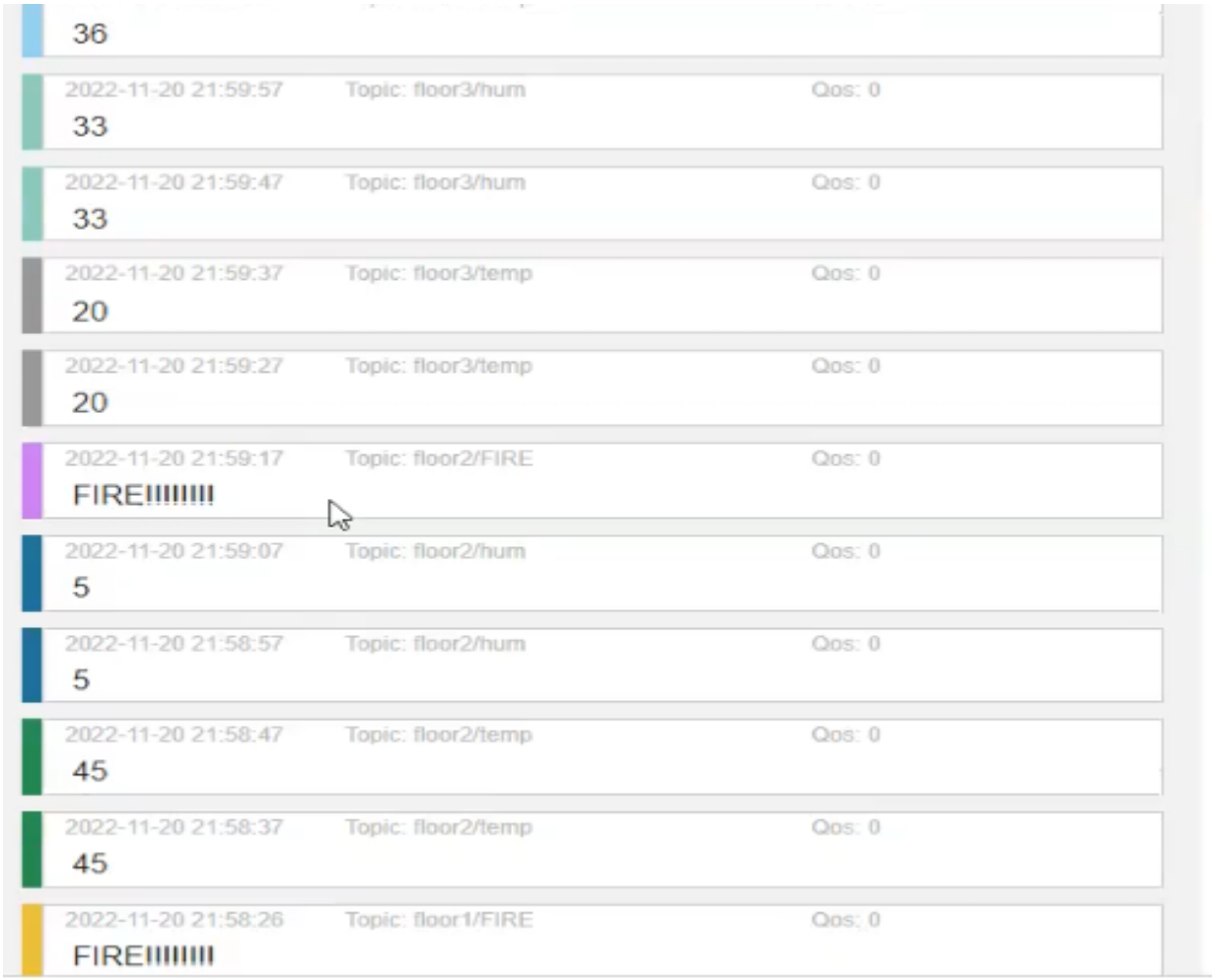
i. Design the dashboard based on floor plan
ii. Display the live status of sensor installed and notify the admin using MQTT IN
iii. Login to dashboard with signed admin
iv. Once fire status received from MQTT IN, share the alert the registered using MAIL
v. Also, we can access the dashboard using mobile application using REMOTE ACCESS




