**INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM**

**PROJECT BASED LEARNING**

**Submitted by**

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**K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM**

**ANNA UNIVERSITY: CHENNAI 600 025.**

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**BONAFIDE CERTIFICATE**

Certified that this project report **“INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM”** is the bonafide work of “ADITHYA SS (910619104004)”, “AJAY M (910619104005)”, “ARVIND P (910619104008)” and “DHEERAJ T.B (910619104016)”, “ HARIHARAN P (910619104023)” who carried out the project under my supervision.

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**MENTOR EVALUATOR**

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**ABSTRACT**

The proposed model in this paper 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 GSM network system. The system uses various sensors to detect fire, smoke and gas , then transmits the message using GSM module. After the message, send by the module the help arrives in 15 minutes. The system is associated with water pump and a sprinkler. The Water system is associated with a water tank and a sprinkler. The water tank uses a Ultrasonic sensor to monitor the level of water level in the tank for refilling the water tank .Once fire is detected, it automatically sends the emergency message and sprinkles the water.

**CHAPTER – 1**

**INTRODUTION**

Nowadays, fire incidents have become a critical issue , which must be dealt with on time without any unnecessary delay to avoid the loss in lives and belongings . It is considered a fire situation when the monitored temperature exceeds 50 oC. In critical places such as hospitals, schools, and banks, personnel's arrival time to come for help in fire hazards is around 15 minutes. The statistics show that there are 1,291,500 structural fires annually in the United States, causing 2,950 civilian deaths, 16,600 civilian injuries, and 14.8 billion in direct property damage. According to the national fire protection association (NFPA), two-third of U.S. household fires occur in premises with no working smoke alarms, alarms with no proper maintenance, or misplaced alarms . The appropriate allocation of fire alarms with a proactive warning could save lives and reduce property losses. Particularly, there are many types of fire alarms as heat detectors and smoke detectors studying these types helps to decide which type is more suitable for home or store. For instance, heat detectors are classic options when the temperature reaches a certain level. Thus, it is more suitable for applications that rapid response is not required or in an environment where smoke detectors cannot be placed like frozen areas. Heat detectors have a lower false alarm rate but still slower in response because the temperature rises slowly .With all these lacks, smoke detectors remain better than heat detectors . Smoke alarms will more likely detect fires before it really starts. Smoke comes when the energy of an object is consumed due to the loss of carbon dioxide (CO2) from heat. Smoke detectors are classified into three types: ionization, photoelectric, and combination. All these types can be studied further in instruments and measurement books. In this study, we will highlight a brief description of ionization. In brief, ionization is a radioactive material that receives radiation from the fire. It enters the ionization chamber, which is an air-filled space between two electrodes and permits a small, constant current between the electrodes. This type is the best for fast fires or fires caused by bombs or accidents.

The concept of internet of things (IoT) nowadays is applied in many applications ranging from the smart industry, smart agriculture to smart healthcare, and smart home application . Home automation is an area where IoT has several advantages. In the case of remote plant locations, for example, technology enabling remote operation and maintenance will benefit; autonomous interappliance such that devices are mutually aware of the information exchange, thereby minimizing engineering costs in handling all devices involved. Nowadays, fires can get out of control because people intend to save money rather than installing proper fire alarm systems. Some problems are still on, such as affordability, effectiveness, and responsiveness. Previous related works such as network-based real-time integrated fire detection and alarm (FDA) system with building automation have been done to overcome these problems.

Considering the aforementioned challenges, this study focuses on building an advanced fire alarm using heat and smoke alarms. The system reads the flame, heat, and smoke data using IoT, analyzes these data, and then quickly triggers the automatic water sprinkler. Thus, this study's importance is to provide a low-cost fire alarm system considering the affordability, effectiveness, and responsiveness.

Many studies have been conducted to address these issues like ; however, fire detection issues are not addressed properly since these systems rely on machine vision, where the algorithms need more images to train, and the detection rate is not satisfactory. Other approaches like [36, 37] suffer from some limitations, mainly slow time responses and low accuracy. Thus, this paper aims to minimize false alarms, provide faster response, and a new IoT approach than previous studies that used mostly Node-Red. The contribution is as: i) To determine which combinations and algorithms of sensors can accurately and quickly detect fires; ii) We have designed and then developed a system that detects fire and activates the fire alarm; iii) the proposed system evaluates the situation and initiates an automatic water sprinkler where the water unit was designed separately; and iv) the system analyses the collected data using Ubidots platform which results in a faster response. Thus, the highlighted four points make the proposed system superior in terms of affordability, effectiveness, and responsiveness.

**1.1.PROJECT OVERVIEW:**

This project's main objective is to help the Authority to automatically monitor the industry by providing them with access to a web app that lets them monitor variables like temperature, gas and flame on the industry. They also intimate the nearest fire station for help and automatically switch on the motor to sprinkle water on fire.

**1.2.PURPOSE :**

The fields of Fire accident prevention and Fire accident alarms are the subject of substantial research by numerous academics and professionals. In order to increase safety and prevent Fire accidents, many different techniques are applied. For ease of reference, stand-alone, cooperative, and hybrid strategies are separated in the Fire accident detection and avoidance literature. While stand-alone approaches use sensors for Fire accident avoidance and detection, such as Flame sensor, Temperature sensor and Gas sensor.

**CHAPTER – 2**

**IDEATION PHASE**

**2.1. LITERATURESURVEY:**

A literature survey or a literature review is that section which shows the various analyses and research made in the field of your interest and the results already published, taking into account the various parameters of the project and the extent of the project**.**

The following papers are studied in the following survey:

**F. He; Z. Du; Y. Sun, “Indoor dangerous gas environment detected by mobile robot,” in 2009 IEEE International Conference on Robotics and Biomimetic (ROBIO).**

**V. Jelicic; M. Magno; G. Paci; D. Brunelli; L. Benini, "Design, characterization and management of a wireless sensor network for smart gas monitoring," in 2011 4th IEEE Int. Workshop on Adv in Sensors and Interfaces (IWASI).**

Fire is a very dangerous situation and it is very much necessary to monitor and give warning before anything untoward happens. In many developing countries, houses do not come fitted with fire alarm system as seen in developed countries like Singapore, USA etc. This results in fire being unattended and leading to lot of losses like property, human. This is the IOT (internet of things) based fire monitoring and controlling system which not only gives the real time information about the situation on the monitor but also takes the corrective action as per the need. In this system the sensors transfer data wirelessly with the help of MQTT (message queuing telemetry transport) networking protocol which is designed for constrained with low-bandwidth. MQTT allows us to send commands to control output, read and publish data from sensors nodes and much more. The first concept is the publish and subscribe system. In a publish and subscribe system, a device can publish a message on a topic, or it can be subscribed to a particular topic to receive message. Also, it is perfect solution for internet of things application. Due to this all data can be stored in server and this data can be access by the Application program interface which we can display on the monitor and with the help of software the operator can visualize the condition at the time of fire accident.

**Iot Based Smart Gas Management System**

**Kumar Keshamoni, SabbaniHemanth, “Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT”, 2017 IEEE 7th International Advance Computing Conference.**

**Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu, “Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor”, 2017 IJEDR, Volume 5, Issue 2, ISSN: 2321-9939.**

The problem of gas leakage and fire is often encountered in our day-to-day life. LPG, Liquified Petroleum Gas, is highly flammable gas used as fuel in heating appliances. Leakage of this gas raises the risk of building fire, suffocation or an explosion. The mentioned problem can be solved with the development of reliable techniques to detect gas leakage. As soon as gas leakage will be detected, user will be notified via SMS and call so that he/she can turn off gas valve from anywhere in his work place. The issue of flame and fire at kitchen can be monitored with the help of fire sensor. The buzzer starts beeping whenever fire is detected. In addition to these, it is often found that a person forgets to book gas cylinder due to his/her busy schedule. The main aim of this paper is to design an IOT based Smart Gas Management System that will be able to detect gas leakage and fire. With the help of load sensor, automatic booking of a gas cylinder is also facilitated. Notification is sent to the booking agency to book a gas cylinder whenever load cell detects that the weight of gas cylinder has reached below a threshold value. At the same time, user will be notified about gas cylinder going empty.

