PROJECT REPORT

IBM-Project-11176-1659275003

Industry-Specific Intelligent Fire Management System

Domain: Internet Of Things

Team ID: PNT2022TMID53674

Team Leader: Vijayaraj D

Team member 1: Vignesh M S

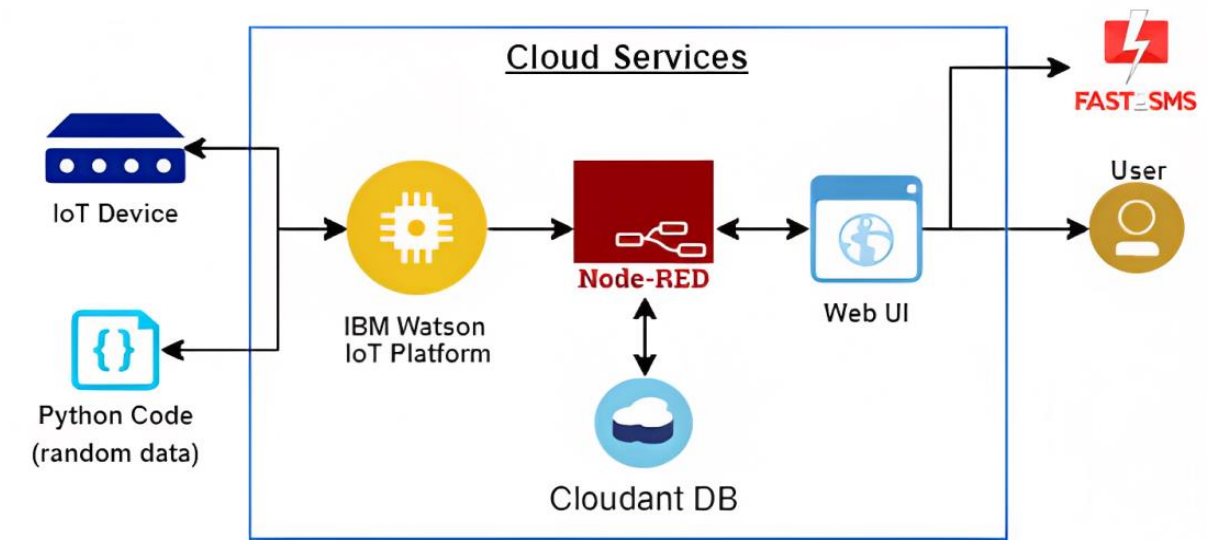
Team Member 2: Vignesh V M

Team Member 3: Yogesh Balaji G

1.**INTODUCTION**

1.1 Project Overview

- Sending random fire and temperature values will be sent to the IBM IoT platform
- Sensors values can be viewed in the Web Application
- Notifies the admin the random values cross the threshold value
- To accomplish this, we have to complete all the activities and tasks listed below:
- Create and configure IBM Cloud Services
- Create IBM Watson IoT Platform
- Create a device & configure the IBM IoT Platform
- Create Node-RED service
- Create a database in Cloudant DB to store location data
- Develop a web Application using Node-RED Service.
- Develop the web application using Node-RED
- Develop a python script to publish the location details to the IBM IoT platform



1.2 Purpose

The objective of "Industry specific-intelligent fire management system" is to avoid the unintended fire accidents in industries and also take appropriate measures to avoid any mishap. The smart fire management system includes a Gas sensor, Flame sensor and temperature sensors to detect any changes in the environment. If any flame is detected the sprinklers will be switched on automatically. The model incorporates MQ2 gas sensor for detecting propane and methane gases, flame is detected by IR flame sensor module and LM35 Temperature Sensor for the measurement of the environment. These readings are monitored continuously by IBM Watson IOT Platform and stored in Cloudant DB. Based on the temperature readings and if any Gases are present, the exhaust fans are powered ON. In case any variation occurs, the authorities and fire station will be alerted via Fast2SMS web service. Emergency alerts are notified to the authorities and Fire station.

2.LITERATURE SURVEY

***2.1** Existing Problems*

- Inadequate Acceptance Testing of Gas Turbine Enclosure Gaseous Fire Extinguishing Systems.
- Failure to Consider Adjacent Sprinkler System Operation.
- Unreliable Water Supply
- Substandard Protection for Steam Turbine-Generator
- Cooling Tower Protection

***2.2** References*

Book based on our project Introduction to Fire Alarm System by NIYAJ B

Research papers based on our project:

- https://www.researchgate.net/publication/280620907_Developed_Intelligent_Fire_alarm_system

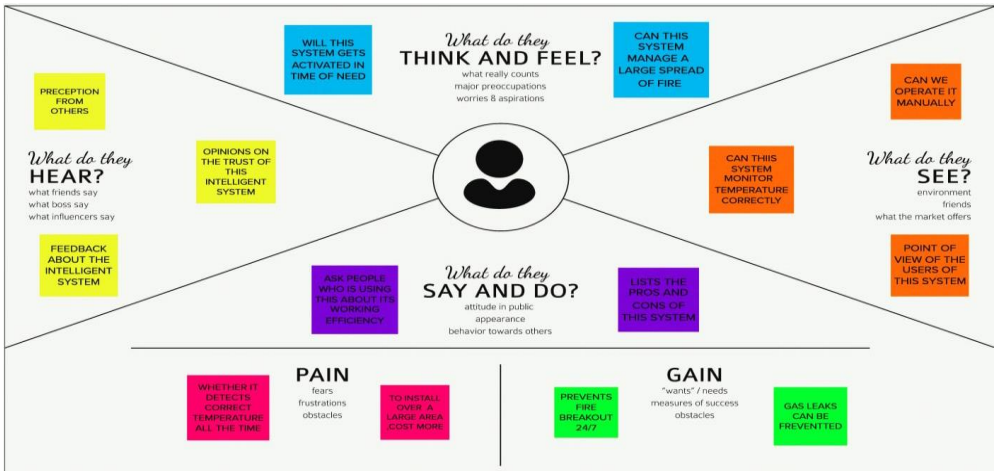
- https://www.researchgate.net/publication/333538169_Intelligent_fire_detection_and_alert_system_using_labVIEW

2.3 Problem Statement Definition

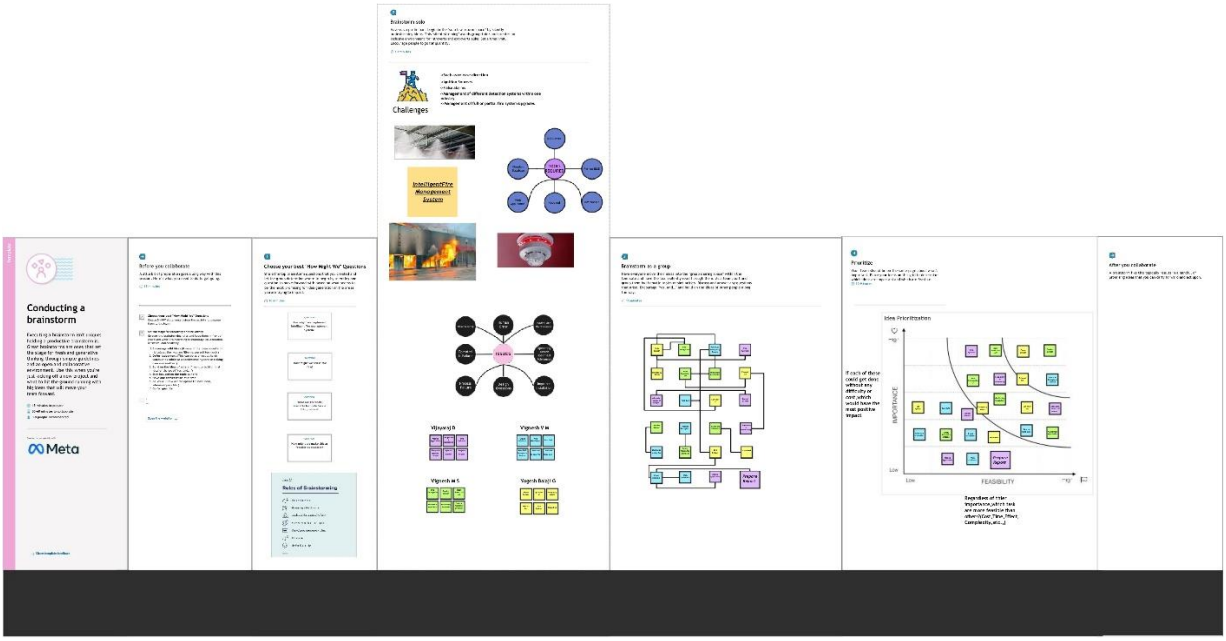
- The smart fire management system includes a Gas sensor, Flame sensor and temperature sensors to detect any changes in the environment.
- Based on the temperature readings and if any Gases are present the exhaust fans are powered ON.
- If any flame is detected the sprinklers will be switched on automatically.
- Emergency alerts are notified to the authorities and Fire station.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