## Messages

| | | |
|---|---|---|
| 2022-11-18 11:24:12 | Topic: floor4/FIRE | Qos: 0 |
| FIRE!!!!!!!! | | |
| 2022-11-18 11:24:02 | Topic: floor4/hum | Qos: 0 |
| 73 | | |
| 2022-11-18 11:23:52 | Topic: floor4/hum | Qos: 0 |
| 73 | | |
| 2022-11-18 11:23:42 | Topic: floor4/temp | Qos: 0 |
| 7 | | |
| 2022-11-18 11:23:32 | Topic: floor4/temp | Qos: 0 |
| 7 | | |
| 2022-11-18 11:23:22 | Topic: floor3/FIRE | Qos: 0 |
| FIRE!!!!!!!! | | |
| 2022-11-18 11:23:12 | Topic: floor3/hum | Qos: 0 |
| 92 | | |
| 2022-11-18 11:23:02 | Topic: floor3/hum | Qos: 0 |
| 92 | | |
| 2022-11-18 11:22:52 | Topic: floor3/temp | Qos: 0 |
| 45 | | |
| 2022-11-18 11:22:42 | Topic: floor3/temp | Qos: 0 |
| 45 | | |

Qos: 2 floor3/temp x
Qos: 2 floor4/temp x
Qos: 2 floor1/hum x
Qos: 2 floor2/hum x
Qos: 2 floor3/hum x
Qos: 2 floor4/hum x
Qos: 2 floor1/FIRE x
Qos: 2 floor2/FIRE x
Qos: 2 floor3/FIRE x
Qos: 2 floor4/FIRE x




# CHAPTER 8

# TESTING

## 8.1 Test Cases

## 8.2 User Acceptance Testing

### 1. Purpose of Document

The main **Purpose of UAT** is to validate end to end business flow. It does not focus on cosmetic errors, spelling mistakes or system testing. User Acceptance Testing is carried out in a separate testing environment with production-like data setup. It is kind of black box testing where two or more end-users will be involved.

UAT is performed by –

- Client
- End users

## 2. Defect Analysis

This reports how the number of resolved or closed bugs at each severity level, and how they were resolved

| Resolution | Severity1 | Severity2 | Severity3 | Severity4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 2 | 2 | 2 | 1 | 10 |
| Duplicate | 0 | 0 | 3 | 1 | 5 |
| External | 2 | 4 | 0 | 1 | 6 |
| Fixed | 10 | 2 | 4 | 15 | 31 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 0 | 5 | 2 | 1 | 8 |

