Anna University Regional Campus ,Nalaiya Thiran

executed by-

Industry-specific intelligent fire management system

Project ID: PNT2022TMID24257

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PRATHYUSHA ENGINEERING COLLEGE

INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

Team ID	PNT2022TMID24257
Project Name	Industry-Specific Intelligent Fire Management System

Submitted by

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PROJECT REPORT

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1. INTRODUCTION

Project Overview

- 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.

Purpose

- he purpose of the system is :To prevent life losses , assets damage and uncontrollable spread of fire.
- To ensure the safety of workers and alert the manager and fire department.

- To not to recklessly endanger the life of the fire workers. This can be done by taking the control measures automatically.

2.LITERATURE SURVEY

Existing problem

The existing problems of the system are:

- Cost of ownership : The fire management system should be cost effective. In average, the fire management is expected to last 10 years. The biggest problem is when the system cannot be maintained any longer due to component non-availability or due to being unsupported by the manufacturer.
- Structural changes : The structure of the hospital changes over time. The fire management system should be easily able to upgrade and adaptable to the changing structure.
- Evacuation and fire strategy : The alert and the control measures are taken immediately, so that the building can be completely evaculated.
- System performance changes within specific environments : The industry will have unique or specified condition at some time. The major problem caused is the false fire alarm.

References

[1] Gazi weldesyase, Bahta G/meskel, Mekonen Abreha, Solomon Baynes, "GSM Based Fire and Smoke Detection and Prevention System", on 08/10/2010, Adigrat, Tigray, Ethiopia.

[2] May Zaw Tun, Htay Myint, "Arduino based Fire Detection and Alarm System Using Smoke Sensor", Volume 6, Issue 4, on April – 2020, Myanmar.

[3] Nitin Galugade, Mahesh Jakka, Devika Nair, Madhur Gawas, "Fire Monitoring and Controlling System based on Iot", 2020, Mumbai, India.

Problem Statement Definition

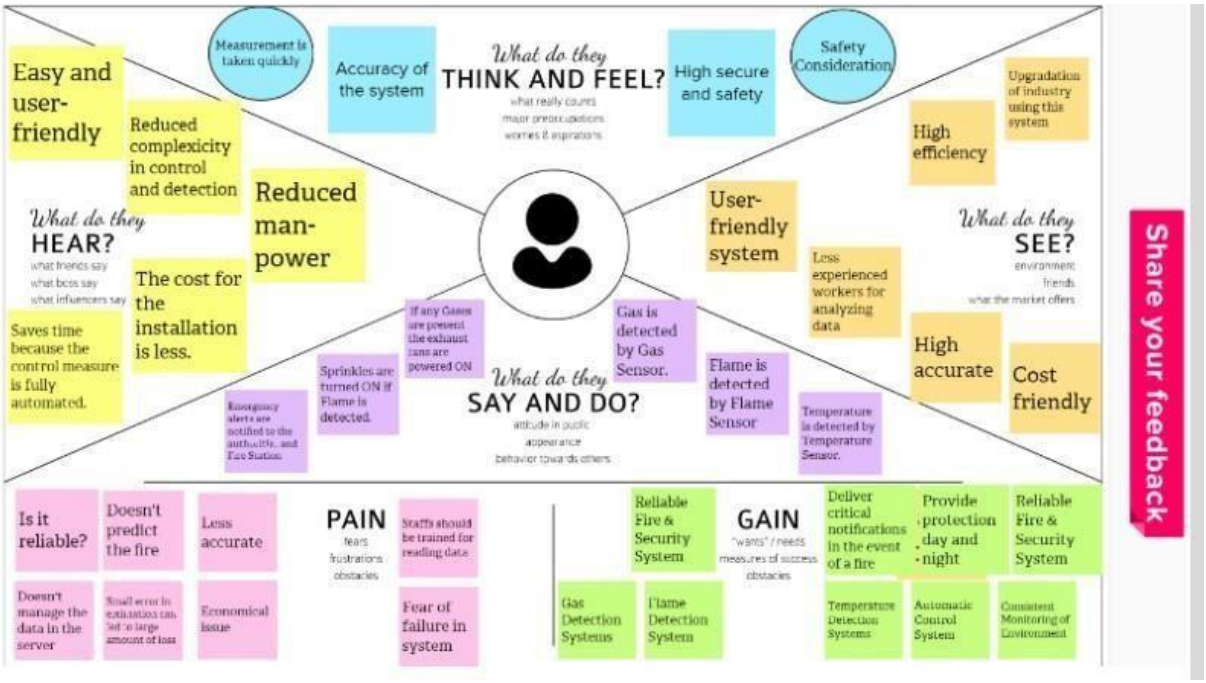
Background: Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, releasing heat, light and various reaction products. Although it's a natural process, it can lead to great destruction. On average, everyday 35 people killed due to Fire-related accidents in the five years between 2016 and 2020, according to a report by Accidental Deaths and Suicides in India (ADSI), maintained by the National Crime Records Bureau. Fire is one of the major

concerns when analyzing the potential risks on the building. Industrial Fires and Explosions cost companies and governments billions of Rupees every year apart from the loss of life, which can't be described in monetary terms. These Fires not only results only in huge loss of Lives and Property but also disrupt production in the Industry. The Nilflisk says that the five major causes of industrial fires and explosions are Combustible dust, hot works, Flammable liquids and gasses, equipment and machinery and Electrical hazards.

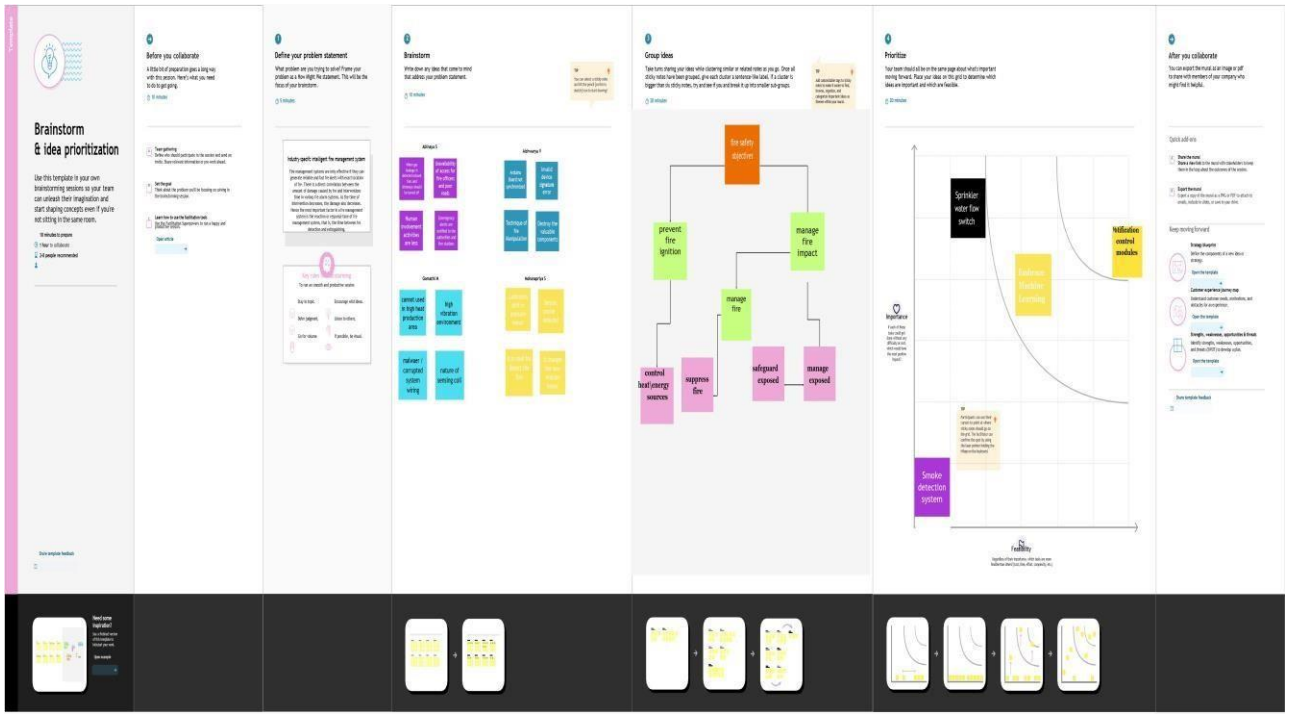
Objective: The objective of this Industry-Specific Intelligent Fire Management System is to detect any changes in environment like detecting hazardous gas, flame detection and temperature that can lead to fire and exploitation incident. Based on the temperature readings and if any Gasses are present the exhaust fans should be powered ON automatically to replace contaminated and stale air with fresh, healthy air. If any flame is detected the sprinklers will be switched on automatically. Emergency alerts are notified to the authorities and Fire station. So that the authorities and Fire Fighters can control the situation.