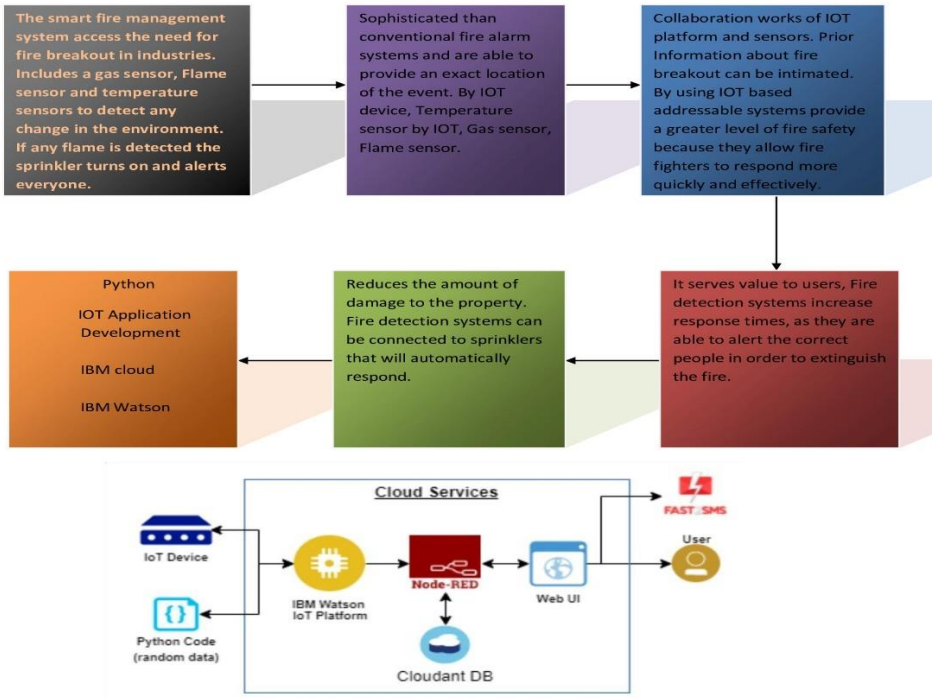


3.2 Ideation & Brainstorming



3.3 Proposed Solution

PROPOSED SOLUTION:-

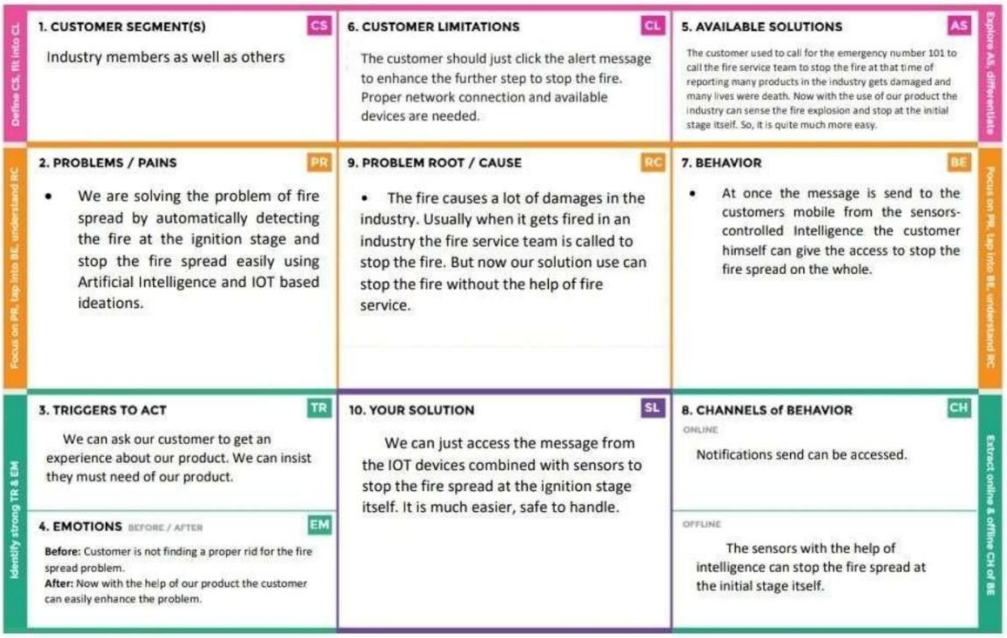


3.4 Problem Solution fit

Project Design Phase-I

Problem Solution Fit

Date	30 September 2022
Team ID	PNT2022TMID53674
Project Name	Industry-Specific Intelligent Fire Management System



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	03 October 2022
Team ID	PNT2022TMID53674
Project Name	Industry-Specific Intelligent Fire Management System

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through website or application Registration through Social medias (like Instagram, Facebook) Registration through LinkedIN
FR-2	User Confirmation	Verification via Email Verification via OTP
FR-3	User Login	Login through website or App using the respective username and password
FR-4	User Access	Allows the app requirement
FR-5	User Guide	Guides the basic steps of using the application
FR-6	User Upload	User should be able to send the data
FR-7	User Solution	Data report should be generated and delivered to user for per every 24 hours
FR-8	User Data Sync	API interface to increase to invoice system

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Usability requirements can consider language barriers and localization tasks. Usability can be assessed from the below functions. Efficiency of use. Low perceived workload. Easy and simple UI.
NFR-2	**Security**	Access permissions for the particular system information may only be changed by the system's data administrator.
NFR-3	**Reliability**	The database update process must roll back all related updates when any update fails.
NFR-4	**Performance**	The front-page load time must be no more than 2 seconds for users that access the website using an VoLTE mobile connection.
NFR-5	**Availability**	New module deployment mustn't impact front page, product pages, and check out pages availability and mustn't take longer than one hour. The rest of the pages that may experience problems must display a notification with a timer showing when the system is going to be up again.
NFR-6	**Scalability**	We can increase scalability by adding memory, servers, or disk space. On the other hand, we can compress data, use optimizing algorithms. The website attendance limit must be scalable enough to support 500,000 users at a time.

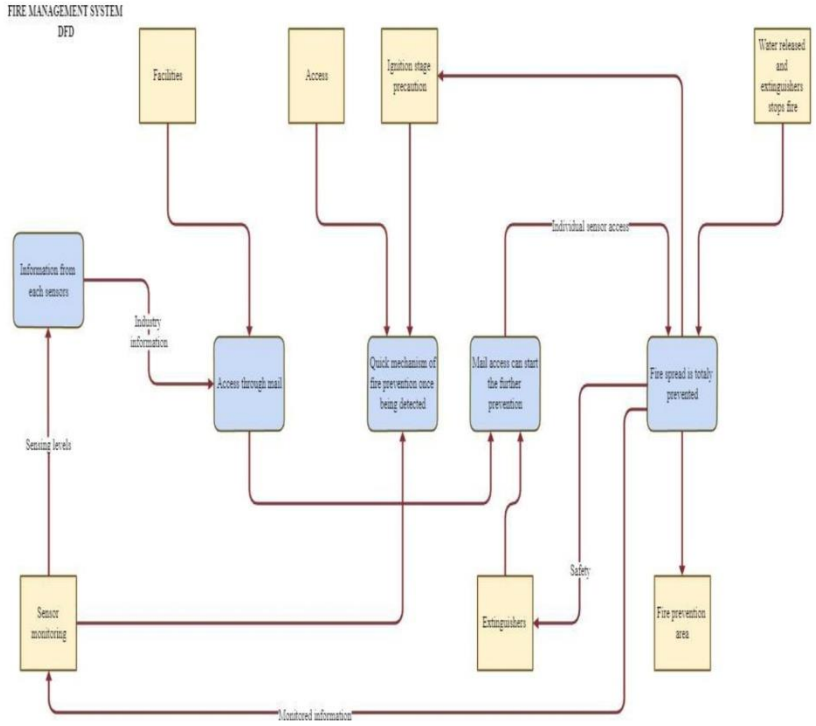
5. PROJECT DESIGN

5.1 Data Flow Diagrams

Project Design Phase- II

Data Flow Diagram & User Stories

Date	3 October 2022
Team ID	PNT2022TMID53674
Project Name	Industry-Specific Intelligent Fire Management System



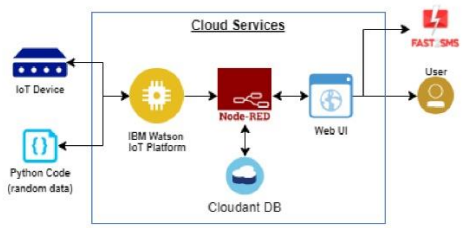
5.2 Solution & Technical Architecture

Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	14 October 2022
Team ID	PNT2022TMID53674
Project Name	Project – Industry-Specific intelligent fire management system
Maximum Marks	4 Marks

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2



Guidelines:

1. Include all the processes (As an application logic / Technology Block)
2. Provide infrastructural demarcation (Local / Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate Data Storage components / services
5. Indicate interface to machine learning models (if applicable)

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web UI, Node-RED, MIT app	IBM IoT Platform, IBM Node red, IBM Cloud
2.	Application Logic-1	Create Ibm Watson IoT platform and create node-red service	Ibm Watson, ibm cloudant service,ibm node-red
3.	Application Logic-2	Develop python script to publish and subscribe to IBM IoT Platform	python
4.	Application Logic-3	Build a web application using node-red service	IBM Node-red
5.	Database	Data Type, Configurations etc.	MySQL
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant
7.	File Storage	Developing mobile application to store and receive the sensors information and to react accordingly	Web UI,python
8.	External API-1	Using this IBM fire management API we can track the temperature of the incident place and where the fire had been attacked.	IBM fire management API
9.	External API-2	Using this IBM Sensors it detects the fire, gas leaks , temperature and provides the activation of sprinklers to web UI	IBM Sensors
10.	Machine Learning Model	Using this we can derive the object recognition model	Object Recognition Model
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Cloud Server Configuration	IBM cloudant, IBM IoT Platform

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	MIT app Inventor	MIT License
2.	Security Implementations	IBM Services	Encryptions, IBM Controls
3.	Scalable Architecture	sensor-IoT Cloud based architecture	cloud computing and AI
4.	Availability	Mobile, laptop, desktop	MIT app
5.	Performance	Detects the Fire, gas leak,temperature	sensors

User Stories

User Type	Functional requirement	User story number	User story/task	Acceptance criteria	Priority	Release
Customer (Mobile user, Web user, Care executive, Administrator)	Registration	USN-1	As a user, I can register for the application by entering my mail, password, and confirming my password	I can access my account/ dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
	Dashboard	USN-3	As a user, I can register for the application through internet	I can register & access the dashboard with Internet login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can confirm the registration in Gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login with my id and password	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Project Planning Phase

Milestone and Activity List

Date	22 October 2022
Team ID	PNT2022TMID53674
Project Name	Industry-specific intelligent fire management system

TITLE	DESCRIPTION	DATE
IDEATION PHASE		
Literature Survey & Information Gathering	Literature survey on the selected project and information gathering by referring the, technical papers, research publications etc.	03 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements.	10 SEPTEMBER 2022
Problem Statement	List of problem in the project.	10 SEPTEMBER 2022
Brainstorm And Idea Prioritization	List the ideas (atleast 4 per each team member) by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	17 SEPTEMBER 2022
Project Design Phase - I		
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	24 SEPTEMBER 2022

Problem Solution Fit	Prepare problem - solution fit document.	01 OCTOBER 2022
Solution Architecture	Prepare the solution architecture document.	01 OCTOBER 2022

TITLE	DESCRIPTION	DATE
	Project Design Phase - II	
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	08 OCTOBER 2022
Functional Requirement	Prepare the functional requirement document.	08 OCTOBER 2022
Data Flow Diagrams	Prepare the data flow diagrams and submit for review.	15 OCTOBER 2022
Technology Architecture	Prepare the technology architecture of the solution.	15 OCTOBER 2022
	Project Planning Phase	
Prepare Project Planning & Sprint Delivery Plan	Prepare the Product Backlog, Sprint Planning, Stories, and Story points.	22 OCTOBER 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	22 OCTOBER 2022
	Project Development Phase	
Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	IN PROGRESS

6.2 Sprint Delivery Schedule:

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	22 October 2022
Team ID	PNT2022TMID53674
Project Name	Project – Industry Specific Intelligent Fire Management system
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	VIJAYARAJ D(TEAM LEAD) VIGNESH V M VIGNESH M S YOGESH BALAJI G
Sprint-1	User Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	
Sprint-1	Login	USN-3	As a user, I can register for the application through email and password	1	High	
Sprint-2	Sensor	USN-4	As a user, I can use it in Industries where the sensors can sense fire and smoke	2	High	
Sprint-2	Actuators	USN-5	As a user, I can implement the system where the sensors detect that may lead to extinguishing with the help of sprinklers.	2	High	
Sprint-3	Cloud	USN-6	All the dynamic values are stored using cloud database	2	High	
Sprint-4	Siren	USN-7	If the fire is detected, users are said to be evacuated by intimation of Siren/Buzzer	2	High	
Sprint-4	Event management	USN-8	Notifications are sent immediately to the Concerned departments like Fire Department, Proprietor, etc.	2	High	

Project Tracker, Velocity & Burndown Chart: (4 Marks)

PROJECT TRACKER:

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

VELLOCITY:

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)

SPRINT-1

Sprint duration = 6 Days

Velocity Of team = 20

Points

Average Velocity (AV) =Velocity / Sprint Duration

AV = 20/6 = 3.333

Average Velocity = 3.33

SPRINT : 1-4

Sprint duration = 24 Days
Velocity Of team = 80
Points

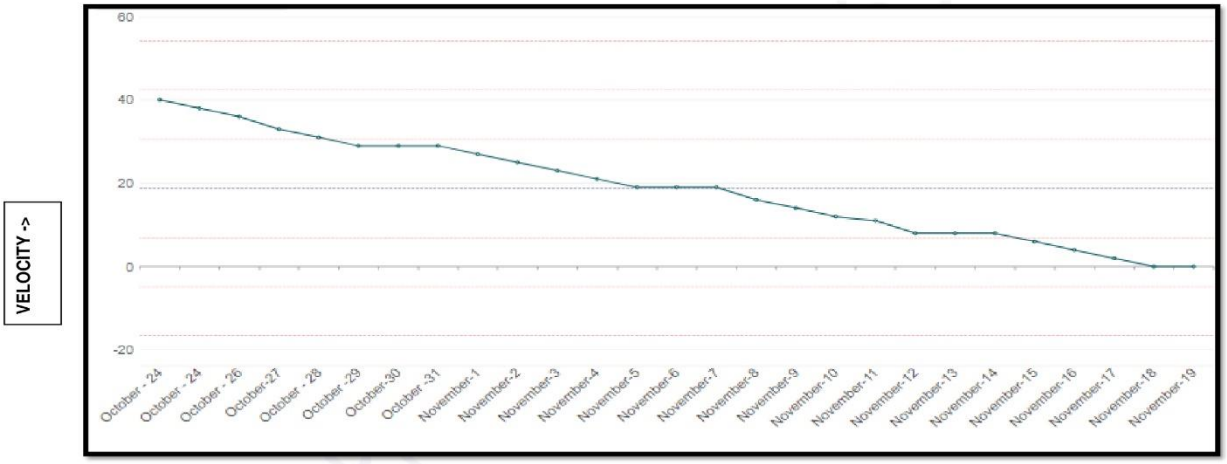
Average Velocity (AV) =Velocity / Sprint Duration

AV = 80/24 = 3.333

Average Velocity = 3.33

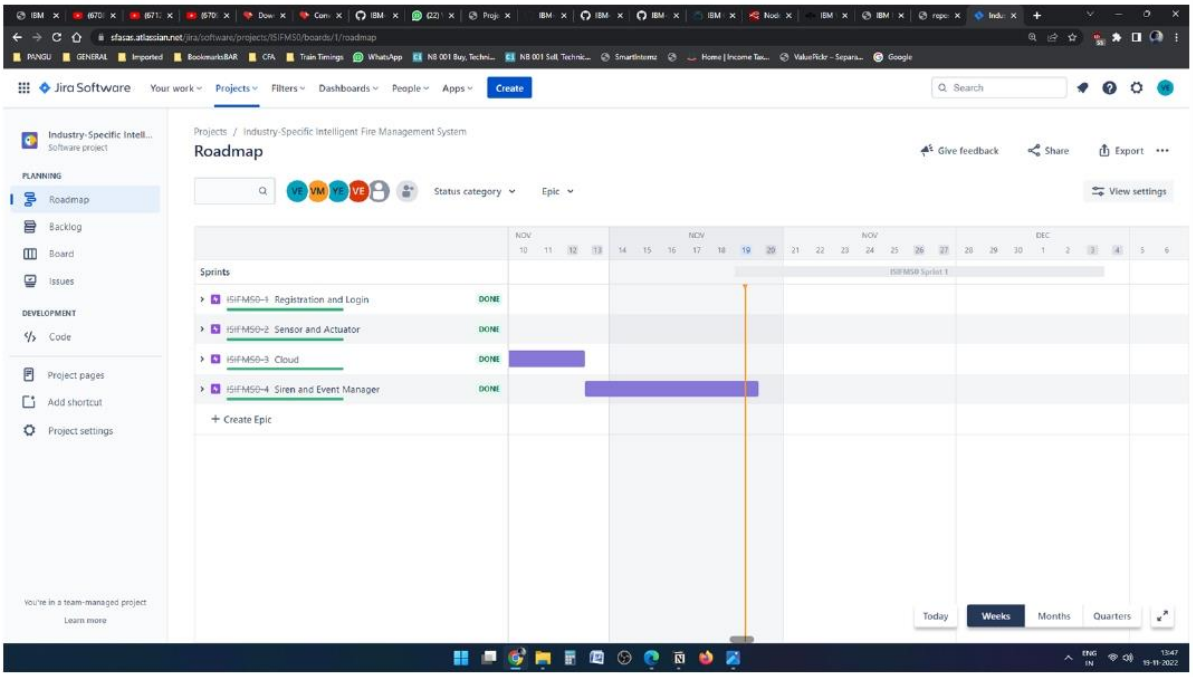
BURNDOWN CHART

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.

