KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

HX 8001-PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

NALAIYA THIRAN PROJECT REPORT 2022

Submitted by

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CHAPTER 1

1. INTRODUCTION

1.1 Project Overview

Fire mishaps frequently occur in homes, businesses, markets, and other places because there is insufficient fire protection and poor fire alarm systems. We try to design a fire detection system with water sprinklers because fire incidents are extremely dangerous to people's lives. Fire mishaps frequently occur in homes, businesses, markets, and other places because there is insufficient fire protection and poor fire alarm systems. We try to design an automatic fire detection system with water sprinklers because fire incidents are extremely dangerous to people's lives. A good fire suppression system minimises damage from the fire as much as possible while also limiting any further harm the system can create. A device that can pinpoint the exact location of the fire and direct water solely at that location would be the best fire defence. Depending on whether the fire is still present or not, this system should be able to determine how to react.

An automatic fire-fighting system is made up of a sensor that can detect combustion, alarm signalling devices, fire-extinguishing equipment, starting and stopping devices. In some cases, it also includes control equipment for the production process that is being protected. The most often used systems use powders, carbon dioxide, aerosols, or water (water sprinkler systems). A sprinkler system comprises of sprinkler heads connected to the pipes by threaded connections, which are arranged in a grid on the room's ceiling. A solenoid valve in a sprinkler's opening is kept closed by a hydraulic clock so that it is in the closed state. The fire detection, notification, and fire protection systems are the three key phases of the desire procedures.

The system's primary objective is to locate the fire accident, and as a result, it can recognise three different types of fire. Heat, flame, and smoke are these. The system's microcontroller detects the occurrence of fire if any two of the three types of fire mentioned above occur together. We select the rate of rise heat detector type for the heat detection system because it has a good compensator for normal changes in ambient temperature that are anticipated in non-fire conditions and is sensitive to rapid change.

Installing the fire notification system comes after installing the detecting system. We can inform the workers that a fire is there by using horns, bells, and strobes.

Figure.1.1 Firefighters work valiantly to put out the flames.

The importance of protecting one's home and business from fire is growing today. A good way to cut down on property and personal losses from a fire disaster is to monitor commercial and residential areas all the time.

Since it is difficult to identify residential fires, the development of automatic detection systems is a top priority in the majority of developed countries. A fire alarm system should reliably and swiftly alert building

inhabitants to the presence of fire signs, such as smoke or high temperatures. A fire detector is frequently used as a smoke sensor due to its early fire detection capability, short response time, and reasonably low cost. Other fire detection methods rely on temperature, sensors or gas sensors.

These devices often use smoke sensors, which have high false alarm rates due to temperature changes. Automatic fire detection is becoming more and more necessary for decreasing fire in both buildings and industry. Accurate and early detection are essential for either avoiding fires from starting or lessening their impact. Monitoring and real-time surveillance are provided by an automatic fire alarm system. Fire protection must include prompt detection of a developing fire emergency and notification of the building's occupants and fire emergency organisations.

This is what fire detection and alarm systems are intended to do. Automatic fire alarms send out signals to fire extinguisher facilities, technical and technological equipment, smoke detection systems, and other fire protection measures. A fire alarm system's main function is to automatically identify fires before fire signals need to be activated. In most cases, fire alarm and connection systems come with fire detectors, a security and fire panel, a computer with specialised software, and a system that collects and processes data from fire detectors.

A fire alarm will sound if there is an open flame, smoke or carbon monoxide in the air, or if the temperature rises. These indicators are recognised using sensors that detect light, smoke, and heat as well as combined and numerous touches. A firefighting system can be used to block, localise, put out, or prevent fires in small spaces. Automatic fire-fighting systems are installed in buildings and other areas where there is a greater risk of fire. To distinguish between systems that are activated automatically and run in accordance with a predetermined programme and those that are operated manually, the words "automatic fire protection systems" and "fire protection units" are used.

An automatic fire-fighting system includes a sensor that can detect combustion, alarm signalling devices, fire-extinguishing equipment, starting and stopping mechanisms, and feeders for the fire-extinguishing material.

The four primary indicators of combustion that fire detectors are designed to identify at an early stage are often heat, smoke, flame, or gas. There isn't an one form of detector that is effective in all sorts of structures or flames. Heat detectors respond to the increase in temperature caused by a fire, whereas smoke detectors respond to the smoke or gas created by a fire.

1.2 Purpose

Parallel-wired smoke, heat, and flame detectors can also be included in this fire alarm system. The fire alarm system's brain, the microcontroller directs all actions. The monitoring system the fire alarm system uses, which can show the data gathered by each sensor in the monitoring system, allows it to locate and identify the area that is on fire.

The fire pump, fire sprinkler, and fire alarm systems must go through inspection, testing, and maintenance in order to remain in a safe, dependable, and efficient functioning state. Each fire that occurs in the sector can be found using temperature, flame, and gas sensors to keep people safe and to keep an eye out for industrial fires with a robot fire extinguisher. To use IOT and a fire alarm to alert people in the event of an industrial fire.

CHAPTER 2

2. LITERATURE SURVEY

2.1 Existing Problem

One type of automated industrial robot called a firefighting robot helps to put out fires autonomously in any location based on fire direction rather than fire quantity. The motion detector is still not in use in the forest to detect animals or people near burning sites. The sole information in that model is related to fire in those locations.

Foam-based fire detection systems can be used as a fire control, preventative, or extinguishing agent in processing industrial places including refineries, oil & gas fields, and commercial areas. Foam-based fire detection systems are efficient and effective when used correctly, and they don't hurt the environment.

2.2 Reference

1. Technologies for detecting fires, Kumar, A., Lala, S., Kapoor, K., Mukhopadhyay, S.C., Srivastava, V., Kumar, A., Singh, A., and K.S. Kulkarni (2019)

Fire sensing technologies have advanced significantly in recent years as a result of advancements in sensing, information, and communication technology. The authors of this paper have addressed the variations in hardware and algorithm development as they relate to fire sensing technologies. An overview of the most recent state-of-the-art techniques in the field of fire sensing and control systems is provided in the review, with a focus on the system's excellent heat detection capabilities, decrease of false positive detections, notify of occupants, transmission of information about fires and

their condition to the fire service, and automatic control of occupant safety and control functions.

The main components of a fire, such as the ambient heat, flame, smoke, and gases level, are examined along with their benefits and drawbacks, measurement standards, and parameter measurement ranges. There is additional discussion of the causes and governing factors of fires in residential and commercial structures. The aforementioned worries were acknowledged in research articles on fire detecting technology. The need for reliable systems, though, that satisfy all or the majority of the aforementioned benchmarks, is still a challenge and is only partially met. A modified fire sensing and control system concept has been put forth to fill in the gaps.

2. Home Fire Low Voltage Wireless Smoke Detector System, Juan Aponte, Juan Antonio Gomez Galan, and Javier Alcina Espigado (2015)

Since it is difficult to identify residential fires, the development of automatic detection systems is a top priority in the majority of developed countries. A fire alarm system should reliably and swiftly alert building inhabitants to the presence of fire signs, such as smoke or high temperatures. A fire detector is frequently used as a smoke sensor due to its early fire detection capability, short response time, and reasonably low cost. Other fire detection methods rely on temperature or gas sensors.

Single-sensor fire detectors—typically smoke sensors—present high false-alarm rates due to temperature fluctuations. The smoke sensor's principle of operation is the refraction of infrared (IR) light brought by by smoke entering a small chamber. The IR LED and photodiode's sensitivity to smoke is thus temperature-dependent, albeit high-performance electronics can overcome this issue. As a result, a fire detector with integrated sensors of different sorts delivers a fire suppression system that is more efficient.

Because wired systems, like the CAN bus, offer a high level of safety in critical applications, conventional techniques are built on them.

Wireless systems, which offer a low-cost solution and spatial flexibility, have grown increasingly popular in recent years despite the fact that bus networks have significantly improved in expansibility and maintenance. Sensor nodes for a wireless sensor network must be compact to simplify deployment and have low power requirements due to their battery-powered operation.

A wireless fire system must guarantee the RF communications' operation and safety in order to prevent false alarm messages. To facilitate maintenance and reduce wasted costs, the system must also notify users of hardware failures, physical damage, or planned sabotage.

3. Ways for detecting fires using machine vision C. S. Abjishek, C. S. Akshayant, and S. Geetha (2021)

The danger of fires is constantly increasing along with the expansion in urban building. The current methods for detecting fires, which rely on smoke sensors across large areas, have a drawback.

Our ability to detect smoke and flame coming from a distance has significantly improved with the introduction of video monitoring systems, which lowers this risk. The vast amount of data involved in using these video and image data makes processing difficult. To solve this problem and discriminate between fire and smoke, several strategies have recently been presented. Earlier methods include estimation of smoke based on motion, algorithms for detecting flames and smoke in images, and more. Numerous methods have recently been proposed using Deep Learning and Convolutional Neural Networks (CNNs) to predict and automatically recognise flame and smoke in videos and pictures.

We provide a thorough analysis and performance assessment of various machine vision-based fire/smoke detection systems in this paper. First addressed are the fundamentals of image processing methods, CNNs, and their possible application to video smoke and fire detection. The

datasets used today are then discussed, followed by a summary of recent methods used in this area. Finally, it looks at the challenges and potential solutions for expanding the use of CNNs in this area.

A strong system that would considerably lower the loss of human life and material wealth due to fires might be built with increased development of CNNs, which have been proven to have a high potential for detecting smoke and fire. Finally, in order to further this crucial area of research, research suggestions for future studies in data augmentation, fire and smoke detection models are given to peers.

4. For tracking fire extinguishers and their surroundings in buildings, use the smart platform SmartFire. Alfonso Gonzalez-Briones, Roberto Garcia-Martin, and Juan M. Corchado (2019)

One of the most crucial safety features of any business is making sure that the necessary fire safety procedures are in place. There needs to be a clear path that leads people out of the building safely and to the emergency exit. However, additional safety measures must be implemented to make every effort to extinguish or control fire inside the structure. Use of fire extinguishers, which are tools used to extinguish or confine minor flames in emergency situations, is one such measure.

They are not meant to be used in unattended fires that pose a threat to the user (such as those with no visible means of escape, smoke, explosion threats, etc.), or that necessitate the assistance of a fire department. An agent that can be released to put out a fire often exists inside a cylindrical pressure vessel that serves as a fire extinguisher. Other pressure containers besides cylindrical ones can be used to make fire extinguishers, but they are less common. There are two primary types of fire extinguishers: stored-pressure and cartridge-operated. The expellant and the real firefighting agent are both held in the same chamber in stored pressure units.