3. IDEATION & PROPOSED SOLUTION

Empathy Map Canvas



Ideation & Brainstorming

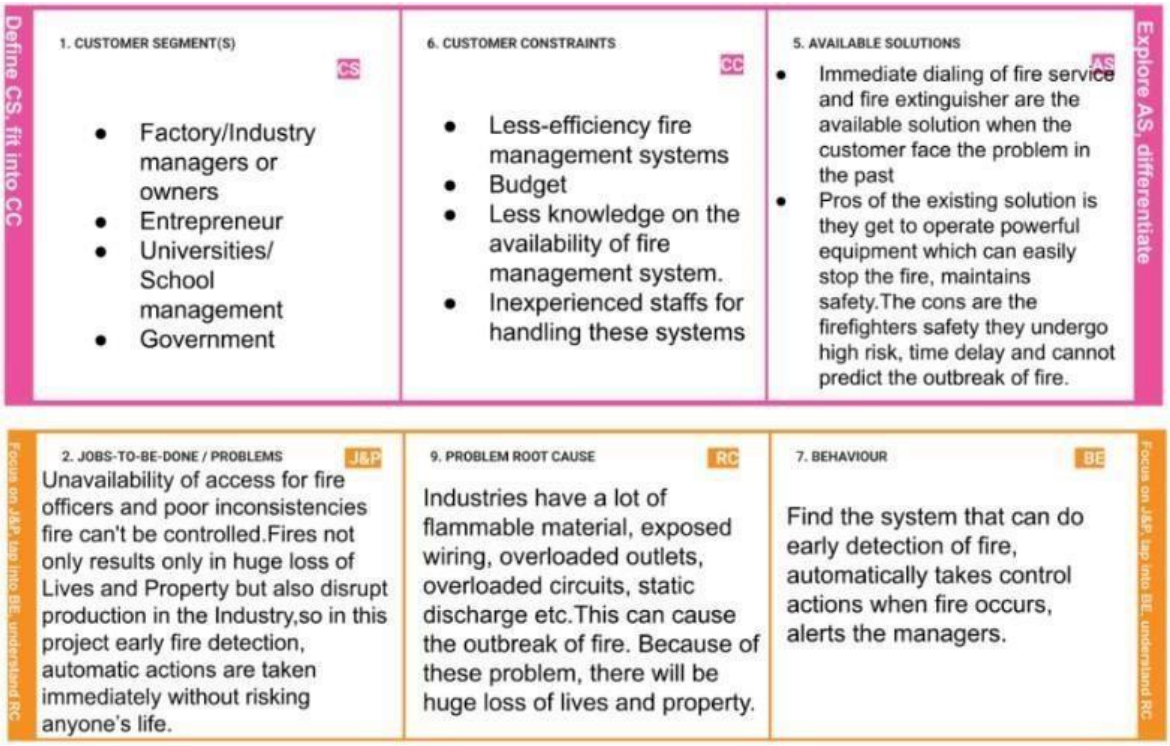


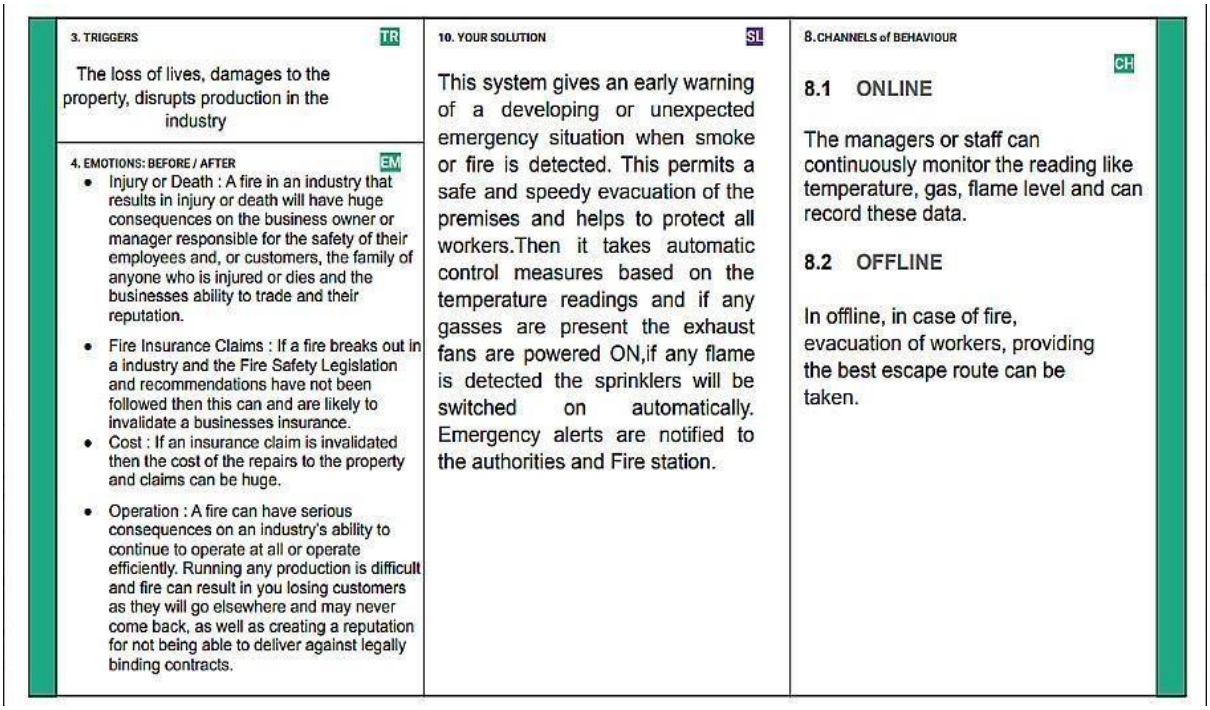
Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	this system can perform different parameter measurements early detection of building fires
2.	Idea / Solution description	This fire alarm system incorporates the heat and flame detector that are connected in parallel.The micro controller is used as the heart of this fire alarm system that controls the entire operation involved . The fire alarm system is capable to locate and identified the place that is in fire where by its monitored using the monitoring system.
3.	Novelty / Uniqueness	In this paper, the installed Arduino device which was programmed with Android Studio receives gas smoke ,the temperature and humidity signal from the sensors . The sensor is connected to the input of the Arduino with the help of connecting the cables or jumper cables . Further the circuit goes toward output where the buzzer is connected. If we differ the value of the buzzer then we get a variation in the buzzer sound.