# A Smart Fire Detection System using IoT Technology with Automatic Water Sprinkler .

**Bu, F. and Gharajeh, M. S., “Intelligent and vision-based fire detection systems: A survey,” *Image and Vision Computing*, vol. 91, 2019.**

**Mahgoub, A., Tarrad, N., Elsherif, R., Al-Ali, A. and Ismail, L., “IoT-based fire alarm system,” *2019 Third World Conference on Smart Trends in Systems Security and Sustainablity (WorldS4)*, London, United Kingdom, 2019.**

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 House combustion is one of the main concerns for builders, designers, and property residents. Singular sensors were used for a long time in the event of detection of a fire, but these sensors cannot measure the amount of fire to alert the emergency response units. To address this problem, this study aims to implement a smart fire detection system that would not only detect the fire using integrated sensors but also alert property owners, emergency services, and local police stations to protect lives and valuable assets simultaneously. The proposed model in this paper 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 IoT technology has been esponsiveness as the system uses the Ubidots platform, which makes the data exchange faster and reliable.

## LPWAN Based IoT Surveillance System for Outdoor Fire Detection

**S. R. Vijayalakshmi and S. Muruganand, ``A survey of Internet of Things in fire detection and fire industries,'' in *Proc. Int. Conf. I-SMAC (IoTSocial, Mobile, Anal. Cloud) (I-SMAC)*, Palladam, India, Feb. 2017.**

**K. Mekki, E. Bajic, F. Chaxel, and F. Meyer, ``A comparative study of LPWAN technologies for large-scale IoT deployment,'' *ICT Express*, vol. 5, no. 1, pp. 1-7, Mar. 2019.**

Many fire situations have represented the loss of lives and material costs due to the lack ofearly fire detection through smoke or gas sensing, which can become complex and critical. Meanwhile,engineers worldwide develop and test multiple systems for smoke and gas detection, commonly based onsensor networks, digital image processing, or computer vision. Furthermore, the detection system must workthoroughly with alarms and warnings that aware of a risk situation for prompt evacuation of the population inthe surroundings based on a reliable data network topology with adequate device deployments that will let usknow the moment a fire outbreak. This paper presents a low-cost Internet of Things (IoT) prototype for firedetection in outdoor environments based on sensors and Low Power Wide Area Network (LPWAN), focusedon the accuracy in the temperature and gas measurement at the moment a fire starts. For its achievement,we integrated wireless components, development boards, and electronic devices, following the managementof information updates through a database schema for the alarm settings based on the data gathered from the Sensors.

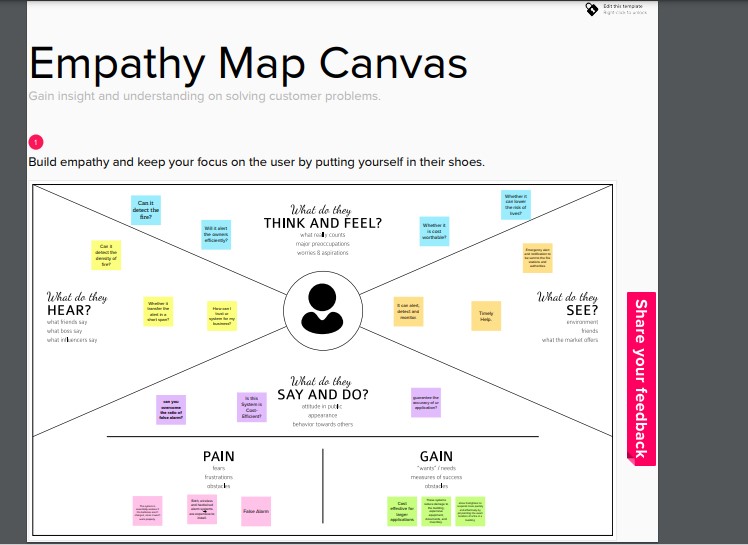
**Application of NB-IoT in Intelligent Fire Protection System**

**Zhang Quan, Technological Performance and Application of the Cellular-based Narrow Band Internet of Things (NB-IoT), Science Communication, 2018.**

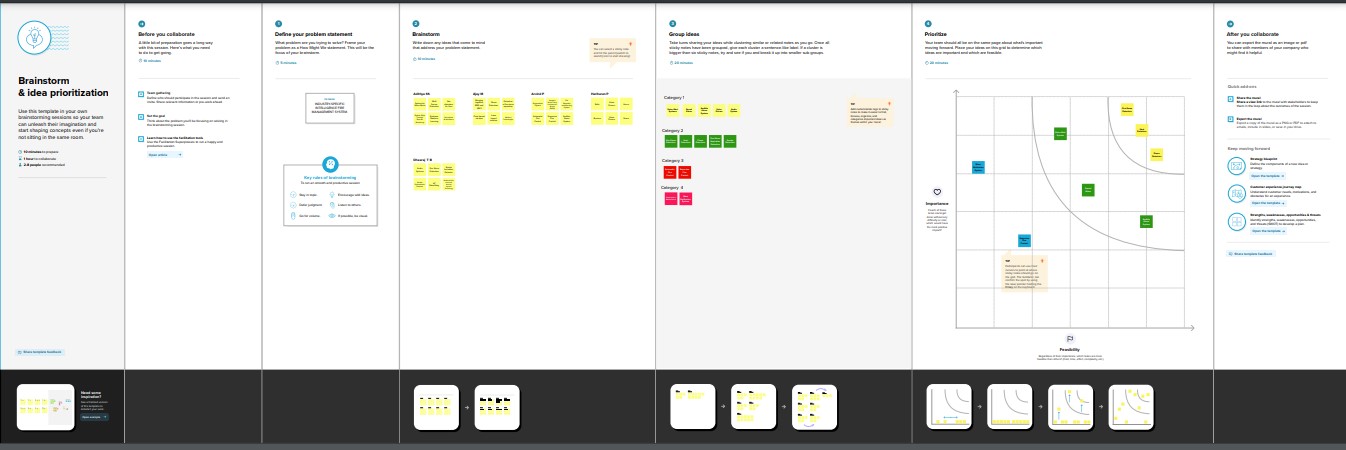
**Huang Fengwei, Wu Rongwen. Applied Research of Intelligent FireControl System in Intelligent Buildings, Electronic World, 2017, 7:10-12.**

NB-IoT refers to a cellular-based narrowband Internet of Things, which has become an important part of the Internet of Things. NB-IoT is a new technology emerging in the field of Internet of Things in recent years. It has obvious advantages in technology and application. In addition, the application of narrowband Internet of Things (NB-IoT) technology in the field of fire protection can fundamentally enhance the combat capability of fire fighting forces, avoid fire and reduce the loss of life and property of the people. This thesis analyses and introduces an intelligent fire-fighting system based on the new industry standard, and a smoke-fire detection and alarm device based on the Internet of Things (IoT) platform and Nb-IoT technology. It also puts forward corresponding solutions to the problem of smart smoke, such as the value, advantages and future expectations of the solution.

**2.2. EMPATHY MAP:**

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**2.3. IDEATION AND BRAINSTORMING:**

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**2.4. PROBLEM STATEMENT:**

* Many Industries are becoming in fire trouble/hazards where the Organisation lost their belongings, properties and their Worker lives.
* To reduce that problem, the proposed system for fire detection and alert in case fire outbreak and inform to the respective authorities should be designed and implemented.

**ABSTRACT :**

* This project's main objective is to help the Authority to automatically monitor the industry by providing them with access to a web app that lets them monitor variables like temperature, gas and flame on the industry.
* They also intimate the nearest fire station for help and automatically switch on the motor to sprinkle water on fire.

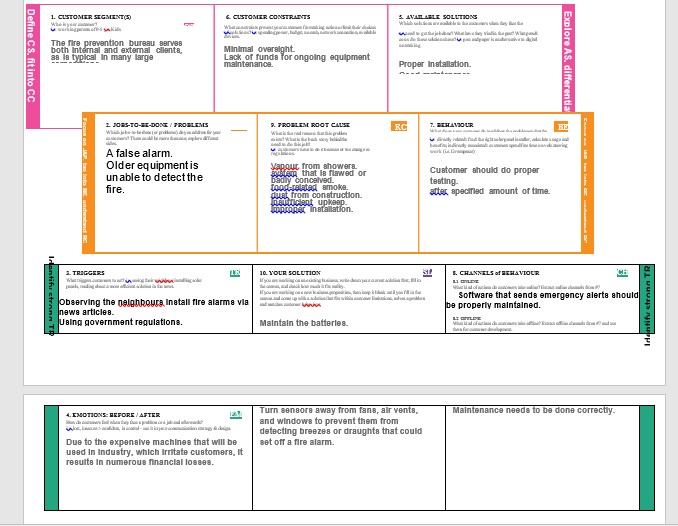
**CHAPTER - 3**

**PROJECT DESIGN PHASE – I**

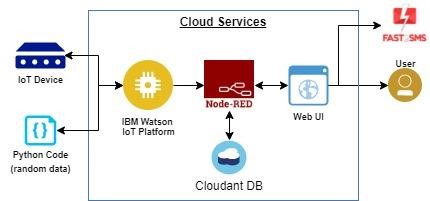
**3.1. PROPOSED SOLUTION:**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
| 1. | Problem Statement (Problem to be solved) | Improving Safety management systems in the Industry. Establishment of a Safety Management System for Fire accidents in the Industrial World. |
| 2. | Idea / Solution description | The Proposed system helps the Industries in detecting the leakage of fire using sensors like flame, gas, temperature sensors, then send alert notification to the respective industry admins and Sprinkles water on the fire using a motor. |
| 3. | Novelty / Uniqueness | * Sends the Fire Explosion / Fire leakage location to administrator and Fire station. * Controlls the fire by sprinkling water using motor. |
| 4. | Social Impact / Customer Satisfaction | The Industrial Admin can prevent a huge loss before the accident through the fire leakage monitoring System. |
| 5. | Business Model (Revenue Model) | * Low Cost * Timely Help * High Security |
| 6. | Scalability of the Solution | High Scalability |