5. AdViSED: Advanced Video SmokE Identification for Measurements in Antifire Indoor and Outdoor Devices by Alessio Gagliardi and Sergio Saponara (2020)

According to recent National Fire Protection Association (NFPA) figures, there are around 1.3 million fires annually in the US alone, with a significant human and financial cost (more than 3000 civilian fire fatalities) (fire losses are projected to cost around 55 billion USD per year). In light of the rise of the Internet of Things (IoT) and the rising concern over safety in public areas, it is therefore necessary to implement an early fire-smoke detection system for the benefit of all citizens.

Smoke is the first indication of a fire threat since it manifests before flames do. Within a few minutes of combustion starting to form flames and raise the temperature of the surrounding air, standard smoke detectors, which rely on chemical, temperature, or PIR (Passive Infrared) detectors, sound an alarm. A photoelectric smoke detector and a genuine smoke chamber were coupled to measure smoke temperature. Normal systems like EN50155 for on board public transport specify a 1 minute window between the start of a fire and its detection. This is why the available commercially on board train anti fire systems use point-based optical & temperature smoke detectors.

6. Methods for detecting fires intelligently using vision-based technology, Fengju Bu and Mohammad Samadi Gharajeh (2019)

Fire is one of the most frequent natural disasters in the globe. A fire detection system should be utilised for the quickest detection of flames in a variety of environments (such as houses, forests, and rural areas). By doing this, financial losses and humanitarian calamities will be reduced. In practise, fire sensors cooperate with more conventional point sensors, such smoke and heat detectors, to provide people early notice of fires. When image processing

is used, point sensors are less effective than cameras at detecting fires. Additionally, they are able to communicate fire size, growth, and direction information more clearly than conventional detectors.

The important characteristics of various habitats, including buildings, forests, and mines, that should be taken into account when constructing fire detection systems are briefly reviewed in the first half of this study. Fire is one of the most common natural disasters. A fire detection system should be able to promptly recognise flames in a range of scenarios in order to minimise financial losses and humanitarian calamities (such as buildings, forests, and rural areas).

In actuality, to give people early warning of fires, fire sensors function in conjunction with more conventional point sensors, such smoke and heat detectors. Point sensors are not as quick at spotting flames as cameras and image processing techniques. Additionally, they make determining the size, progression, and direction of fires simpler than with conventional detectors. The study begins with a brief discussion of the key traits of several settings, including buildings, forests, and mines. When creating fire detection systems, these qualities should be considered.

7. Haiming Xiong, Jinyue Zhang, Jianing Guo, Xiangchi Liu, and Daxin Zhang, "An Intelligent and Personalized Fire Evacuation Management Framework" (2019)

Urban fires have the potential to cause fatalities or serious injuries to city dwellers. In comparison, China reported 237,000 fires in 2018, resulting in 1407 fatalities, 798 injuries, and a financial loss of 3.67 billion Chinese Yuan. In contrast, the United States reported 1.319 million fires overall in 2017, leading to 3400 fatalities, 14,670 injuries, and a loss of 23 billion dollars. The most crucial element in terms of building safety when

dealing with a fire is the ability to safely evacuate every resident of the building. The occupants of the building must typically rely on themselves during the initial stages of a fire event, with the requirement that fire safety facilities (such as fire extinguishers) in the building can provide a sufficient fire response.

Measures presently required by design guidelines do not always work as intended in practise due to subpar facility upkeep or a lack of operational expertise on the side of the tenants. Human behaviour during this early stage turns into a highly essential factor in the safety of the residents since evacuation behaviour anticipates how individuals will react during an escape and defines the actions they will do depending on their views of the circumstance.

Building evacuation was studied because early 20th-century academics thought that technological factors essentially governed how people moved through physical areas (such hallways and stairs). The relationship between transit speed and human density in a physical place with defined dimensions is the foundation for many fire safety-related building design standards, such as the minimum width of evacuation staircases. Around the turn of the 20th century, experts studying fire safety began to realise and integrate human psychology and facility management theories with architectural and technical concepts.

A safe escape depends on the personality characteristics of the occupants, the technical characteristics of the building, and how occupants perceive and understand their surroundings, such as their familiarity with the floor plan, awareness of fire safety features, consciousness of fire and smoke growth trends, and so on. Occupancy shows how individuals and their surroundings interact.

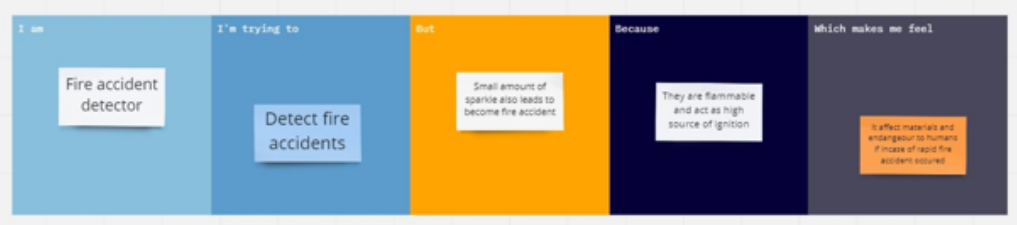
2.3 Problem Statement

Recently, extreme temperatures or the presence of explosive materials have made it occasionally difficult for firefighters to reach the scene of a fire, even when the fire results in significant property damage and human casualties. Fire-fighting robots can be helpful in such circumstances for putting out a fire. So, in locations where fire fighters are unable to work, fire-fighting robots are used.

In addition, firefighters can be protected by firefighting robots in petrochemical, chemically harmful product, toxic city, or explosion fire catastrophes from great risk. As a result, it can also lessen the harm that a fire might cause to people. A tiny quantity of shine in the fire accident also contributed to the fire accident. They have a high potential for ignite and are flammable.

In the event that a rapid fire mishap occurs, it affects the materials and puts people in danger. The entire industry will be impacted by careless errors. In the event of a fire disaster, it might be challenging to contain the fire from spreading over the surrounding area and industry. Additionally, it will be challenging to safeguard the workforce in industrial settings. If we carried out a task in a careless manner, it would harm the workers as well as the entire industry and its surroundings.

Reference Link: https://miro.com/app/board/uXjVPSAFtTs=/



Problem Statement (PS)	I am	I'm trying to	But	Because,	Which makes me feel
PS-1	Fire accident detector	Detect fire accidents	Small amount of sparkle also leads to become fire accident	They are flammable and act as high source of ignition	It affect materials and endanger to humans if in case of rapid fire accident occurred
PS-2	Fire accident detector	To hire careful/experience employees in industry	Careless mistakes will affect whole industry	They are flammable and act as high source of ignition	If we done a work with careless method, it affect whole industry and their surrondings

CHAPTER 3

3. IDEATION & PROPOSED SYSTEM

3.1 Empathy Map Canvas

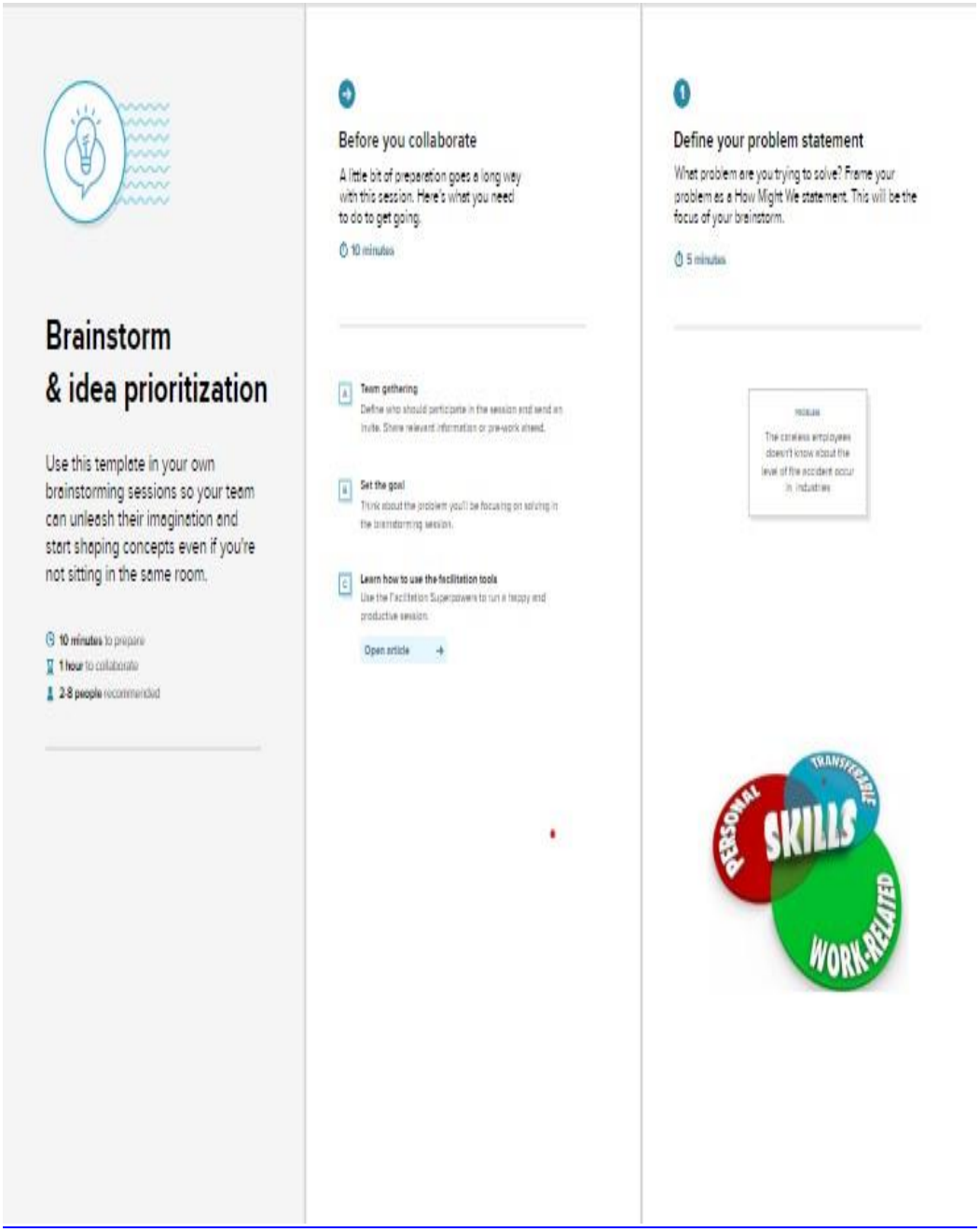
An empathy map is a straightforward, simple-to-understand picture that summarises information about a user's actions and views. It is a helpful tool that enables teams to comprehend their users more fully. It's important to comprehend both the actual issue and the person who is experiencing it in order to develop a workable solution. Participants learn to think about situations from the user's perspective, including goals and challenges, through the exercise of creating the map.

