INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

(TEAM ID:PNT2022TMl24775)

Submitted by

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INTRODUCTION

1.1Project Overview

The objective of the Industry Specific Fire Management System is to provide the early detection of fire.This project targets to turn on the sprinkler and turn on the alarm when any flame or gas is detected.The smart fire management system includes a gas sensor, flame sensor and temperature sensors to detect any changes in the environment. If the temperature value,gas value exceeded beyond a certain value or if flame is detected the sprinklers will be turned on immediately and alarm will be turned on if the temperature value or the gas value is exceeded beyond a certain value, or if flame is detected.This project also provides a facility where the authorities and the management can monitor the temperture values,gas values and if any flame values remotely using the mobile application.

1.2Purpose

The Primary purpose of the Industry Specific Intelligent Fire Management System is to design ,manage,plan and co-ordinate appropriate fire safety procedures to reduce the risk of fire in industries and to ensure the safety of building occupants.A complete fire management system ensures legal compliance and protection of lives and assets. This fire management system aims to save the lives of the employees,properties of the management . The primary purpose of fire alarm system is to provide an early warning of fire so that people can be evacuated and immediate action can be taken to stop or eliminate of the fire effect as soon as possible.Another important purpose of the fire management system is to reduce the financial loss happens to the industry.

2. LITERATURE SURVEY

2.1 Existing problem

In cracker industries the chemicals used for manufacturing fireworks are highly sensitive to friction, impact, heat and static electricity. These friction and impact causes fire accidents. The fire accidents or blasts also occur in god owns either due to sparks from electrical fittings or from the impact stimuli generated during loading and unloading of boxes containing fireworks. These fire accidents cause great loss to the industry and also to the lives of the people working in the industries. So, to overcome this problem we have proposed a solution that uses sensors to detect the fire before it causes damage, sprinklers are used to control the fire and a fire alarm is used to alert the workers about the fire breakage.

Developed Intelligent Fire alarm system.

[Hussam Elbehiery. J Am Sci2012;8(8):1016-1024].

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, 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 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 alarm system. In the wireless fire alarm, individual units are powered by primary & secondary batteries for the communication.

Research on Fire Alarm Computer Monitoring System in Fire Engineering

Xiyang Feng and Chaofei Wang 2021 J. Phys.: Conf. Ser. 1915 042061

With the in-depth development and application of computer technology, the fire alarm computer monitoring system in fire protection engineering has become more and more essential equipment in modern life. With the support of network technology, the fire alarm monitoring system of fire protection engineering has formed a complete system, including alarm monitoring, automatic fire control, fire linkage control, and fire data monitoring and analysis modules. This article mainly analyzes the fire alarm computer monitoring system in fire engineering.

Hamood Alqourabah,Amgad Muneer,Suliman Mohamed Fati in the paper titled"A Smart Fire Detrection using 10T Technology with Automatic Water Sprinkler", which employs different integrated detectors, such as heat, smoke, and flame. The signals from those detectors go through the system algorithm to check the fire's potentiality and then broadcast the predicted .result to various parties using GSM modem associated with the system. To get real-life data without putting human lives in danger, an 10T technology has been implemented to provide the fire department with the necessary data. Finally, the main feature of the proposed system is to minimize false alarms, which, in turn, makes this system more reliable. The experimental results showed the superiority of our model in terms of affordability, effectiveness, and responsiveness as the system uses the Ubidots platform, which makes the data exchange faster and reliable.

Poonam Sonsale, Rutika Gawas, Siddhi Pise, Anuj Kaldate in the paper" Intelligent Fire Extinguisher System"which proposes an adaptive fusion algorithm for fire detection,and uses a smoke sensor, flame sensor, and temperature sensor to detect fire incident. In reality, the phenomenon of the fire incident may have smoke, flame, and high temperature situations. However, these signals may happen simultaneously or sequentially. We develop an intelligent multi sensor based security system that contains a fire fighting system in our daily life. The security system can detect abnormal and dangerous situation and notify us. First, we design a firefighting system with extinguisher for the intelligent building. We design the fire detection system using sensors in the fire fighting system, and program the fire detection and fighting procedure using sensor based method. Finally, we implement the fire detection system using fire fighting system.

GPS-based fire detection system (Global Positioning System) and SMS Gateway .A Aryanti, I Mekongga and R S Dewi et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1108 012023 This research aims to produce a GPS-based fire detection system (Global Positioning System) and SMS Gateway. The benefits of this detection system can detect early fire occurrence based on the detection of temperature conditions by accommodating the nature of the fire and able to detect any rise in temperature caused by the existence of the fire.

This detection system must also be able to read any smoke produced by a fire. To realize the system, required sensors capable of reading the temperature and smoke. The Arduino Uno microcontroller is the brain control system of the system. At a temperature of> 35 C, the system will activate the DHT 11 and MQ 2 sensors that detect smoke> 50 ppm from fire. The system will activate Buzzer as a warning in the form of the next alarm sound Global Positioning System (GPS) will provide information in the form of coordinates of the location of the point of fire through GSM SIM900 Module Short Message Service (SMS) to the user. The results obtained mq2 = 128 ppm and temperature value = 38 ^{0} C and GPS data with latitude of -3.04798388 and a longitude of 104.78263092. From the data it is seen that the mq2 value reaches> 50ppm and the temperature value reaches> 35 ^{0} C, and the detector outputs buzzer sound and warning notification of coordinate point in the form of SMS containing the message "FIRE available" with the coordinates of the location of the fire detected by GPS.

10T Based Fire Detection System Using Machine Intelligence

4 authors, including Arun Rajesh DOI: 10.13140/RG.2.2.18979.99365Fire alarms play an important role in residential safety work. While the Fire Services are the first line of defence against fire accidents, they are heavily underresourced and lack adequate manpower. After analysing the needs of the Indian Fire Department, this paper proposed a 10T architecture based fire alarm system that alerts the owner and fire station of a fire outbreak. This paper also uncovers the ideal conditions to set off the fire alarm based on the temperature, humidity and the nature of gases present in the environment using the decision tree algorithm. Several cases are recorded for experimentation and training. Results show 91.15% accuracy in detecting fire.

IOT Based Fire Detection System

Rashmi Vinod Patill, Sayali Fakira Jadhav, Kaveri Sitaram Kapse, Prof. M. B. Thombare, Prof. S. A. Talekar Article • July 2021 DOI: 10.48175/1JARSCT1681 Fire Detection Systems are now widely used in various safety and security applications. The major amount of fire starts due to the electric short circuit. It leads to damage to property and also loss of life. To avoid that or to minimize the damage caused by fire outbreaks due to electric short circuits an 10T technology is used to control such a kind of risk. Traditional fire detection systems are not that effective and quick to alert the owner about fire, in case no one is present on the location. To overcome this problem in this paper we present the design and development of 10T based Fire Detection System. A system that combines qualities for fire, temperature and smoke detection, sending alert Text Message about the fire to the user along with onsite alarm(buzzer), updating temperature, humidity and smoke on ThingSpeak cloud every 15 seconds, and it also moves manually with the help of Android Application. The Fire Detection System consists of four main parts: Multiple sensors, communication system (Bluetooth, GSM, NodeMCU), motion planning (Manual patrolling), and Android application for manual patrolling of the system. This Fire Detection system can be used in college, school, office, and industry for safety purposes.