4.	Social Impact / Customer Satisfaction	This product has huge social impact as presentation of the industry workers from fire related accidents.Prevention of the industry fire accident can also increases the industrial financial status
5.	Business Model (Revenue Model)	This product can be utilized by a industries .This can be thought of as a productive and helpful item as industries great many current rescuing people and machine from the fire accident
6.	Scalability of the Solution	It is trying to execute this technique as we need to introduce an Arduino gadget which was modified with an Arduino studio that takes received signals from sensors . This recognizes the fire from each area in turn assuming there is fire in other area the framework can not distinguish . So this item will be introduced in each required area independently.

Problem Solution fit





4. REQUIREMENT ANALYSIS:

FUNCTIONAL REQUIREMENT

Following are the functional requirements for the proposed solution.

- **User Requirements-** Industrial workers, automatic Water Sprinkler System that monitors Smoke, Gas and Temperature
- **User Registration-** Manual Registration

  Registration through webpage

  Registration through Form

Registration through Gmail

- **User Confirmation-** Confirmation via Phone number

  Confirmation via Email id

  Confirmation via (One time password) OTP

- **Payment Options-** Cash on Delivery

  Net Banking (with standard gateways)

UPI mode of transaction

Credit card/Debit card/ATM card

- **Product Delivery and Installation-** Door Step delivery

  Take away

  Free installation and service for 1st year.

- **Product Feedback-** Via official Webpage

  Via Phone calls

  Through Google forms

NON FUNCTIONAL REQUIREMENTS

The following are the non-functional requirements.

- **Reliability-** Hardware configurations requires periodical service to avoid mishap. Software may be updated periodically. Immediate alert is provided in case of any system failure.

- **Performance-** Enhanced with proper user interface. Lesser energy consumption and long life of the battery. The product should work fine with real time applications as it has to deal with lives of people and products.

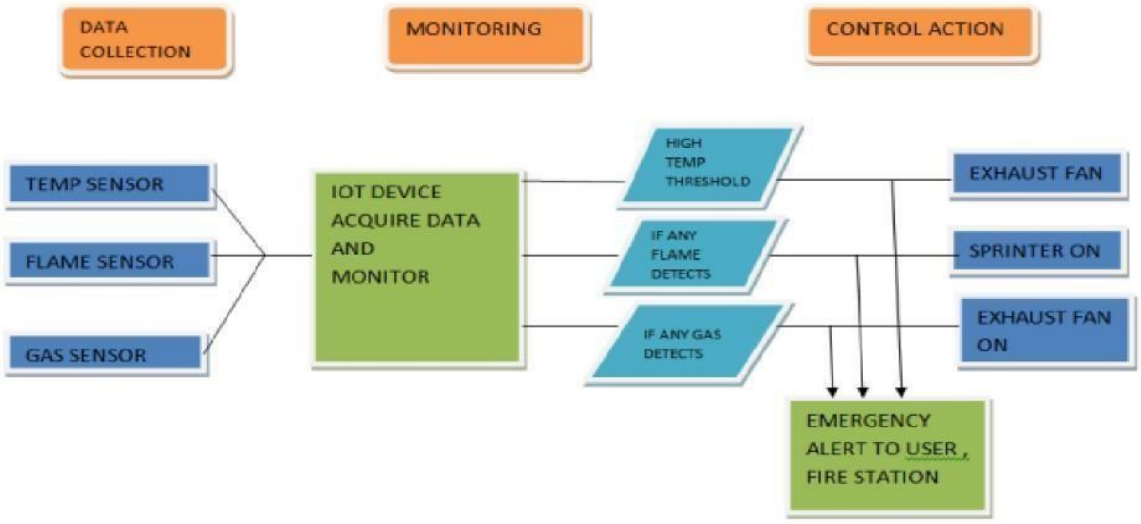
- **Availability-** According to the user requirement the features will be available at any
  time. Primarily, depends on the user requirement and the type of customization he wants.

- **Scalability-** The product has to adapt, accommodate and assemble to any portion of the industry ambience irrespective of space and size.

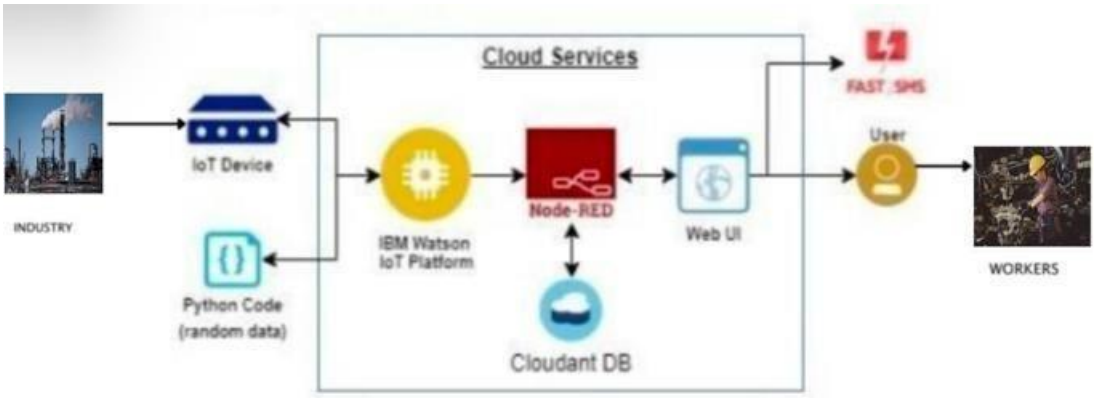
- **Usability-** Proper installation manual. Easier to use. Understandable by workers.
- **Security-** Periodically, inspected by the Fire Alarm technician and tagged by a contractor annually.

5. PROJECT DESIGN:

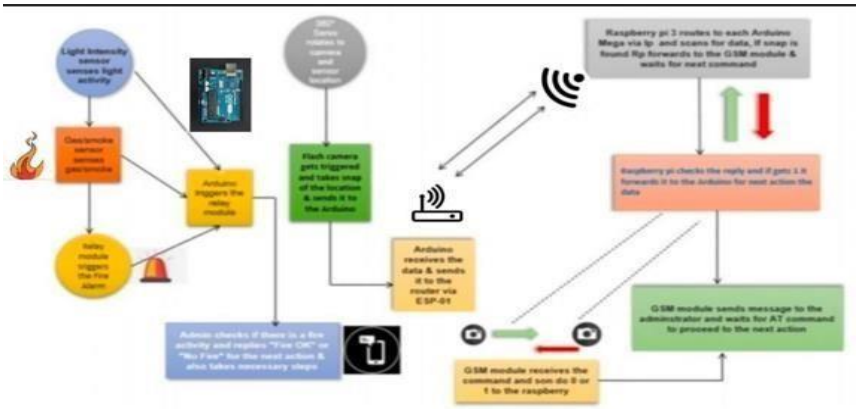
DATA FLOW DIAGRAM



SOLUTION AND TECHNICAL ARCHITECTURE



Architecture employed



USER STORIES

- Being a user, one can register the application by entering email id, password and confirming the credentials.
- Connecting the sensors and arduino board with respective python code.
- Creation of specific devices in the IBM Watson IoT, and workflow using NodeRed.