**3.2. PROBLEM SOLTTION FIT:**

****

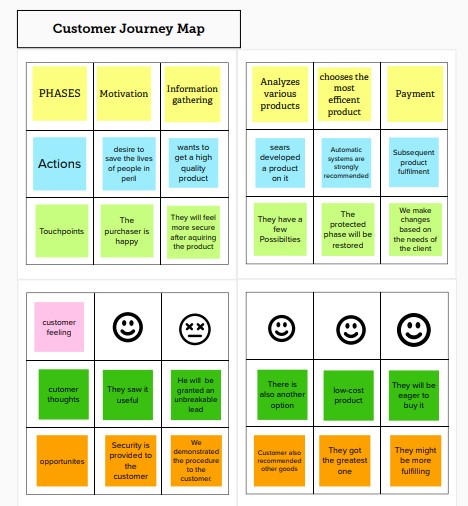
**3.3. SOLUTION ARCHITECTURE:**



**CHAPTER – 4**

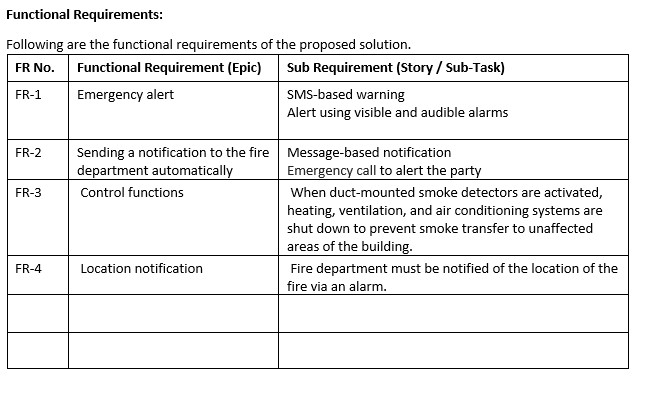
**PROJECT DESIGN PHASE – II**

**4.1. CUSTOMER JOURNEY:**

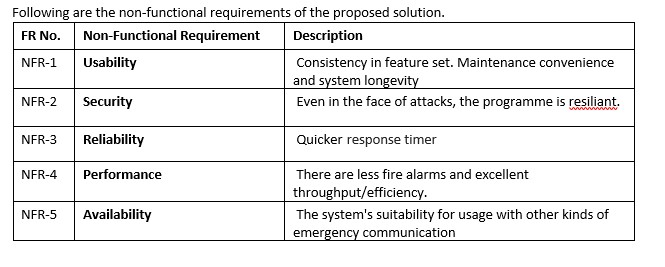
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**4.2. REQUIREMENT ANALYSIS:**

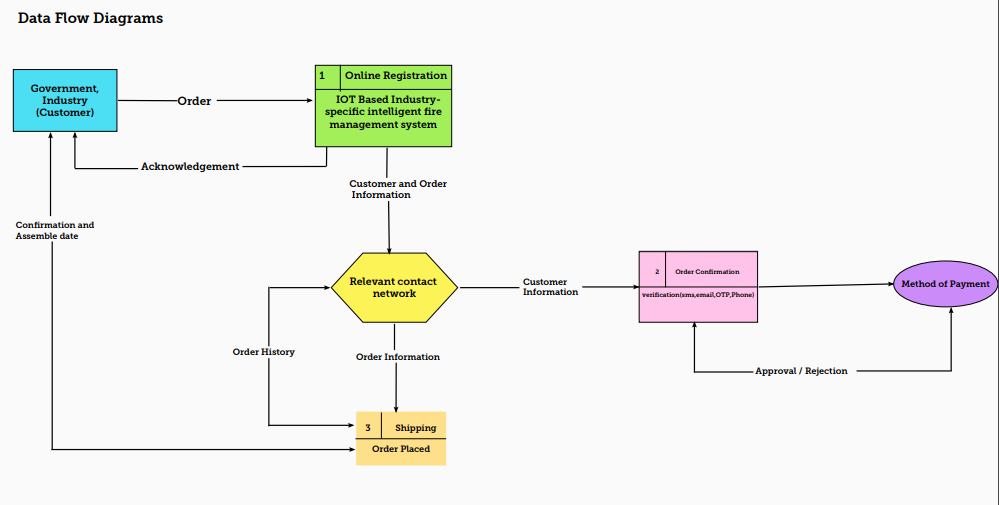
**FUNCTIONAL REQUIREMENTS:**

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**NON – FUNCTIONAL REQUIREMENTS:**

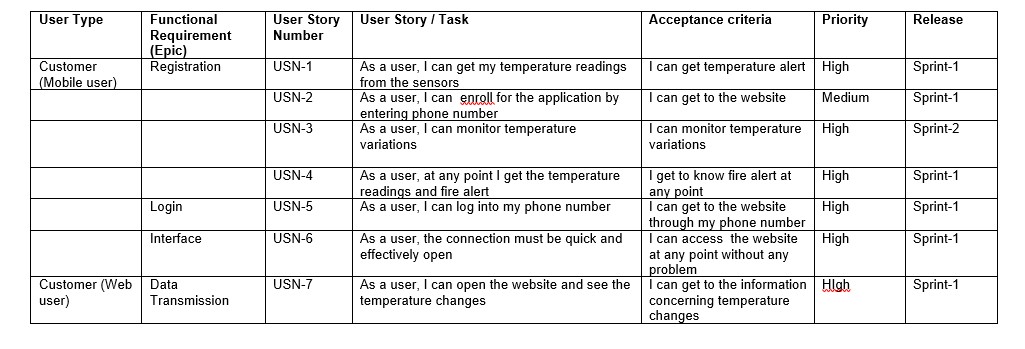
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**4.3. DATA FLOW DIAGRAM:**

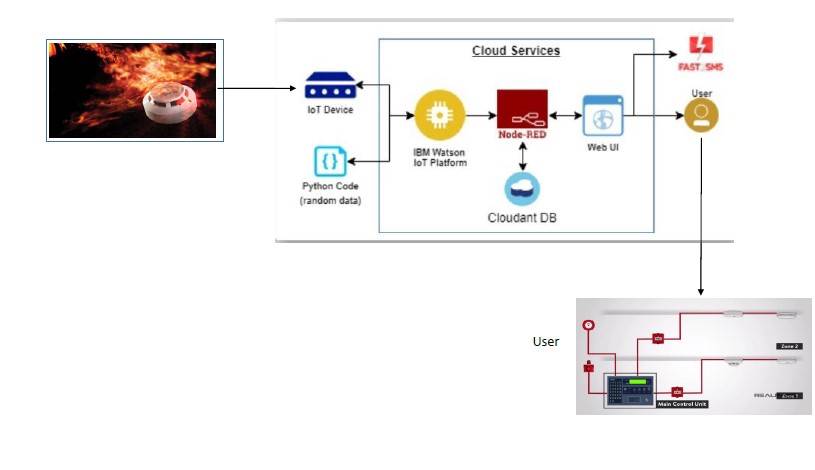


**User Stories**

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



**4.4. TECHNOLOGY ARCHITECTURE:**



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

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Component** | **Description** | **Technology** |
|  | User Interface | Sending Alert SMS to user | GSM Module ,Wifi Module, Voice Module. |
|  | Application Logic-1 | Gets alert notification through website | Python |
|  | Application Logic-2 | Logic for a process in the application | IBM Watson STT service |
|  | Application Logic-3 | Logic for a process in the application | IBM Watson Assistant |