GSM based smart fire and high-temperature detection system

Ravindra Koggalage, Manjula Welihindaand Hasitha Nuwan Article in
ITEGAM- Journal of Engineering and Technology for Industrial Applications
(ITEGAM JETIA) • January 2021

This research refers to an Arduino and Global System for Mobile (GSM) based system for efficient detection of fire hazards. This project's purpose is industrial and domestic safety, and the primary concern is to avoid the fire hazards that occur to the employees and the properties inside the buildings. As a solution, a smart fire and high-temperature detection system is design using GSM technology, smoke/temperature sensors, and Arduino technology. A smoke sensor is used to detect the smoke from the fire and a temperature sensor is used to detect temperature increase inside the building. In event of a fire, an alert message will be sent to the user via short message service (SMS) via the GSM module. Furthermore, when a fire is detected, a signal will be sent to the main power supply circuit breaker via a microcontroller and then the power supply of the particular building will shut down. Results from the test are documented and discussed in this paper. This system helps users to respond immediately to the situation and so improve their safety by protecting their lives and the properties from a disaster.

2.2 References

I.Developed Intelligent Fire alarm system. [Hussam Elbehiery. J Am Sci 2012;8(8):1016- 1024].

2. Research on Fire Alarm Computer Monitoring System in Fire

Engineering Xiyang Feng and Chaofei Wang 2021 J. Phys.: Conf. Ser. 1915 042061

3. Hamood Alqourabah,Amgad Muneer,Suliman Mohamed Fati in the paper titled"A Smart Fire Detrection using 10T Technology with Automatic Water Sprinkler"

4. Poonam Sonsale, Rutika Gawas, Siddhi Pise, Anuj Kaldate in the paper" Intelligent Fire Extinguisher System"

5. GPS-based fire detection system (Global Positioning System) and SMS Gateway A Aryanti, I Mekongga and R S Dewi et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1108 012023

6. 10T Based Fire Detection System Using Machine Intelligence 4 authors, including Arun Rajesh DOI: 10.13140/RG.2.2.18979.99365

7. IOT Based Fire Detection System Rashmi Vinod Patill, Sayali Fakira Jadhav, Kaveri Sitaram Kapse, Prof. M. B. Thombare, Prof. S. A. Talekar

   Article • July 2021 DOI: 10.48175/1JARSCT-1681

8. GSM based smart fire and high-temperature detection system Ravindra Koggalage, Manjula Welihindaand Hasitha Nuwan Article in ITEGAM- Journal of Engineering and Technology for Industrial Applications (ITEGAM-JETIA) January 2021

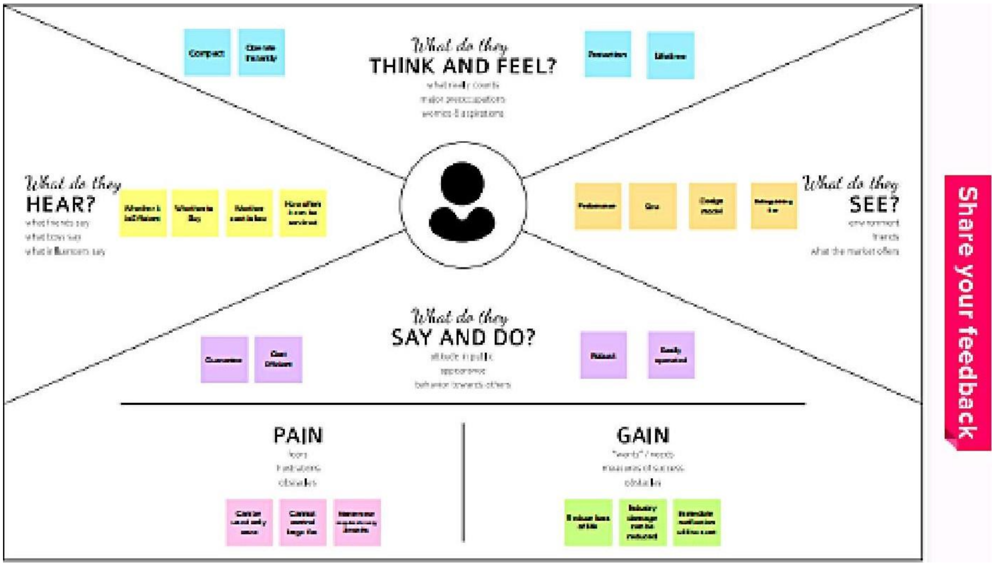
2.3 Problem Statement Definition

A fire detection system uses a smoke detector to detect a fire before it actually starts. An 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 centre. 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 then the alarm is triggered. If any flame is detected the sprinklers will be switched on automatically. Emergency alerts are notified to the authorities and fire station.

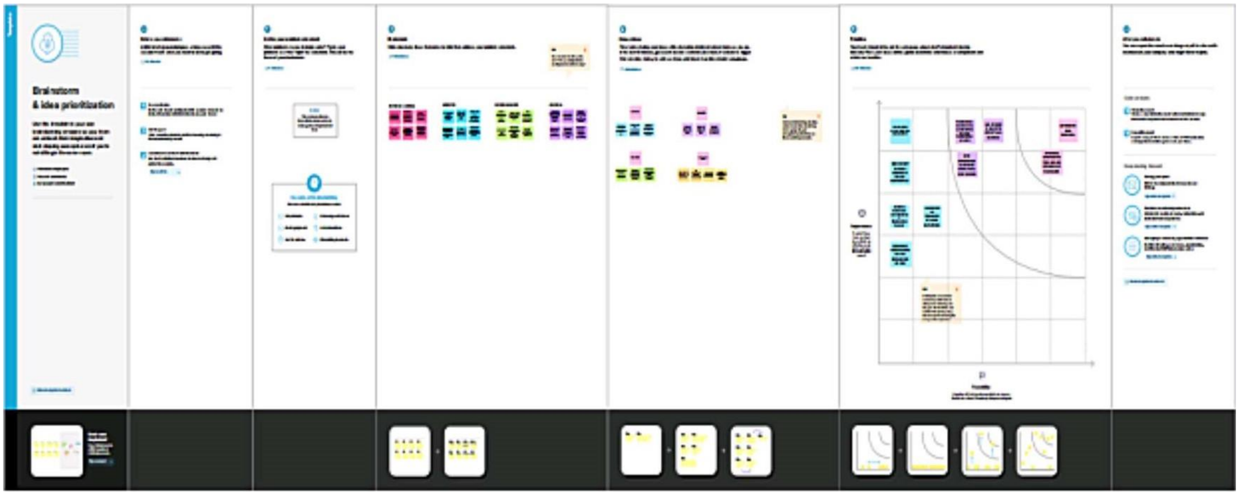
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map