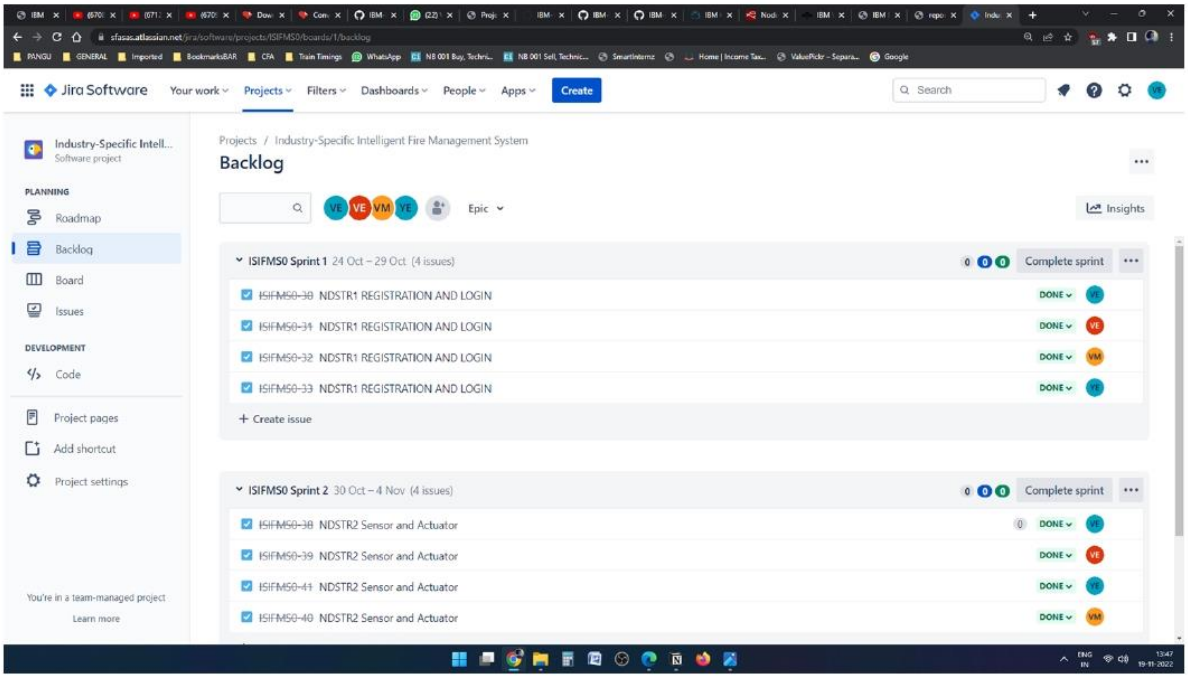


6.3 REPORT FROM JIRA

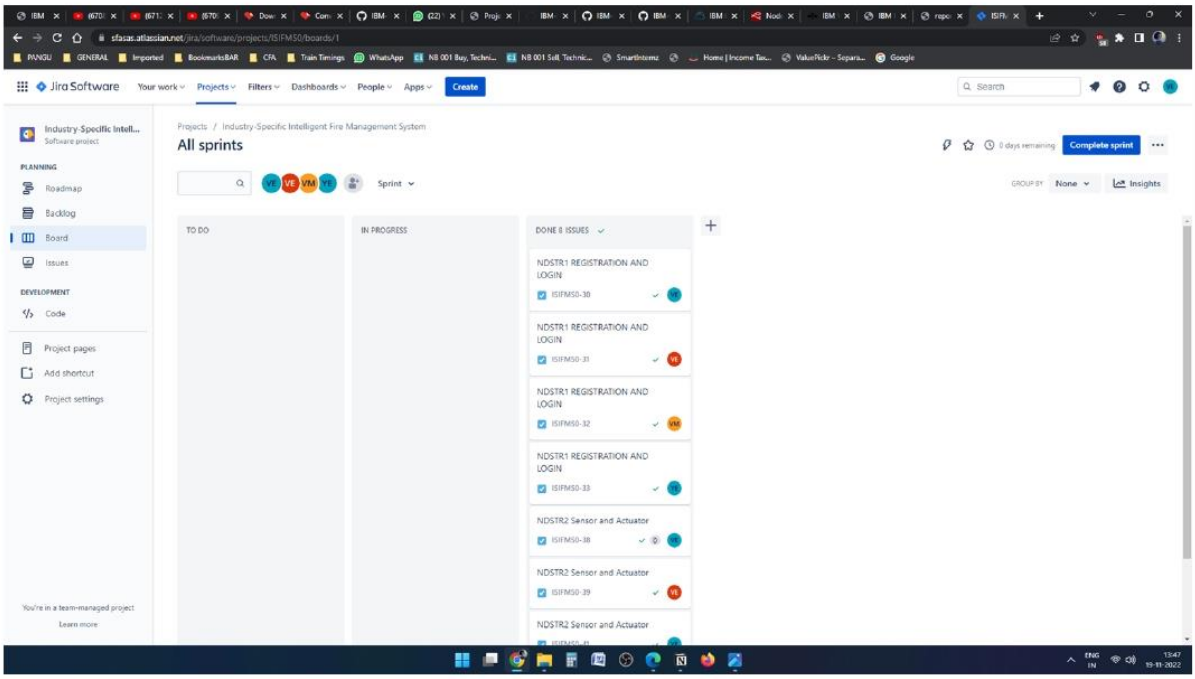
Date	13 November 2022
Team ID	PNT2022TMID53674
Project Name	Industry-specific intelligent fire management system
Maximum Marks	8 Marks



