Industry-Specific Intelligent Fire Management System

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1. INTRODUCTION

Industrial intelligent fire management system that can control security and safety of the industry intelligently within the minimum time and the design of a system using wireless sensor networks, fire alarm sensor, and human detecting sensor to address the problems with existing disaster emergency response systems in times of fire hazard. To address this problem, this study aims to implement a smart fire detection system that would not only detect the fire using integrated sensors but also alert industry owners, emergency services, and local police stations to protect lives and valuable assets simultaneously. The proposed model of our project employs different integrated detectors, such as heat, smoke, and flame. The signals from those detectors go through the system algorithm to check the fire's potentiality and then broadcast the predicted result to various parties using GSM modem associated with the system. To get real-life data without putting human lives in danger, an IoT technology has been implemented to provide the fire department with the necessary data. Finally, the main feature of the proposed system is to minimize false alarms, which, in turn, makes this system more reliable.

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
- 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

- To prevent and suppress unwanted fires by rendering prompt and efficient services so as to keep the loss of life and property to the minimum.
- To reduce amounts of flammable and combustible materials.
- To reduce ignition hazards.
- To ensure safe emergency evacuation of occupants.
- To allow for quick emergency response.

2. LITERATURE SURVEY

The related work of the existing solutions were studied in the various technical papers and referred in the Research Publications.

[1] Ahmed Imteaj et.al. Studied the problems faced by factory workers in times when fire breaks out. They proposed a system using Raspberry Pi 3 which is capable of detecting fire and providing information about area of fire. The Raspberry Pi controls multiple Arduino boards which are connected with several motors and cameras to capture the fire incident. In their proposed model, they discussed about the modern technology that can be used to reduce extremely unfortunate accidents caused by fire; designed the whole system and calculated its effectiveness.

[2] Ondrej Krejcar proposed a model for location enhancement and personnel tracking using Wi-Fi networks. The project has represented the control system concept that is used in handling information of location and control unit operations. The location of the user present in the building, is obtained through Wi-Fi access points. From this points, it is to understand the usability of the Wi-Fi networks in live tracking and then have utilized this functionality to track fire and give information about location of fire to various devices intimating people about the mishap.

[3] “Design and Implementation of a fire detection and control system for automobiles using fuzzy logic” is used to get the safety features in home and industrial areas. They have designed new model using WSN. Not only have they incorporated temperature and humidity sensors but

also included fire and smoke sensors while developing the model. They present a preceding study of WSN is able to detect fire alarm. It is for setting up a wireless sensor network with three sensors. An application was developed for getting home information

[4] Azka Ihsan Nurrahman, Kusprasapta Mutijarsa have proposed a prototype for a centralized management system for homes or offices which helps better in managing the safety features. In this, home management system is required. This system controls the room lights by turning on and off automatically, it keeps the record of use of electronic device status, turning on and off the ac regulator automatically, it displays the room temperature in home. If fire is detected in the house, it turn on sprinkler at home, it supervises at home via surveillance cameras, take photos and store them including recordings of surveillance at home, it detects the movements of people at home, and provide notification when someone enters the house

[5] An efficient smart emergency response system for fire hazards using IoT is explained in detail which provide a quality public safety and security services to adopt leveraged data driven emergency response systems with urban IoT design standards.

[6] An intelligent fire detection and mitigation system safe from fire is being specified in detail with proper safety system.

[7] The design and Implementation of a fire detection and control system for automobiles using fuzzy logic is given with early detection and exact fire location detection using fuzzy logic.

[8] The efficiency increase for electrical fire detection and alarm systems through implementation of fuzzy expert systems is explained with high efficiency detection system.

2.1.Existing Problem

- On the edge of the system, there are pieces of hardware that detect the fire. The hardware includes- Fire Panel systems or sensors for smokes or gas leakages.
- The next level in the architecture comprises of hardware that is responsible for communicating with the prior layer by the means of either wired means or wireless RF signals.

- RS-485 is an industrial specification that defines the electrical interface and physical layer for point-to-point communication of electrical devices.

- Prior layer consists of hardware like Nodes, Hubs or Gateways and these hardware devices have Internet access by wired or wireless means.

2.2.Reference

[1] Lakshmana Phaneendra Maguluri, Tumma Srinivasarao, Maganti Syamala, R. Ragupathy, N.J. Nalini, "Efficient Smart Emergency Response System for Fire Hazards using IoT", International Journal of Advanced Computer Science and Applications, Vol. 9, No. 1, 2018.

[2] MD Iftekharul Mobin, MD Abid-Ar-Rafi, MD Neamul Islam and MD Rifat Hasan, "An intelligent fire detection and mitigation system safe from fire (sff)", International journal of computer applications (0975 - 8887), volume 133 - no.6, January 2016.

[3] MS. Vidhy Khule, MS. Divya Dhagate and MS. Rajashree Kadam, "Design and Implementation of a fire detection and control system for automobiles using fuzzy logic", ISSN: 2277-9655, April, 2017.

[4] Ionuţ-Lucian Homeag, Radu Pârlog-Cristian and Mircea Covrig, "Efficiency increase for electrical fire detection and alarm systems through implementation of fuzzy expert systems", ISSN: 1454-234x, 2013.

[5] Aiswarya Muralidharan and Fiji Joseph, "Fire Detection System Using Fuzzy Logic", ISSN: 2277-9655, April, 2014.

[6] Ms.Simmi Sharma, Diwankar Singh, Sanjay Singh Rathore and Paras Bansal, "Fire Detection System with GSM Using Arduino", Imperial Journal of Interdisciplinary Research (IJIR), ISSN: 2454-1362, 2017

[7] Li Da Xu, Wu He and Shancang Li, "Internet of Things in Industries: A Survey", IEEE Transactions on Industrial Informatics, November 2014. [8] Chang-Su Ryu, "IoT-based Intelligent for Fire Emergency Response Systems", International Journal of Smart Home, 2015.

[8] ZHANG Ying-cong, YU Jing, “A Study on the Fire IOT Development Strategy”, Procedia Engineering 52 (2013).

[9] Vikshant Khanna, Rupinder Kaur Cheema, “Fire Detection Mechanism using Fuzzy Logic”, International Journal of Computer Applications (0975 – 8887), Volume 65– No.12, March 2013.