Build empathy and keep your focus on the user by putting yourself in their shoes-


Compact
What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
What do they
HEAR?
what friends say
what boss say
what influencers say
Size
What do they
SEE?
environment
friends
what the market offers
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
Easily operated
PAIN
fears
frustrations
obstacles
GAIN
"wants" / needs
measures of success
obstacles
Share your feedback

3.2 Ideation & Brainstorming


Brainstorm
& idea prioritization

3.3 Proposed Solution

s.N0.	Parameter	Description

1.	Problem Statement (Problem to be solved)	On October 20, 2016 in Tamilnadu a major fire broke out in the huge cracker manufacturing hub in Sivakasi. Many people lost their lives in this accident. In cracker industries the chemicals used for manufacturing fireworks are highly sensitive to friction, impact, heat and static electricity. These friction and impact causes fire accidents. The fire accidents or blasts also occur in godowns either due to sparks from electrical fittings or from the impact stimuli generated during loading and unloading of boxes containing fireworks. These fire accidents cause great loss to the industry and also to the lives of the people working in the industries. So, to overcome this problem we have proposed a solution that uses sensors to detect the fire before it causes damage, sprinklers are used to control the fire and a fire alarm is used to alert the workers about the fire breakage.This can also be used in all the other industries like textile industries, mining industries etc.,

2.	Idea / Solution description	In the proposed model, a gas sensor, flame sensor and temperature sensors are used for the detection of fire. Gas Sensor Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability. They are often part of a large Embedded systems, such as hazmat and security systems, and they are normally connected to an audible alarm or interface. Because gas sensors are constantly interacting with air and other gasses, they have to be calibrated more often than many other types of sensors. In general gas sensors have the potential to detect all fires because every fire is

		emitting gas and an according fire detector is not dependent from the release of heat or smoke. Flame sensor The flame sensor detects the presence of fire or flame based on the Infrared (IR) wavelength emitted by the flame. It gives logic 1 as output if a flame is detected, otherwise, it gives logic 0 as output. Arduino Uno checks the logic level on the output pin of the sensor and performs further tasks such as activating the buzzer, sending an alert message. Temperature sensor A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. The alarm is triggered when the temperature exceeds a particular value. Fire alarm A fire alarm system warns people when smoke, fire, carbon monoxide or other fire-related emergencies are detected. These alarms may be activated automatically from temperature sensors and gas sensors. If fire is detected by using flame sensors, then the sprinklers will be turned on. Sprinklers A fire sprinkler system is an active fire protection method, consisting of a water supply system, providing adequate

		pressure and flowrate to a water distribution piping system, onto which fire sprinklers are connected. Fire sprinkler systems are extensively used worldwide, with over 40 million sprinkler heads fitted each year. Even though Fire Sprinkler Systems are a Life Saving System and are not designed to protect the building, 96% of buildings that had fires and were completely protected by fire sprinkler systems were controlled by the fire sprinklers alone. Arduino Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. 10T The Internet of Things (IOT) is the ability to have devices communicate with one another via the internet or other networks, remotely tracking information to provide feedback to assist with decision making for commercial, industrial and residential purposes. This is commonly done using sensors connecting to a back-to-base system. The internet of things, or IOT, is a system

		of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to computer interaction. How does 10T work? An 10T ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. 10T devices share the sensor data they collect by connecting to an 10T gateway or other edge device where data is either sent to the cloud to be analysed or analysed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices - for instance, to set them up, give them instructions or access the data. In addition, the Cloud Server application supports notification management, i.e., the automated and manual ability to communicate with all occupants connected with the affected property areas to guide them through the event. This communication can occur through App notifications, emails, SMS and PA systems. These communication tools can be

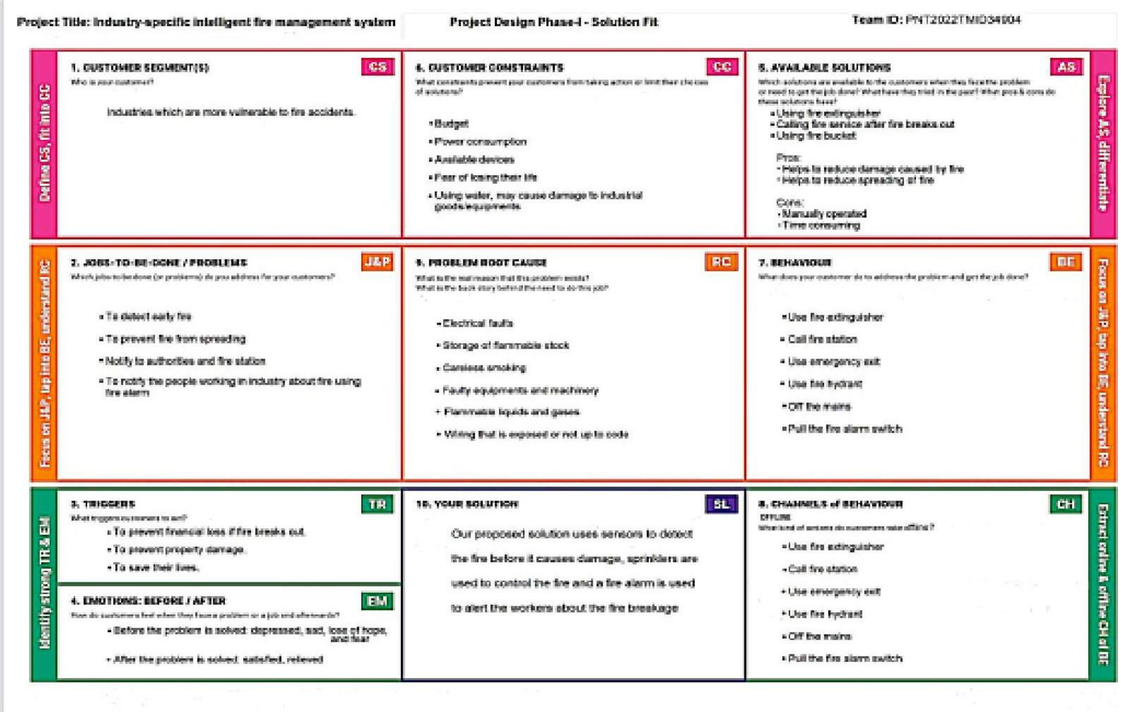
		engaged by the administrators of the application based on how the emergency situation or event evolves. Cloudant DB Cloudant is an IBM software product, which is primarily delivered as a cloud based service. Cloudant is a non-relational, distributed database service of the same name. Cloudant is based on the Apache backed CouchDB project and the open source BigCouch project. Cloudant's service provides integrated data management, search, and analytics engine designed for web applications.
3.	Novelty / Uniqueness	A fire detection system uses a smoke detector to detect a fire before it actually starts. An 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 centre. 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 then the alarm is triggered. If any flame is detected the sprinklers will be switched on automatically. Emergency alerts are notified to the authorities and fire station.