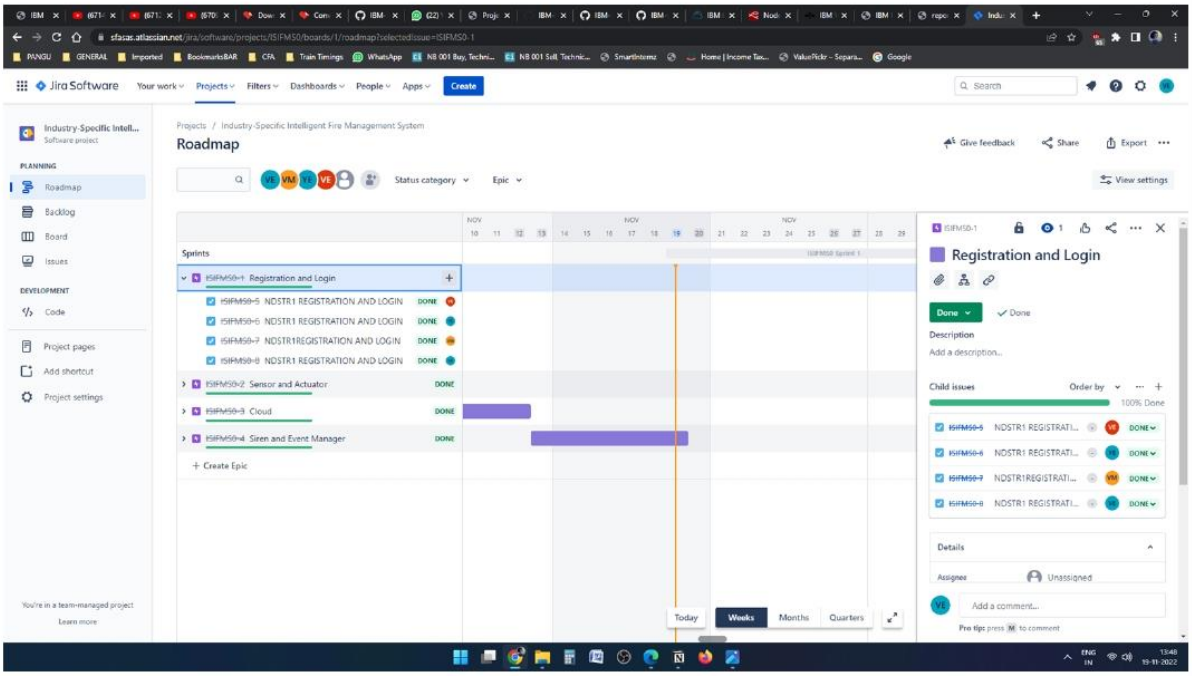
Creating Roadmap



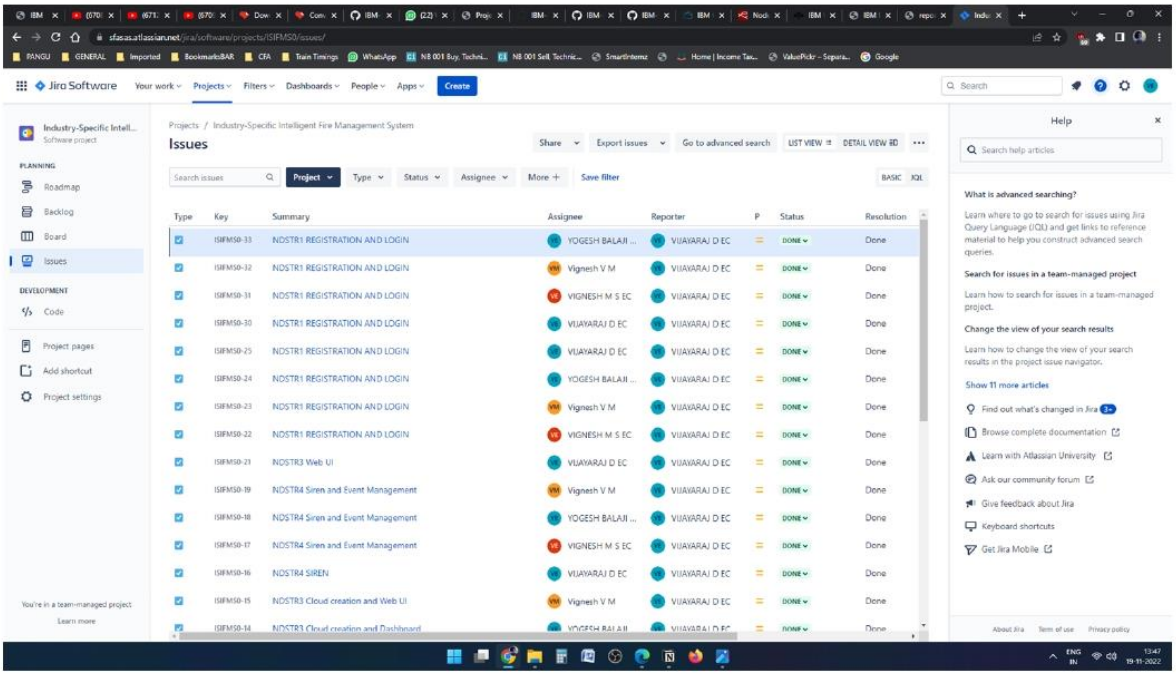
Creating Backlog



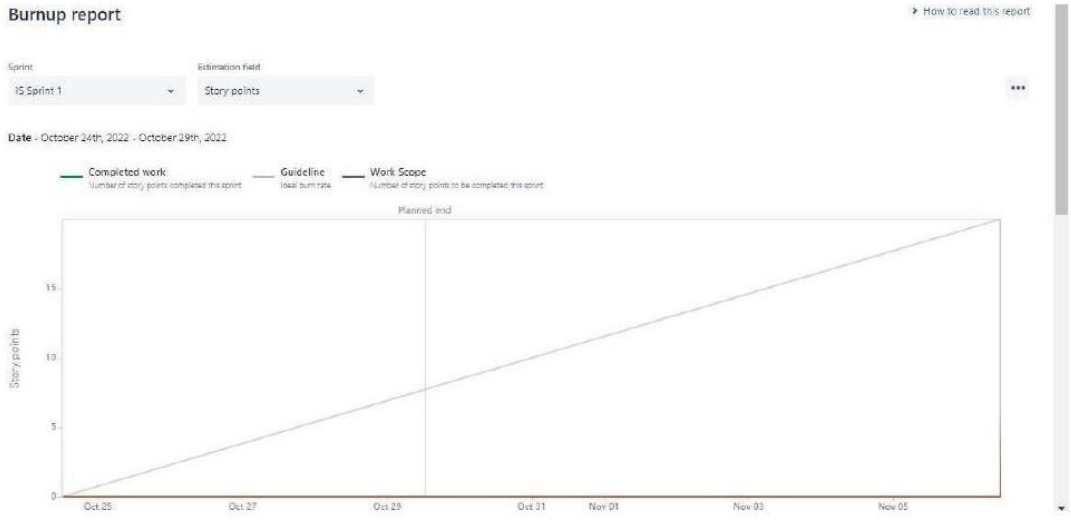
Sprint 1&2 is completed in Board



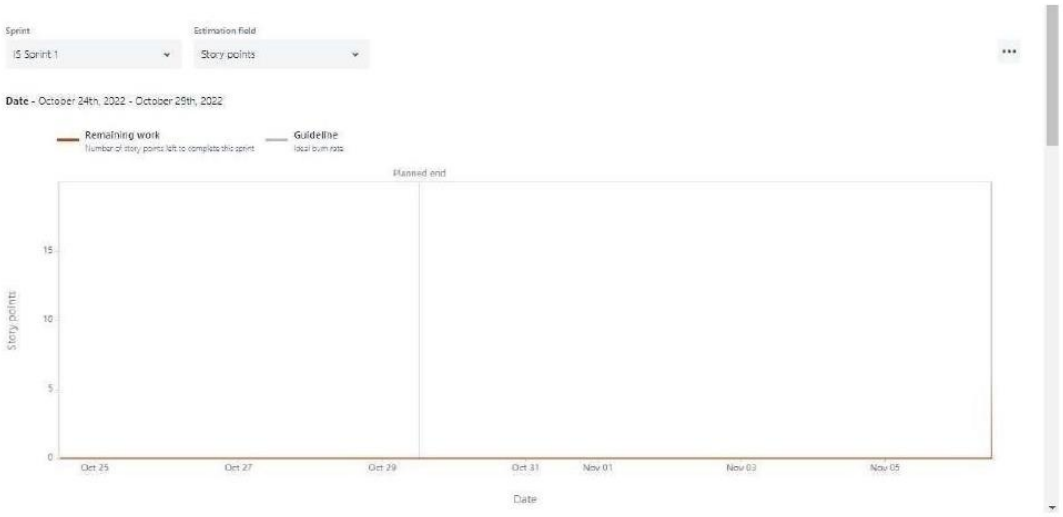
Roadmap by All Sprints



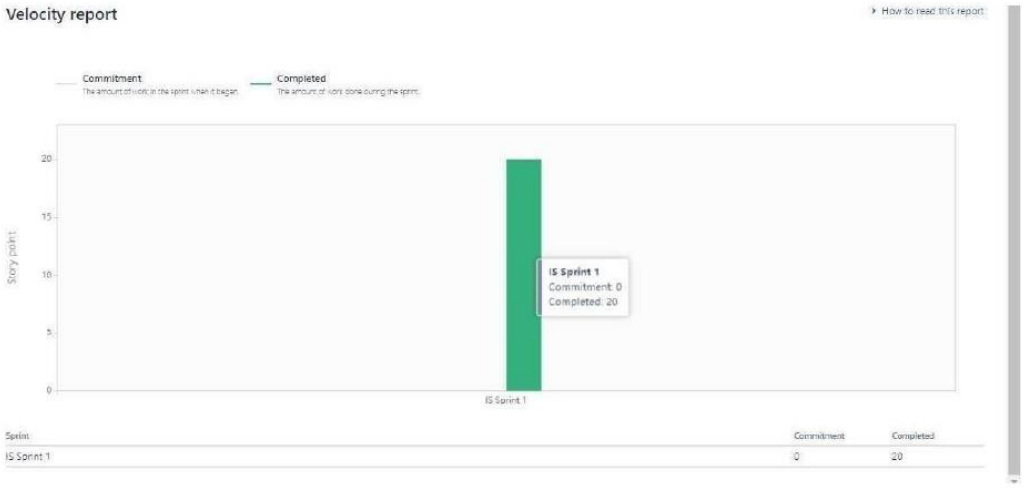
Issues by Sprints



Sprint 1 Burnup Report



Sprint 1 Burndown Report



Sprint 1 Velocity Report

7. CODING & SOLUTIONING

Feature 1

source code.py - C:\Users\HP\Desktop\source code.py (3.7.0)

File Edit Format Run Options Window Help

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


#Provide your IBM Watson Device Credentials
organization = "s80v1q"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="sprinkleron":
        print ("Sprinkler is on")
    elif status == "sprinkleroff":
        print ("Sprinkler is off")
    elif status == "exhaustfanon":
        print ("Exhaust Fan ON")
    elif status == "exhaustfanoff":
        print ("Exhaust Fan OFF")

    #print(cmd)

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

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

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:
        #Get Sensor Data from DHT11

        temp=random.randint(0,100)
        flame_level=random.randint(0,100)
        gas_level = random.randint(0,100)

        data = { 'Temperature' : temp, 'Flame_Level' : flame_level, 'Gas_Level' : gas_level }
        #print data
        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Flame_Level = %s %%" % flame_level, "Gas_Level = %s %%" %gas_level ,"to IBM Watson")

        success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(1)

        deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

Feature 2

7.1 FEATURE 1

- Fire alarm system is designed to alert us to an emergency so that we can take actions to protect ourselves, staffs and general public.
- This project concentrates on the measures to prevent fire accidents caused due to flammable gas, smoke andrise in temperature. This system makes use of the best sensor available that detects any transpose in the environment. Basedon the sensor readings, if any disparity is encountered, appropriate actions will be taken in order to prevent any misfortune.
- This model incorporates MQ2 gas sensor for detecting propane and methane gases, IR Flame sensor module to detect flame and LM35 Temperature sensor for the temperature measurement of the environment.
- These readings are monitored continuously by IBM Watson IoT Platform and stored in Cloudant DB. In case any undesirable variation occurs, the authorities and fire stationwill be alerted via Fast2SMS web service.
- The smart fire management system includes a Gas sensor, Flame sensor and temperature sensors to detect any movement or change in the environment. If the presence of gas is felt, then the exhaust fans are powered ON. If any flame is detected, the sprinklers will be switched on automatically. Emergency alerts are notified to the authorities and Fire station.