- Using MIT app, creation of a mobile application for the fire management system.
- Being a user, I can get notification alerts.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	Being a user, one can register the application by entering email id, password and confirming the credentials.	2	High	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s
Sprint-1	Simulation	USN-2	Connecting the sensors and arduino board with respective python code.	1	High	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s
Sprint-2	Software	USN-3	Creation of specific devices in the IBM Watson IoT, and workflow using NodeRed.	2	Low	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s
Sprint-1	MIT App Inventor	USN-4	Using MIT app, creation of a mobile application for the fire management system.	2	Medium	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s
Sprint-1	Login	USN-5	Using the login credentials , I can login into the application.	1	High	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s

- According to the emergency case, testing of the system is done at the place of deployment.
- Linking the app with IBM cloud.
- Deployment of IoT based Industry specific Intelligent fire management system which is accessible at any circumstances.

1. PROJECT PLANNING AND SCHEDULING:

SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint - 1	Dashboard	USN-6	Being a user, I can get notification alerts.	1	Medium	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s
Sprint-3	Testing and Development Phase 1	USN-7	According to the emergency case , testing of the system is done at the place of deployment.	2	High	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s
Sprint-3	Linking	USN-8	Linking the app with IBM cloud	2	High	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s
Sprint-4	Implementation	USN-9	Deployment of IoT based Industry specific Intelligent fire management system which is accessible at any circumstances.	2	High	Abinaya S, Aishwarya V, Gomathi M, Mohanapriya s

6.PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

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

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	6	High	Indhumathi K,Hariharan S,Athira V R
Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	Indhumathi K,Hariharan S,Athira V R
Sprint-1		US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	5	Medium	Indhumathi K,Hariharan S,Athira V R
Sprint-1		US-4	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials	5	High	Indhumathi K,Hariharan S,Athira V R
Sprint-2		US-1	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	10	High	Indhumathi K,Hariharan S
Sprint-2		US-2	Create a Node-RED service.	10	High	Athira V R, ArunRaj G
Sprint-3		US-1	Develop a python script to publish random sensor data such as temperature, Flame level and Gas level to the IBM IoT platform	7	High	Indhumathi K,Hariharan S,Athira V R,Arun Raj G
Sprint-3		US-2	After developing python code, commands are received just print the statements which represent the control of the devices.	5	Medium	Indhumathi K,Hariharan S,Athira V R,Arun Raj G
Sprint-3		US-3	Publish Data To The IBM Cloud	8	High	Indhumathi K,Hariharan S,Athira V R
Sprint-4		US-1	Create Web UI in Node- Red	10	High	Indhumathi K,Hariharan S,Athira V R
Sprint-4		US-2	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	10	High	Indhumathi K,Hariharan S,Athira V R,Arun Raj G

SPRINT DELIVERY SCHEDULE

- **Registration-** Any user has the ability to register the application through the gmail account.
- **Simulation-** The python code is connected with the Arduino board and sensors to check the process.
- **Software-** Some program oriented devices are created in the IBM watsoniot and workflow for better performance
- **MIT app inventor-** It is created for making a mobile application to prevent fire explosion.
- **Login-** It is used to get into an account for getting further details about the system.
- **Dashboards-** It helps getting notification alerts.
- **Testing and development phase 1-** At deployment phase, testing is done in order to check the working of the application.
- **Linking-** The app is now linked with IBM cloud.
- **Implementation-** This app is now put into action at various fire prone places**.**

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

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

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

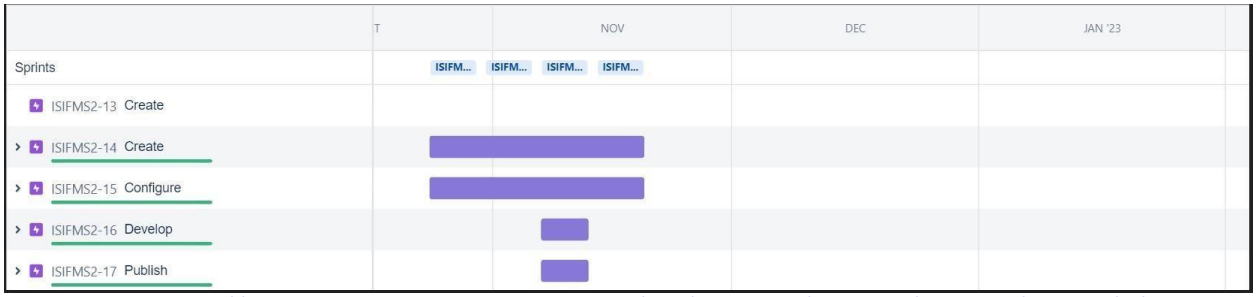
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint).

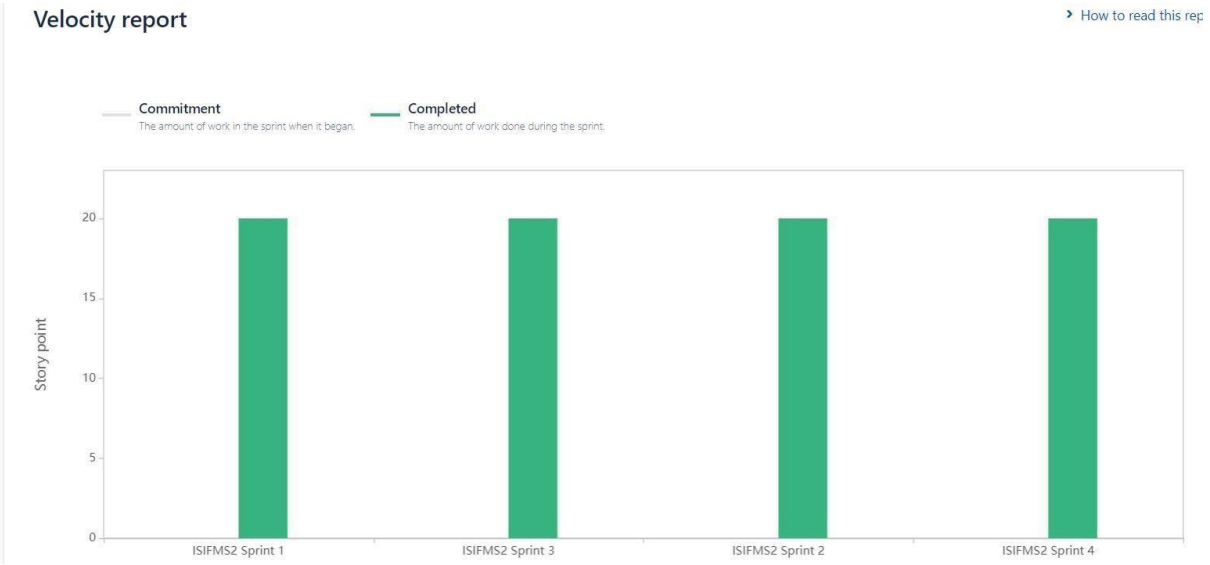
Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Reports from JIRA



https://pnt2022tmid47460.atlassian.net/jira/software/projects/ISIFMS2/boards/2/roadmap