Totals 18 12 12 20 52

### 3. Test Case Analysis

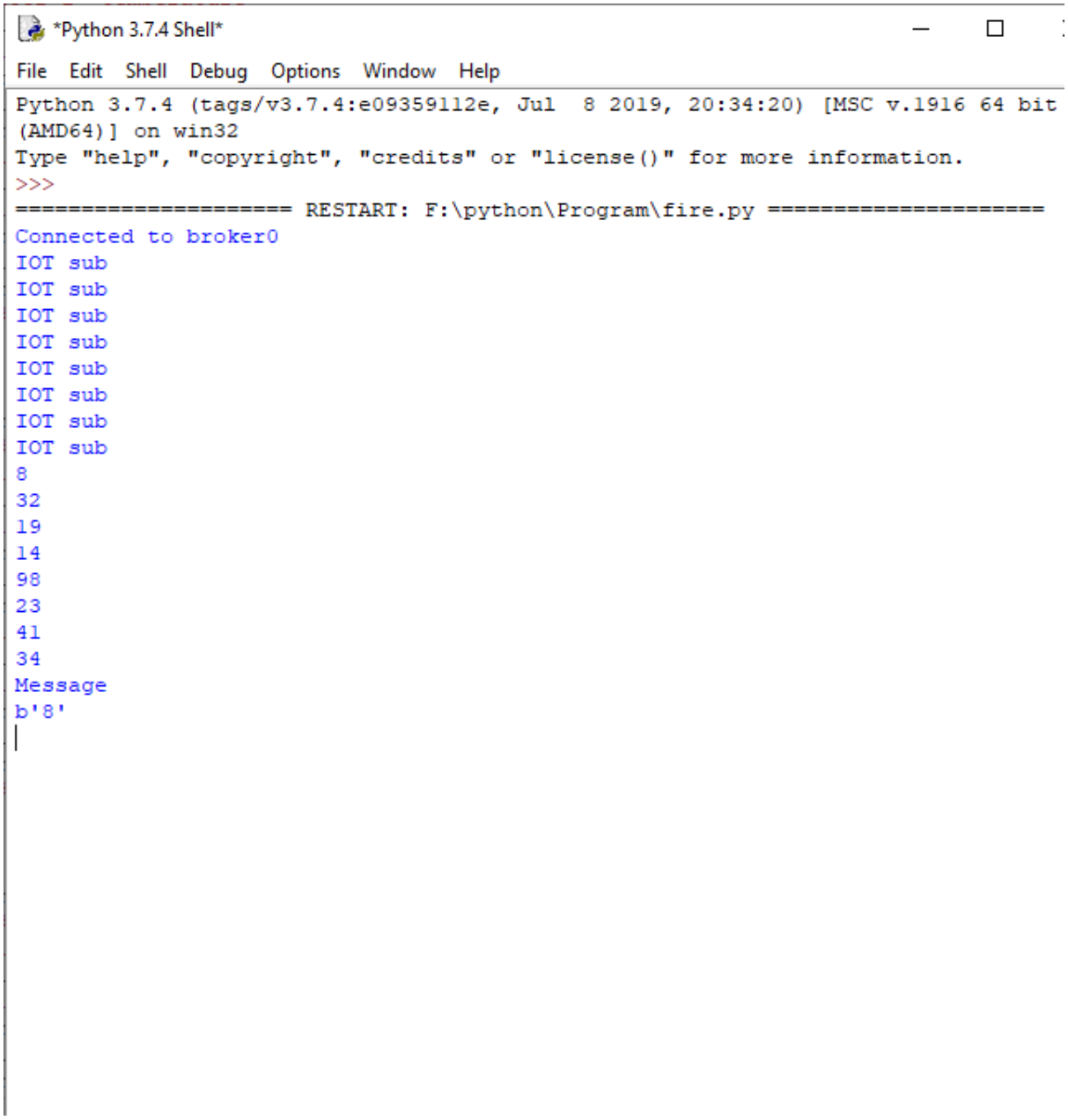
This reports how the number of test cases that have passed, failed, and untested