7.2 FEATURE 2

- This project not only uses special and advanced devices for its working, but also teaches strong leadership quality. Following are the examples.
- Understanding the project requirement- The Aim is team members are assigned with tasks for each to be executed as a responsible team lead. Also create repository in the Git hub-repo, Assign membersand teach how to use and open the Git hub and IBM career education portals.
- Starting phaseof project- Team lead to team members based on regularly attending training sessions for installing and use of prerequisite without skipping.
- Also necessarily attending the training sessions based on python code, development of android app in mobile app MIT inventor app and working along Node Red is ensured by the team lead and acknowledged by team members simultaneously.
- Attend class- Team members and team lead must watch and learn from classes provided by IBM and NALAYATHIRAN and must gain access of MIT license for their project. IBM cloud service cloud Watson and node red service.
- Budget and scope of project- Budgetary planning process taken up on whole as a team to detect the user compatible price to the buy the product based on budgetary on IOT and component level.
- Create a code snippet using python to Extract weather data from OpenWeather Map using APIs Send the extracted data to the cloud Receive data from the cloud and view it in the python compiler

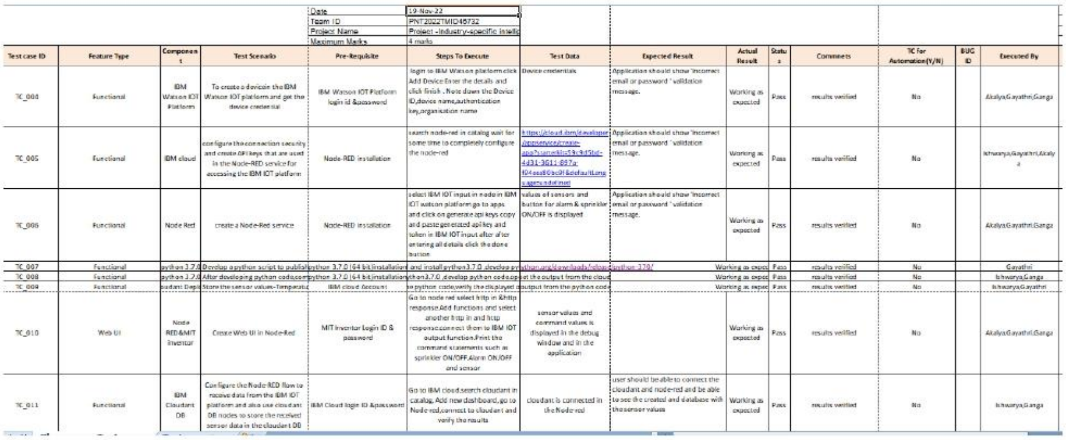
```
*Python 3.7.0 Shell*
File  Edit  Shell  Debug  Options  Window  Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD6
4)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
================ RESTART: C:\Users\HP\Desktop\source code.py ================
2022-11-19 09:33:07,008   ibmiotf.device.Client      INFO    Connected successfu
lly: d:s8ovlq:abcd:12345
Published Temperature = 87 C Flame_Level = 46 % Gas_Level = 7 % to IBM Watson
Published Temperature = 22 C Flame_Level = 49 % Gas_Level = 23 % to IBM Watson
Published Temperature = 77 C Flame_Level = 9 % Gas_Level = 95 % to IBM Watson
Published Temperature = 28 C Flame_Level = 99 % Gas_Level = 99 % to IBM Watson
Published Temperature = 10 C Flame_Level = 82 % Gas_Level = 19 % to IBM Watson
Published Temperature = 48 C Flame_Level = 46 % Gas_Level = 54 % to IBM Watson
Published Temperature = 43 C Flame_Level = 72 % Gas_Level = 90 % to IBM Watson
Published Temperature = 68 C Flame_Level = 48 % Gas_Level = 37 % to IBM Watson
Published Temperature = 34 C Flame_Level = 93 % Gas_Level = 96 % to IBM Watson
Published Temperature = 94 C Flame_Level = 18 % Gas_Level = 27 % to IBM Watson
Published Temperature = 48 C Flame_Level = 2 % Gas_Level = 16 % to IBM Watson
Published Temperature = 35 C Flame_Level = 90 % Gas_Level = 17 % to IBM Watson
Published Temperature = 37 C Flame_Level = 99 % Gas_Level = 39 % to IBM Watson
Published Temperature = 50 C Flame_Level = 67 % Gas_Level = 11 % to IBM Watson
```

TESTING

Test Cases

Date	19-Nov-22
Team ID	PNT2022TMID46732
Project Name	Project -Industry-specific intellig
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)	BUG ID	Executed By
TC_001	Functional	IBM cloud	Create the IBM Cloud services which are being used in this project	IBM Cloud login ID &password	Go to IBM cloud signup page.Enter e-mail id and other credencial.Enter a password	https://cloud.com/login	Login/Signup popup should display	Working as expected	Pass	results verified	No		Ganga,Gayathri
TC_002	Functional	IBM cloud	Configure the IBM cloud services which are being used in completing this project	IBM Cloud login ID &password	Go to Cloud login.Enter user id & password.verify the login by the popup display	https://cloud.com/login	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Lost password? Recovery password link	Working as expected	Pass	results verified	No		Ishwarya,Gayathri,Akalya
TC_003	Functional	IBM Watson IOT Platform	IBM WAtson IOT platform acts as mediator to connect the web application to IOT devices, so create the IBM WAtson	IBM Watson IOT Platform login id &password	login to IBM cloud . click catalog. search IOT and click create.Go to resource list and search IOT platform	https://vg4nsy.internetofthings.ibmcloud.com/dashboard/	User should navigate to user account homepage	Working as expected	Pass	results verified	No		Ishwarya,Ganga
TC_004	Functional	IBM Watson IOT Platform	To create a devicein the IBM Watson IOT platform and get the device credential	IBM Watson IOT Platform login id &password	login to IBM Watson platform click Add Device Enter the details and click Finish . Note down the Device ID,device name,authentication key,organisation name	Device credentials	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No		Akalya,Gayathri,Ganga
TC_005	Functional	IBM cloud	configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IOT platform	Node-RED installation	search node-red in catalog wait for some time to completely configure the node-red	https://cloud.ibm.com/developer/appservice/create-app?starterkit=5fc9d5bd-4d31-3611-897a-f94eaa80b-c9&defaultLanguage=undefined	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No		Ishwarya,Gayathri,Akalya
TC_006	Functional	Node Red	create a Node-Red service	Node-RED installation	select IBM IOT input in node in IBM IOT watson platform go to apps and click on generate api keys copy and paste generated api key and token in IBM IOT input after after entering all details click the done button	values of sensors and button for alarm & sprinkler ON/OFF is displayed	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No		Akalya,Gayathri,Ganga