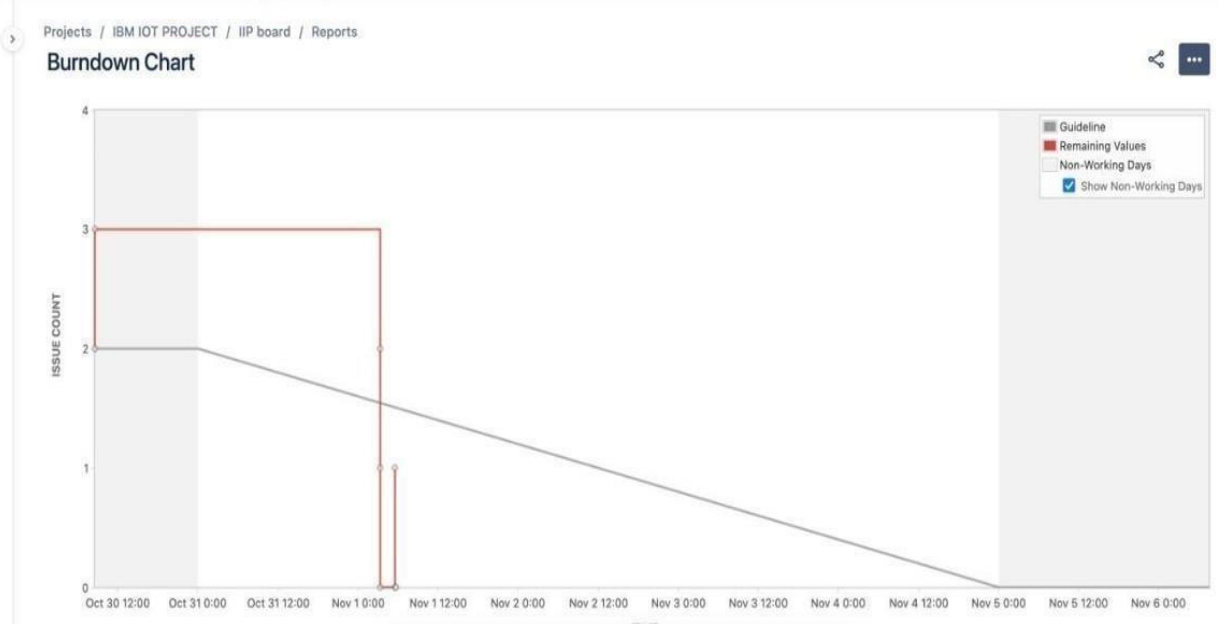


Reports from JIRA

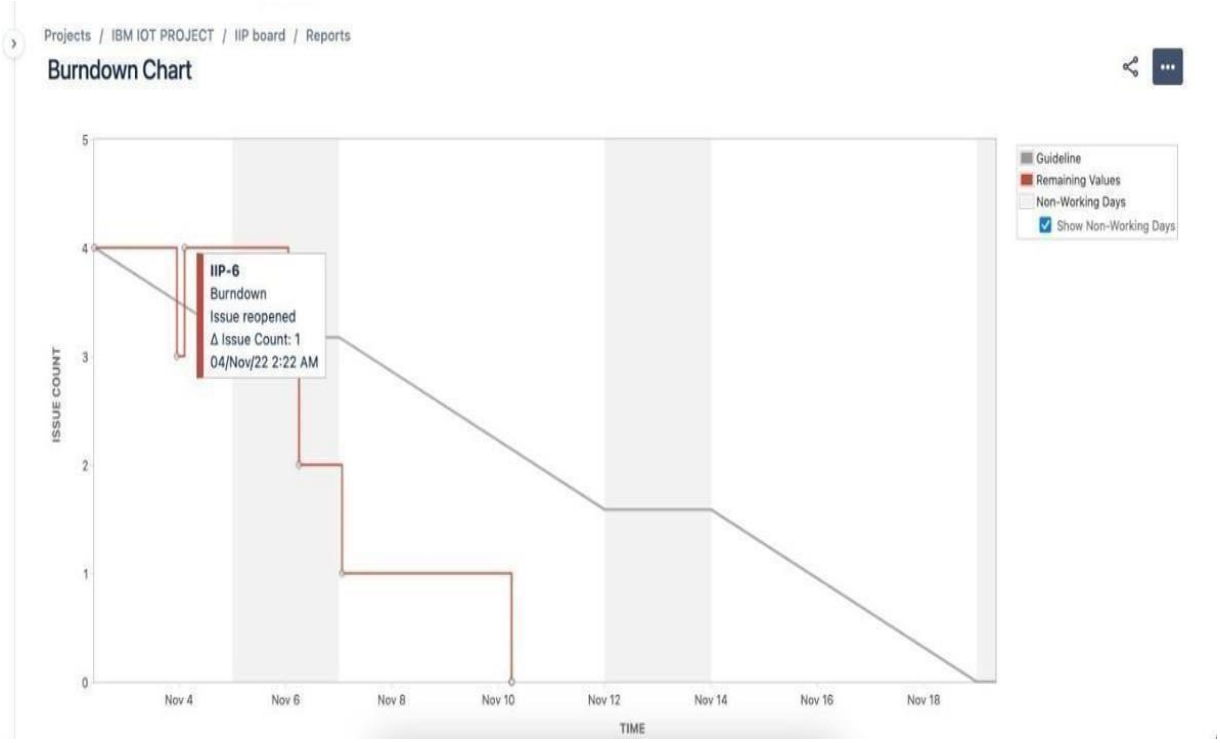
Sprint 1

Sprint 2

Sprint 3



Sprint 4



7. CODING & SOLUTIONING

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.

Python script for generating the random sensor values - Temperature, Flame Level and Gas Level to the IBM Watson IoT Platform.

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


#Provide your IBM Watson Device Credentials

organization = "4aqwut"
deviceType = "12345678dt"
deviceId = "12345678did"
authMethod = "token"
authToken = "*PrtsGAO?B@_tTPEKT"


# 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

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 members and teach how to use and open the Git hub and IBM career education portals.

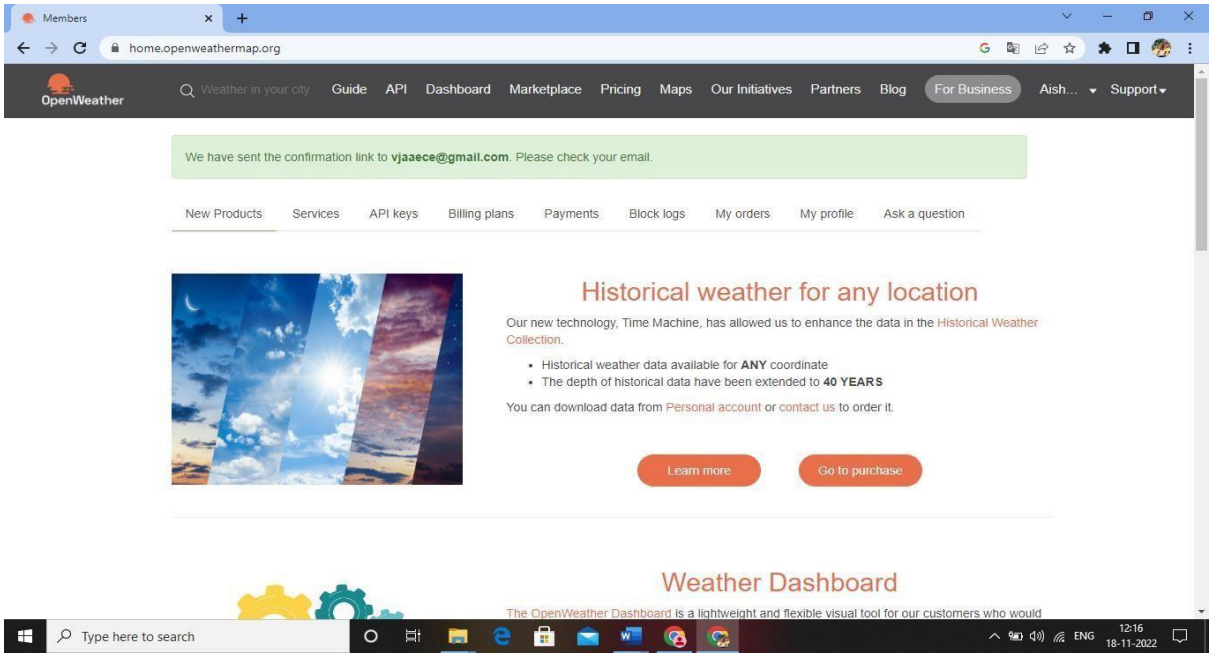
- Starting phase of project- Team lead to team members based on regularly attending training sessions for installing and use of prerequisite without skipping. Also necessarily attending the training sessions based on python code, development of android app in mobile app invtr.com and working along Node Red is ensured by the team lead and acknowledged by team members simultaneously.