ReferenceLink:
https://app.mural.co/t/maddy6366/m/maddy6366/1664034739649/5cd27396f15616c1bf2df8d21d3ac864c411dd39?sender=u3e083a7897715aec13e65405

3.2 Ideation & Brainstorming:

ReferenceLink:

https://app.mural.co/t/mathavanb3266/m/mathavanb3266/1664197060027/674caa90ebd611666a8856665e104cf150bd952f?sender=u3e083a7897715aec13e65405



TEAM LEADER

MATHAVAN B

To check all equipments

To be free ventilation around industry

To make strong security purpose

To make awarness for controlling the fire

TEAM MEMBER 1

PREM KUMAR R

Clean the industry everyplace

Not make complex surrondings

Hire employees for safety protection

To setup camera for roaming

TEAM MEMBER 2

SATHISHKUMAR S

Use branded products

To keep place cooling

To avoid power fluctuation

To hire experience employees for safety control

TEAM MEMBER 3

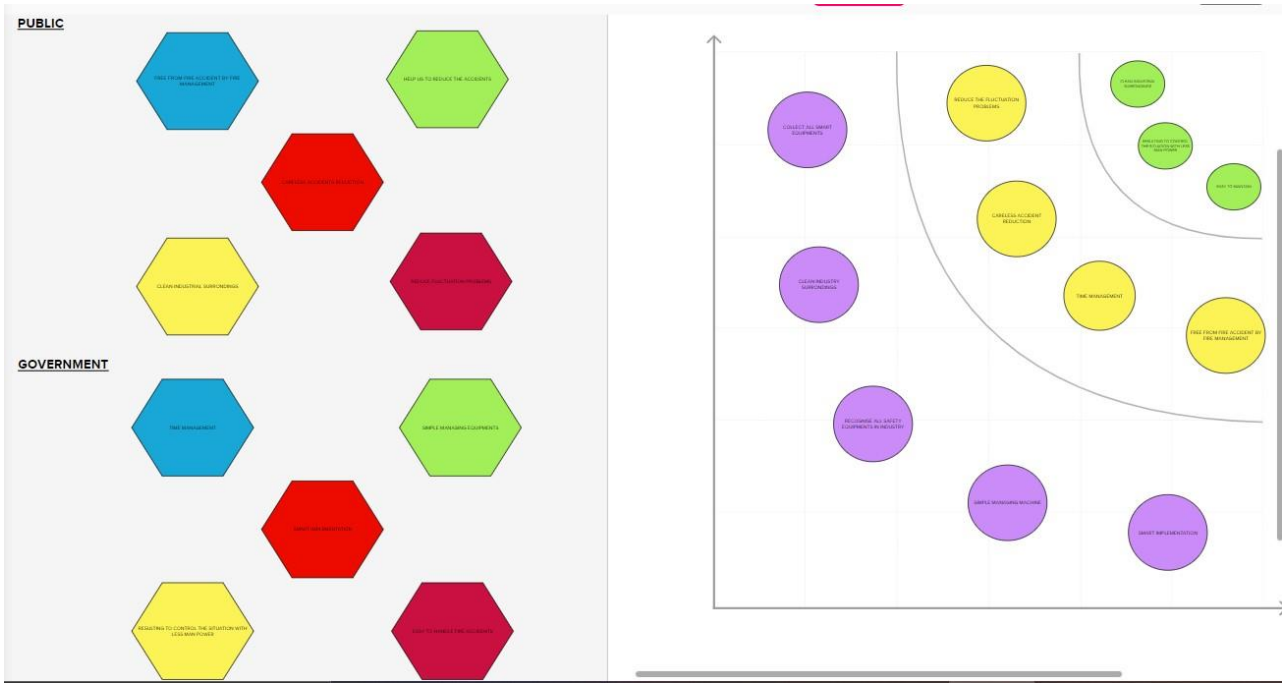
YASVEEN ADITHYA

Don't make complex connections

Keep watching whole industry

Check everyday

Don't allow careless mistakes



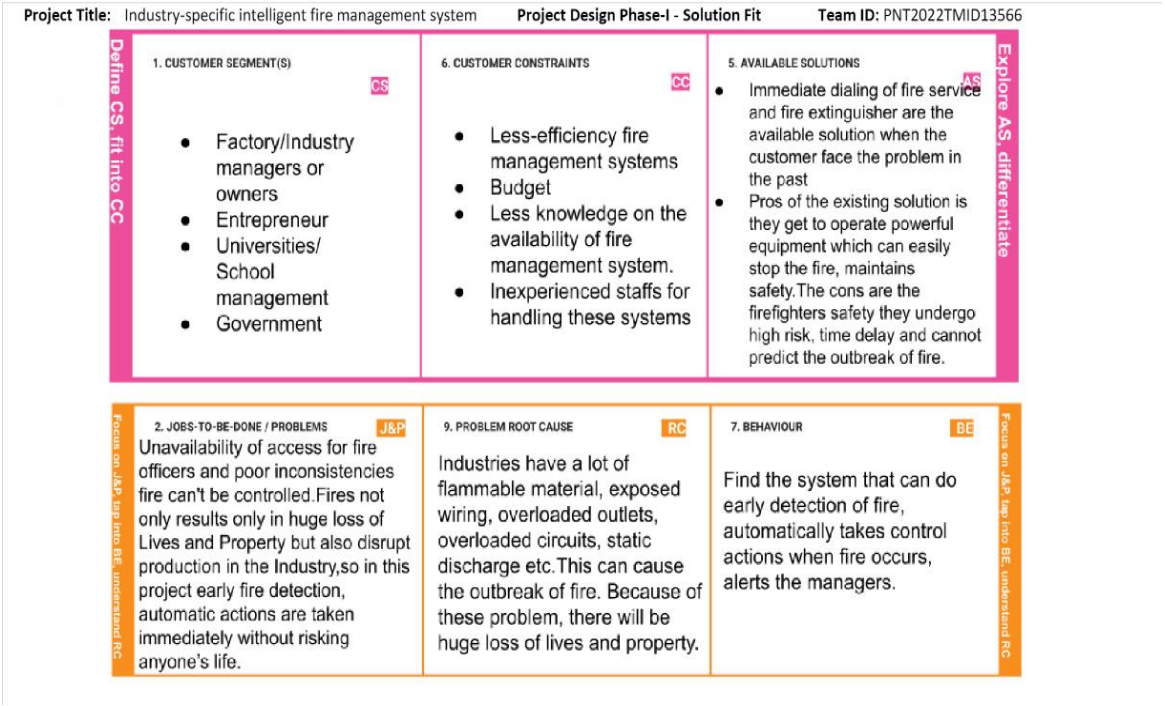
3.3 Proposed Solution:

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The fire accidents can't be full extinguished by humans, if there are no human nearby, it will destroy the whole things. Sometime it is very difficult task for humans to extinguish the fire. Thus,this system will help to alert and extinguish the fire accident occured in the industries.
2.	Idea / Solution description	If the system detects the level of smoke and temperature in the air that exceeds the safety level it will activate the alarm which includes the buzzer to alert the users at industries of the abnormal condition and to take any necessary action.
3.	Novelty / Uniqueness	Reducing the cost of the smoke and temperature detector and increasing the accuracy percentage.
4.	Social Impact / Customer Satisfaction	These leaks cause safety threats and secondary accidents for those working in industry and the environment.
5.	Business Model (Revenue Model)	It has a huge revenue, when it comes to the market.
6.	Scalability of the Solution	A wide range of industrial fixed smoke and temperature detector featuring flexible integration, simple installation, user-friendly operation.

3.4 Problem Solution Fit:



CHAPTER 4

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User visibility	Emergency alerts via Fast SMS.
FR-2	User reception	The data like amount of gas levels, smoke content and temperature are received via SMS.
FR-3	User 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 best escape route, evacuate the workers and take necessary actions to control the fire.

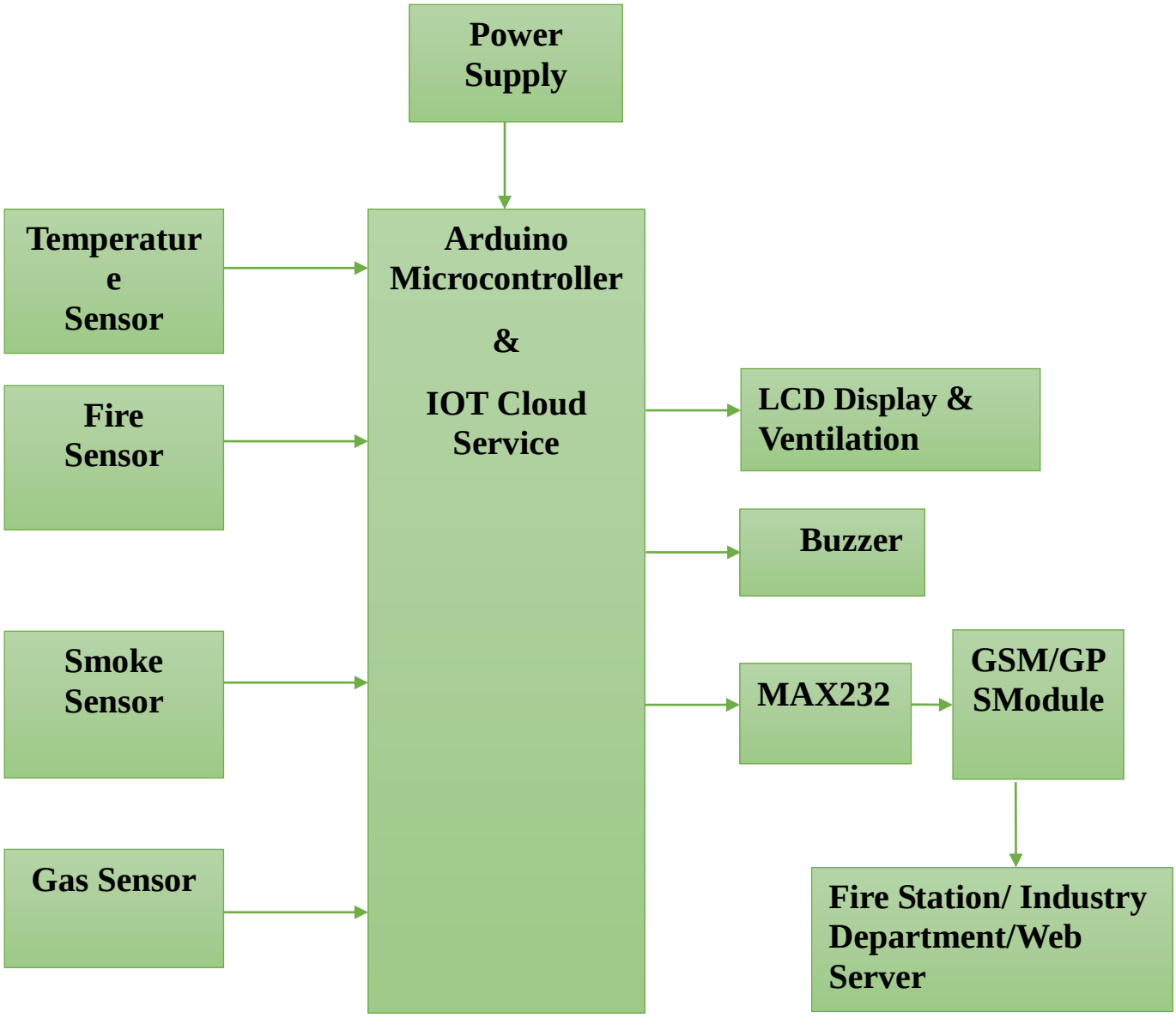
4.2 Non-Functional Requirements:

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

CHAPTER 5

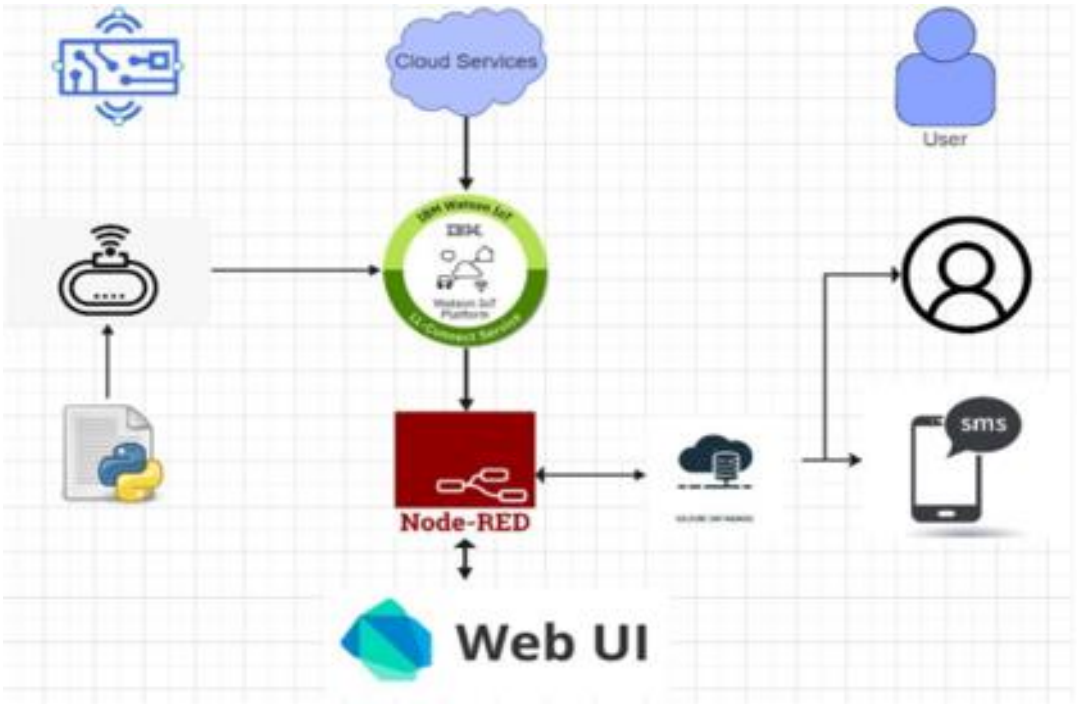
5.1 Data Flow Diagrams:

How information flows through a process can be shown in an information flow diagram. This includes data input/output, data storage, and all of the other supporting procedures involved in transporting data. To characterise various entities and their relationships, DFDs are created using standardised symbols and notations.



5.2 Solution & Technical Architecture:

For communication and analysis, IBM Cloud offers visualisations, exploration, dashboard reports, and tales. A view that includes visualisations, such as a graph, chart, plot, table, map, or any other type of visual representation of data, can be put together. A dashboard provides critical insights and information about your data on one or more pages or screens, allowing you to keep track of events or actions at a glance.



5.3 User Stories:

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can download the application	I can view the data sent by the hardware.	High	Sprint-3
Customer (Web user)	Registration	USN-1	As a user, I can view the application web page	I can view the data sent by the hardware.	High	Sprint-3
Customer (Data types)	Data viewing	USN-1	As a user, I can view Temperature readings	Data by the hardware	High	Sprint-1
		USN-2	As a user, I can view level of gas content	Data by the hardware	High	Sprint-1
		USN-3	As a user, I can view if any flame is detected.	Data by the hardware	High	Sprint-1
Customer	Actions	USN-1	As a user, I will have exhaust fan on and off button	Based on temperature and level of gas content data, actions are taken by the user	Medium	Sprint-2
		USN-2	As a user, I will have sprinkler on and off button	Based on the flame detected data, actions are taken by the user.	Medium	Sprint-2
Administrator	Storage	USN-1	As an administrator, I will store the data in Cloud database	All the data are stored in cloud database.	High	Sprint-4

CHAPTER 6

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	Sensing	USN-1	Sensing the environment using the sensors.	3	High	Mathavan B
	Operating	USN-2	Turning on the exhaust fan as well as the fire sprinkler system in cause of fire and gas leakage.	3	Medium	Prem Kumar R
Sprint-2	Sending collected data to the IBM Watson platform	USN-3	Sending the data of the Sensors to the IBM Watson.	3	High	Sathishkumar S
	Registration	USN-4	Entering my email and password to verify authentication process.	3	High	Yasveen Adithya B
Sprint-3	Storing of sensor data	USN-5	Storing in Cloud ant database.	2	Medium	Mathavan B
	Node red	USN-6	Sending the data from the IBM Watson to the Node red.	3	High	Prem Kumar R
	Web UI	USN-7	Monitors the situation of the environment which displays sensor information.	1	Low	Sathishkumar S
Sprint-4	Application Development	USN-8	To make the user to interact with the software.	3	High	Yasveen Adithya B

6.2 Sprint Delivery Schedule:

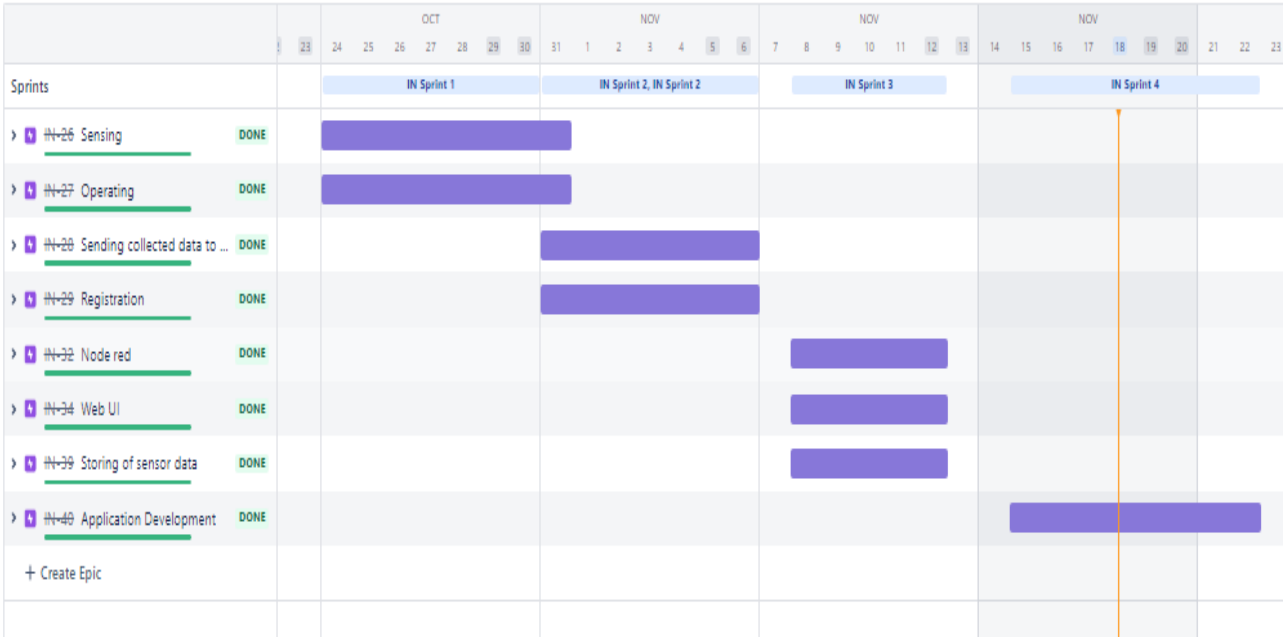
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports From JIIRA :

Agile software development, customer service, start-ups, and businesses are just a few of the things that Jira brings teams together for. Teams can plan, assign, track, report, and manage their work with Jira's help.

Reference Link:

https://pnt2022tmid13566.atlassian.net/jira/software/projects/IN/boards/2/roadmap

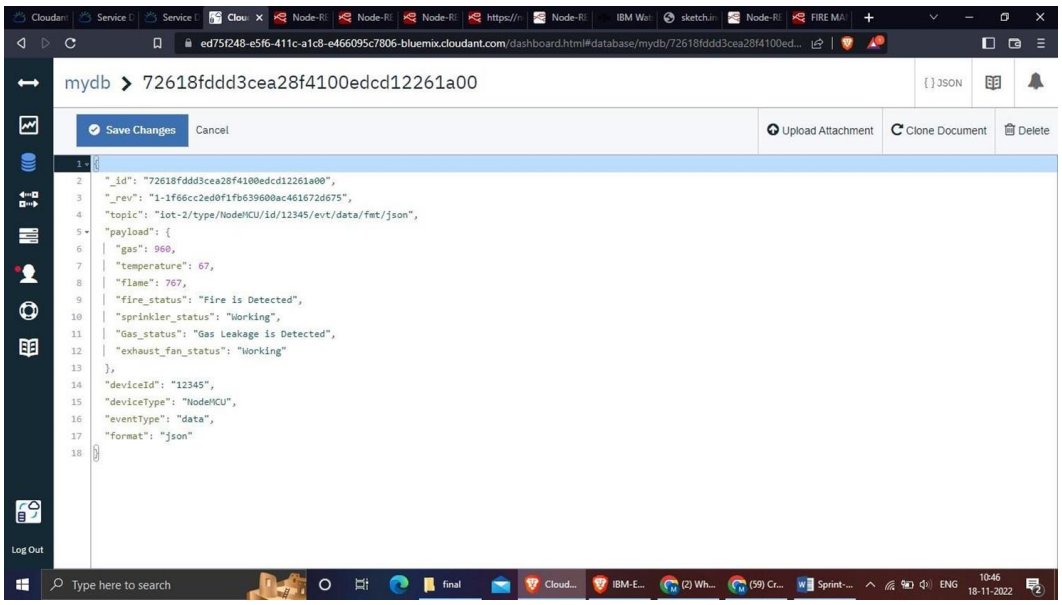


CHAPTER 7

7. CODING & SOLUTIONING

7.1 Feature 1:

To share your insights and analysis, IBM Cloud offers dashboards and stories. A view that includes visualisations, such as a graph, chart, plot, table, map, or any other type of visual representation of data, can be put together.