Date	19-Nov-22
Team ID	PNT2022TMID46732
Project Name	Project -Industry-specific intellig
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)	BUG ID	Executed By
TC_004	Functional	IBM Watson IOT Platform	To create a devicein the IBM Watson IOT platform and get the device credential	IBM Watson IOT Platform login id &password	login to IBM Watson platform click Add Device Enter the details and click finish . Note down the Device ID,device name,authentication key,organisation name	Device credentials	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No		Akalya,Gayathri,Ganga
TC_005	Functional	IBM cloud	configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IOT platform	Node-RED installation	search node-red in catalog wait for some time to completely configure the node-red	https://cloud.ibm.com/developer/appservice/create-app?starterKit=59c9d5bd-4d31-3611-897a-f94eea80bc9f&defaultLanguage=undefined	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No		Ishwarya,Gayathri,Akalya
TC_006	Functional	Node Red	create a Node-Red service	Node-RED installation	select IBM IOT input in node in IBM IOT watson platform go to apps and click on generate api keys copy and paste generated api key and token in IBM IOT input after after entering all details click the done button	values of sensors and button for alarm & sprinkler ON/OFF is displayed	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No		Akalya,Gayathri,Ganga
TC_007	Functional	python 3.7.0	Develop a python script to publish	python 3.7.0 (64 bit)installation	and install python3.7.0 ,develop py	thon.org/downloads/release/python-370/		Working as expec	Pass	results verified	No		Gayathri
TC_008	Functional	python 3.7.0	After developing python code,com	python 3.7.0 (64 bit)installation	thon3.7.0 ,develop python code.op	at the output from the cloud		Working as expec	Pass	results verified	No		Ishwarya,Ganga
TC_009	Functional	oudant Depl	Store the sensor values-Temperatu	IBM cloud Account	ie python code,verify the displayed o	utput from the python code		Working as expec	Pass	results verified	No		Ishwarya,Gayathri
TC_010	Web UI	Node RED&MIT Inventor	Create Web UI in Node-Red	MIT Inventor Login ID & password	Go to node red select http in &http response.Add functions and select another http in and http response.connect them to IBM IOT output function.Print the command statements such as sprinkler ON/OFF,Alarm ON/OFF and sensor	sensor values and command values is displayed in the debug window and in the application		Working as expected	Pass	results verified	No		Akalya,Gayathri,Ganga
TC_011	Functional	IBM Cloudant DB	Configure the Node-RED flow to receive data from the IBM IOT platform and also use cloudant DB nodes to store the received sensor data in the cloudant DB	IBM Cloud login ID &password	Go to IBM cloud,search cloudant in catalog, Add new dashboard,go to Node-red,connect to cloudant and verify the results	cloudant is connected in the Node-red	user should be able to connect the cloudant and node-red and be able to see the created and database with the sensor values	Working as expected	Pass	results verified	No		Ishwarya,Ganga

User Acceptance Testing

Purpose of Document : The purpose of this documentis to briefly explain the test coverageand open issues of the Industry-specific intelligent fire management system projectat the time of the release to User Acceptance Testing (UAT).

Defect Analysis:

Section	TotalCases	NotTested	Fail	Pass
Print the Sensor values	7	0	0	7
ClientMobileApplication	51	0	0	51
Security	2	0	0	2

This reportshows the numberof resolved or closed bugs at each severity level,and how theywere resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37

Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	0	0	1	8
Totals	24	14	13	26	70

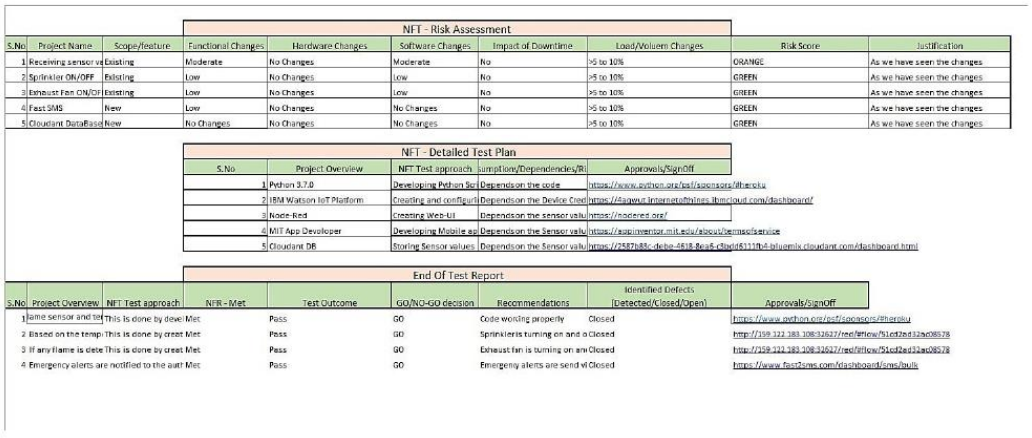
Test Case Analysis

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

Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final ReportOutput	4	0	0	4

RESULTS

Performance Metrics



NFT - Risk Assessment

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Volumn Changes	Risk Score	Justification
1	Receiving sensor va	Existing	Moderate	No Changes	Moderate	No	>5 to 10%	ORANGE	As we have seen the changes
2	Sprinkler ON/OFF	Existing	Low	No Changes	Low	No	>5 to 10%	GREEN	As we have seen the changes
3	Exhaust Fan ON/OF	Existing	Low	No Changes	Low	No	>5 to 10%	GREEN	As we have seen the changes
4	Fast SMS	New	Low	No Changes	No Changes	No	>5 to 10%	GREEN	As we have seen the changes
5	Cloudant DataBase	New	No Changes	No Changes	No Changes	No	>5 to 10%	GREEN	As we have seen the changes

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	sumptions/Dependencies/Ri	Approvals/SignOff
1	Python 3.7.0	Developing Python Scr	Depends on the code	https://www.python.org/psf/sponsors/#heroku
2	IBM Watson IoT Platform	Creating and configuri	Depends on the Device Cred	https://dashboard.internetofthings.ibmcloud.com/dashboard/
3	Node-Red	Creating Web-UI	Depends on the sensor valu	https://nodered.org/
4	MIT App Developer	Developing Mobile ap	Depends on the Sensor valu	https://appinventor.mit.edu/about/bemscfservice
5	Cloudant DB	Storing Sensor values	Depends on the Sensor valu	https://2587b88c-debe-4618-8ea5-d3bdd61111b4-bluemix.cloudant.com/dashboard.html

End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	lame sensor and tes	This is done by devel	Met	Pass	GO	Code working properly	Closed	https://www.python.org/psf/sponsors/#heroku
2	Based on the temp	This is done by creat	Met	Pass	GO	Sprinklers is turning on and o	Closed	http://159.122.183.108:31627/red/#flow/51cd2ed32ac08578
3	If any flame is dete	This is done by creat	Met	Pass	GO	Exhaust fan is turning on an	Closed	http://159.122.183.108:31627/red/#flow/51cd2ed32ac08578
4	Emergency alerts are notified to the auth		Met	Pass	GO	Emergency alerts are send vi	Closed	https://www.fast2sms.com/dashboard/sms/bulk

10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Cost effective for larger applications.
- The location of a fire condition is detected and recorded at each individualdevice, identifying exactly where the fire is occurring. This will improve response time for emergency responders.
- Lower ongoing service cost, because when a device goes into trouble (i.e.needs cleaning, repair or replacement), the panel will tell you the exact location of the device needing service.
- Online capabilities: New intelligent panels have the capability to providedetailed online notification of alarm/trouble/supervisory events.
- As far as fire alarm installers go, a wireless system is ideal because they are much easier to install. A wireless system essentially involves mounting the devices to the appropriate locations around a building or room, setting up the actual system and syncing it to WiFi. Compare this to a wired system, which requires fire alarm installers to connect the systemto power supplies and ensure cables are connected properly.
- Another great advantage of a wireless fire alarm system is it operates off of a battery. This frees up a wall outlet and you can feel safe knowing the system will still work in theevent of a power outage. And adding a second or subsequent wireless device is easy if you add on to your home or office.
- Reduced alarm response time
- Intelligence – devices communicate with the control panel and each other
- Reliable Fire & Security provides regular inspection and maintenance servicefor all types of fire alarms.
- These devices differ from their conventional counterparts because each device constantly communicates with the control panel. Within seconds, alarms, supervisory and trouble conditions are alerted to the control panel and a precise location of the event is displayed. Conventional alarm systems only "communicate"when there is an event.

DISADVANTAGES

- Cost, not as competitively priced for smaller applications.
- Typically with an intelligent panel, your peripheral devices tend to be more expensive than conventional devices.
- This panel is computer like and at times there maybe issues caused by the firmware (panel software). However, this is not common and the advantages ofintelligent panel far outweigh any of these firmware issues.

- Maintaining the integrity of fire alarm systems in any building while integrating them with the building's automation systems (BAS) requires more than just communication standards. The technology of building automationand control systems has advanced at a much faster pace over the past many years. Today's technology provides building owners and designers with a rich assortment of
- options and flexibility with intelligent distributed controllers that process complex set of building information at lightning speed to efficiently characterize state-of-the-art building automation and control systems.
- These advances have taken place across a variety of building services including the control s systems for heating, ventilating, and air conditioning (HVAC), lighting, access and fire alarm. However, in spite of these advances in BAS, due to non- availability of any standard interfacing protocol, fire alarm systems have been finding it difficult to get integrated with BAS. To overcome this difficulty, in 1987, BACnet communication protocol was developed by the American Society of HeatingRefrigerating, and Air-Conditioning Engineers (ASHRAE).
- BACnet product offerings range from gateways that connect proprietary systems tocomplete product lines that use BACnet as the primary or sole means of communication. The adoption of BACnet1 as the standard communication protocolfor integrating building control products has changed the industry and opened thedoor to new innovation in building control technology and true integration of previously isolated building systems.