2.3.Problem statement Definition

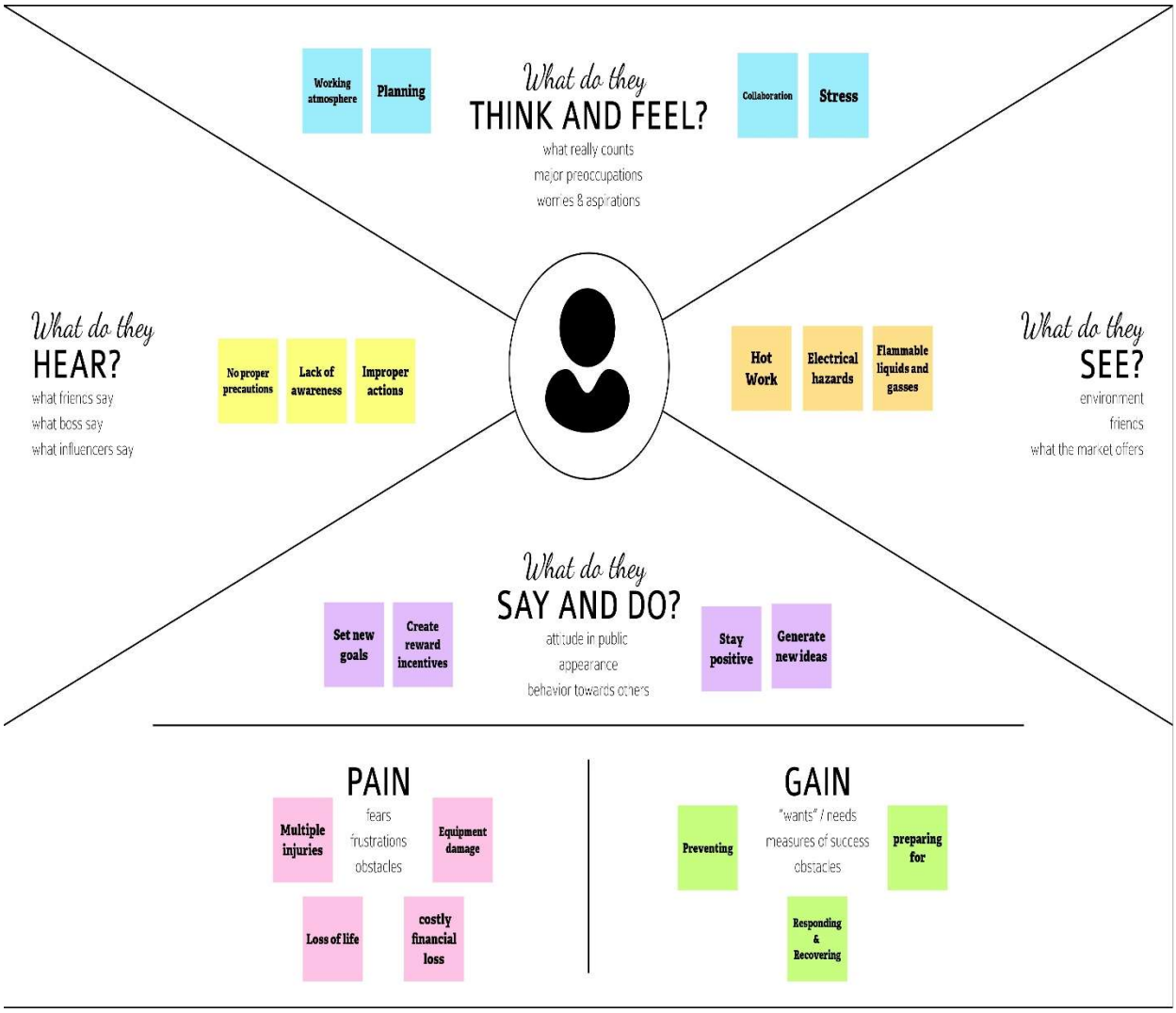
There was an industry outside the town. One day the industry was on an fire accident, the employees stopped the machines and ran outside the industry and they informed the incident to the fire station around. Then the fire officer arrived the industry and they controlled the fire with a minimal damage.

Who does the problem affect?	Working People, Proprietor, Share Holder, Loss of Life, Surrounding Environment etc
What are the boundaries of the problem?	Fire station, Hospitals, Industries
What is the issue?	Fire Alarms should be checked Periodically, Electrical Hazards, Combustible Dust, Hot Work, Flammable Liquids and Gasses, Equipment and Machinery, Smoking.
When does the issue occurs?	Lack of Awareness, Improper Maintenance, False Alarm
Where is the issue occurring?	Industry-Machinery place, Power control Room, Cooking Place.
Why is it important that we fix the problem?	It can help Avoid Injuries, Loss of Life, Costly Damages, Reduce Damage to Facility/building, Protect against Potential Fines, 24/7 Protection.