It is used to store the detected output value of sensor in database with the help of IBM cloud.

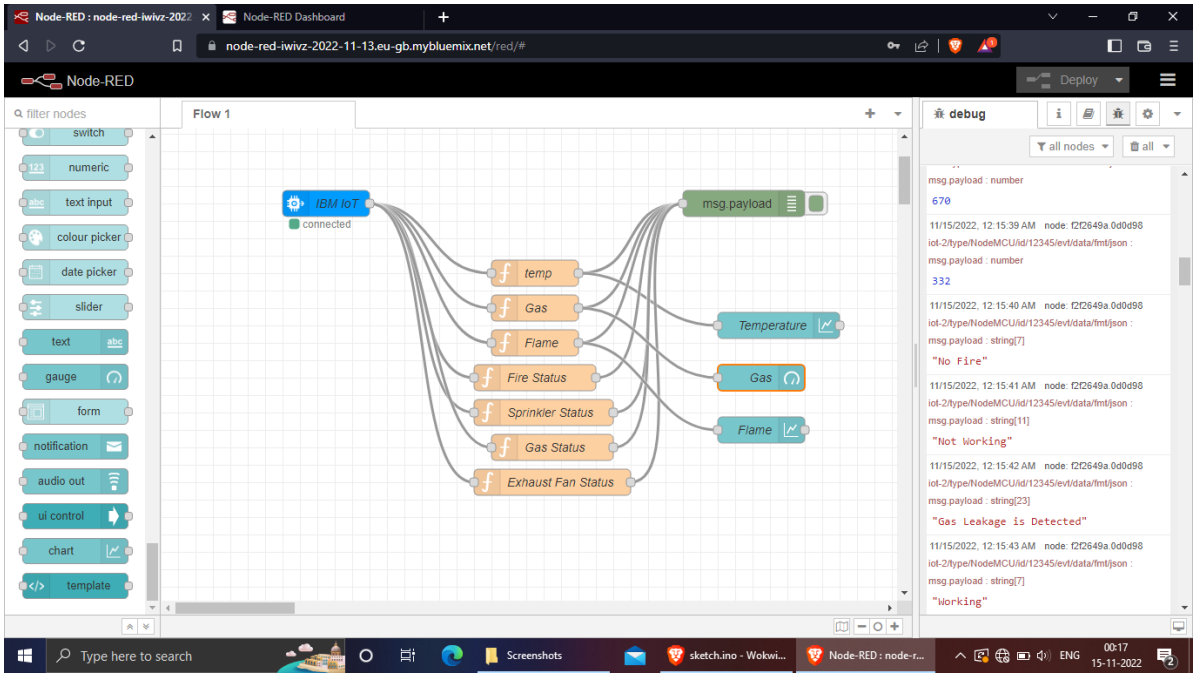
7.2 Feature 2:

Discover trends and correlations that have an impact on your business by exploring sophisticated visualisations of your data in the IBM cloud. By presenting critical insights and analyses about your data on one or

more pages or screens, a dashboard enables you to keep track of events or actions at a glance.

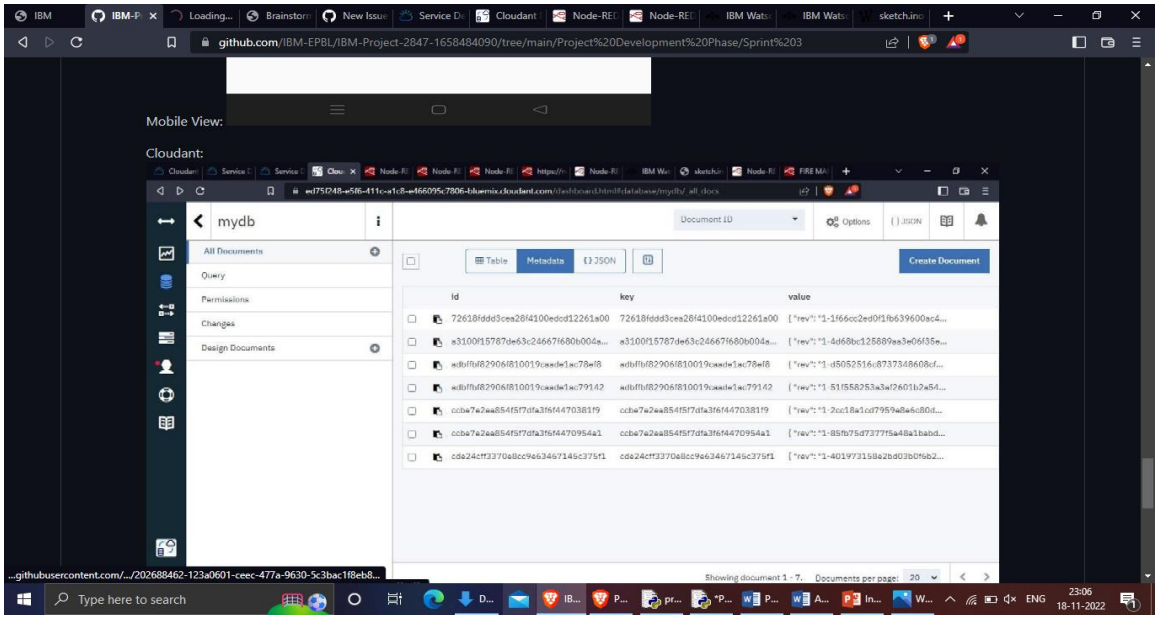
The modules in our work are as follows:

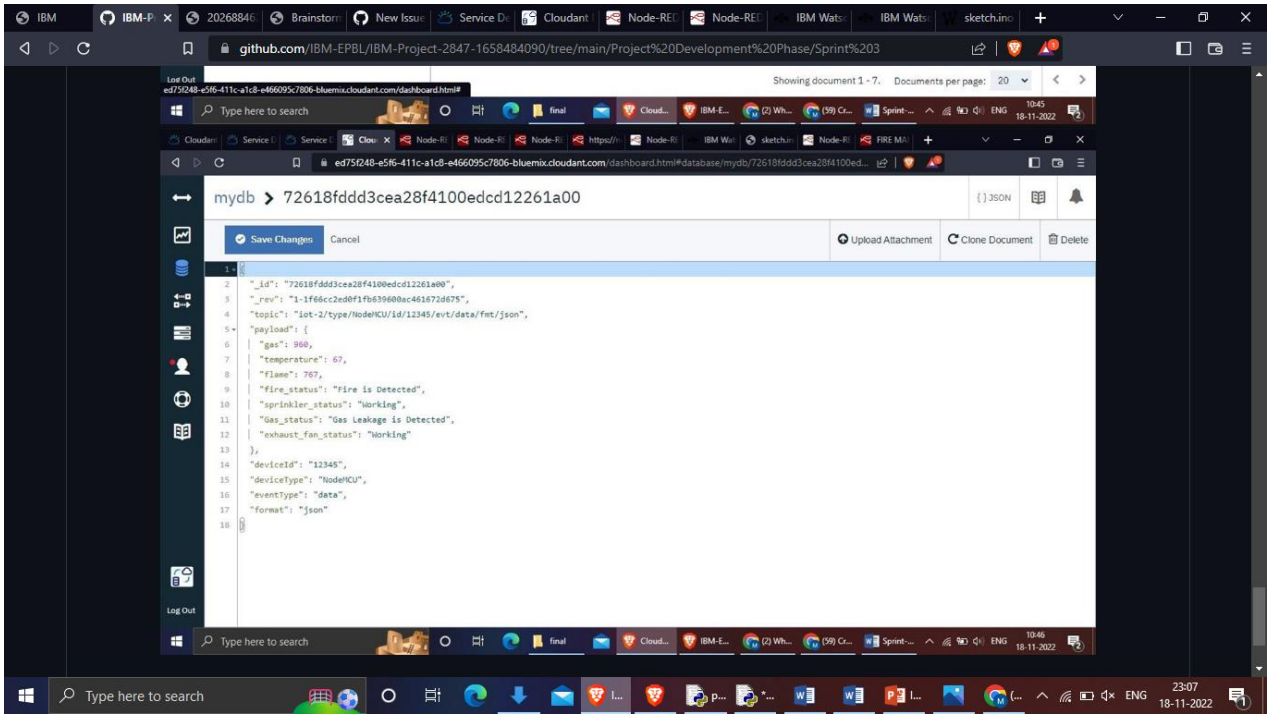
1. Working with the data set
2. Creating charts for data visualisation
3. Building the dashboard



It is used to flow the sensor connection value for showing the output in node-red dashboard. It is one kind of programming tool for interconnecting IBM cloud to Node-red with help of Wiring together.

7.3 Database Schema:





CHAPTER 8

8. Testing

8.1 Test Cases:

Finding errors or vulnerabilities in a piece of work is the process of testing. It provides a way to check the functionality of individual components, sub-assemblies, assemblies, and/or finished goods. Software testing ensures that it satisfies user expectations and complies with specifications without failing in an unacceptable fashion. There are various test types. Each sort of test has a specific response to the testing requirement.

8.2 User Acceptance Testing :

Acceptance by users Any project's testing phase is crucial and necessitates the end user's active involvement. Additionally, it makes sure the system satisfies the functional specifications. All test cases are run at this stage to ensure that the programme is correct and comprehensive.

The test must be completed satisfactorily before the customer will accept the programme. The customer formally accepts delivery of this system once customer personnel have confirmed that the preliminary production statistics load is accurate and that the test suite has been successfully completed.