11.CONCLUSION

- The Industry specific intelligent fire management system can reduce the casualties of the disaster in industries to prevent the employees, industrial machines and infrastructure by providing appropriate evacuation guidance.The system can also aid disaster fighting with the help of water sprinklers because it allows for a quick assessment of the disaster with decentralized control that can intelligently guide evacuees based on the detection of humans.

- The intelligent fire management system makes full use of the fire information,realizes the information sharing of all parties, and improves the rescue ability of trapped persons and rescuers when the fire occurs. However, information collection, centralized processing and how to connect the information with the model to ensure the effectiveness of information and other factors, have a great impact on the overall practicality and reliability of the system, and is also the guarantee of maximizing the success of self-rescue and rescue. Therefore, strengthening the management of fire information will greatly improve the power of fire rescue, and it is of great significance to improve firesafety.

12. FUTURE SCOPE

- Until recently, fire and safety was something that was placed on the back-burner for many organizations. Most of the time was spent on mitigating risks after an accident had occurred rather than detecting or preventing them. In the past decade, however, there has been a hugeshift towards how safety is viewed within enterprises. Many enterprises today are adopting aprevention-based approach and laying emphasis on identifying and addressing issues before someone gets hurt.

- In fact, fire and safety preparedness of a company is now being related to its brand image. Further, business continuity and an always-on environment are a requirement for today's businesses. As fire and safety incidents are major business disruptors, companies are takingproactive approach towards addressing safety issues. Being complaint to international standards is another reason that is driving this change in approach towards security.

- More and more companies are focusing on employee training and education by organizing fire and safety workshops for employees, including contractual workers. Apart from fire andsafety, organizations are also putting immense thrust on physical plant and facility security. They are actively evaluating advanced products and technologies to meet their safety criteriaand objectives.

- India's economic growth, rapid industrialization, as well as growing commercial sector and real estate industry is further fuelling the demand for fire and safety equipment. According tothe findings of TechSci Research, the country's fire & safety equipment market has a strong growth potential and market revenues are expected to reach to about $4.94 billion by 2019.

- To keep pace with the growing demand, the fire, safety and security industry is evolving rapidly and offering innovative products. Industrial Safety Review analyses the key trends.

- Fire poses a significant risk in the workplace. Especially, when we consider work environments, such as construction sites, chemical laboratories and factories, the potential fire safety hazards aremany. If we look at the statistics an average of 59 Indians are killed every day due to fire. In fact,fire accidents take away more lives than any natural calamity or disasters.

- Given these alarming statistics, workplaces have increased their thrust on fire preparedness andare considering advanced fire detection and alarm systems. Fire equipment with ease of use features are also being demanded by organizations.

- Advanced fire alarms today are equipped with individual smoke detector sensitivity adjustment and drift compensation. Fire alarms with maintenance-needed indication feature are also gaining popularity. Many products coming to the market today are equipped with multiple abilities. Theyjust don't detect smoke, but also have the ability to detect heat, carbon monoxide and infrared light from flames as well. These features help reduce the possibility of nuisance alarms as more than one criteria needs to be fulfilled to trigger an alarm and shorten the time required to detect the actual fire.

- Wireless technology is transforming every industry and fire safety industry is no different. Wireless smoke detector systems are rapidly gaining popularity. Another technology that is seeing a surge in demand is voice annunciation as it allows danger to be announced with a pre-recorded message. Voice alert systems are set to become more popular as people have an increased reaction to voice instructions as compared to simple sirens.

- With integrated building systems gaining momentum in residential and commercial complexes alike, the industry is looking at defining the rules as to how fire alarms and detection componentswill work when they are integrated with other building systems. For instance, if there is heavy traffic on the LAN, the system should be able to identify and give priority to fire alarm signals.

- Also, the role of fire alarms and detection components is set to expand as they become integratedwith other building systems. For instance, sensors used for controlling lighting in a room can be used in cases of fire to see if a room is occupied or not. Firefighters can then use this informationto rescue in a speedy manner by eliminating unoccupied room.

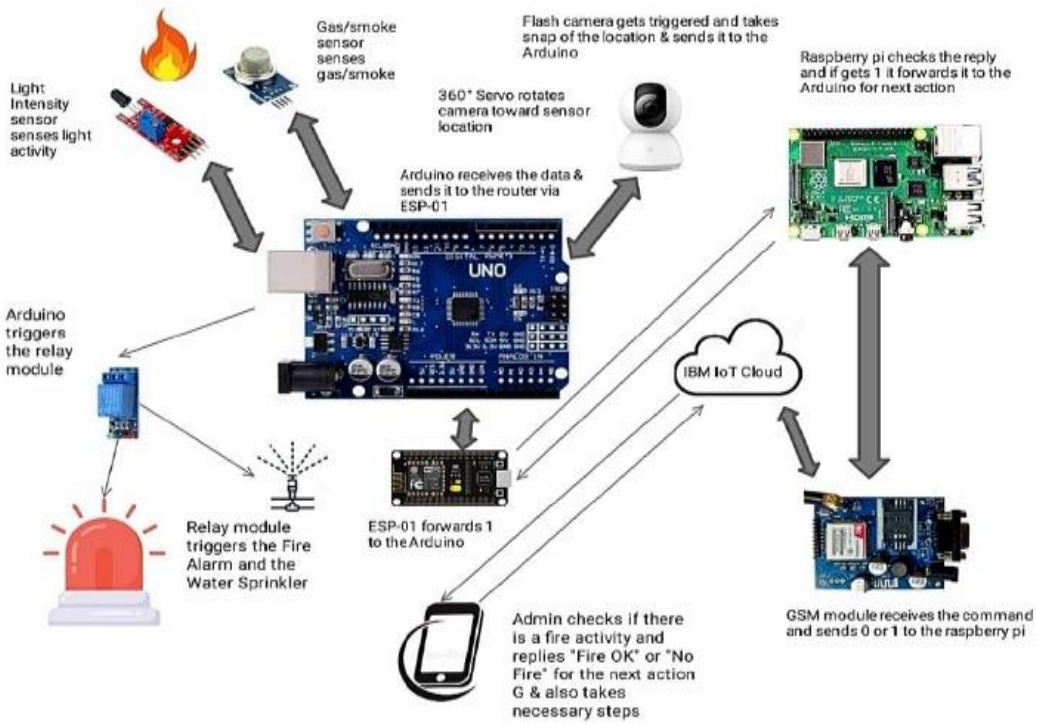
- Workplace safety is witnessing a huge shift with the wide-spread use of mobile phones and smarttechnology. As majority of workers carry their mobile phones to work today, organizations are focusing on utilizing mobile phones to oversee the safety of the employees.

- Another interesting trend to watch out in the safety space is smart technology making its way intoPPE. For years, PPE has consisted of overalls, gloves, masks, harnesses, etc., on which workers rely to ensure safety. Smart technology integrated into PPE has the potential to take workplace safety to another level. Utilizing in-built sensors, PPE equipment can monitor an employee's vitaldata, including blood pressure, heart rate, blood oxygen levels and so on. This data can then be used to determine an employee's alertness and can prove instrumental in preventing workplace accidents.

- Big data analytics is a major trend that is streamlining every industry and safety industry is no different. Compiling and analysing safety, accident and incident reports and information about machines and equipment involved can help companies identify red flag issues. Analyzing this historical data gives companies a fair idea about where danger lurks in an organization and takesteps to prevent future incidents.

12.APPENDIX

Solution Architecture Diagram:



SOURCE CODE

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

#Provide your IBM Watson Device Credentials
organization = "s8ov1q"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="sprinkleron":
        print ("Sprinkler is on")
    elif status == "sprinkleroff":
        print ("Sprinkler is off")
    elif status == "exhaustfanon":
        print ("Exhaust Fan ON")
    elif status == "exhaustfanoff":
        print ("Exhaust Fan OFF")

    #print(cmd)

try:
```

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

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

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:
    #Get Sensor Data from DHT11

    temp=random.randint(0,100)
    flame_level=random.randint(0,100)
    gas_level = random.randint(0,100)

    data = { 'Temperature' : temp, 'Flame_Level' : flame_level, 'Gas_Level' : gas_level }
    #print data
    def myOnPublishCallback():
      print ("Published Temperature = %s C" % temp, "Flame_Level = %s %%" % flame_level, "Gas_Level = %s %%" %gas_level ,"to IBM Watson")

    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback)
    if not success:
      print("Not connected to IoTF")
    time.sleep(1)
```

```
        deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

GitHub & Project Demo Link

GitHub link: *IBM-EPBL/IBM-Project-11176-1659275003: Industry-specific intelligent fire management system (github.com)*

Project Demo Link:
https://drive.google.com/file/d/1ifXUAOf6CXaaO_RJIZfuNyvVgzSz97yG/view?usp=share_link