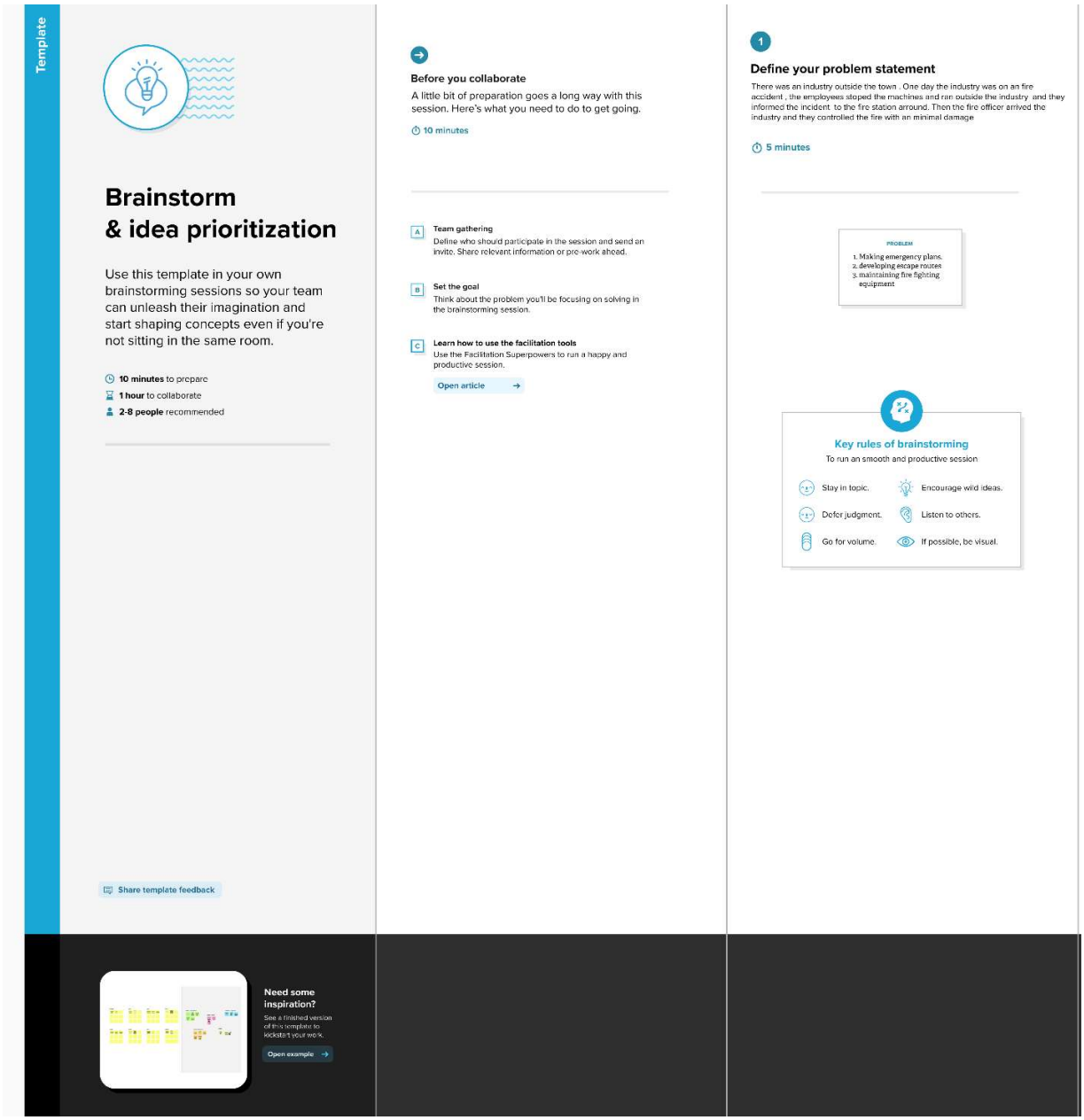
3. IDEATION & PROPOSED SOLUTION

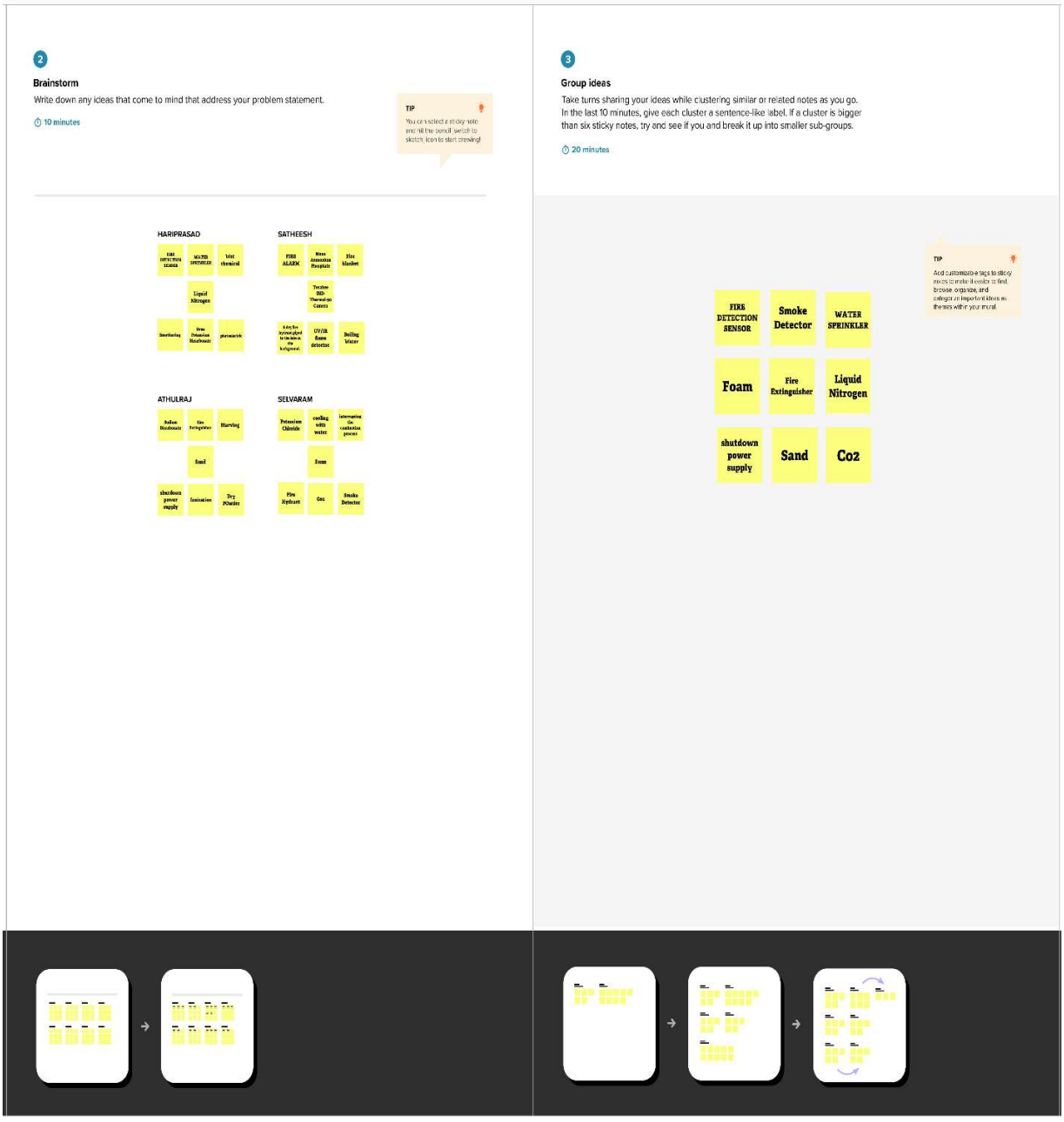
Ideation is the process where you generate ideas and solutions through sessions such as Sketching, Prototyping, Brainstorming, Brain writing, Worst Possible Idea, and a wealth of other ideation techniques. Ideation is also the third stage in the Design Thinking process. Although many people might have experienced a “brainstorming” session before, it is not easy to facilitate a truly fruitful ideation session. In this article, we’ll teach you some processes and guidelines which will help you facilitate and prepare for productive, effective, innovative and fun ideation sessions Ideation is often the most exciting stage in a Design Thinking project, because during Ideation, the aim is to generate a large quantity of ideas that the team can then filter and cut down into the best, most practical or most innovative ones in order to inspire new and better design solutions and products.

3.1.Empathy Map canvas



3.2. Ideation & Brainstorming



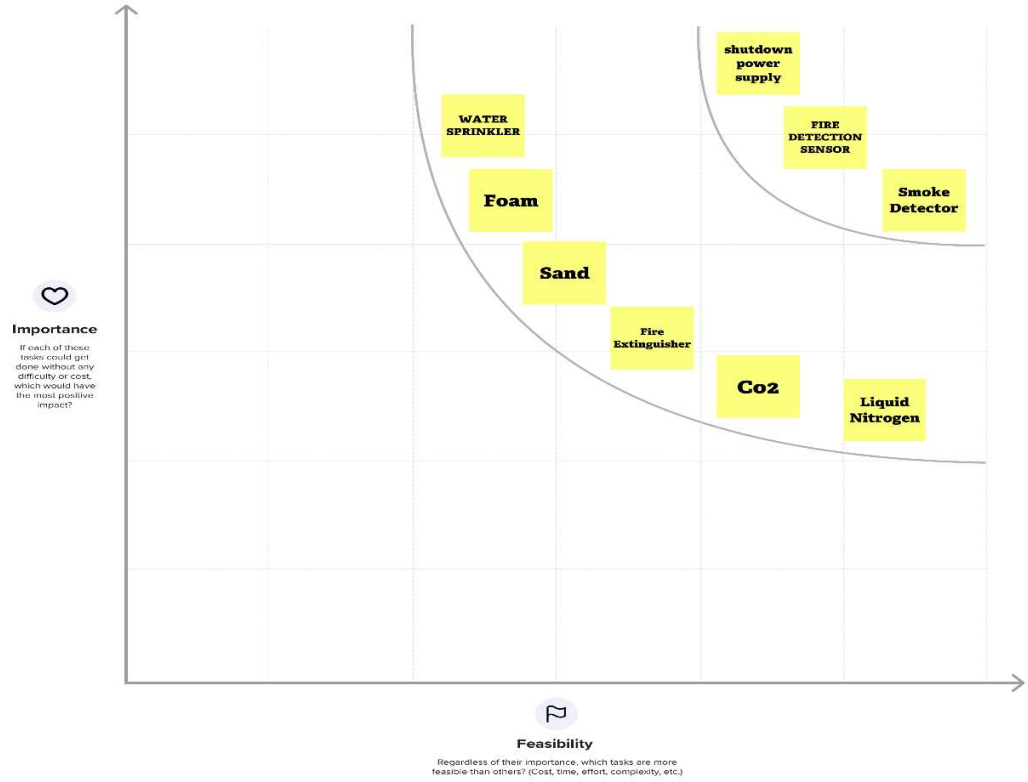

2
Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes
TIP
HARIPRASAD
SATHEESH
ATHULRAJ
SELVARAM
3
Group ideas
Take turns sharing your ideas while clustering similar or related notes as you go.
In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.
20 minutes
TIP
FIRE DETECTION SENSOR
Smoke Detector
WATER SPRINKLER
Foam
Fire Extinguisher
Liquid Nitrogen
shutdown power supply
Sand
Co2

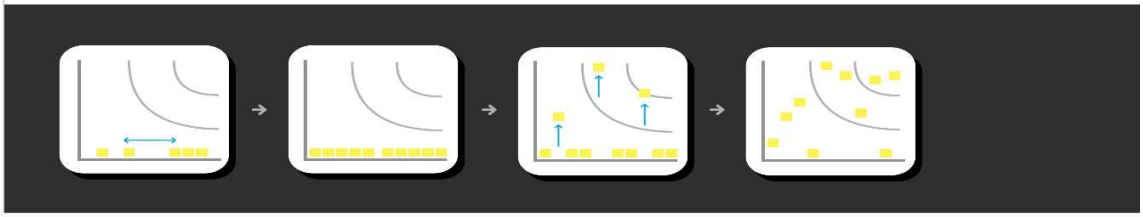
4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes





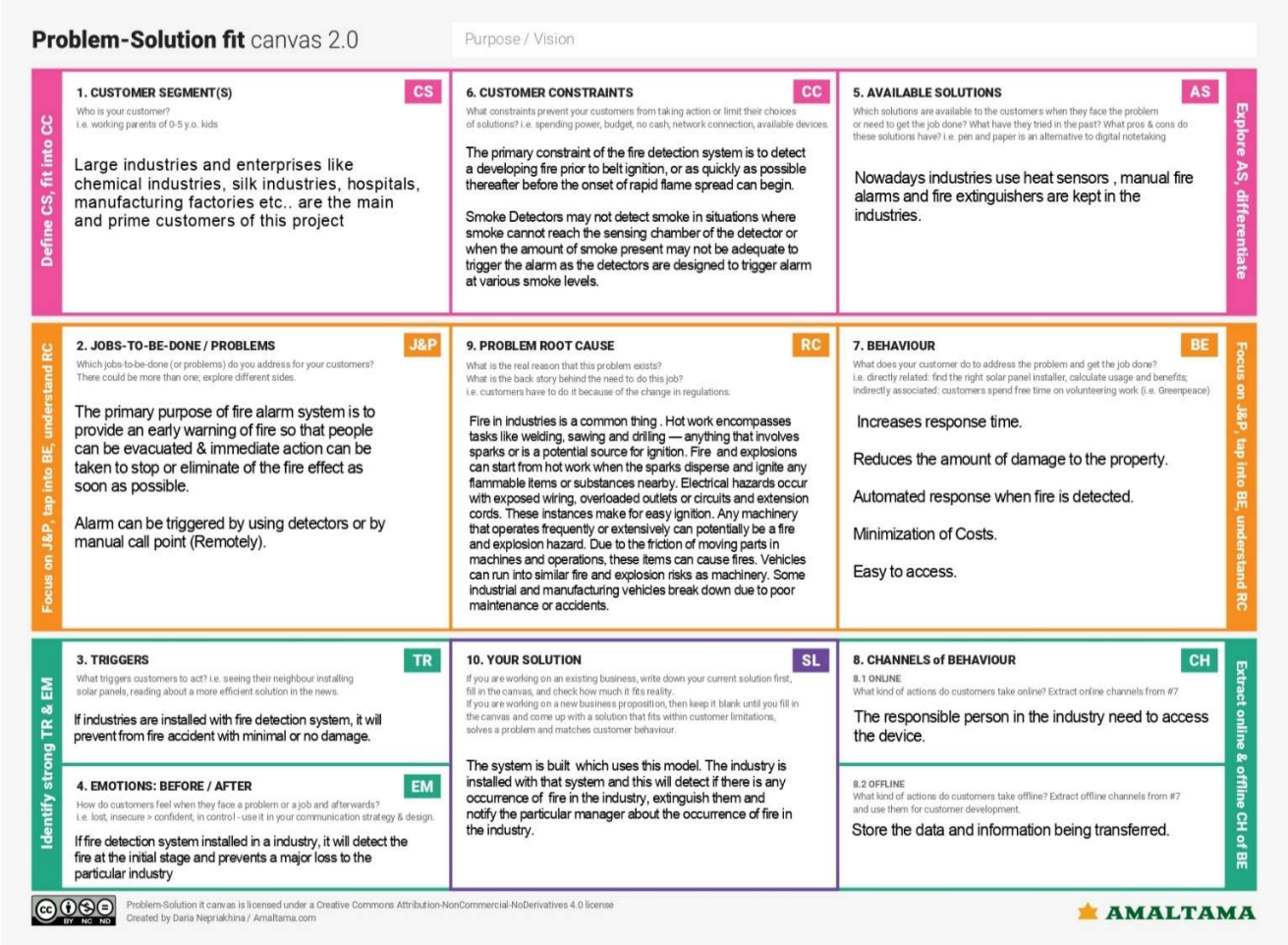
3.3.Proposed Solution

Parameter	Description
Problem Statement (Problem to be solved)	There was an industry outside the town. One day the industry was on a fire accident, the employees stopped the machines and ran outside the industry and they informed the incident to the fire station around. Then the fire station team arrived the industry and they extinguished the fire with a minimal damage.
Idea / Solution description	In an event of electrical fire accident , there are some precautionary measures that are to be followed , • The IoT based Circuit Breaker to be used. A circuit breaker is an electrical switch designed to protect an electrical circuit from damage caused by overcurrent/overload or short circuit. Its basic function is to interrupt current flow after protective relays detect a fault. • IoT security camera to be used for Monitor who is entering and leaving a building in real-time. The oxygen supply should be cut off in that place when there is no employee, which will completely shut down the fire in that place. If oxygen cannot be cut off when the employee is present in that place so, use sodium bicarbonate which can be used in the event of electric fire where we can't use water in such incident. These are all monitor and controlled by Iot.
Novelty / Uniqueness	We can use chemical flame inhibition, such as dry

	chemicals and halogenated hydrocarbons (Halogens), interrupt the flame-producing chemical reaction and stop flaming
Social Impact / Customer Satisfaction	When a fire accident takes place you should be in a position to extinguish the fire with minimal damage which will be the main area of the customer satisfaction.
Business Model (Revenue Model)	Industrial-based intelligent smart emergency response system that can control security and safety of the industry intelligently within the minimum time and the design of a system using wireless sensor networks, fire alarm sensor, and human detecting sensor to address the problems with existing disaster emergency response systems in times of fire hazard. The system has decentralized control that can intelligently guide evacuees based on the detection of humans for removing them from industry to minimize the loss of human life and industrial assist. The existing system was able to secure the industry but not within enough time as the system was designed using various sensors but not as a single unit to address the problems in times of fire or any other. Each sensor were connected to the system separately and function individually which makes the system slow. The modified system can secure the industry intelligently within minimum time as the system is designed using different sensors as a single unit to address the problems in times of fire or any other.

Scalability of the Solution	With businesses and processes changing daily, there will always be demand for new features, products and services for your business. Additionally, there are several different business models and pricing tiers you can implement that will allow you to reach all types of customers.

3.4.Problem Solution Fit



4. REQUIREMENT ANALYSIS

Requirement Analysis, also known as Requirement Engineering, is the process of defining user expectations for a new software being built or modified. In software engineering, it is sometimes referred to loosely by names such as requirements gathering or requirements capturing. Requirements analysis encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product or project, taking account of the possibly conflicting requirements of the various stakeholders, analyzing, documenting, validating and managing software or system requirements.

4.1.Functional Requirement

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 Form
FR-2	User Confirmation	Confirmation via Email
FR-3	Resource discovery	Find devices and services of interest to the requesting entity
FR-4	Resource management	Planning, Scheduling and allocating technology to a program
FR-5	Code management	Integrating sensors to web UI
FR-6	Event management	Integrating data to the users