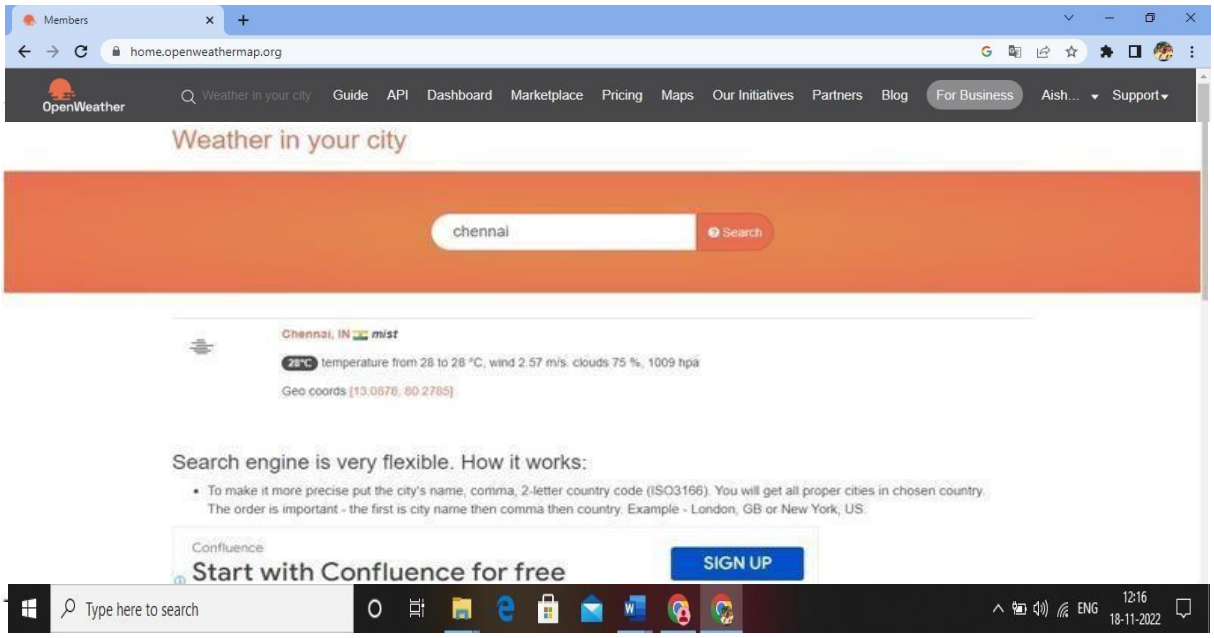
- Attend class- Team members and team lead must watch and learn from classes provided by IBM and NALAYATHIRAN and must gain access of MIT license for their project. IBM cloud service cloud Watson and node red service.

- 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

1. Extract weather data from OpenWeatherMap using APIs
2. Send the extracted data to the cloud
3. Receive data from the cloud and view it in the python compiler





Output :

```
Published Temperature = 3 C Flame_Level = 88 % Gas_Level = 30 % to IBM Watson
Published Temperature = 22 C Flame_Level = 51 % Gas_Level = 16 % to IBM Watson
Published Temperature = 80 C Flame_Level = 32 % Gas_Level = 88 % to IBM Watson
Published Temperature = 98 C Flame_Level = 81 % Gas_Level = 34 % to IBM Watson
Command received: sprinkleroff
Sprinkler is off
Command received: exhaustfanoff
Exhaust Fan OFF
Command received: sprinkleron
Sprinkler is on
Published Temperature = 93 C Flame_Level = 77 % Gas_Level = 43 % to IBM Watson
Command received: exhaustfanon
Exhaust Fan ON
Published Temperature = 18 C Flame_Level = 37 % Gas_Level = 88 % to IBM Watson
Published Temperature = 61 C Flame_Level = 53 % Gas_Level = 65 % to IBM Watson
Published Temperature = 95 C Flame_Level = 76 % Gas_Level = 90 % to IBM Watson
Published Temperature = 56 C Flame_Level = 14 % Gas_Level = 27 % to IBM Watson
Published Temperature = 34 C Flame_Level = 33 % Gas_Level = 51 % to IBM Watson
Published Temperature = 9 C Flame_Level = 56 % Gas_Level = 80 % to IBM Watson
Published Temperature = 42 C Flame_Level = 51 % Gas_Level = 18 % to IBM Watson
```

8. TESTING

Test Cases

				Date	15-Nov-22								
				Team ID	PNT2022TMID47460								
				Project Name	Project - Industry-Specific Intelliger								
				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	1.Go to IBM Cloud signup page 2.Enter e-mail id and other credentials 3.Enter a password	https://cloud.ibm.com/login	Should be able to create the IBM Cloud account.	Working as expected	Pass	Results verified	No		Athira V R, Indhumat K, Arun Raj G, Hariharan S
TC_002	Functional	IBM Cloud	Configure the IBM Cloud services which are being used in completing this project.	IBM Cloud Login ID & Password	1.Go to Cloud login 2.Enter user ID & Password 3.Verify login by the popup display	https://cloud.ibm.com/login	Should able login to IBM Cloud and navigated to IBM Cloud dashboard page	Working as expected	Pass	Results verified	No		Athira V R, Indhumat K, Arun Raj G, Hariharan S
TC_003	Functional	IBM Watson IoT Platform	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	IBM Watson IoT Platform Login ID & Password	1.Login to IBM Cloud 2.Click Catalog 3.Search IoT and click create 4.Go to resource list and search Internet of Things platform 5.Press Launch and click Sign in IBM Watson Platform	https://vg4nsy.internetofthings.ibmcloud.com/dashboard/	Should be able to navigate to IBM IoT Watson Platform	Working as expected	Pass	Results verified	No		Athira V R, Indhumat K, Arun Raj G, Hariharan S
TC_004	Functional	IBM Watson	To create a device in the IBM Watson IoT platform and get the device credentials.	IBM Watson IoT Platform Login ID & Password	1.Login to IBM Watson Platform 2. Click Add Device 3.Enter the details and click Finish. Note down the Device ID, Device Name, Authentication key, Organization name	Device credentials	Should be able to get Device details	Working as expected	Pass	Results verified	No		Athira V R, Indhumat K, Arun Raj G, Hariharan S
TC_005	Functional	IBM Cloud(Node Red)	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	1. Search "Node-red" in catalog 2. Wait for some time to completely configure the Node-Red.	https://cloud.ibm.com/developer/appservice/create-app?starterKit=59c9d5bd-4d31-3611-897a-f94eea80dc9f&defaultLanguage=undefined	Should be able to open Node-Red service	Working as expected	Pass	Results verified	No		Arun Raj G, Hariharan
TC_006	Functional	Node Red	Create a Node-RED service.	Node Red Installation	1.Select IBM IoT input in Node. In IBM IoT Watson Platform, go to apps and click on generate API keys. 2.Copy & paste generated API key and token in the IBM IoT input. After entering all details, click the done button. 3.Add debug to the IBM IoT and rename as Msg.payload and click on done. Click gauge from the dashboard and fill the details & add functions to the gauge. Check	Values of sensors and button for Alarm & Sprinkler ON/OFF is displayed	Values of sensors and button for Alarm & Sprinkler ON/OFF should be displayed	Working as expected	Pass	Results verified	No		Sheeba Lourdes Angeline H