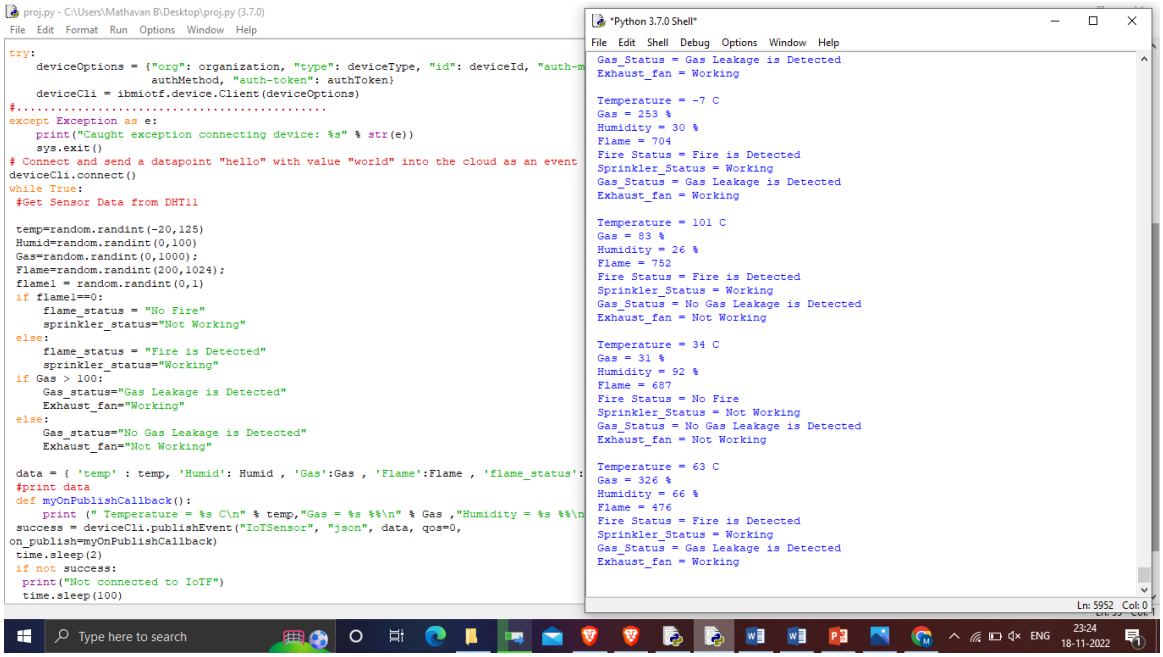
CHAPTER 9

9. RESULTS

9.1 Performance Metrics:

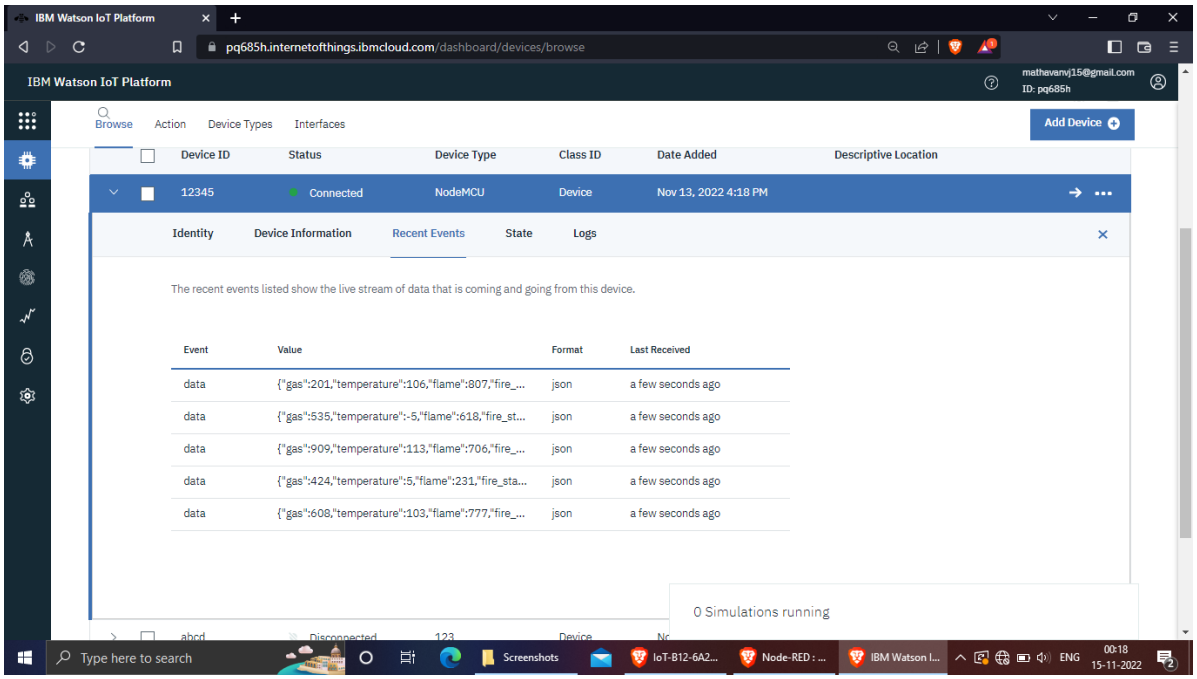
9.1.1 Python Code:

To create and execute the python program for the purpose of identify , detect and prevent the workers and their surrounding against fire accident. It send the detection of information to IBM Watson Cloud.



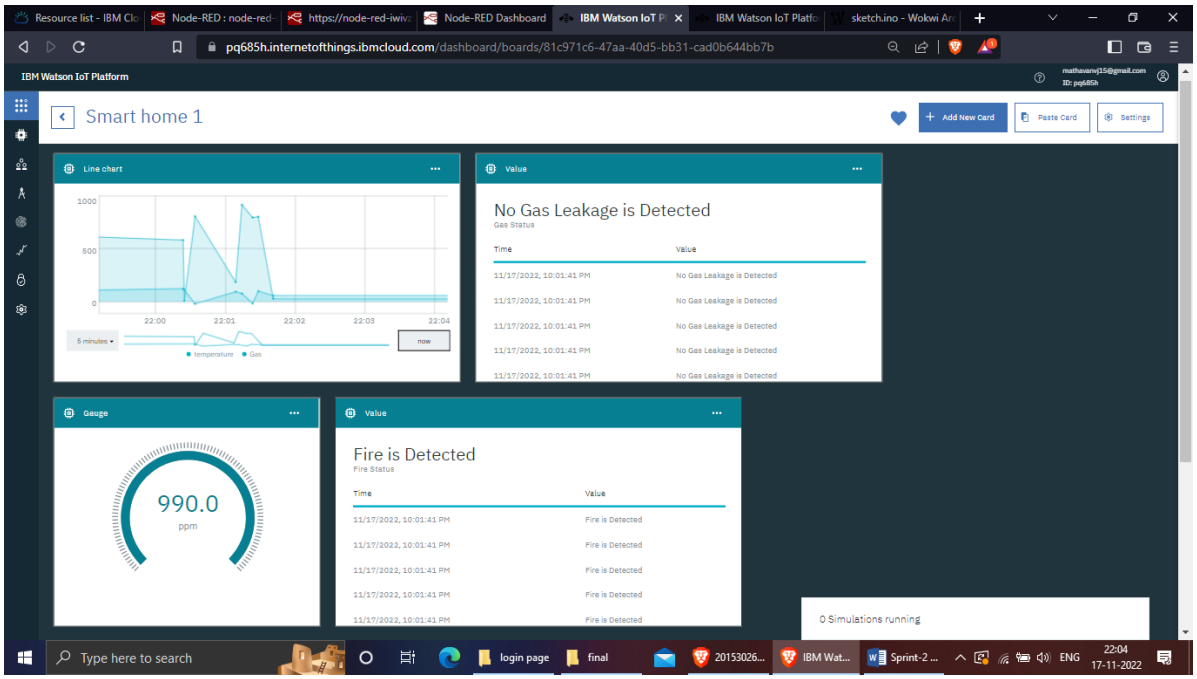
9.1.2 IBM Watson Output:

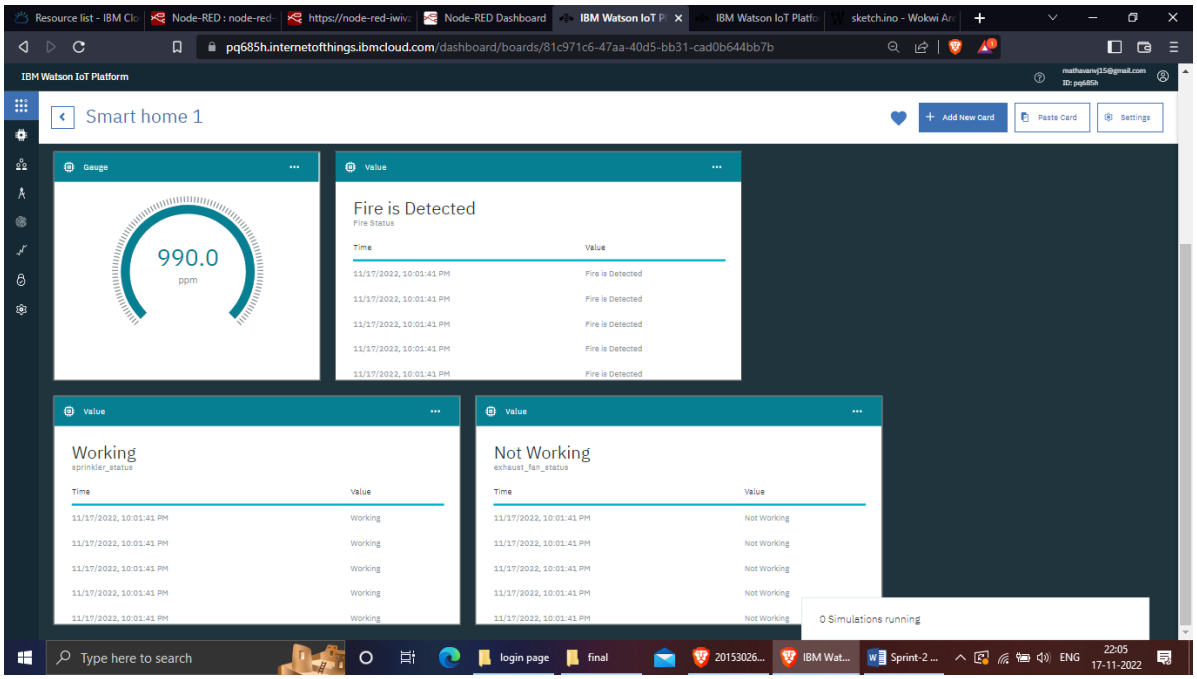
It is interconnect with Python code and transfer the detection of leakage output for preventing the industry and surroundings.