4.2. Non-Functional Requirement

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

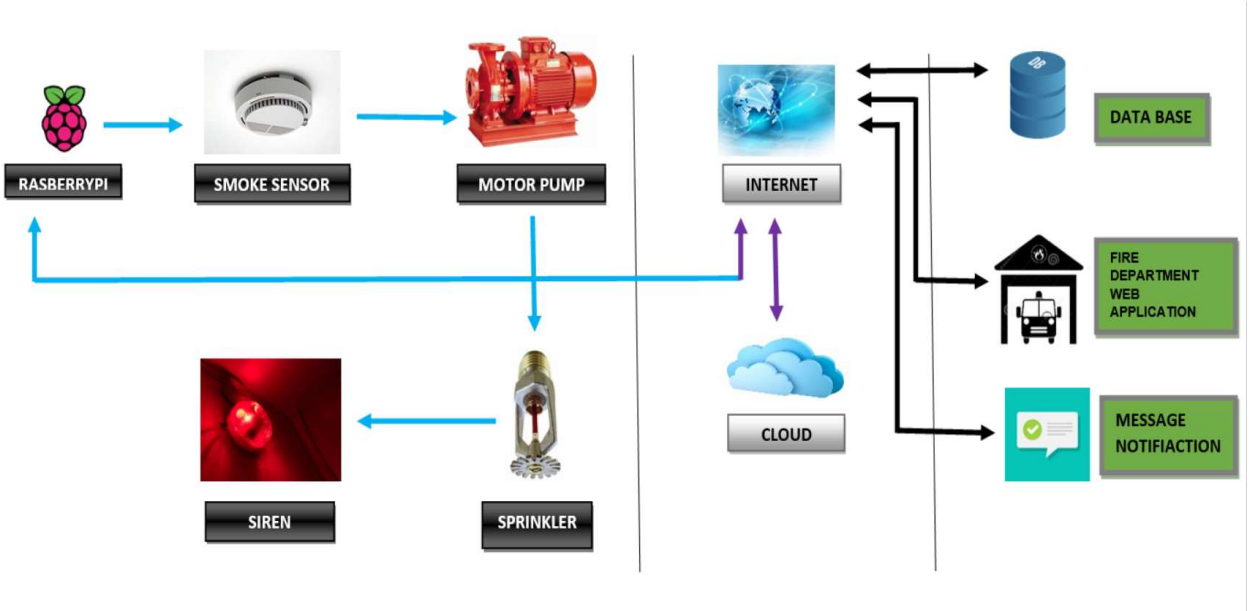
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The Application perform the tasks safely,

		effectively, and efficiently
NFR-2	**Security**	Assuring all data inside the system or its part will be protected against malware attacks or unauthorized access.
NFR-3	**Reliability**	The Application does not recover from failure quickly, it takes time as the application is running in single server.
NFR-4	**Performance**	Response Time and Net Processing Time is Fast
NFR-5	**Availability**	This application is available to all the time
NFR-6	**Scalability**	The fire and smoke detectors has a response time of 0.013 minutes which is more effective than normal system

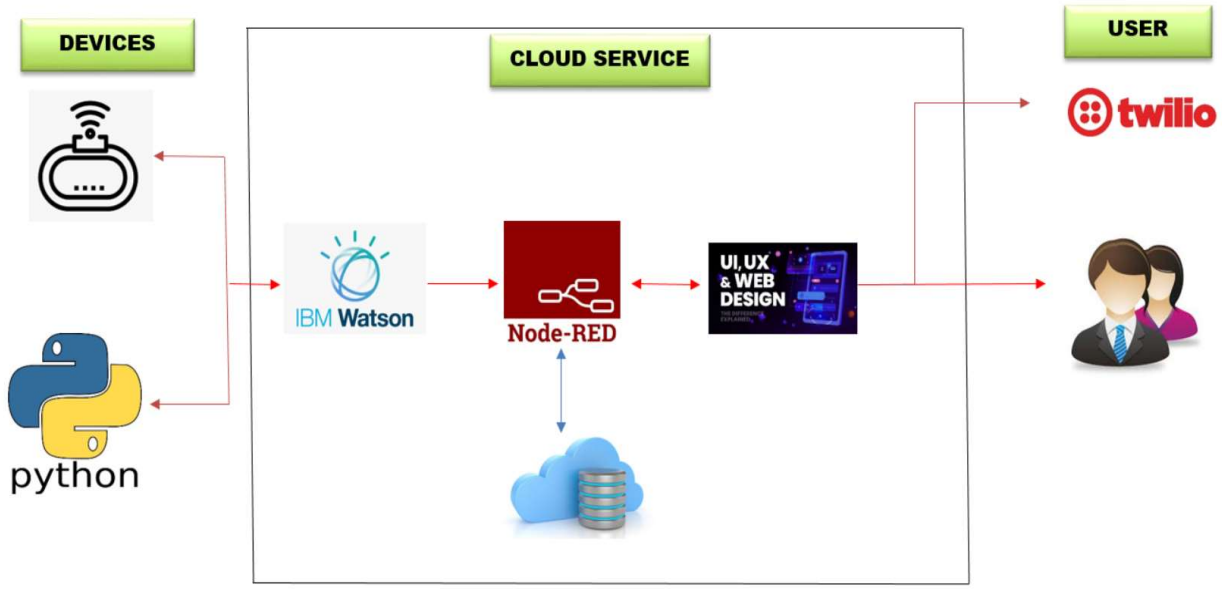
5. PROJECT DESIGN

Project design is an early phase of a project where the project's key features, structure, criteria for success, and major deliverables are planned out. The aim is to develop one or more designs that can be used to achieve the desired project goals. Stakeholders can then choose the best design for the execution of the project. The project design steps might generate various outputs, such as sketches, flowcharts, site trees, HTML screen designs, prototypes, photo impressions, and more. The project design includes everything from who is responsible for completing the project to a description of the project, its goals, outcomes and objectives. It describes when these goals, outcomes and objectives will be reached, and the major deliverables, products or features that will be completed

5.1.Data Flow Diagrams



5.2.Solution & Technical Architecture



5.3.User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
	User Confirmation	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
	Login	USN-3	As a user, I can log into the application by entering email & password		High	Sprint-1
Sensing	Sensor	USN-4	In industry, sensor sense the fire and smoke.	Indicate by sensor	High	Sprint-2
Extinguish	Actuators	USN-5	If the sensor detected the fire, next step is extinguishing the fire with the help of Sprinkler.	Extinguish the fire	High	Sprint-2
Data	Cloud	USN-6	All the values are stored in the cloud database	Store the data	High	Sprint-3

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Intimation	Siren	USN-7	If the fire is detected, employee should evacuate by the intimation by Siren/Buzzer.	Evacuate	High	Sprint-4
Notification	Event management	USN-8	Notification message will be sent to the fire department, proprietor.	Notify	Medium	Sprint-4

6. PROJECT PLANNING & SCHEDULING

Planning and scheduling of your resource plays a key role in project management. It helps you understand the scope of the project ahead of time and manage/assign your resource accordingly. Besides, it provides an overview of who's responsible for delivering what and by when. A comprehensive process that outlines the project phases, tasks under each stage, and dependencies is known as project scheduling. It also considers skills and the number of resources required for each task, their order of occurrence, milestones, interdependencies, and timeline. Compare two scenarios– one, where your project details are all over the place, and second, where you maintain a centralized data repository of your project plan. This is what a project schedule does. It brings together all the project-related information in one place that opens doors for seamless communication between the project manager and stakeholders.