**Table-2: Application Characteristics:**

| **S.No** | **Characteristics** | **Description** | **Technology** |
| --- | --- | --- | --- |
|  | Security Implementations | Gets notified only by the phone number | Using GSM Module |
|  | Accuracy | More Accurate | Various Sensors |
|  | Performance | High Performance | IOT |

**CHAPTER – 5**

**PROJECT DESIGN**

**5.1. MILESTONE AND ACTIVITY LIST:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Milestone No.** | **Milestone** | **Task Description** | **Milestone status** |
| **Milestone 1** | **Ideation Phase** | In this activity, we must collect the permanent data for the project use case and consult any recent developments, technical papers, research articles, etc. | Completed |
| **Literature survey on selected project and Information gathering** |
| **Problem Statement** | Pertaining to the problem experienced by clients and the suggested solution | Completed |
| **Prepare Empathy Map** | In order to capture the user's gains and sufferings, we must set up the empathy map canvas for this task. List potential problem formulations. | Completed |
| **Ideation** | As part of this exercise, we are expected to create a list of ideas by setting up the brainstorming session and to rank the top three ideas according to their viability and significance. | Completed |
| **Milestone 2** | **Project Design Phase-I** | For this assignment, we must develop a proposed solution document outlining the navelless, viability of the concept, commercial strategy, social impact, scalability of the solution, etc. | Completed |
| **Proposed Solution** |
| **Problem Solution**  **Fit** | For this work, we must produce a problem solution-fit paper and submit it for approval. | Completed |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Solution**  **Architecture** | For this task, we must write a solution architecture paper and submit it for evaluation. | Completed |
| **Milestone 3** | **Project Design Phase - II** | To understand how users interact with and use the application, customer journey maps were created (entry to exit). | Completed |
| **Customer Journey** |
| **Functional Requirement** | In this task, we are supposed to draught the functional requirement document. | Completed |
| **Data Flow Diagrams** | For this task, we are required to create the data flow diagrams and submit them for review. | Completed |
| **Technology Architecture** | We are required to develop the technological architecture diagram for this activity. | Completed |
| **Milestone 4** | **Project Planning Phase** | The project's milestones and activity list are to be prepared during this activity. | Completed |
| **Prepare Milestone & Activity List** |
| **Sprint Delivery Plan** | The sprint delivery plan preparation is what we are expected to do in this activity. | In Progress |
| **Milestone 5** | **Project**  **Development Phase** | We will begin project development at this point and plan to complete coding and solutions, acceptability testing, and performance testing based on the sprint and submit them. | In Progress |
| **Development of**  **Sprint 1,2,3,4** |
| **Milestone 6** | **Data Collection** | We will be collecting data on this in order to develop our research. We'll make two folders: one for testing, the other for training. The model will be developed using photos from the training folder, and it will be validated using photos from the testing folder.. | |
| **Milestone 7** | **Model Building** | Initialization, inclusion of convolutional layers, and layer pooling Layer flattening and complete layer joining | |
| **Milestone 8** | **Test the Model** | Presently, we perform a model test by giving it a picture and asking it to make predictions. We must make sure the test image is scaled before sending it to the model, that its dimensions are accurate, and that it is the test image's appropriate size for the model. | |
| **Milestone 9** | **Application Building** | We will now create a Flask application in order to design our user interface and connect to the model in the backend to get predictions. A Python file is required for the backend, which manages the model interface, and an HTML page is required for the frontend of a Flask application. | |

**5.2. SPRINT DELIVERY PLAN:**

**PRODUCT BACKLOG, SPRINT SCHEDULE, AND 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 | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
|  | Operating | USN-2 | Turning on the exhaust fan as well as the fire sprinkler system in cause of fire and gas leakage. | 3 | Medium | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
| Sprint-2 | Sending collected data to the IBM Watson platform | USN-3 | Sending the data of the Sensors to the IBM Watson. | 3 | High | Adithya  Ajay  Arvind  Dheeraj  Hariharan |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional**  **Requirement (Epic)** | **User Story**  **Number** | **User Story / Task** | **Story Points** | **Priority** | **Team Members** |
|  | Node red | USN-4 | Sending the data from the IBM Watson to the Node red. | 3 | High | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
| Sprint-3 | Storing of sensor data | USN-5 | Storing in Cloudant database. | 2 | Medium | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
|  | Registration | USN-6 | Entering my email and password to verify authentication process. | 1 | Medium | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
|  | Web UI | USN-7 | Monitors the situation of the environment which displays sensor information. | 3 | High | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
| Sprint-4 | Fast SMS Service | USN-8 | Use Fast SMS to Send alert message once the parameters like temperature, flame and gas sensor readings goes beyond the threshold value. | 3 | High | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
|  | Turn ON/OFF the actuators | USN-9 | User can turn off the Exhaust fan as well as the sprinkler system If need in that Situation. | 2 | Medium | Adithya  Ajay  Arvind  Dheeraj  Hariharan |
| **Sprint** | **Functional**  **Requirement (Epic)** | **User Story**  **Number** | **User Story / Task** | **Story Points** | **Priority** | **Team Members** |
|  | Testing | USN-10 | Testing of project and Final Deliverables. | 1 | Low | Adithya  Ajay  Arvind  Dheeraj  Hariharan |

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

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

**Velocity:**

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



# AV = 6/6=1

**Burndown Chart:**

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile [softwaredevelopment m](https://www.visual-paradigm.com/scrum/what-is-agile-software-development/)ethodologies such as [Scrum.](https://www.visual-paradigm.com/scrum/scrum-in-3-minutes/) However, burn down charts can be applied to any project containing measurable progress over time.