9.1.3 IBM Watson Dashboard :

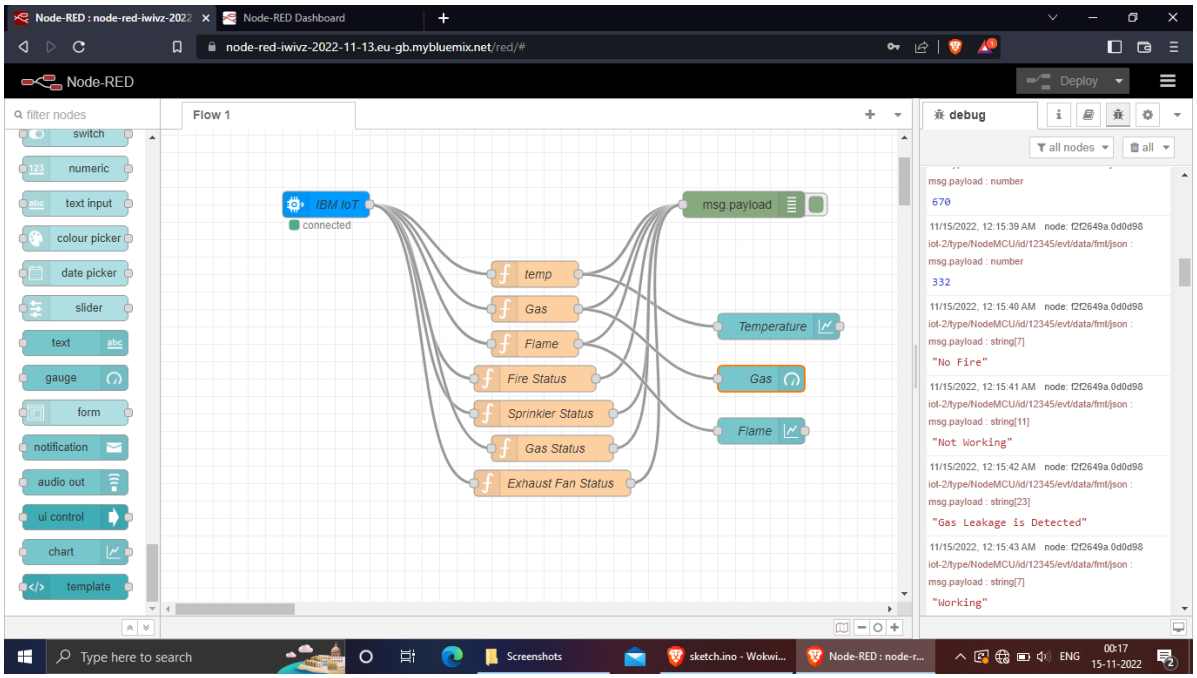
It is used to express the output in various form like flow chart, line chart, pie chart etc.

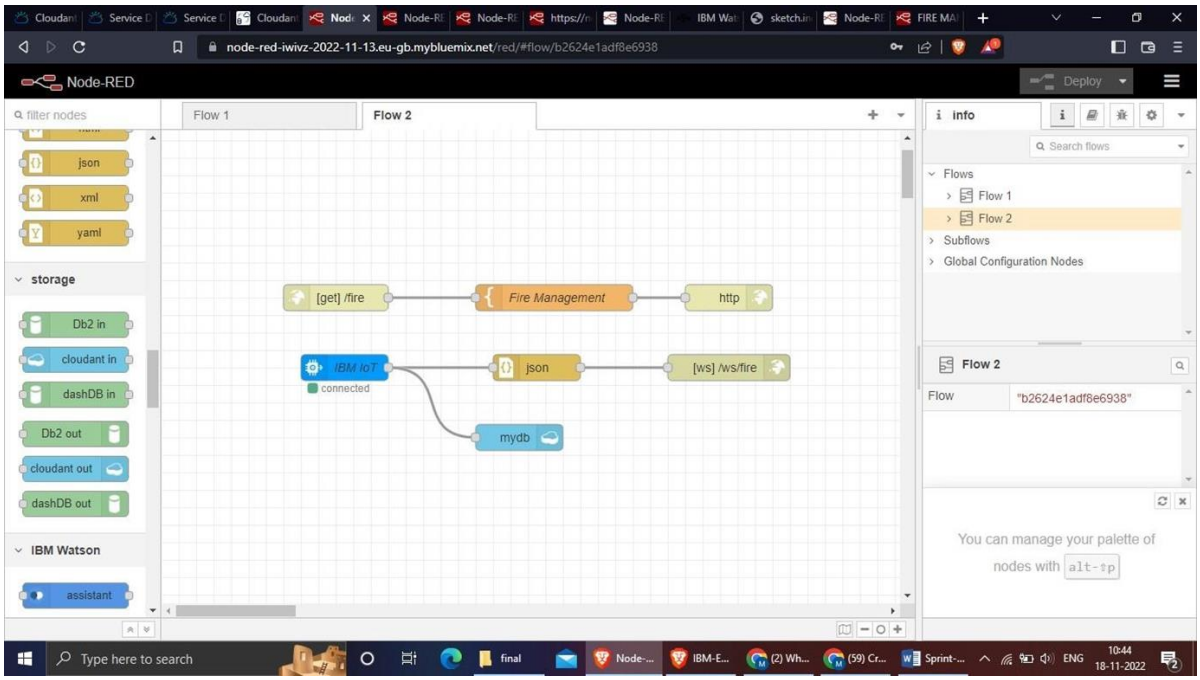




9.1.4 Node-Red :

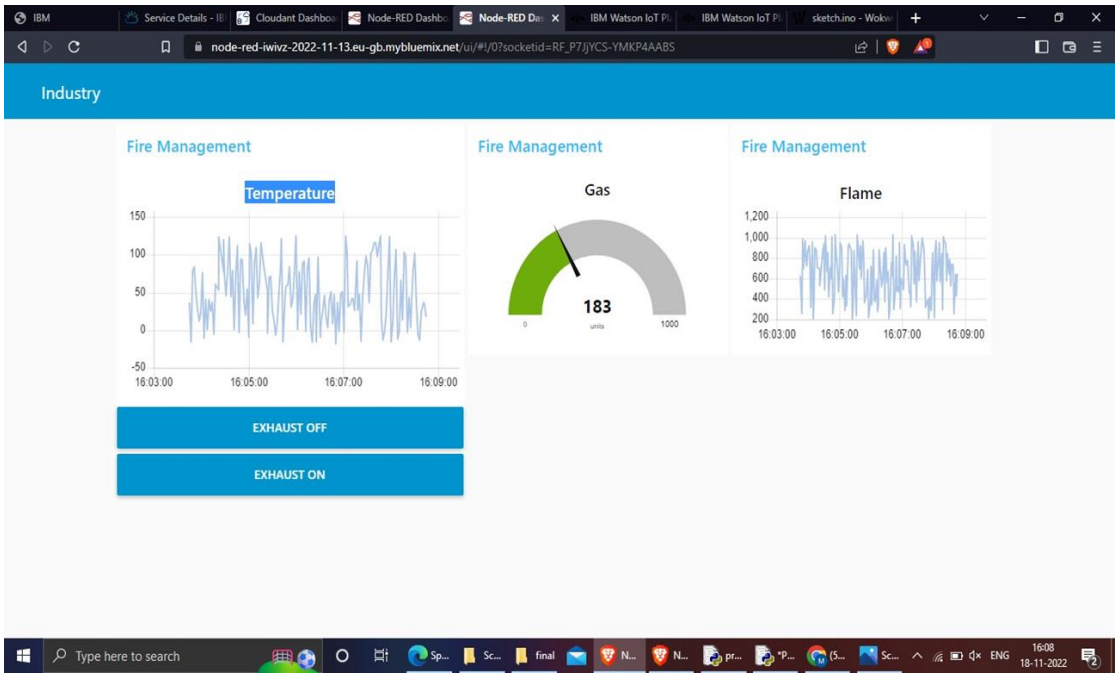
It interconnect with IBM watson and used to reate functionality by wiring together flows of data between nodes using a browser





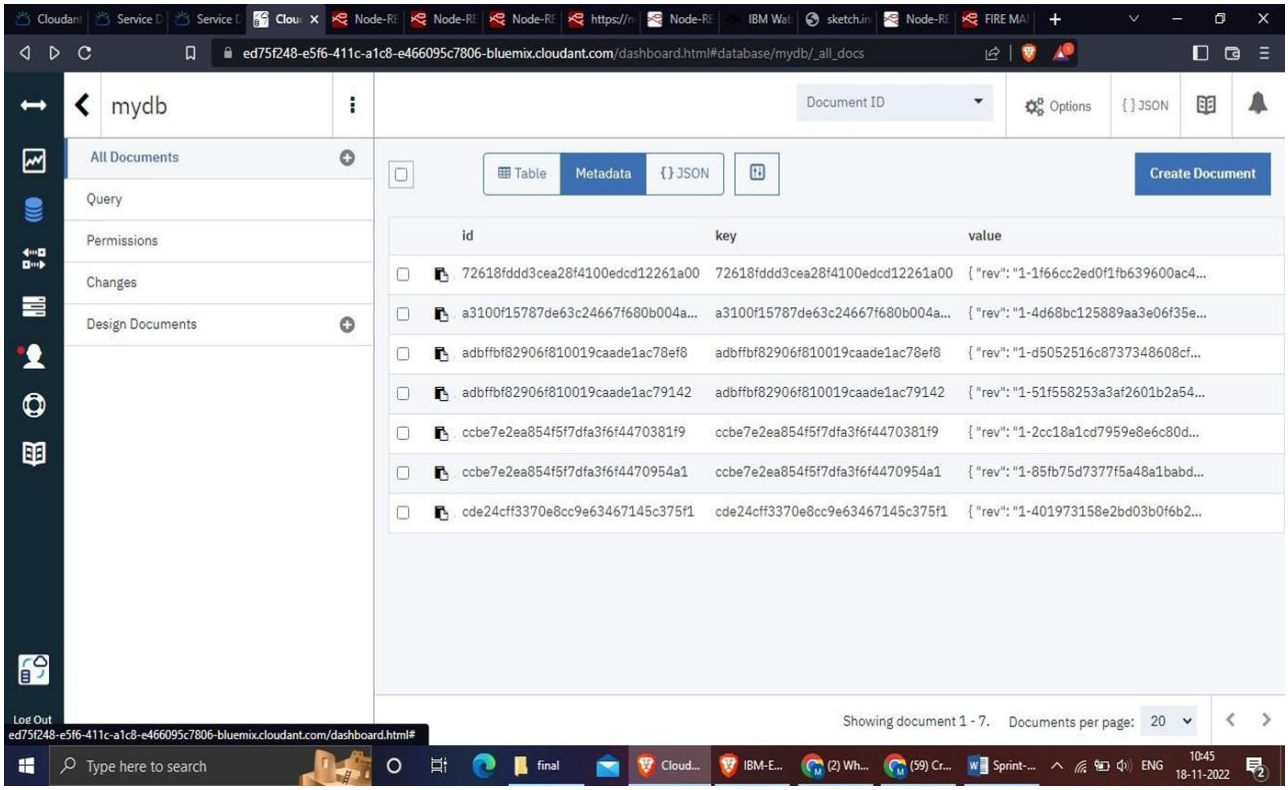
9.1.5 Node-Red Dashboard :

It is a module that gives Node-RED users a collection of nodes they may use to quickly build a live data dashboard. It offers nodes, for instance, to quickly build user interfaces with buttons, switches, charts, gauges, etc.