4.	Social Impact / Customer Satisfaction	Fire management system provides an early warning of fire so that people can be evacuated and immediate action can be taken to stop or eliminate the fire effect as soon as possible. If fire is detected immediate notification will be sent to authorities and fire stations. The number one reason to install a fire alarm is to make the building safe for your employees, customers, and tenants. A combination of smoke and heat detectors, sirens and bells, and strobe lights detect fires and alert building occupants, giving them ample time to evacuate in an orderly fashion. Using automatic fire sprinklers protects the environment while further verifying that they reduce property damage and protect lives. It reduces financial loss in industries.

5.	Business Model (Revenue Model)	Customer segment This alarm system is designed for industries. Its purpose is industrial safety, and the primary concern is to avoid the fire hazards that occur to the employees and the properties inside the buildings. Industrial buildings shall include any building in which products or materials of all kinds and properties are fabricated, assembled, manufactured or processed, for example, assembly plants, industrial laboratories, dry cleaning plants, power plants, generating units, pumping stations, laundries, buildings or structures in gas plants, refineries, dairies and saw mills etc. Customer relationship The industry premises will be inspected

		and after a full assessment, recommendations will be made for the location specifically to ensure maximum safety without excess cost to the business. After installation the following will be provided in the premises. • Owner's manual and manufacturer's instructions covering all system equipment. • Operator instructions for basic system operations. • A detailed description of routine maintenance and testing as required and recommended, including: Listing of the individual system components that require periodic testing and maintenance. • Step-by-step instructions detailing the requisite testing and maintenance procedures, and the intervals at which these procedures need to be performed, for each type of device installed. • A testing and maintenance schedule. • Detailed troubleshooting instructions. • A service directory that includes a list of the names and telephone numbers of those who provide service for the system.
6.	Scalability of the Solution	The proposed model can be used in textile industries, paper industries, automobile industries, mining industries, cracker industries, cement industries etc.

3.4 Problem Solution fit



Project Title: Industry-specific intelligent fire management system **Project Design Phase-I - Solution Fit** **Team ID:** PNT2022TMID34004

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS
Who is your customer?

Industries which are more vulnerable to fire accidents.

6. CUSTOMER CONSTRAINTS CC
What constraints prevent your customers from taking action or limit their choices of solutions?

- Budget
- Power consumption
- Available devices
- Fear of losing their life
- Using water, may cause damage to industrial goods/equipments.

5. AVAILABLE SOLUTIONS AS
Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have?

- Using fire extinguisher
- Calling fire service after fire breaks out
- Using fire bucket

Pros:
- Helps to reduce damage caused by fire
- Helps to reduce spreading of fire

Cons:
- Manually operated
- Time consuming

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P
Which jobs-to-be-done (or problems) do you address for your customers?

- To detect early fire
- To prevent fire from spreading
- Notify to authorities and fire station
- To notify the people working in industry about fire using fire alarm

9. PROBLEM ROOT CAUSE RC
What is the real reason that this problem exists?
What is the back story behind the need to do this job?

- Electrical faults
- Storage of flammable stock
- Careless smoking
- Faulty equipments and machinery
- Flammable liquids and gases
- Wiring that is exposed or not up to code

7. BEHAVIOUR BE
What does your customer do to address the problem and get the job done?

- Use fire extinguisher
- Call fire station
- Use emergency exit
- Use fire hydrant
- Off the mains
- Pull the fire alarm switch

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR
What triggers customers to act?

- To prevent financial loss if fire breaks out.
- To prevent property damage.
- To save their lives.

4. EMOTIONS: BEFORE / AFTER EM
How do customers feel when they face a problem or a job and afterwards?

- Before the problem is solved: depressed, sad, loss of hope, and fear
- After the problem is solved: satisfied, relieved

10. YOUR SOLUTION SL

Our proposed solution uses sensors to detect the fire before it causes damage, sprinklers are used to control the fire and a fire alarm is used to alert the workers about the fire breakage

8. CHANNELS of BEHAVIOUR CH
OFFLINE
What kind of actions do customers take offline?

- Use fire extinguisher
- Call fire station
- Use emergency exit
- Use fire hydrant
- Off the mains
- Pull the fire alarm switch

Extract online & offline CH of BE

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-I	Rapid Detection of fire	The system must be able to detect fire rapidly.
FR-2	Automatic, Accurate, Dynamic Aiming	The system must be able to quickly aim a large volume of water directly onto the flames, and it must be able to dynamically follow the flames if the fire grows or spreads .
FR-3	3D location	The system must be able to accurately determine the three-dimensional position and volume of the flames in 3-dimensional space .

FR-4	Automation and Autonomy	The system must be able to activate and function completely autonomously, without any external network or power and any human intervention.
FR-5	Web server	The system must have a web server for system monitoring and allow for remote control by designated persons .
FR-6	Cloud server	Cloud servers allows us to store information on the cloud and access this information using an internet connection. As the cloud provider is responsible for providing security, so they offer various backup recovery application for retrieving the lost data.