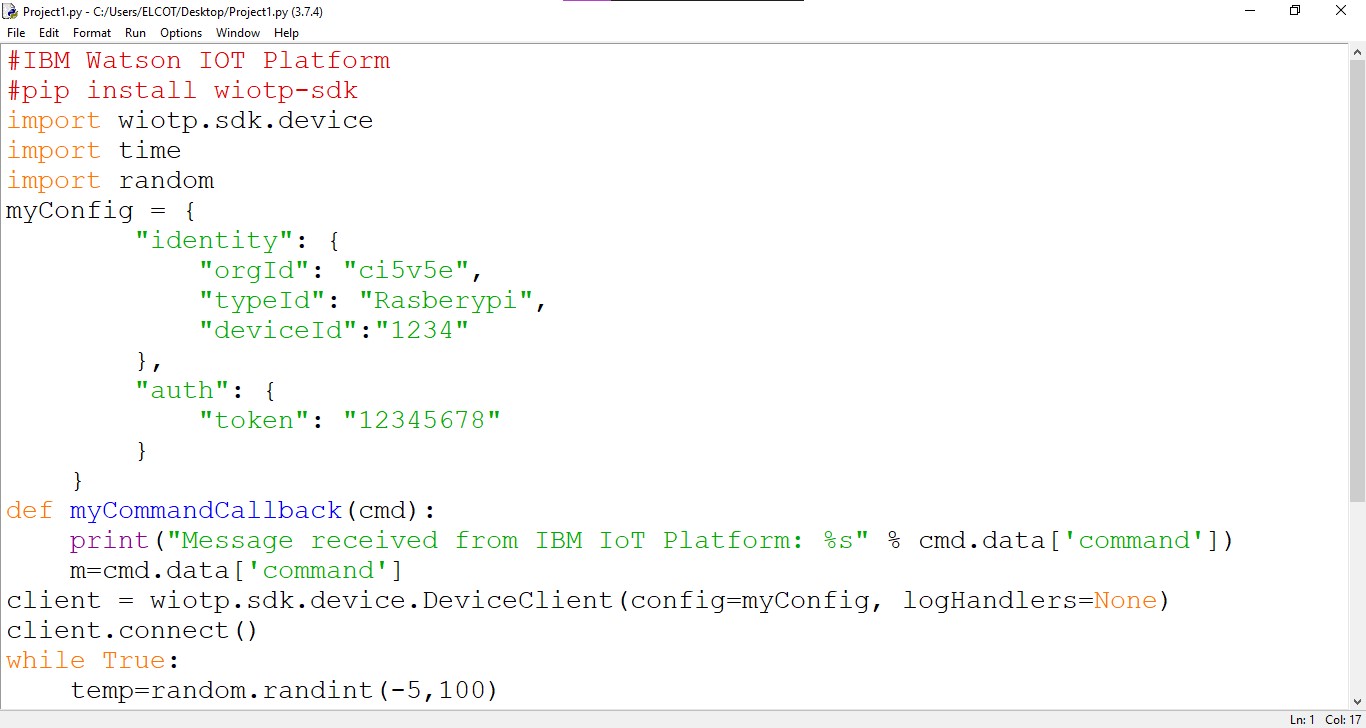


**CHAPTER – 6**

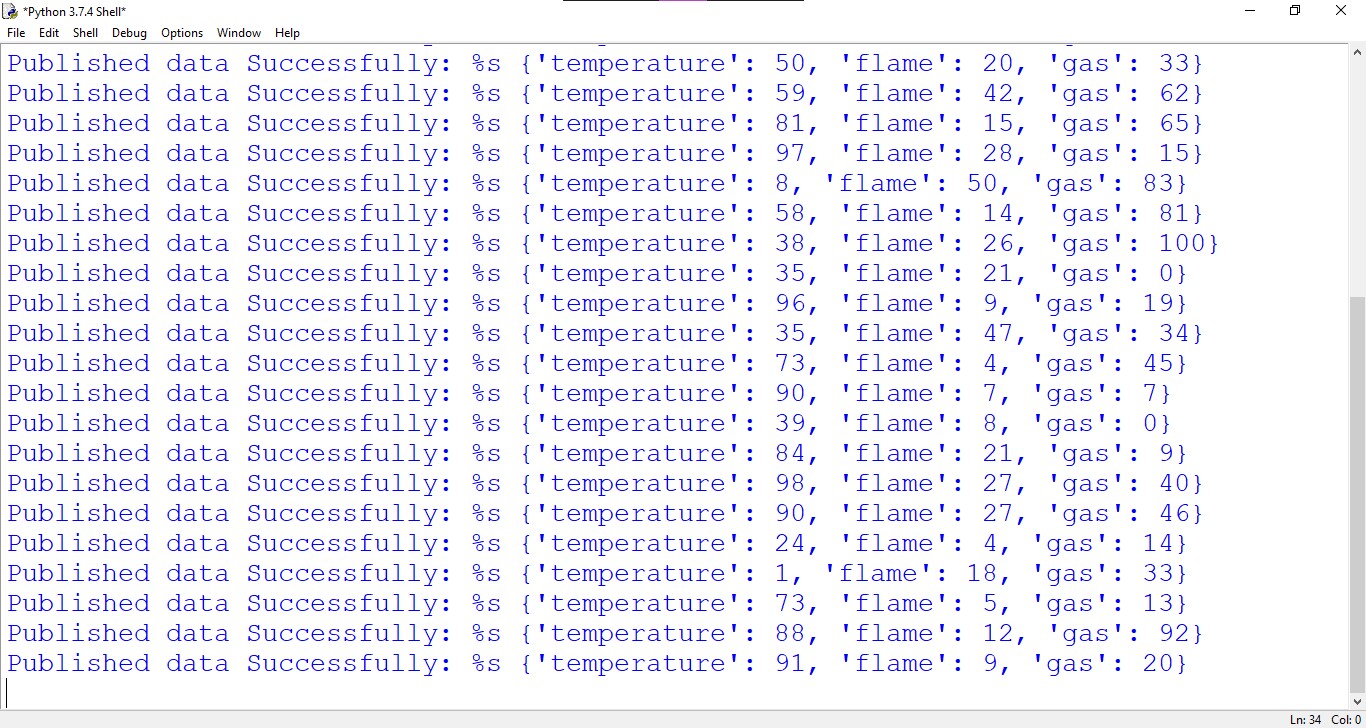
**PROJECT DEVELOPMENT PHASE**

**6.1. DELIVERY OF SPRINT – 1:**

Getting sensor values:







Code:

#IBM Watson IOT Platform #pip install wiotp-sdk import wiotp.sdk.device import time import random myConfig = {

"identity": {

"orgId": "ci5v5e",

"typeId": "Rasberypi",

"deviceId":"1234"

},

"auth": {

"token": "12345678"

}

}

defmyCommandCallback(cmd):

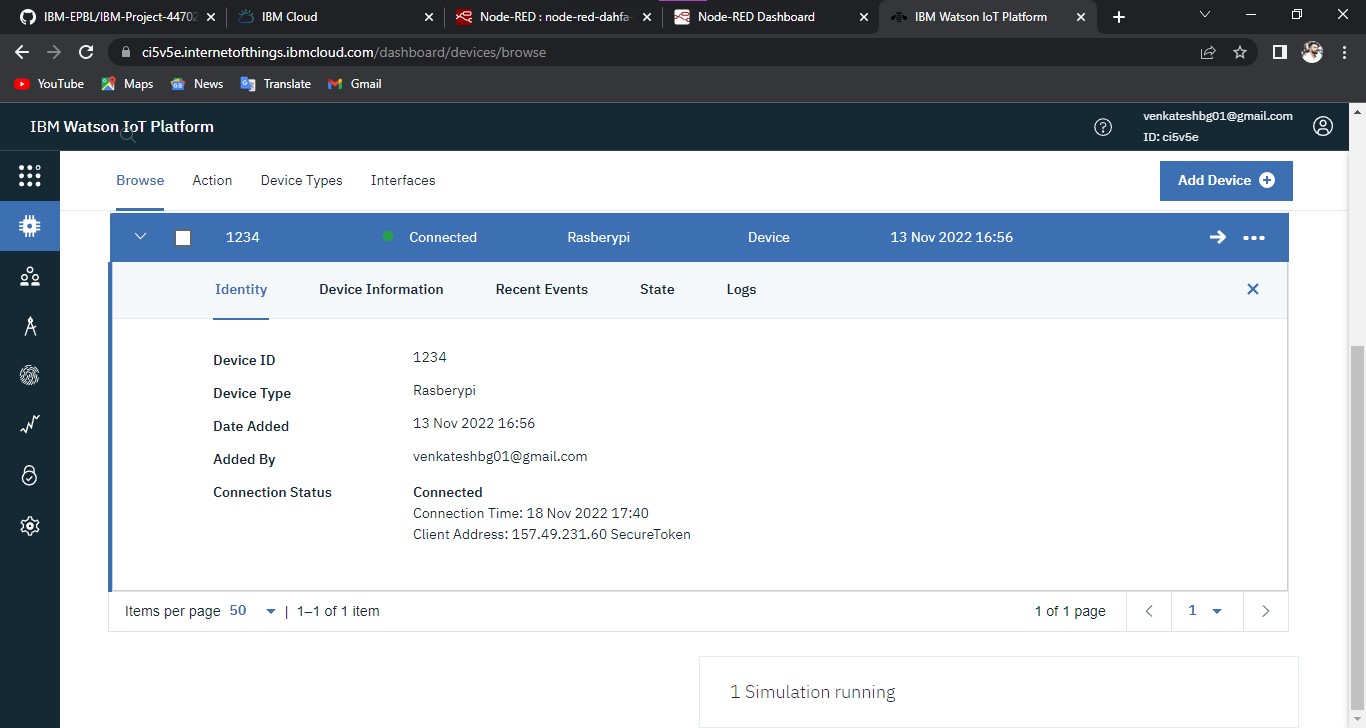
print("Message received from IBM IoT Platform: %s" % cmd.data['command']) m=cmd.data['command'] client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)