				Date	15-Nov-22											
				Team ID	PNT2022TMID47460											
				Project Name	Project - Industry-Specific Intelli											
				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_007	Functional	Python 3.7.0	Develop a python script to publish random sensor data such as temperature, humidity level and Gas level to the IBM IoT platform	Python 3.7.0(64 bit) installatio	1.Download and install Python 3.7.0 2.Develop python code	https://www.python.org/downloads/release/python-370/	Should be develop a python script that can randomly generate and send Temperature, Gas level and Flame level values to the IBM IoT Watson Platform	Working as expected	Pass	Results verified	No		Athira V R			
TC_008	Functional	Python 3.7.0	After developing python code, commands are received just print the statements which represent the control of the	Python 3.7.0(64 bit) installatio	1.Download and install Python 3.7.0 2. Open Node-Red or MIT mobile app	Get the output from the cod	Should be able to display the commands like Sprinkler ON, Sprinkler OFF, Exhaust Fan ON, Exhaust Fan OFF	Working as expected	Pass	Results verified	No		Athira V R, Indhumathi K			
TC_009	Functional	IBM Cloudant DB	Store the sensor values - Temperature, Flame Level and Gas Level in the Cloud	IBM Cloud Account	1.Run the python code 2.Verify the displayed output	Output from the python cod	Should be able to store the sensor values generated by the python script in the cloud	Working as expected	Pass	Results verified	No		Hariharan S			
TC_010	Web UI	Node Red & MIT Inventor	Create Web UI in Node-Red	MIT Inventor Login ID & password	1.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 and function.Print the command statements such as Sprinkler ON/OFF, Alarm ON/OFF and sensor 2.Go to MIT app inventor and create frontend using buttons,horizontal arrangement, text bar, etc. Add blocks and so	Sensors values and command values is displayed in the Debug window and in the mobile application	Sensors values and command values is displayed in the Debug window and the User shoulb be able to view these data in the MIT Mobile APP and be able to press the buttons if any value exceeds the threshold value	Working as expected	Pass	Results verified	No		Indhumathi K, Athira V R, Arun Raj G			
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	1.Go to IBM cloud, search Cloudant in Catalog, Add new dashboard, go to Node Red 2.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 cloud database with the sensor values	Working as expected	Pass	Results verified	No		Athira V R, Hariharan S			

User Acceptance Testing

Purpose of Document :

The purpose of this document is to briefly explain the test coverage and open issues of the Industry-specific intelligent fire management system project at the time of the release to User Acceptance Testing (UAT).

Defect Analysis :

Section	Total Cases	Not Tested	Fail	Pass
Print the Sensor values	7	0	0	7
Client Mobile Application	51	0	0	51
Security	2	0	0	2

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

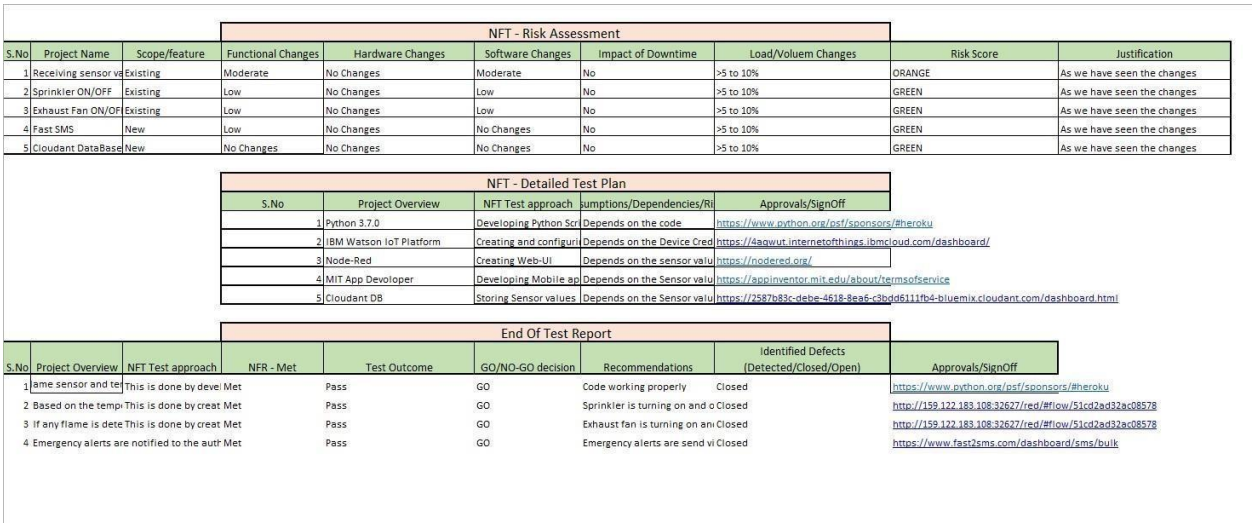
This report shows the number of test cases that have passed, failed, and untested

Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4

Version Control	2	0	0	2

9. RESULTS

Performance Metrics



NFT - Risk Assessment

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem 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://4aqwut.internetofthings.ibmcloud.com/dashboard/
3	Node-Red	Creating Web-UI	Depends on the sensor valu	https://nodered.org/
4	MIT App Devoloper	Developing Mobile ap	Depends on the Sensor valu	https://appinventor.mit.edu/about/termsofservice
5	Cloudant DB	Storing Sensor values	Depends on the Sensor valu	https://2587b83c-debe-4618-8ea6-c3bdd6111fb4-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	ame sensor and te	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	Sprinkler is turning on and o	Closed	http://159.122.183.108:32627/red/#flow/51cd2ad32ac08578
3	If any flame is dete	This is done by creat	Met	Pass	GO	Exhaust fan is turning on an	Closed	http://159.122.183.108:32627/red/#flow/51cd2ad32ac08578
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 individual device, 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 provide detailed 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 system to 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 the event 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 service for 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 of intelligent 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-ofthe-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 nonavailability 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 Heating Refrigerating, and Air-Conditioning Engineers (ASHRAE).
- BACnet product offerings range from gateways that connect proprietary systems to complete product lines that use BACnet as the primary or sole means of communication. The adoption of BACnet1 as the standard communication protocol for integrating building control products has changed the industry and opened the door to new innovation in building control technology and true integration of previously isolated building systems.

- 11the integThough BACnet providof network technology and appropriate use ofin an emergency can be effectively eliminated.practices for constructing networks of integrated systems. By appropriate home fire alarm terference problems and conc. CONCLUSION: The primary ation possibilities. An s the ecealternatrns abary isolation to Fout guaranteed access to network bandwidth v approach is to devel advantage of rours and bridges to filter traffic, re Alarm Systp the

bestm, i also limitsselection d sign

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 fire safety.