4.2 Non-Functional requirements

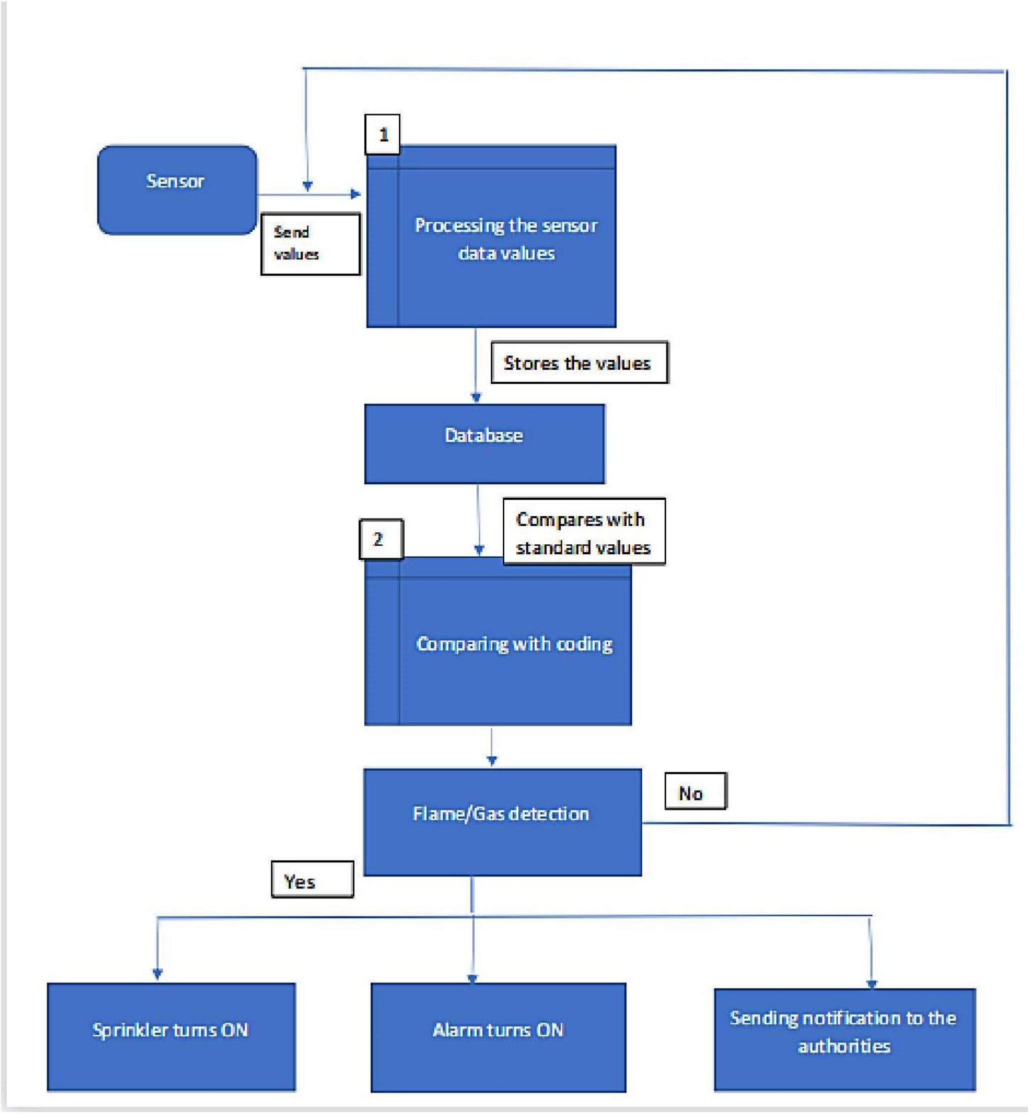
FR No.	Non-Functional Requirement (Epic)	Description
NFR-I	Usability	It is completely automated. No need to manually remove any pin like a fire extinguisher. Instead, when the flame is detected, the sprinkler is turned on immediately and when a gas sensor detects any gases, an alarm is sent immediately and notifications are sent to the authorities. It is easier to use the fire management system.
NFR-2	Security	According to the testing and maintenance schedule, frequent

		tests are done to secure the fire management system. Fire management systems should be discharged, disassembled, and inspected annually. Mock drills should be conducted periodically. It should be checked whether it includes all the fire safety standards.
NFR-3	Reliability	This is the highest quality and most innovative fire sprinklers and special systems on the market;distributes a full line of best-in-class system components; and backs it up with premier customer service
NFR-4	Performance	All the minimum durations of operations are here decided for every fire management system, according to the value of the flame sensor, gas, and temperature sensor. The emission of sprinklers shall start within a few seconds since the flame is detected and in case of any gas is detected, an alarm is turned on within a few seconds.

NFR-5	Availability	The fire management systems were effective in extinguishing fires 95% of the time. A new installation of the system shall be available for first-time use within 24 hours of the start of the installation.
NFR-6	Scalability	This model is not only used for small industries but it can also be used in large industries and buildings with proper infrastructure and technology.

5. PROJECT DESIGN

5.1 Data Flow Diagrams


Sensor
Send values
1
Processing the sensor data values
Stores the values
Database
Compares with standard values
2
Comparing with coding
Flame/Gas detection
No
Yes
Sprinkler turns ON
Alarm turns ON
Sending notification to the authorities

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story Number	Acceptance criteria	Priority	Release
Customer (Industrial user)	Rapid Detection of fire	USN-I	user, I need rapid detection of fire	I can safeguard my properties and employees	High	Sprint-I

Customer (Industrial user)	3D location	USN-2	As a user, I require a 3D location	Fire can be detected accurately	Medium	Sprint-I
Customer (Industrial user)	Automation and autonomy	USN-3	As a user, I need automation and autonmy	Human interaction can be avoided	High	Sprint-2
Customer (Industrial user)	Web server	USN-4	user, it's essential to have a web server	I can monitor and allow for remote control by designated persons	Medium	Sprint-4
Customer (Industrial user)	Automatc, Accurate, Dynamic Aiming	USN-5	As a user, I require automatic, accurate, and dynamic aiming	Aim a large volume of water directly at the flames, and dynamically follow the flames if the fire grows	High	Sprint-2

Customer (Industrial user)	Cloud server	USN-6	As a user, I need a cloud server	I can store the data securely	Low	Sprint-3
Customer (Industrial user)	Alarm	USN-7	As a user, I need an alarm	I can be safe before the fire spreads	High	Sprint-2
Customer (Fire station)	Notification	USN-8	user, I need a notification about the fire	I can know about the nearby fire breakage	Low	Sprint-3

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-I	Sensing the values	USN-I	As a user, I want to see the temperature values	3	High	Fershia G Geona, Reshma Xavier
Sprint-I	Sensing the values	USN-2	As a user, I want to see gas values	2	High	Fershia G Geona, Reshma Xavier

Sprint-I	Sensing the values	USN-3	As a user, I want to see if flame is present	2	High	Godsy D, Aswini A
Sprint-2	Displaying temperature value	USN-4	As a user, I want to see the temperature values in dashboard	2	Medium	Fershia G Geona, Reshma Xavier
Sprint-2	Displaying gas value	USN-5	user, I want to see the gas values in dash board	2	Medium	Fershia G Geona, Reshma Xavier

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Displaying flame value	USN-6	As a user, I want to see flame values in dashboard	2	Medium	Godsy D, Aswini A

Sprint-3	Alarm On	USN-7	As a user, the alarm should be turned on immediately if temperature, gas, flame values exceeds a particular threshold in web application	3	High	Fershia G Geona, Reshma Xavier
Sprint-3	Alarm Off	USN-8	As a user, I need to turn off alarm in web application	2	Low	Fershia G Geona, Reshma Xavier
Sprint-3	Sprinkler On	USN-9	As a user, the sprinkler should be turned on immediately if temperature, gas, flame values exceeds a particular threshold in web application	3	High	Godsy D, Aswini A
Sprint-3	Sprinkler Off	USN-IO	As a user, I need to turn off sprinkler in web application	2	Low	Godsy D, Aswini A

Sprint-4	Registration	USN-Il	As a user, I can register for the application by entering email, password, and confirming my password	3	High	Fershia G Geona
Sprint-4	Displaying sensor values	USN-12	Displaying gas, flame and temperature sensor values	3	High	Reshma Xavier
Sprint-4	Alarm On	USN-13	As a user, the alarm should be turned on immediately if temperature, gas, flame values exceeds a particular threshold using mobile application	3	High	Fershia G Geona, Reshma Xavier
Sprint-4	Alarm Off	USN-14	As a user, I need to turn off alarm using mobile application	2	Low	Fershia G Geona, Reshma Xavier