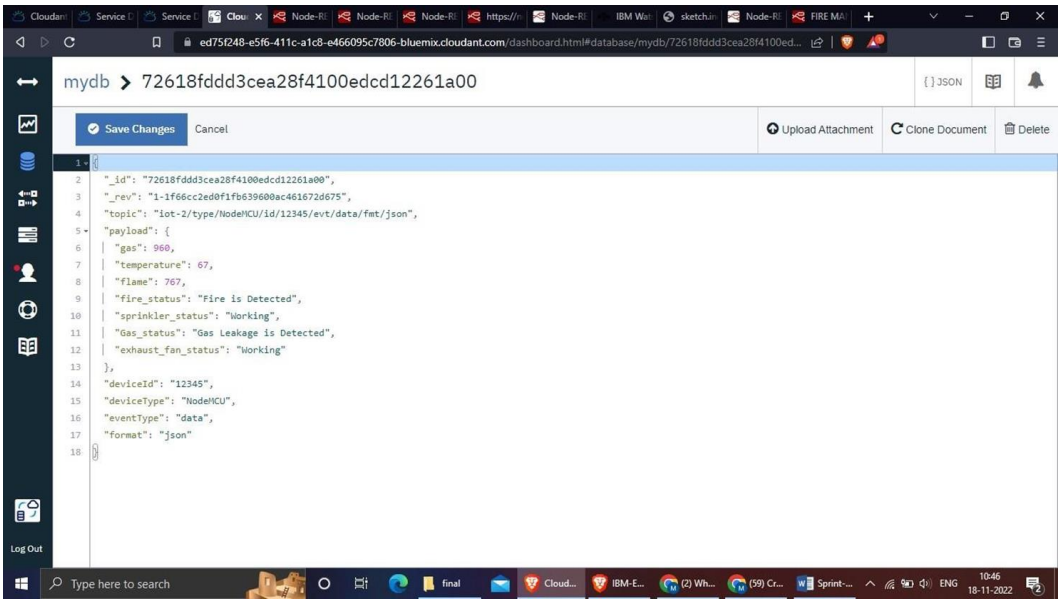


9.1.6 Cloudant :

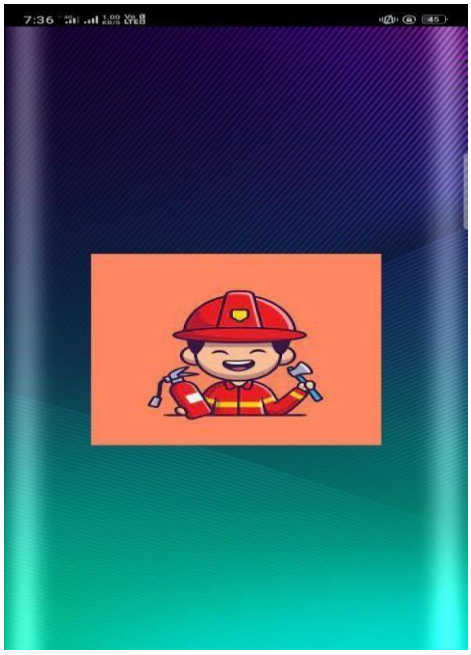
It handles software and hardware provisioning, management and scaling, and support.

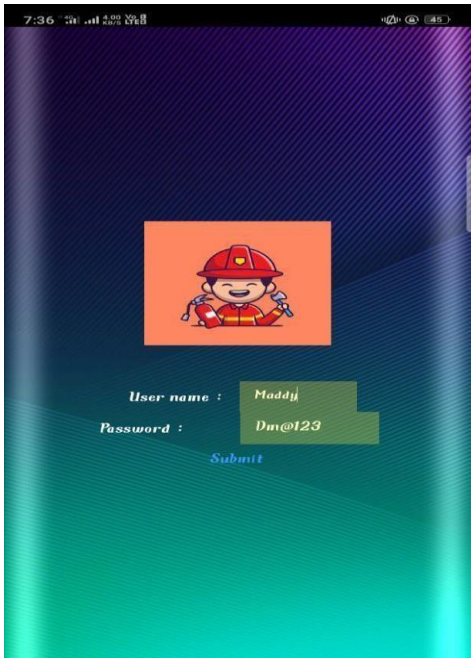


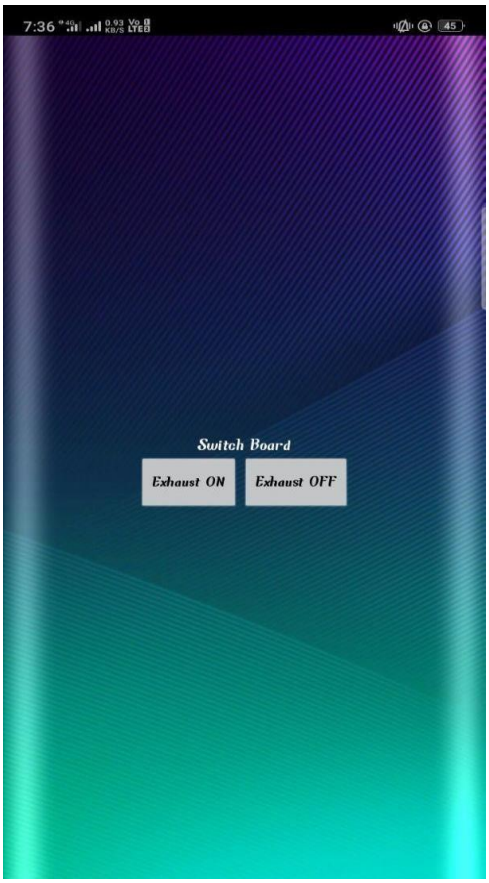
9.1.7 Cloudant Dashboard:



9.1.8 MIT App Inventor :







CHAPTER 10

10.ADVANTAGES & DIS-ADVANTAGES

10.1 Advantages :

1. It is used to preventing the industries before fire accident occurred.

2. It is used to alert and warning everyone and prevent everyone against the fire detection.

3. It is connected with various components of fire sprinkler, exhaust fan to take speedy actions.

4. It reduce the risk of dying.

5. It provide early warning and it help us to make a preventive actions and it is less expensive.

10.2 Dis-Advantages :

1. It possible to detect false detection, because of industry always become heavy temperature, so it is certain difficult task.

CHAPTER 11

11. CONCLUSION

We may infer from the project's performance that the system's ability to detect fire and smoke is amazing. Useful for both residential and commercial purposes. We can use this technique to save lives in dangerous situations. The GSM module indicates an alert. Propane, CO2, and other gases are detected by a sensor node. Power usage and transmission range estimates are made. The sensor was constructed using straightforward techniques and an Arduino UNO Micro controller.

Oxygen depletion and poisonous, flammable, and combustible gases can all be found with gas detectors. This kind of instrument is frequently employed in industry and is found in places like oil rigs to keep an eye on production procedures and cutting-edge technology like photovoltaics. They could be employed in battling fires.

If you're looking for a small, palm-sized fire and smoke detector, choose the Techamor Y201. It is inexpensive to use this method to determine whether your home or place of business has any gas or smoke leaks.

CHAPTER 12

12. FUTURE SCOPE

- In this study, we leverage IOT technologies to improve current safety regulations.
- The goal in developing this prototype was to completely eliminate any big or minor hazards that might have been brought on by hazardous and dangerous gas leaks into the environment.
- Using IOT technology, which can perform predictive analytics on sensors and Smart Alerting protocols that involve text messaging the appropriate authority, we have developed a fire and smoke detector for society.
- This system will be able to recognise smoke and gas in the immediate environment using gas sensors. This will provide protection from the most dangerous problem. This simple smoke and fire detector offers the benefits of being user-friendly and providing fire accident alerts.
- Using gas sensors, this system will be able to identify smoke and gas in the surrounding area. This will shield against the main dangerous issue.
- This straightforward smoke and fire detector has the advantage of being easy to use and of giving fire accident warnings.
- With the ability to travel along a track that runs the length of the pipeline, a mobile gas and smoke sensing robot may be built to detect the leaking of smoke and gas for the detection of fires.
- The key benefit of this method is that it turns off the cylinder's regulator knob automatically when gas and smoke leaks are discovered.
- This system employs GSM technology to send alarm messages to the appropriate person if there is a gas leak and no one is home.

CHAPTER 13

13.APPENDIX

13.1. Source Code :

```
#include <time.h>
#include <WiFi.h>
#include <PubSubClient.h>

#define ORG "pq685h"
#define DEVICE_TYPE "NodeMCU"
#define DEVICE_ID "12345"
#define TOKEN "12345678"

char server[]= ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/data/fmt/json";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;

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

float temperature  = 0;
int gas = 0;
int flame = 0;

String flame_status = "";
String Gas_status = "";
```

```
String exhaust_fan_status = "";
String sprinkler_status = "";


void setup() {
  Serial.begin(99900);
   wifiConnect();
   mqttConnect();
}

void loop() {

  srand(time(0));

    //initial variables and random generated data

    temperature = random(-20,125);
    gas = random(0,1000);
    int flamereading = random(200,1024);
    flame = map(flamereading,200,1024,0,2);

    //set a flame status

    switch (flame) {
    case 0:
        flame_status = "No Fire";
        break;
    case 1:
        flame_status = "Fire is Detected";
        break;
```

```
}

//send the sprinkler status

if(flame==1){
   sprinkler_status = "Working";
}
else{
   sprinkler_status = "Not Working";

}

//toggle the fan according to gas reading

if(gas > 100){
   Gas_status = "Gas Leakage is Detected";
   exhaust_fan_status = "Working";

}
else{
   Gas_status = "No Gas Leakage is Detected";
   exhaust_fan_status = "Not Working";
}

//json format for IBM Watson

String payload = "{";
payload+="\"gas\":";
payload+=gas;
payload+=",";
```

```
  payload+="\"temperature\":";
  payload+=(int)temperature;
  payload+=",";
  payload+="\"flame\":";
  payload+=flamereading;
  payload+=",";
  payload+="\"fire_status\":\""+flame_status+"\",";
  payload+="\"sprinkler_status\":\""+sprinkler_status+"\",";
  payload+="\"Gas_status\":\""+Gas_status+"\",";
  payload+="\"exhaust_fan_status\":\""+exhaust_fan_status+"\"}";

  if(client.publish(publishTopic, (char*) payload.c_str()))
  {
    Serial.println("Publish OK");
  }
  else{
    Serial.println("Publish failed");
  }
  delay(1000);


  if (!client.loop())
  {
   mqttConnect();
  }
}


void wifiConnect()
{
```

```
  Serial.print("Connecting to ");
  Serial.print("Wifi");
  WiFi.begin("Wokwi-GUEST", "", 6);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.print("WiFi connected, IP address: ");
  Serial.println(WiFi.localIP());

}


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

    Serial.println();
  }
}
```

13.2. GitHub & Project Demo Link :

GitHub: https://github.com/IBM-EPBL/IBM-Project-2847-1658484090

Project Demo Link: https://youtu.be/Xj6nwsmhY08