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 huge shift towards how safety is viewed within enterprises. Many enterprises today are adopting a prevention-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 taking proactive 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 and safety, organizations are also putting immense thrust on physical plant and facility security. They are actively evaluating advanced products and technologies to meet their safety criteria and 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 to the 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 and innovations emerging in the fire, safety and security segment and the future growth prospects.

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 are many. 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 and are 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. They just 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 prerecorded 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 components will 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 integrated with 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 information to 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 smart technology. 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 into PPE. 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 vital data, 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.

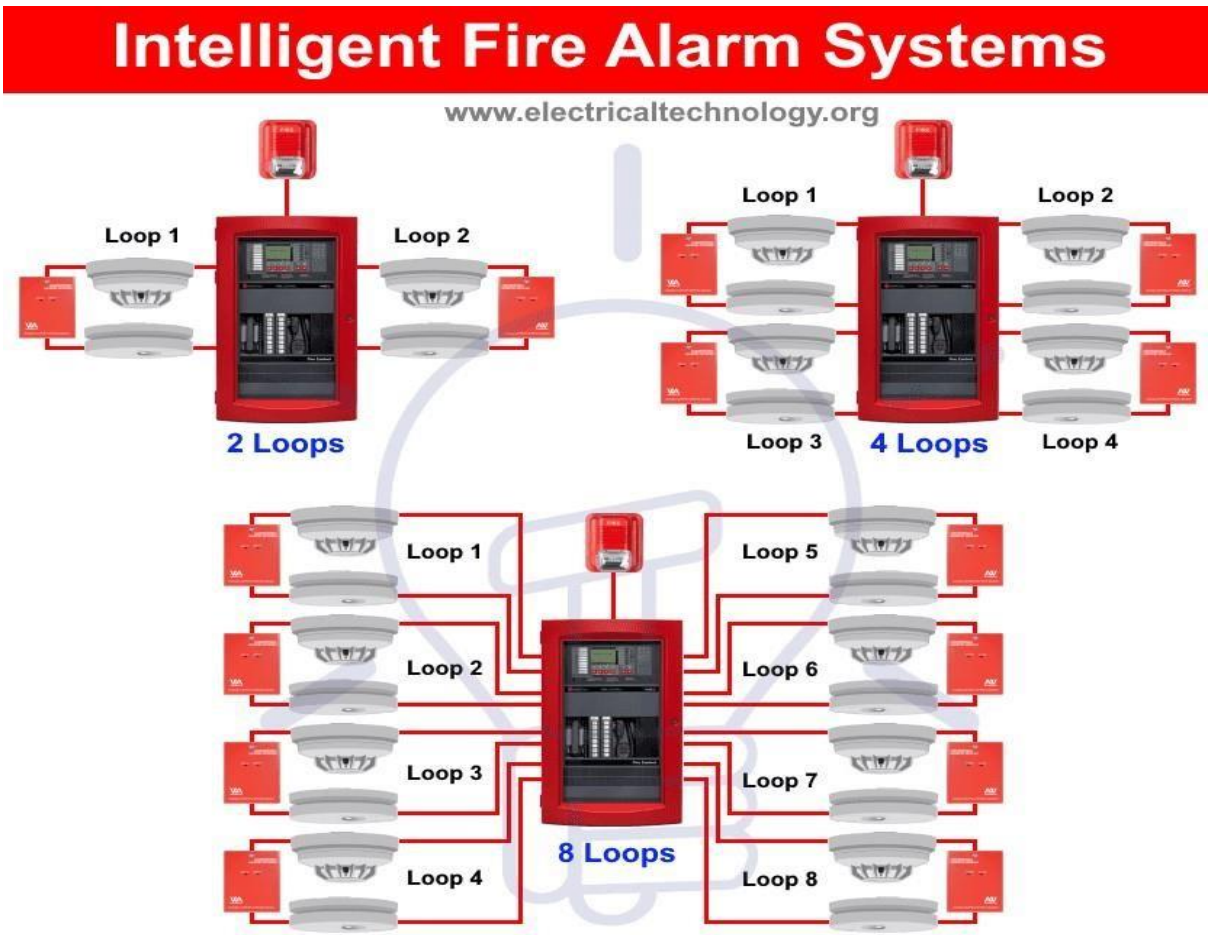
Big data analytics is a major trend that is streamlining every industry and safety industry is no different. Compiling and analysing safety, accident and incident reports and information about machines and equipment involved can help companies identify red flag issues. Analyzing this historical data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

Technology revolution is also impacting the traditional signage. Today, there is digital 'smart' signage that can change with changing conditions, and provide more eyecatching alerts for employees.

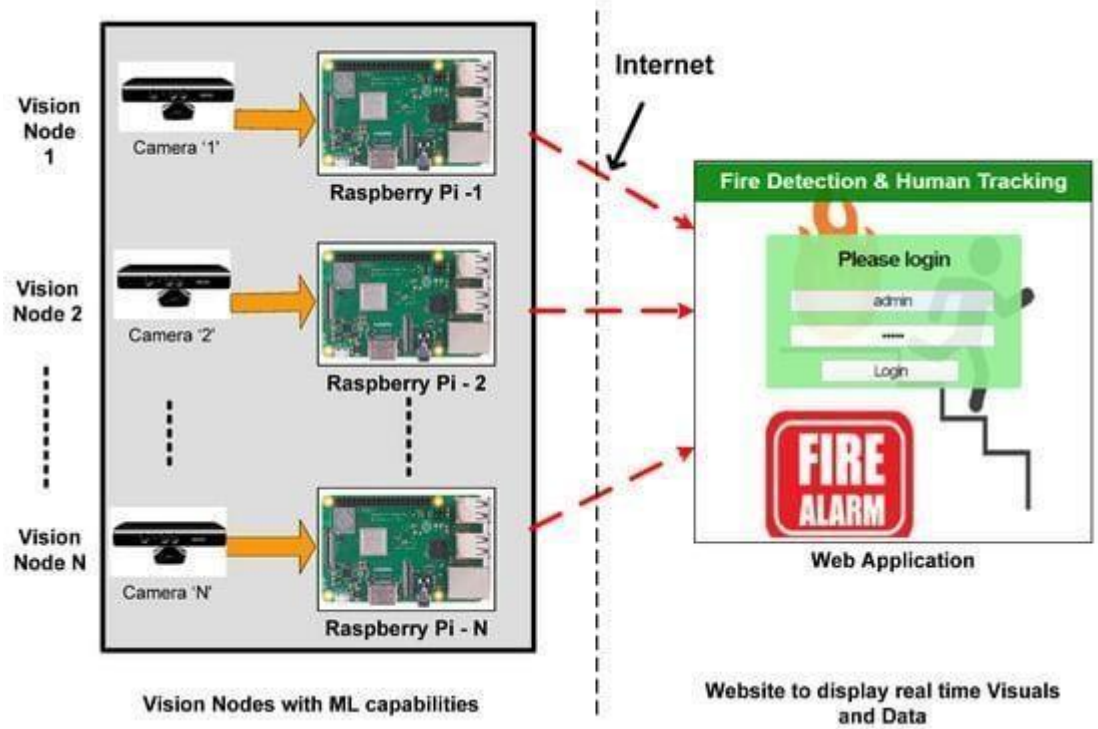
In the future, augmented reality will also be used to enhance workplace safety. For instance, wearable goggles may be embedded with AR technology. This will help to give employees live feedback, such as temperature readings, as well as instructions with best practices.

13.APPENDIX:

SOURCE CODE



TYPES OF FIRE ALARMS



FIRE SAFETY MANAGEMENT USING RASPBERRY PI