Sprint-4	Sprinkler On	USN-15	As a user, the sprinkler should be turned on immediately if temperature, gas, flame values exceeds a particular threshold using mobile application	3	High	Godsy D, Aswini A
Sprint-4	Sprinkler Off	USN-16	As a user, I need to turn off sprinkler using mobile application	2	Low	Godsy D, Aswini A

6.2 Sprint Delivery Schedule

TITLE	DESCRIPTION	COMPLETED DATE
Literature survey on the project and Information Gathering	Collect the relevant information on project use case, refer the existing solutions, technical papers, research publications etc.	19th September 2022
Prepare Empathy Maps	Prepare the empathy map canvas to capture the user pains and gains, Prepare list of problem statements.	19th September 2022
Ideation	List the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on the	19th September 2022

	feasibility and importance.	
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	24th September 2022
Problem Solution Fit	Prepare solution fit document	01st October 2022
Solution Architecture	Prepare solution architecture document	01st October 2022
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application	08th October 2022
Functional Requirement	Prepare the functional requirement document	15th October 2022

- CODING & SOLUTIONING (Explain the features added in the project along with code)

CODING

```
#include <WiFi.h>

#include

<PubSubClient.h>

#include "DHT.h"

#define DHTPIN 15

#define DHTTYPE DHT22
```

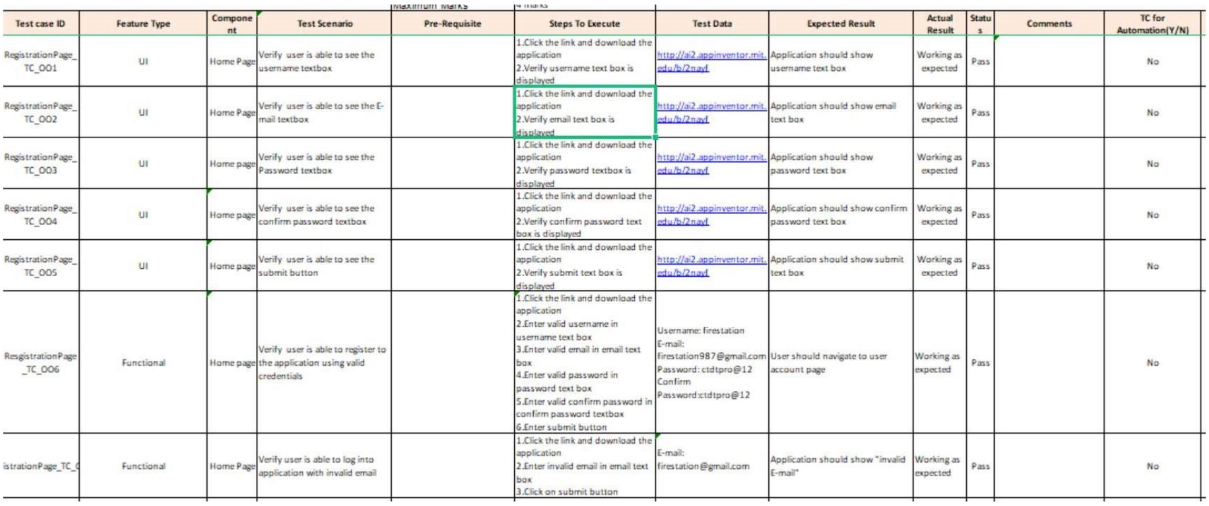
```
#define LED 2
DHT dht (DHTPIN, DHTTYPE)•, void callback(char*
subscribetopic, byte* payload, unsigned int payloadLength);
//-------credentials of IBM Accounts-----#define
ORG "zbgr67"
#define DEVICE TYPE "fershidevicetype"
#define    DEVICE    ID    "fershideviceid"
#define TOKEN "fershiageona"
String data3;
float t;
//--------Customise the above values --------char server[] = ORG
".messaging.internetofthings.ibmcloud.com"; char publishTopic[]
—    "iot-2/evt/Data/fmt/json";    char    subscribetopic[]    "iot-
2/cmd/command/fmt/String" ; char authMethod[] = "use-token-
auth"; char token[] = TOKEN; char clientld[] = "d:" ORG ' '
DEVICE TYPE ' ' DEVICE ID
————————————————————————
WiFiClient wifiClient;
PubSubClient client(server, 1883, callback ,wifiClient);
void setup()


  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();

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

  String payload = "{\"temperature\ .";
  payload += temp;
  payload +="}";
  Serial.print("Sending payload: I');
  Serial.println(payload); if (client.publish(publishTopic,
  (char*) payload.c_str())) {
    Serial.println("Publish ok"); }
  else {
    Serial.println("Publish failed");



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


     initManagedDevice();
     Serial.println();
void wificonnect()


  Serial.println();
  Serial.print("Connecting to ");
  WiFi.begin("Wokwi-GUEST", "",6);
  while (WiFi.status() WL_CONNECTED) { delay(500);
    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=—

  "lighton")


 Serial.println(data3);
digitalWrite(LED,HIGH);


  else


Serial.println(data3);

digitalWrite(LED,LOW);
```

data3=''''.