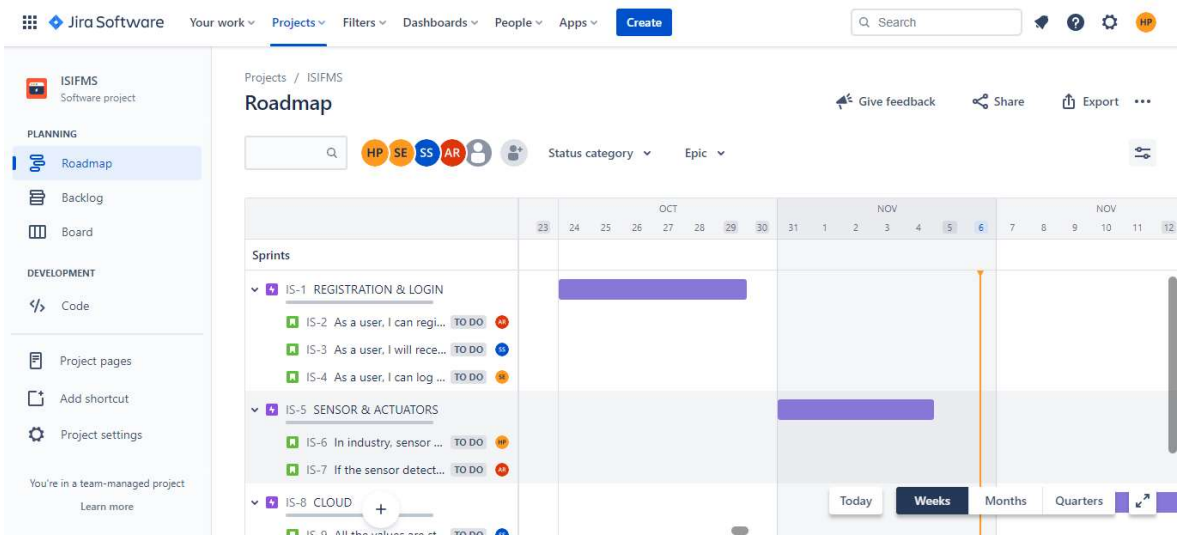
6.1.Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	Registration & Login	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	6	High
		USN-2	As a user, I will receive confirmation email, once I have registered for the application	7	High
		USN-3	As a user, I can log into the application by entering email & password	7	High
Sprint-2	Sensor & Actuators	USN-4	In industry, sensor sense the fire and smoke.	10	High
		USN-5	If the sensor detected the fire, next step is extinguishing the fire with the help of Sprinkler.	10	High
Sprint-3	Cloud	USN-6	All the values are stored in the cloud database.	20	High
Sprint-4	Siren & Event management	USN-7	If the fire is detected, employee should Evacuate by the intimation by Siren/Buzzer.	10	High
		USN-8	Notification message will be sent to the fire Department, proprietor.	10	High