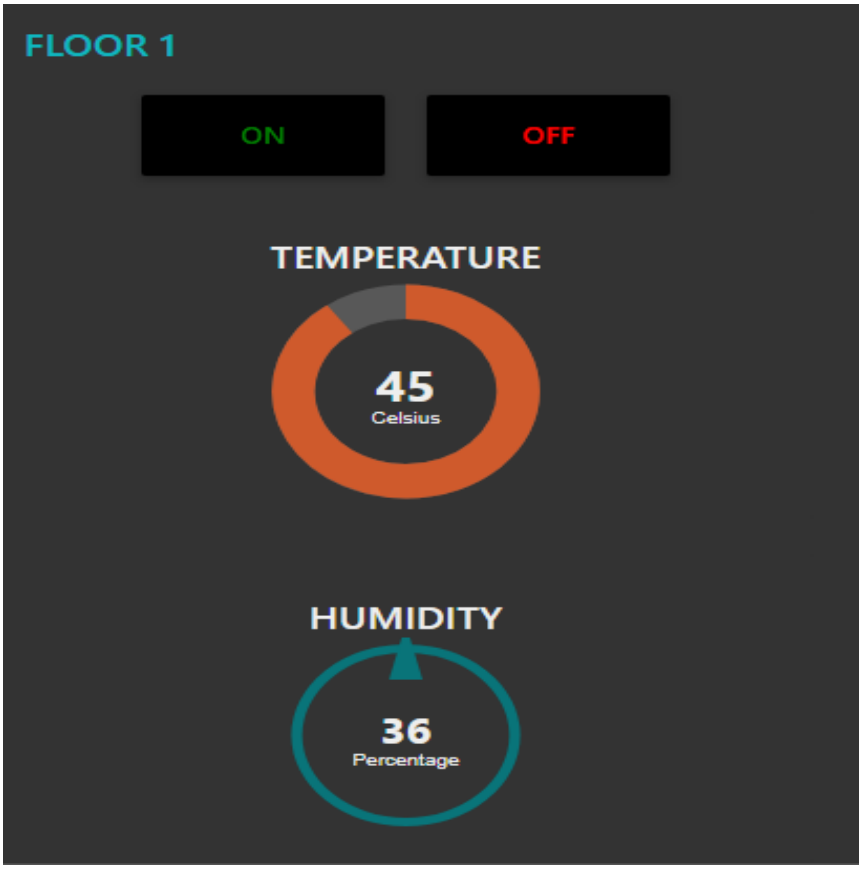
| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| Login Page | 10 | 0 | 0 | 10 |
| Node Red Dashboard | 35 | 0 | 0 | 35 |
| MQTT | 2 | 0 | 0 | 2 |
| Python | 3 | 0 | 0 | 3 |