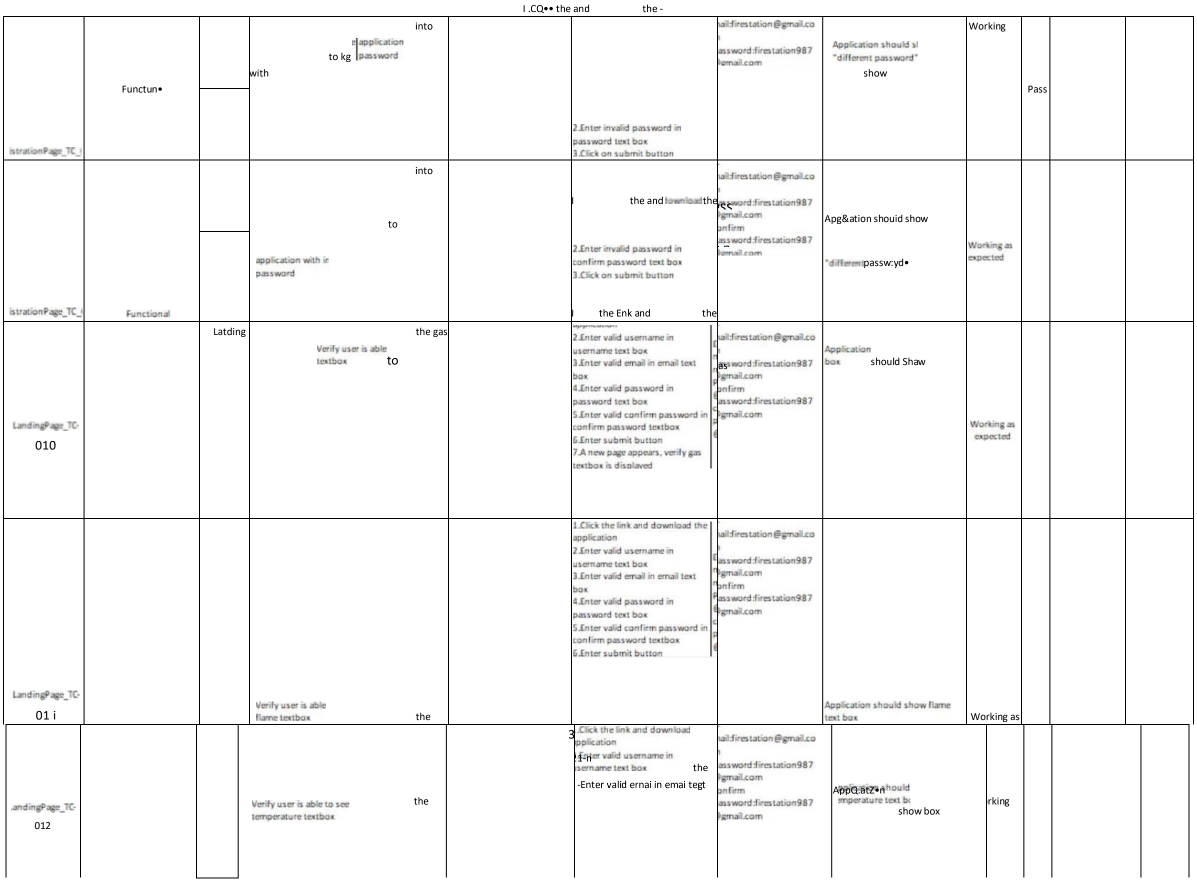
8. TESTING

8.1 Test Cases Report



Maximum Marks | 4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)
RegistrationPage_TC_OO1	UI	Home Page	Verify user is able to see the username textbox		1.Click the link and download the application 2.Verify username text box is displayed	http://ai2.appinventor.mit.edu/b/2nayf	Application should show username text box	Working as expected	Pass		No
RegistrationPage_TC_OO2	UI	Home Page	Verify user is able to see the E-mail textbox		1.Click the link and download the application 2.Verify email text box is displayed	http://ai2.appinventor.mit.edu/b/2nayf	Application should show email text box	Working as expected	Pass		No
RegistrationPage_TC_OO3	UI	Home page	Verify user is able to see the Password textbox		1.Click the link and download the application 2.Verify password textbox is displayed	http://ai2.appinventor.mit.edu/b/2nayf	Application should show password text box	Working as expected	Pass		No
RegistrationPage_TC_OO4	UI	Home page	Verify user is able to see the confirm password textbox		1.Click the link and download the application 2.Verify confirm password text box is displayed	http://ai2.appinventor.mit.edu/b/2nayf	Application should show confirm password text box	Working as expected	Pass		No
RegistrationPage_TC_OO5	UI	Home page	Verify user is able to see the submit button		1.Click the link and download the application 2.Verify submit text box is displayed	http://ai2.appinventor.mit.edu/b/2nayf	Application should show submit text box	Working as expected	Pass		No
ResgistrationPage_TC_OO6	Functional	Home page	Verify user is able to register to the application using valid credentials		1.Click the link and download the application 2.Enter valid username in username text box 3.Enter valid email in email text box 4.Enter valid password in password text box 5.Enter valid confirm password in confirm password textbox 6.Enter submit button	Username: Firestation E-mail: firestation987@gmail.com Password: ctdtpro@12 Confirm Password:ctdtpro@12	User should navigate to user account page	Working as expected	Pass		No
istrationPage_TC_(	Functional	Home Page	Verify user is able to log into application with invalid email		1.Click the link and download the application 2.Enter invalid email in email text box 3.Click on submit button	E-mail: firestation@gmail.com	Application should show "invalid E-mail"	Working as expected	Pass		No



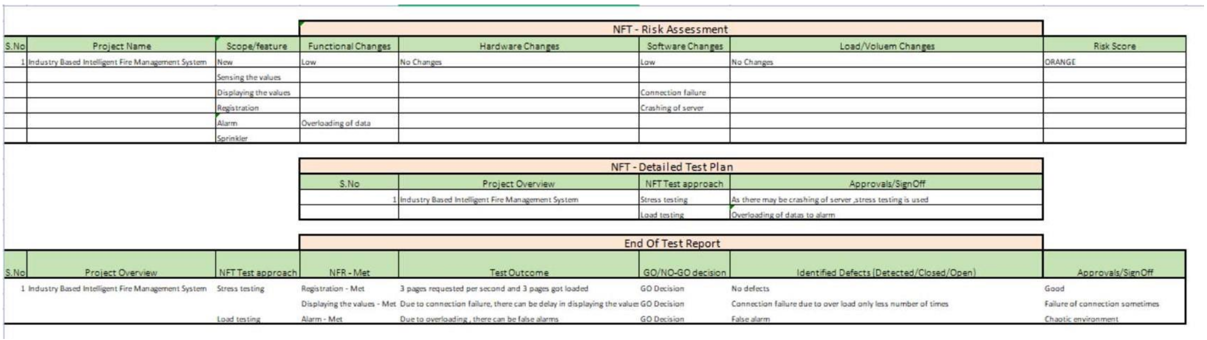
I .CQ•• the and the -

istrationPage_TC_(	Functun•		with to kg application password into		2.Enter invalid password in password text box 3.Click on submit button	ail:firestation@gmail.co n assword:firestation987 @email.com	Application should sl "different password" show	Working	Pass		
istrationPage_TC_(	Functional		into to application with ir password		I the and lownload the 2.Enter invalid password in confirm password text box 3.Click on submit button I the Enk and the	ail:firestation@gmail.co n assword:firestation987 @gmail.com onfirm assword:firestation987 @email.com	Apg&ation shouid show "different passw:yd•	Working as expected			
LandingPage_TC-010		Latding	Verify user is able the gas textbox to		2.Enter valid username in username text box 3.Enter valid email in email text box 4.Enter valid password in password text box 5.Enter valid confirm password in confirm password textbox 6.Enter submit button 7.A new page appears, verify gas textbox is displaved	ail:firestation@gmail.co n assword:firestation987 @gmail.com onfirm assword:firestation987 @gmail.com	Application box should Shaw	Working as expected			
LandingPage_TC-01 i			Verify user is able flame textbox the		1.Click the link and download the application 2.Enter valid username in username text box 3.Enter valid email in email text box 4.Enter valid password in password text box 5.Enter valid confirm password in confirm password textbox 6.Enter submit button	ail:firestation@gmail.co n assword:firestation987 @gmail.com onfirm assword:firestation987 @gmail.com	Application should show flame text box	Working as			
.andingPage_TC-012			Verify user is able to see temperature textbox the		3 .Click the link and download pplication ?1-n Enter valid username in isername text box the -Enter valid ernai in emai tegt	ail:firestation@gmail.co n assword:firestation987 @gmail.com onfirm assword:firestation987 @gmail.com	AppQ.atZ•n should mperature text bc show box	rking			