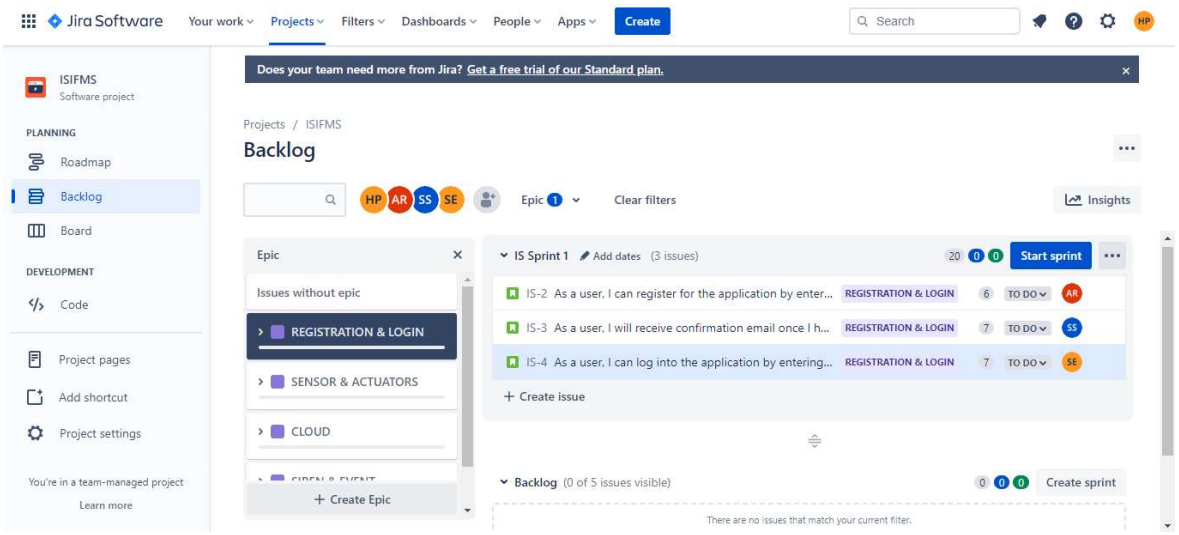
6.3.Sprint Delivery Schedule

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

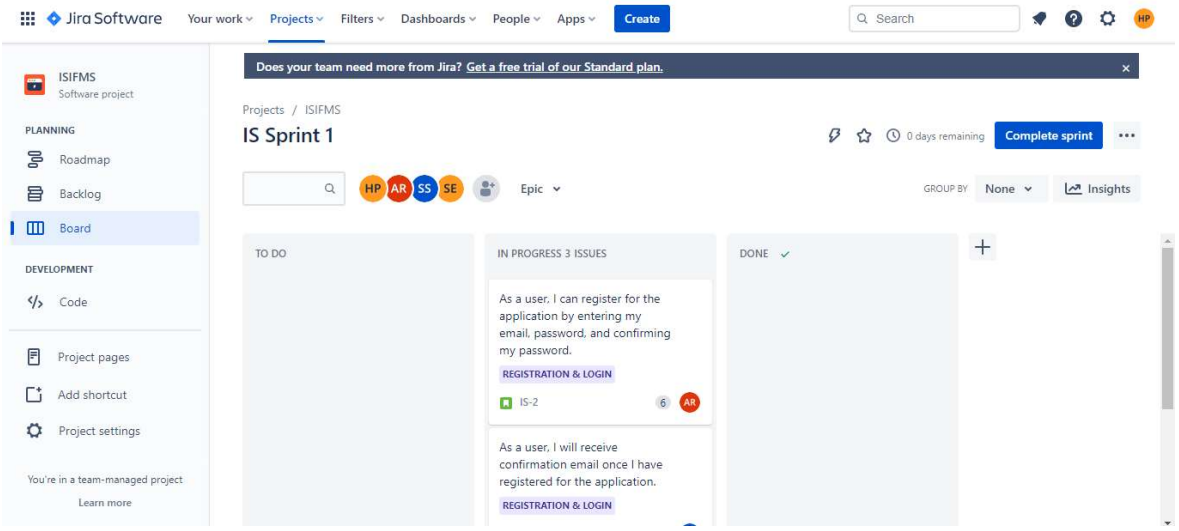
6.4.Reports From JIRA



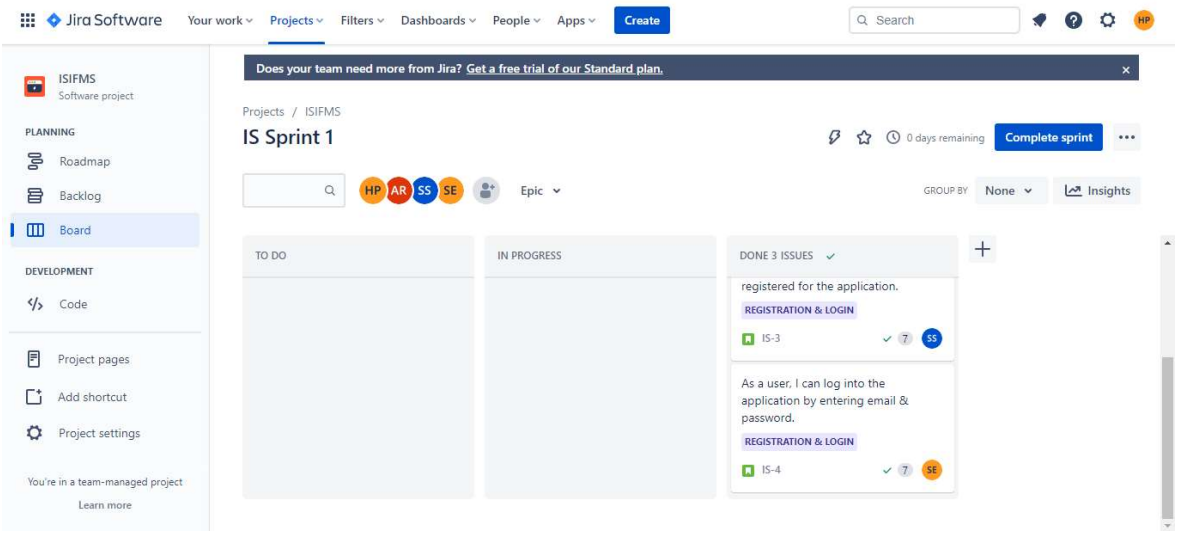
Creating Roadmap



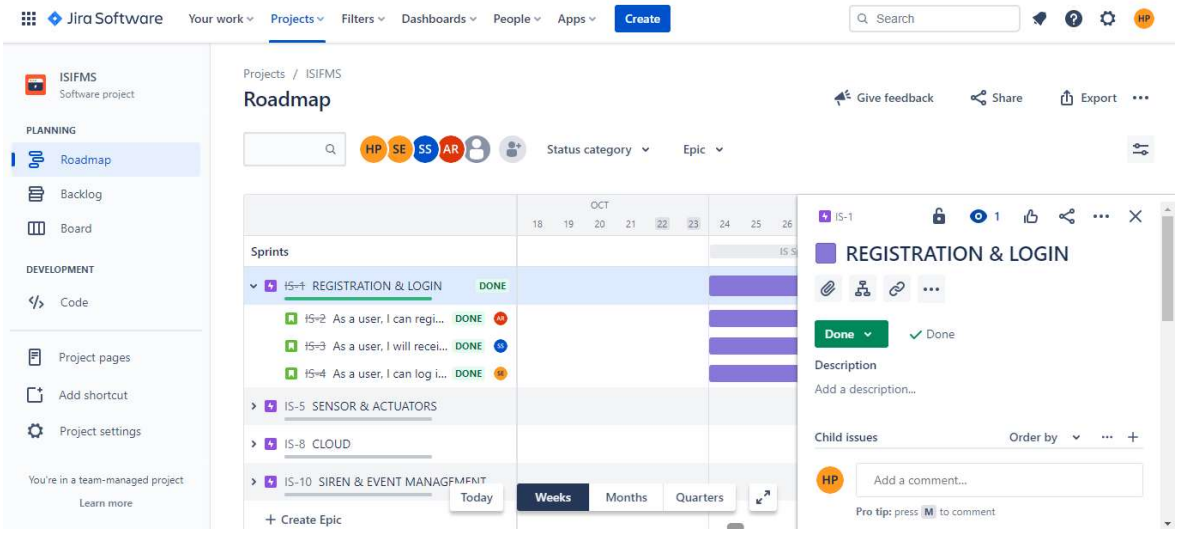
Creating Backlog



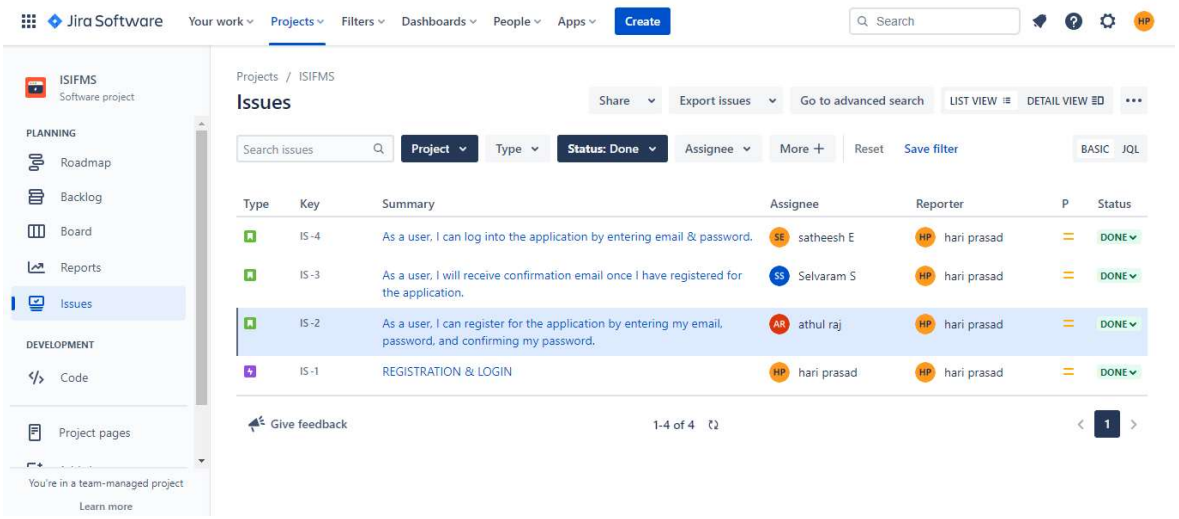