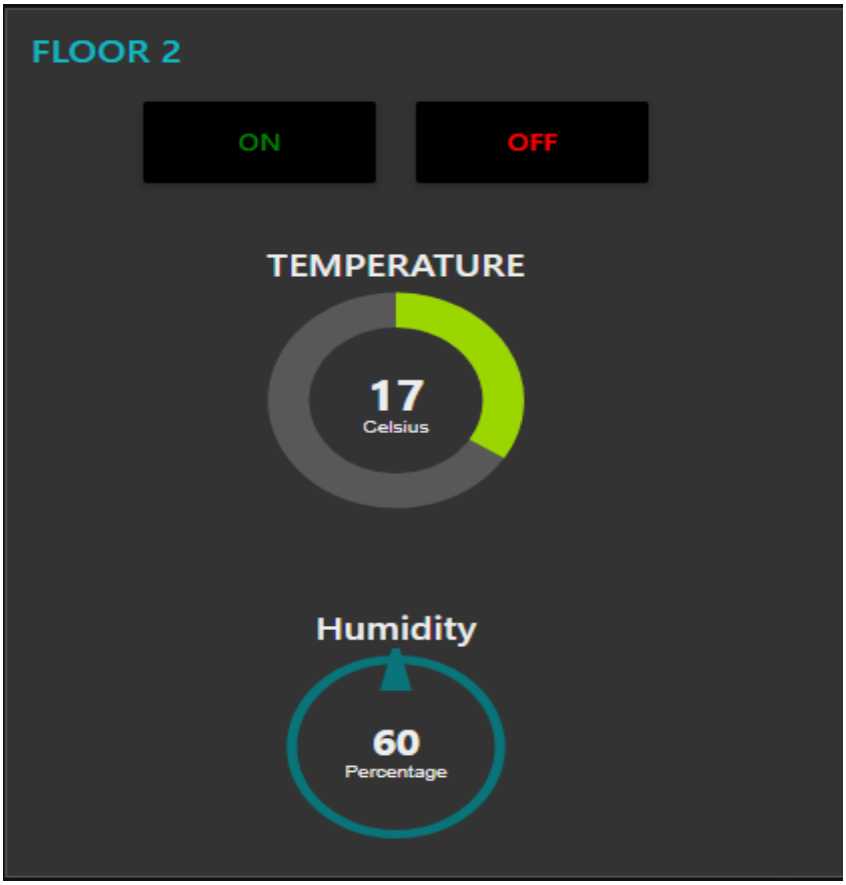
# CHAPTER 9

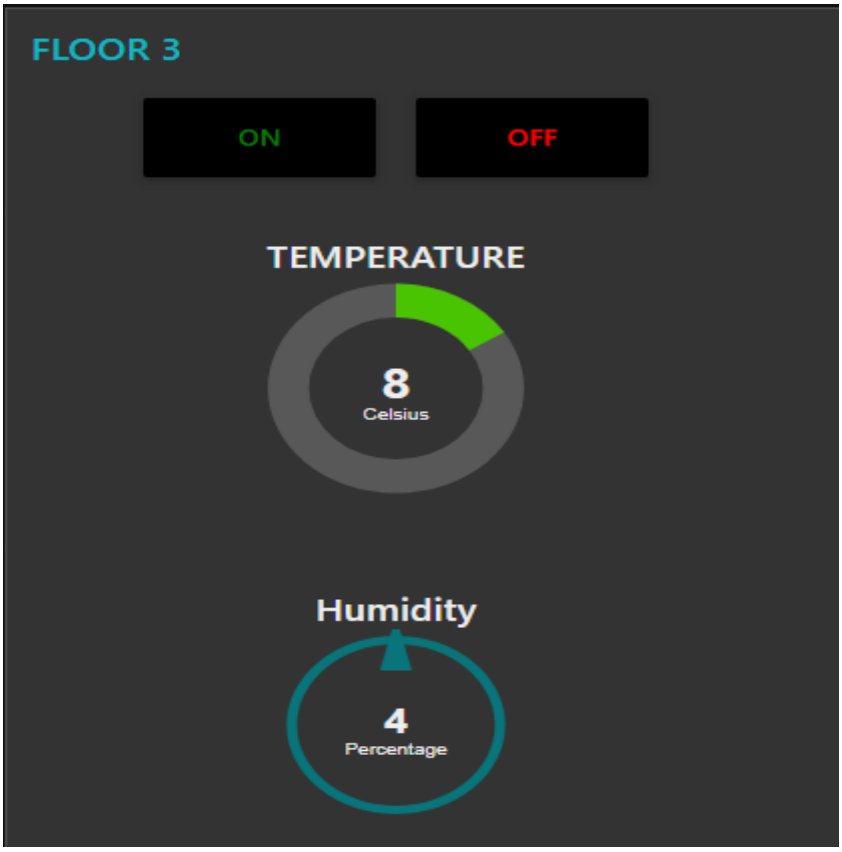
# RESULTS

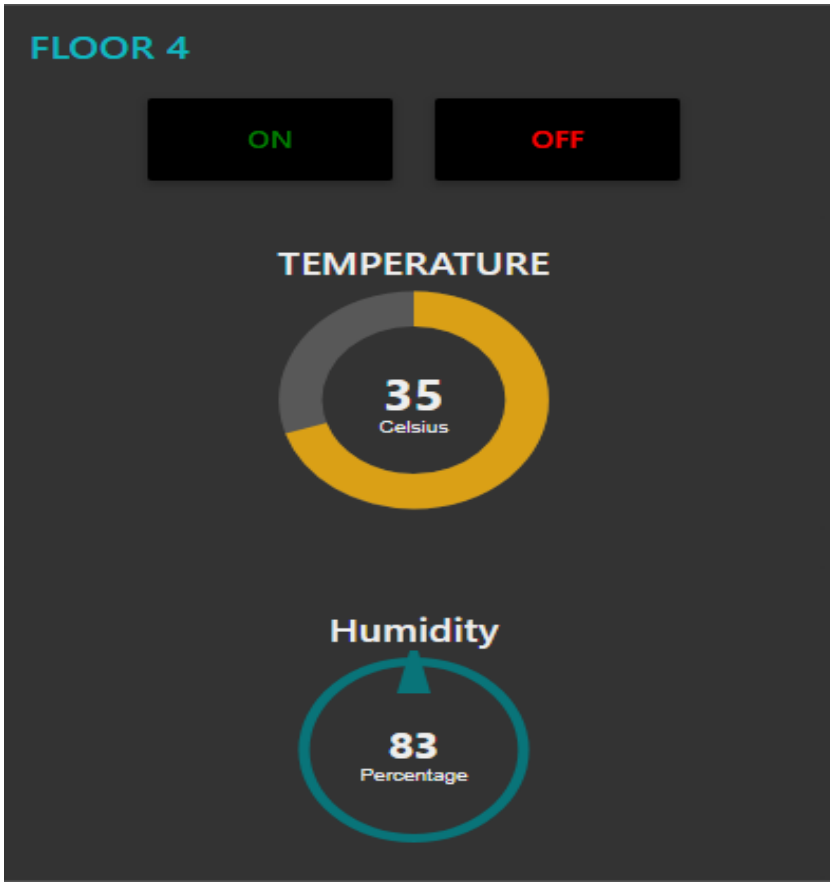
The proposed system is verified the fire detection using different sensor data like temperature and humidity. It also successfully shared the alert using mail to respective user regarding the fire status. The dashboard can be utilized from both webui and mobile application using authorized login.