					box 4.Enter valid password in password text box 5.Enter valid confirm password confirm password textbox 6.Enter submit button 7.A new page appears, verify temoeratute textbox is displave in						
LandingPage_TC- on			Verify user is able to see on, alarm off,sprinkler on,sprinkler off button		..Click the link and downloa pplication 2.Enter valid username in isername text box the .Entet vabd enaa in ernaa text box 4.Enter valid password in password text box 5.Enter valid confirm password in on firm password textbox 3nter submit button arm on. alarm sprit' kier Oerollbuttonisdis 6	naa:frestation@gmail.co assword:firestation987 @gmail.com onfirm assword:firestation987 @gmail.com	pplication should show sprinkler n, sprinkler off, alarm on, alarm ff button	Working ex			
andingPage_TC_ 014	Functional	dins	Verify user is able to turn the alarm on whenever alarm on button is clicked		..Click the link and download pplication 2.Enter valid username in isername text box 3.Enter valid email in email text box 4.Enter valid password in password text box 5.Enter valid confirm gasswotdi confirm password textbox 6.Enter submit button the	naJ:firestatZnegnaico assword:firestatior 987 @gmail.com onfirm assword:firestatior 987 @gmail.com	Application should turn	rking			
andingPage_TC_ 015	Functional	bu	erify user is able to turn the arm off whenever 0m Off utton is clicked		Click the link and download the pplication 2 Enter valid username in ername text box 3 Enter valid email in email text box 4 Enter valid password in asswzrd text box Enter valid confirm password in onfirm password textbox Enter submit button 6 A new page appears, click alarm 7 ff	ail:firestation@gmail.co assword:firestation987 @gmail.com onfirm assword:firestation987 @gmail.com	Application shouu turn Off	Working as expected	Pass		
LandingPage_TC_ 016	Functional	Landing on	erify user is able to turn the prinkler on whenever sprinkler on button is clicked		Click the link and download the pplication Enter valid username in ername text box Enter valid email in email text box Enter valid password in ssword text box Enter valid confirm password in onfirm password textbox Enter submit button 5 A new page appears, click prinkler on 6	ail:fires asswon 987 ail:firestation@gmail.co assword:firestation987 @gmail.com onfirm assword:firestation987 @gmail.com	Application should turn on sprinkler	Working as expected			
Land*'gPage_TC_ 017	Functional	Landing	e•ilv user is able to turn the sprinkler off whenever ff button is clicked		2 Click the link and download the pplication 3 Enter valid username in ername text box 4 Enter valid email in email text box Enter valid password in ssword text box Enter valid confirm password in onfirm password textbox Enter submit button 7 —A new	ail:firestation@gmail.co assword:firestation987 @gmail.com onfirm assword:firestation987 @gmail.com	Application sho•uz turn Off sprinkler	Wc-ret g as expected			

9. RESULTS

Performance Metrics



NFT - Risk Assessment

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Load/Voluem Changes	Risk Score
1	Industry Based Intelligent Fire Management System	New	Low	No Changes	Low	No Changes	ORANGE
		Sensing the values					
		Displaying the values			Connection failure		
		Registration			Crashing of server		
		Alarm	Overloading of data				
		Sprinkler					

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	Approvals/SignOff
1	Industry Based Intelligent Fire Management System	Stress testing	As there may be crashing of server ,stress testing is used
		Load testing	Overloading of datas to alarm

End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	Industry Based Intelligent Fire Management System	Stress testing	Registration - Met	3 pages requested per second and 3 pages got loaded	GO Decision	No defects	Good
			Displaying the values - Met	Due to connection failure, there can be delay in displaying the value	GO Decision	Connection failure due to over load only less number of times	Failure of connection sometimes
		Load testing	Alarm - Met	Due to overloading , there can be false alarms	GO Decision	False alarm	Chaotic environment

10. ADVANTAGES & DISADVANTAGES

10.1ADVANTAGES

- ➤It saves the lives of the employees.
- ➤It prevents property damages.
- ➤ It saves immense finacial losses.
- ➤ It reduces maual work.
- ➤ It provides low cost infrastructure for fire management system.
- ➤ It detects the early fire.
- ➤ It prevents fire from spreading.

10.2DISADVANTAGES

- ➤ Frequent maintanance and services are required.

• CONCLUSION

We conclude that the system protects the industry from huge loss of lives of the employees and the immense finacial loss caused by the fire.It provides a low cost infrastructure for managing the fire.It also saves manual work.It is highly useful in early detection of fire.

12. FUTURE SCOPE

This model is not only used for small industries but it can also be used in large industries and buildings with proper infrastructure and technology.

13. APPENDIX

13.1 Source Code

```
#include <WiFi.h>

#include

<PubSubClient.h>

#include "DHT.h"
```

```
#define DHTPIN 15

#define DHTTYPE

DHT22

#define LED 2

DHT dht (DHTPIN, DHTTYPE)•, void callback(char*
subscribetopic, byte* payload, unsigned int payloadLength);

//-------credentials of IBM Accounts-----#define

ORG "zbgr67"

#define DEVICE TYPE "fershidevicetype"

#define DEVICE ID "fershideviceid"

#define TOKEN "fershiageona"

String data3;

float t;

//--------Customise the above values --------char server[] = ORG

".messaging.internetofthings.ibmcloud.com"; char publishTopic[]

— "iot-2/evt/Data/fmt/json";

char subscribetopic[] — "iot-2/cmd/command/fmt/String"; char

authMethod[] = "use-token-auth"; char token[] = TOKEN; char

clientld[] = "d:" ORG ' ' DEVICE TYPE ' ' DEVICE ID

________________________________

WiFiClient wifiClient;

PubSubClient client(server, 1883, callback ,wifiClient);

void setup()


  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();

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

```
  String payload = "{\"temperature\ .";

  payload += temp;

  payload +="}";

  Serial.print("Sending payload: I");

  Serial.println(payload); if (client.publish(publishTopic,
  (char*) payload.c_str())) {
    Serial.println("Publish ok");
  } else {
    Serial.println("Publish failed");




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


     initManagedDevice();
     Serial.println();



void wificonnect()


  Serial.println();

  Serial.print("Connecting to ");
```

```
 WiFi.begin("Wokwi-GUEST", "", 6);

 while (WiFi.status() WL CONNECTED) {

   delay(500); Serial.print(".");


 Serial.println("");

 Serial.println("WiFi connected");

 Serial.printlnC'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—"".
```