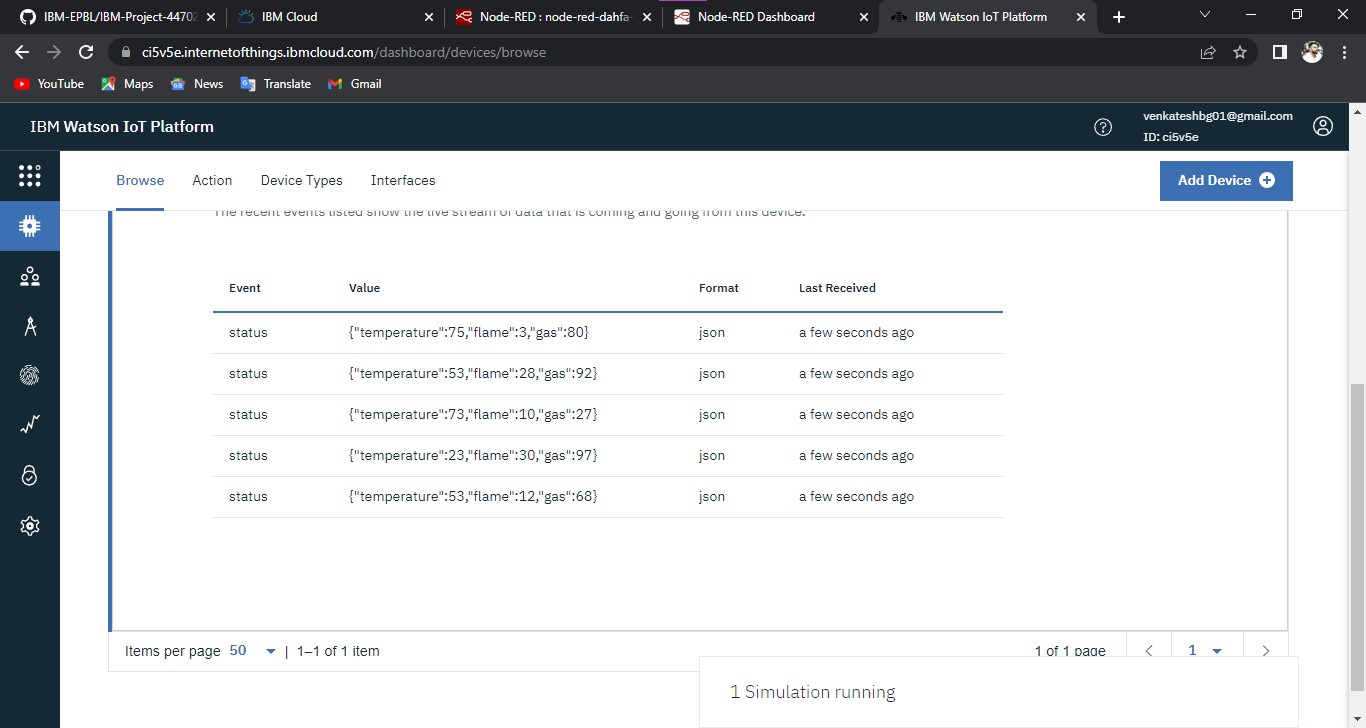
client.connect() while True:

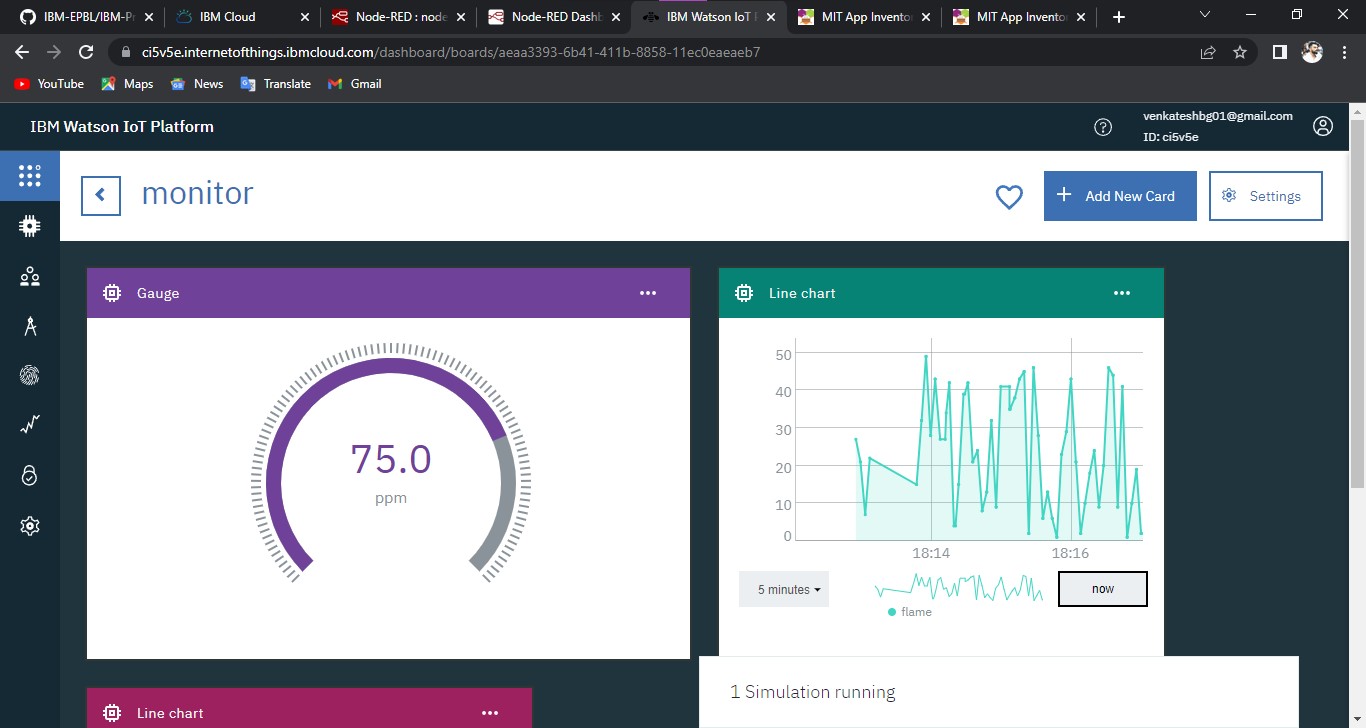
temp=random.randint(-5,100) #hum=random.randint(0,100) flame=random.randint(0,50) gas=random.randint(0,100) myData={'temperature':temp,'flame':flame,'gas':gas} client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None) print("Published data Successfully: %s", myData) client.commandCallback = myCommandCallbacktime.sleep(4) client.disconnect()

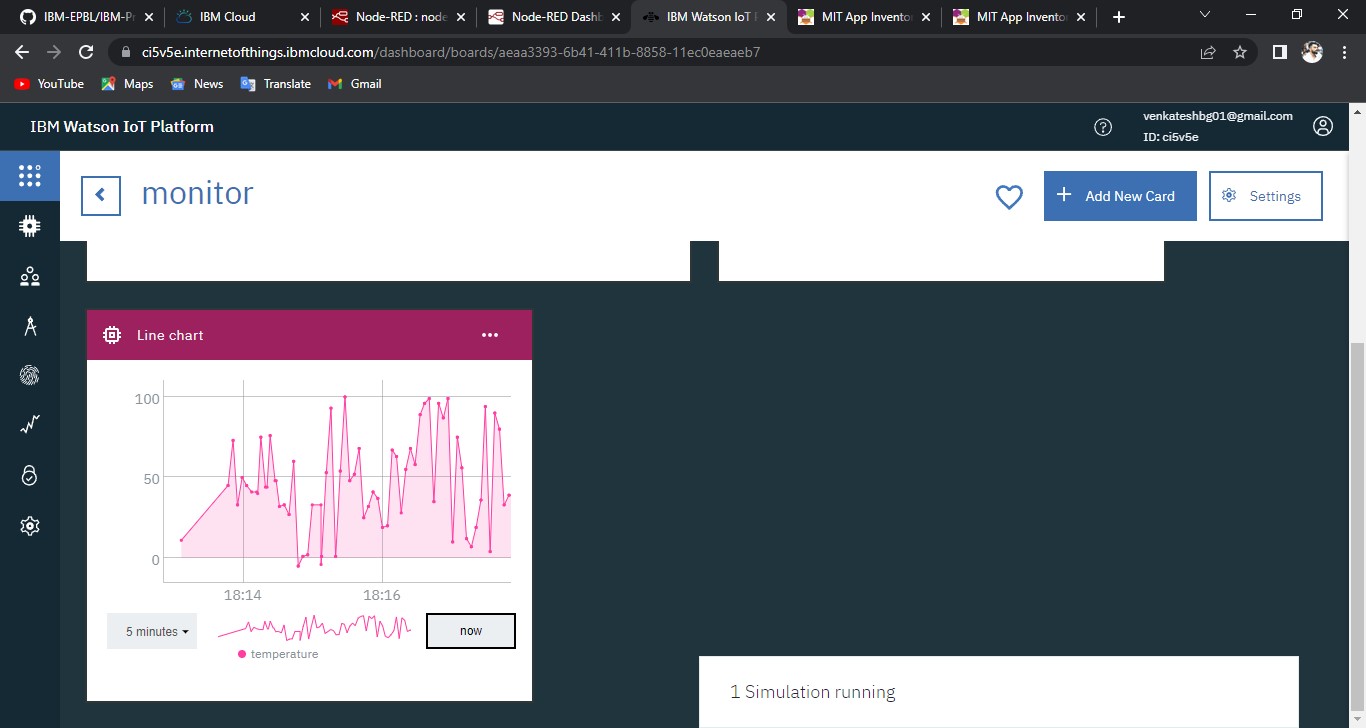
**6.2. DELIVERY OF SPRINT – 2:**

Sending the data of sensors to the IBM Cloud:



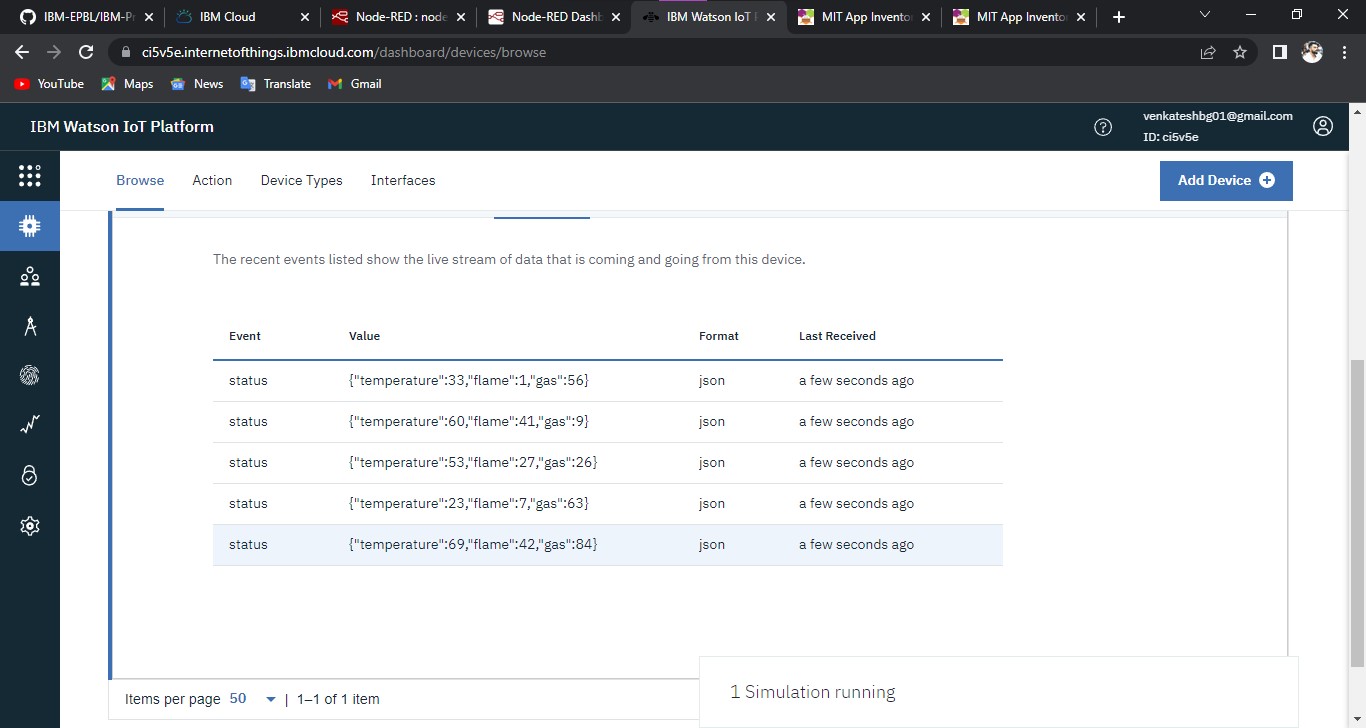




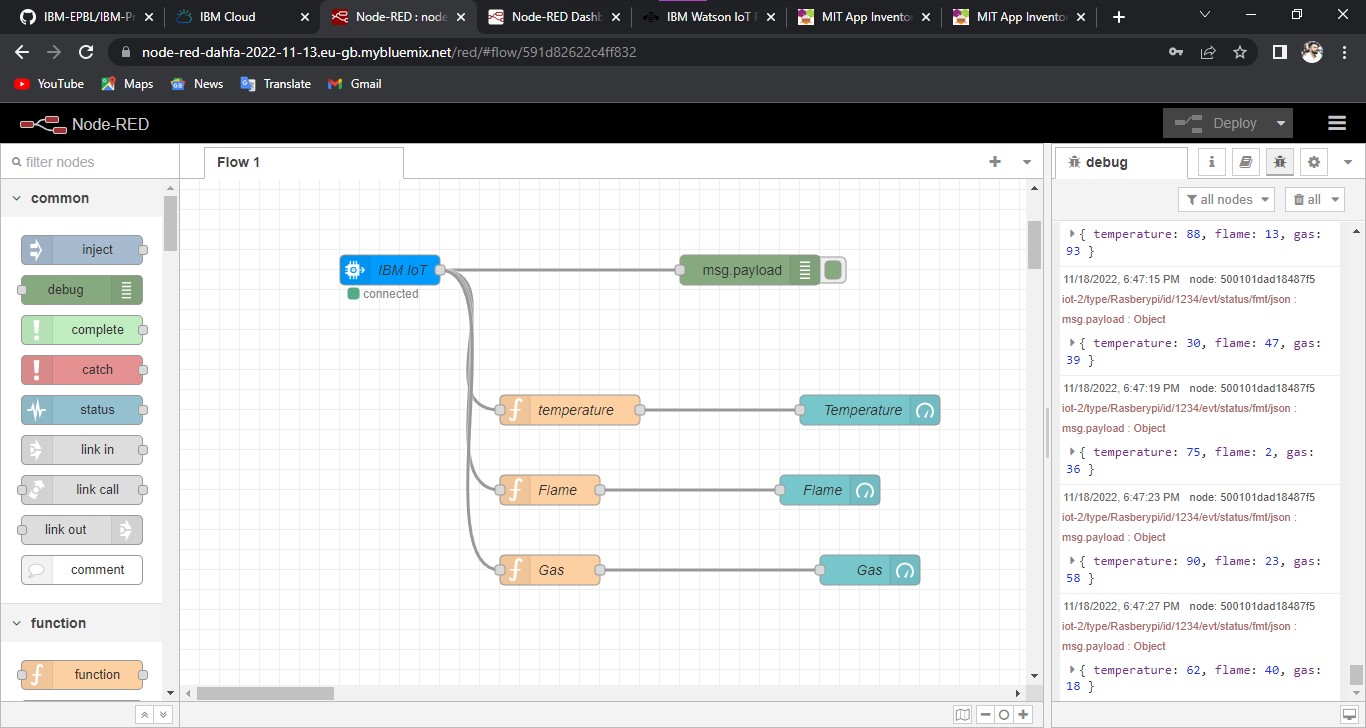


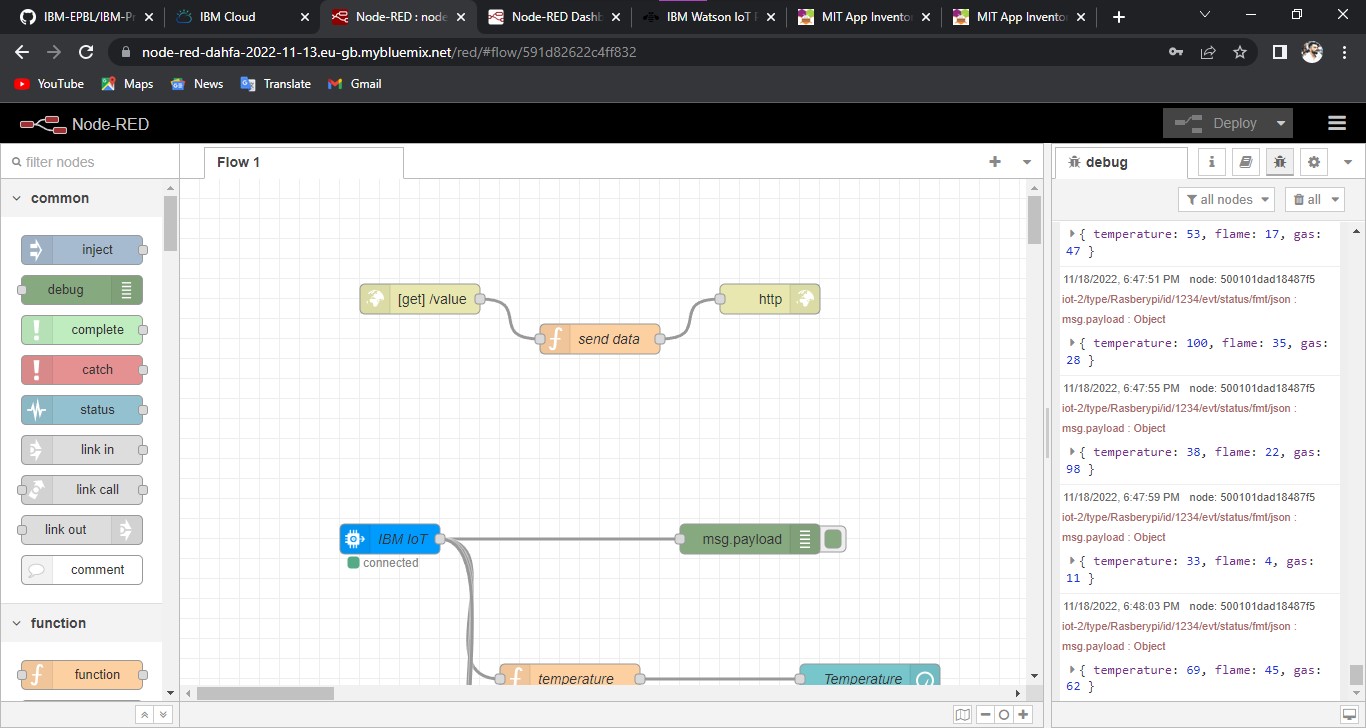
**6.4. DELIVERY OF SPRINT – 3:**

Sending the data from IBM Watson to Node Red:

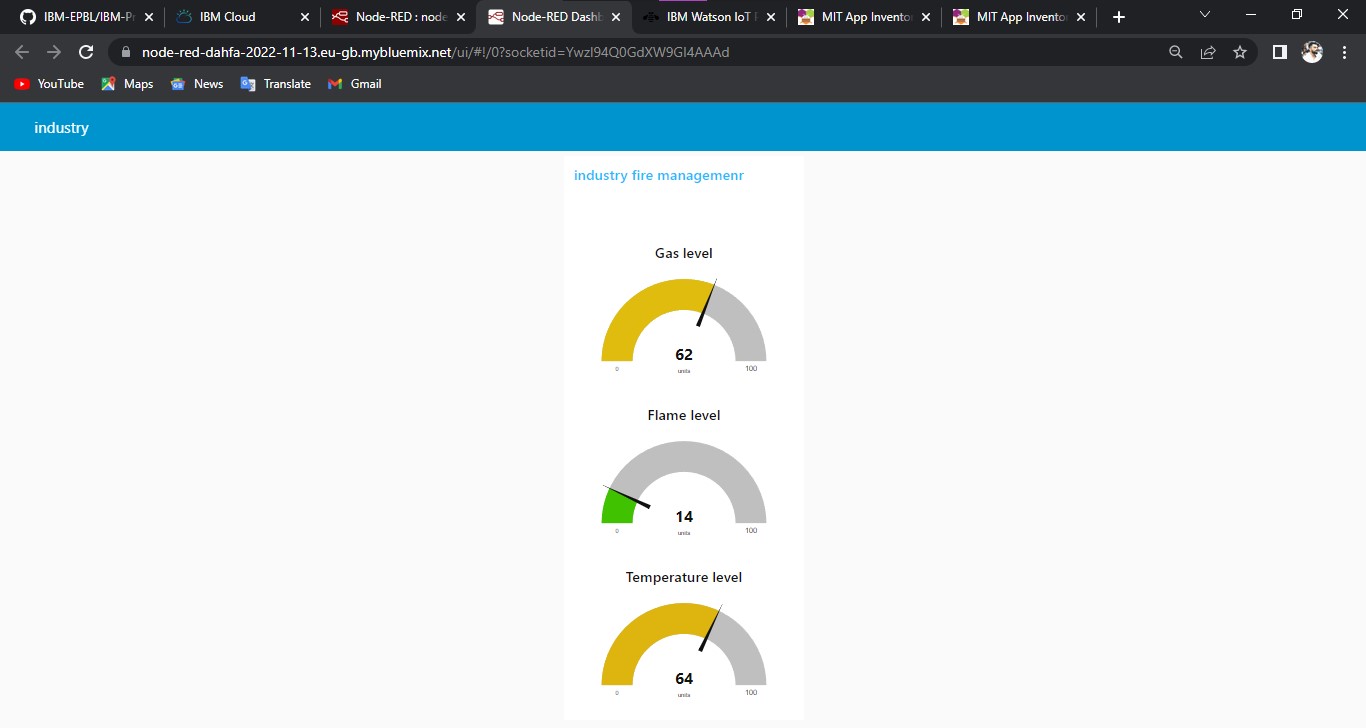


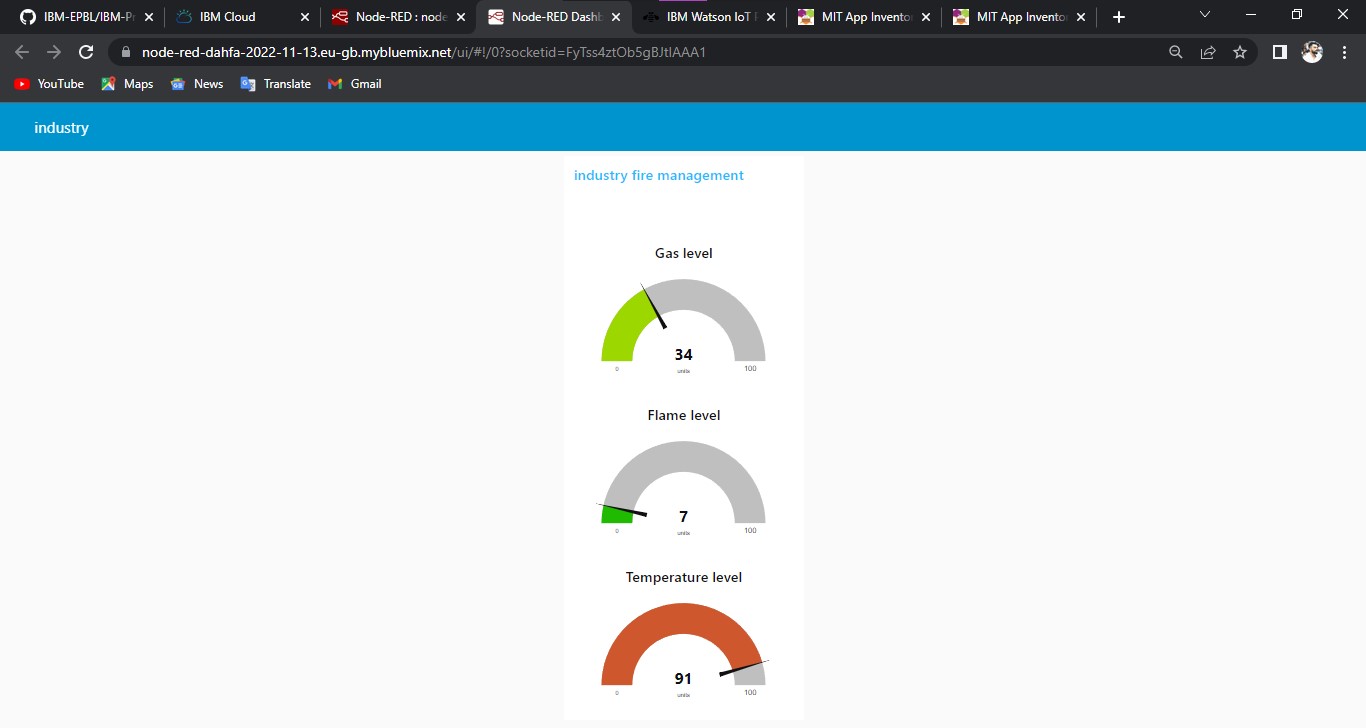
Node Red Connection:





Web UI:



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**CONCLUSION**

The World won’t change by itself, but we can make it’s safer, better and less harmful. The fire detection systems proposed in the literature served fire stopping with no care of the responsiveness. Thus, this study considers the existing issues and build an efficient and effective fire detection system based on IoT technology, gas, temperature, and smoke sensors to collect the data accurately and rapidly. The continuous readings sent over WIFI modules to the central unit to analyze the data and trigger the water sprinkle. This system structure enhances the efficiency and effectiveness of fire detection. Moreover, using the Ubidots platform in this system made the data exchange faster and reliable. However, this study's proposed approach obtained an average response of 5 seconds to detect the fire and alert the property owner. Meanwhile, the water pump activated to suck water from the tank and release it into the water sprinkler to minimize the fire until the property owners and emergency services reached. Hence, the proposed system overcame the challenges of the issues of affordability, effectiveness, and responsiveness. The proposed system still needs further enhancements. Thus, one of the enhancement directions is integrating machine learning with the system to predict the potentiality of fire based on the collected data from different sources. Machine learning may help the operators find and overcome the vulnerabilities in their building to prevent fire instead of detection only.

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