*Python 3.7.4 Shell*
File Edit Shell Debug Options Window Help
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul 8 2019, 20:34:20) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: F:\python\Program\fire.py ==========
Connected to broker0
IOT sub
IOT sub
IOT sub
IOT sub
IOT sub
IOT sub
IOT sub
IOT sub
8
32
19
14
98
23
41
34
Message
b'8'


FLOOR 1
ON
OFF
TEMPERATURE
45
Celsius
HUMIDITY
36
Percentage


FLOOR 2
ON
OFF
TEMPERATURE
17
Celsius
Humidity
60
Percentage


FLOOR 3
ON
OFF
TEMPERATURE
8
Celsius
Humidity
4
Percentage


FLOOR 4
ON
OFF
TEMPERATURE
35
Celsius
Humidity
83
Percentage

Whenever the alert message receives, we turn on the water sprinkler and buzzer with our mobile application or dashboard via ON and OFF button

# CHAPTER 10
# ADVANTAGES & DISADVANTAGES

## Advantages

- Certainty of avoiding the outbreak and spread of fire
- Retaining access to protected areas at any time
- Proactive and permanent fire protection to secure business processes and valuable goods
- Protecting multiple hazards with just one system
- Fire protection without any interruption - no refilling or replacement needed
- Absolute safety for human beings through using breathable air - no nitrogen injection
- Environmentally friendly - no chemicals used
- Easy to install and maintain
- Very small footprint and little building space needed
- Scalable to any size of protected areas and number of protected compartments
- No design limitations
- No damages by fire, released water, foam or other extinguishing agents
- No excessive piping, no nozzles, no pressurized cylinders, no leaking
- No false discharges, no discharge failures, no loss of work time, no interruptions of working processes, no consequential costs

• No disruption of working processes, no consequential costs, no closing of unusable areas due to fire damages, clean-up or repair.

## CHAPTER 11
## CONCLUSION

So, in conclusion our problem premise is solved using IoT devices by creating a smart management system that solves many inherent problems in the traditional fire management system like actively monitoring for fire breakouts as well as gas leakage and sending SMS alerts to the admin as well as to the fire authorities.

## CHAPTER 12
## FUTURE SCOPE

The proposed fire detection system is mainly designed formonitoring fires in indoor buildings. As a further study, thiswork could be further improved to detect fires in outdoorareas, such as food area, transport area and other facilities near the industry. In addition, we intendto extend this work to monitor fires based on a sensingsystem that integrates both image and chemical-based sensorsto improve the detection rate and reliability. By using thesensing system instead of a single data source, more complexor ambiguous (i.e., nuisance) fire scenarios, such as boilingwater, smoking, and cooking, could be effectively monitored.

**SOURCE CODE:**

```
import paho.mqtt.client as mqtt
import time
import random
def on_connect(client,userdata,flags,rc):
print('Connected to broker'+str(rc))
client.subscribe('floor2/temp')
print("IOT sub")
client.subscribe('floor2/hum')
print("IOT sub")
client.subscribe('floor3/temp')
print("IOT sub")
client.subscribe('floor3/hum')
print("IOT sub")
client.subscribe('floor4/temp')
print("IOT sub")
client.subscribe('floor4/hum')
print("IOT sub")
client.subscribe('floor1/temp')
print("IOT sub")
client.subscribe('floor1/hum')
print("IOT sub")
def on_message(client,userdata,msg):
    print (str(msg.payload))

client = mqtt.Client()
client.clientID="clientId-qMjlvTE4Wb"
client.on_connect=on_connect
```

```
client.on_message=on_message
#Client.connect(broker,port=port)

client.username_pw_set("wait","kkkk")
client.connect('broker.mqtt-dashboard.com',1883,60)



client.loop_start()
time.sleep(1)

Temperature1 = random.randint(0,50)
print(Temperature1)
Temperature2 = random.randint(0,50)
print(Temperature2)
Temperature3 = random.randint(0,50)
print(Temperature3)
Temperature4 = random.randint(0,50)
print(Temperature4)
Humidity1 = random.randint(0,100)
print(Humidity1)
Humidity2 = random.randint(0,100)
print(Humidity2)
Humidity3 = random.randint(0,100)
print(Humidity3)
Humidity4 = random.randint(0,100)
print(Humidity4)
while True:
    #Floor 1--temperature
client.publish("floor1/temp",Temperature1)
```

```
print("Message ")
time.sleep(10)
client.publish("floor1/temp",Temperature1)
time.sleep(10)
   #Floor 1--humidity
client.publish("floor1/hum",Humidity1)
print("Message ")
time.sleep(10)
client.publish("floor1/hum",Humidity1)
time.sleep(10)
   ################################
   if (Temperature1>=43 or Humidity1<=50):
client.publish("floor1/FIRE","FIRE!!!!!!!!")
print("b is lesser than a")
time.sleep(10)
   ################################
   #Floor 2--temperature
client.publish("floor2/temp",Temperature2)
print("Message ")
time.sleep(10)
client.publish("floor2/temp",Temperature2)
time.sleep(10)
   #Floor 2--Humidity
client.publish("floor2/hum",Humidity2)
print("Message ")
time.sleep(10)
client.publish("floor2/hum",Humidity2)
time.sleep(10)
   ################################
```

```
    if (Temperature2>43 or Humidity1<=50):
client.publish("floor2/FIRE","FIRE!!!!!!!!")
print("b is lesser than a")
time.sleep(10)
    ################################
    #Floor 3--temperature
client.publish("floor3/temp",Temperature3)
print("Message ")
time.sleep(10)
client.publish("floor3/temp",Temperature3)
time.sleep(10)
    #Floor 3--Humidity
client.publish("floor3/hum",Humidity3)
print("Message ")
time.sleep(10)
client.publish("floor3/hum",Humidity3)
time.sleep(10)
    ################################
    if (Temperature3>43 or Humidity1<=50):
client.publish("floor3/FIRE","FIRE!!!!!!!!")
print("b is lesser than a")
time.sleep(10)
    ################################
    #Floor 4--temperature
client.publish("floor4/temp",Temperature4)
print("Message ")
time.sleep(10)
client.publish("floor4/temp",Temperature4)
time.sleep(10)
```

```
    #Floor 4--Humidity
client.publish("floor4/hum",Humidity4)
print("Message ")
time.sleep(10)
client.publish("floor4/hum",Humidity4)
time.sleep(10)
    ##############################
    if (Temperature4>43 or Humidity1<=50):
client.publish("floor4/FIRE","FIRE!!!!!!!!")
print("b is lesser than a")
time.sleep(10)
   ##############################
client.loop_stop()
client.disconnect()
```

**DEMO LINK:**

**https://www.youtube.com/watch?v=IdnMLts00mo**

**GITHUB LINK:**

**https://github.com/IBM-EPBL/IBM-Project-44992-1660727749**