Sprint 1 is processing in Board



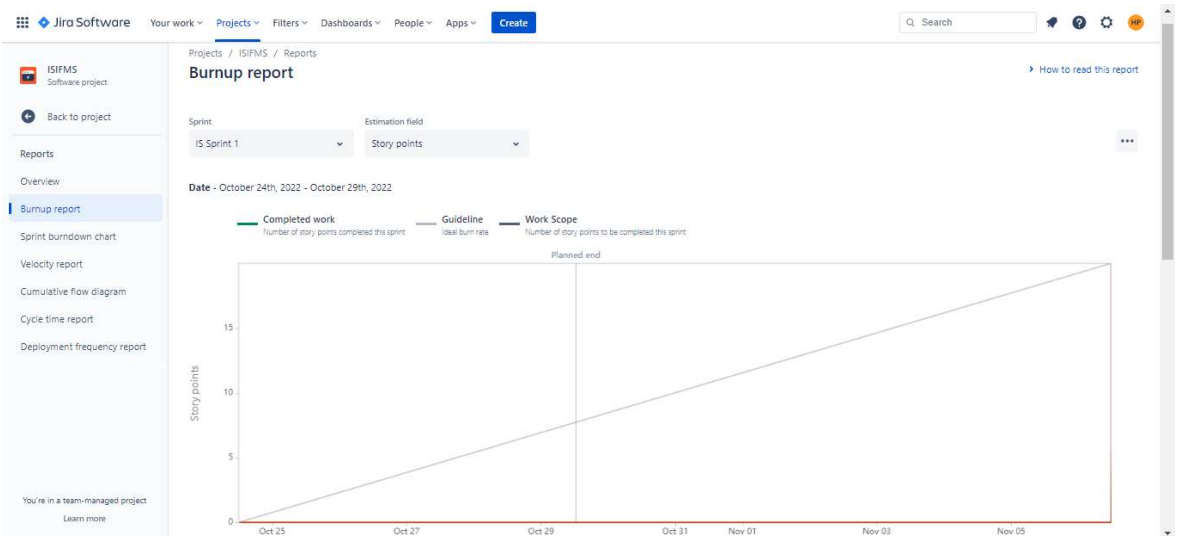
Sprint 1 is completed



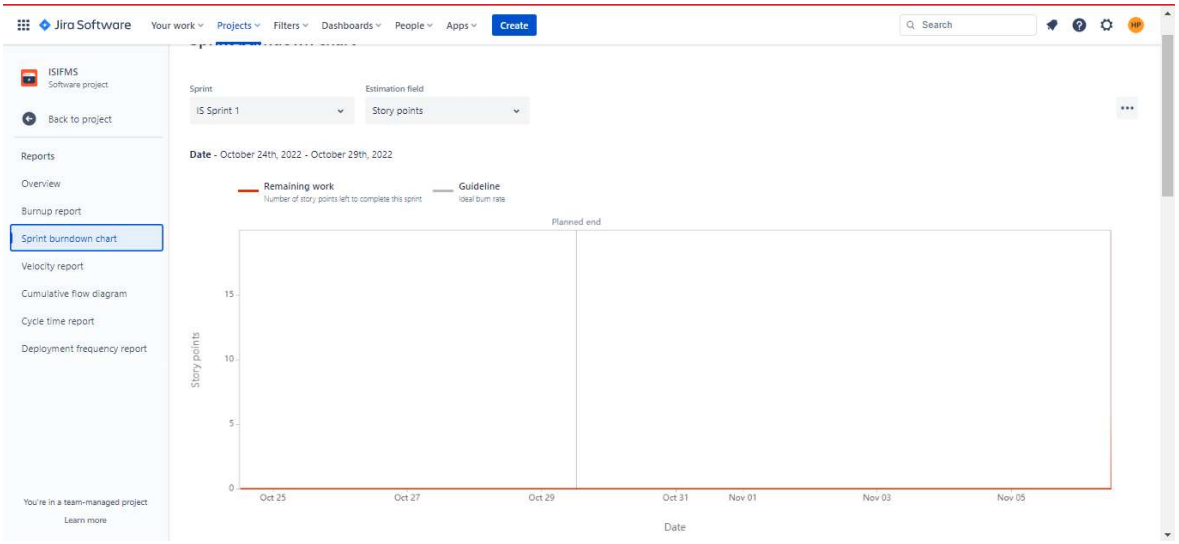
Roadmap by All Sprint



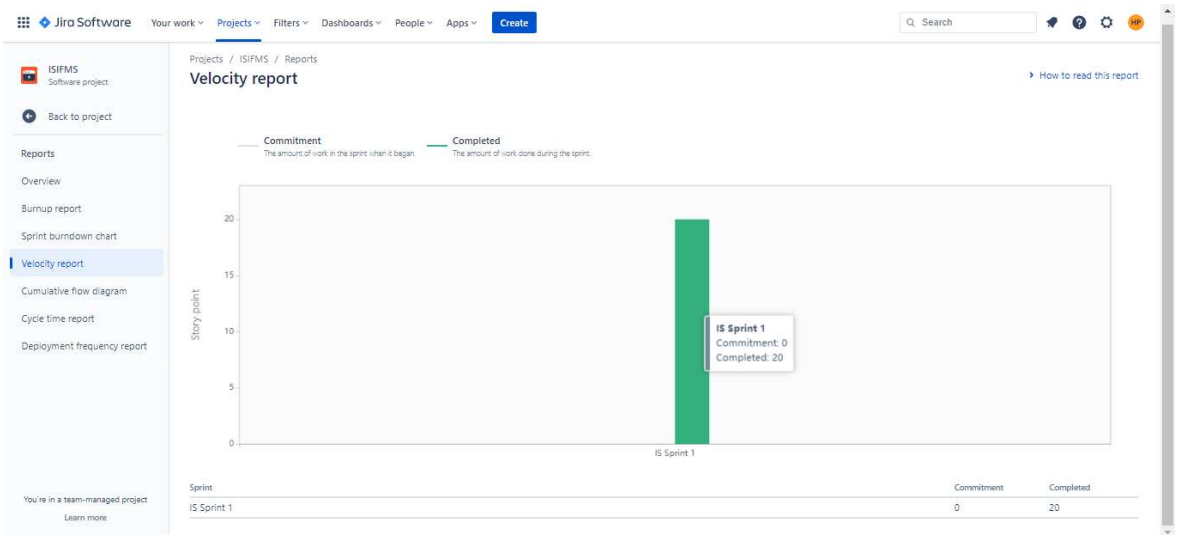
Issues by Sprints



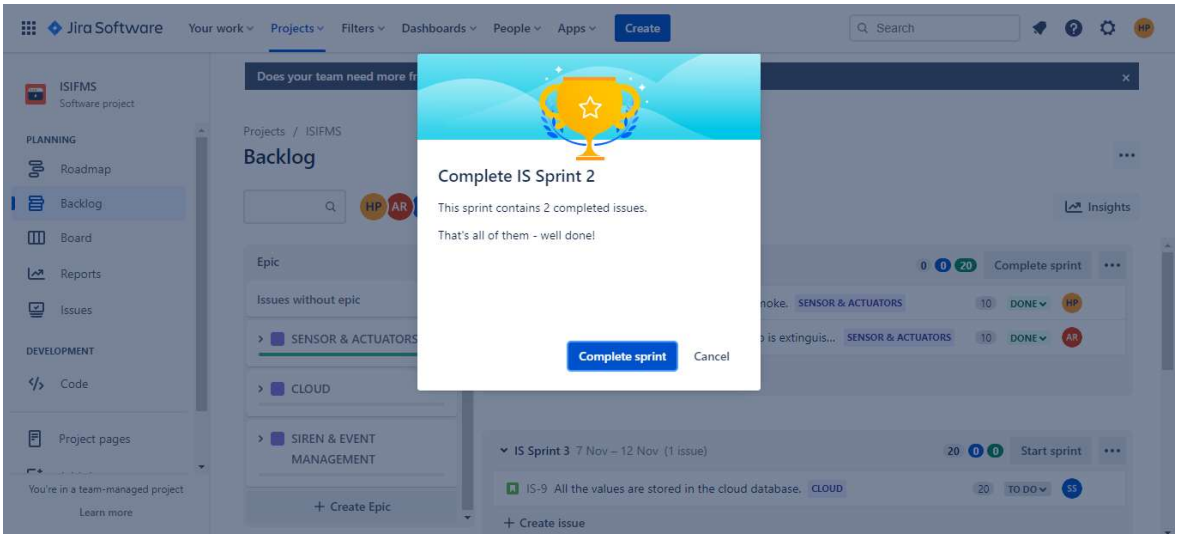
Sprint 1 Burnup Report



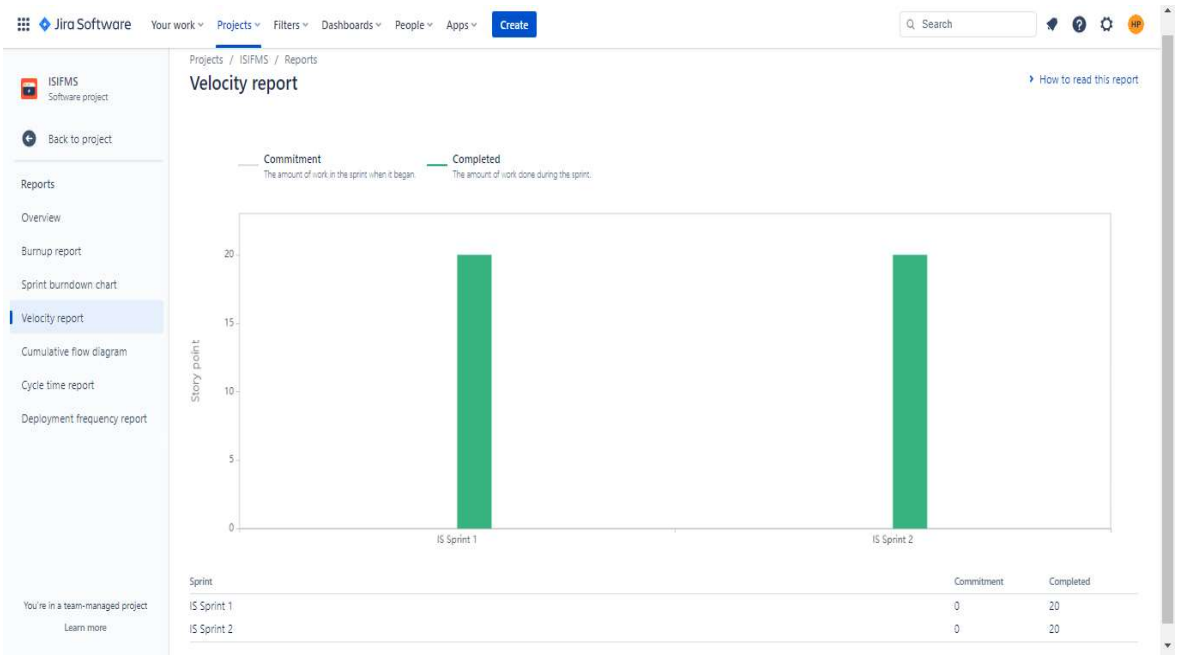
Sprint 1 Burndown Report



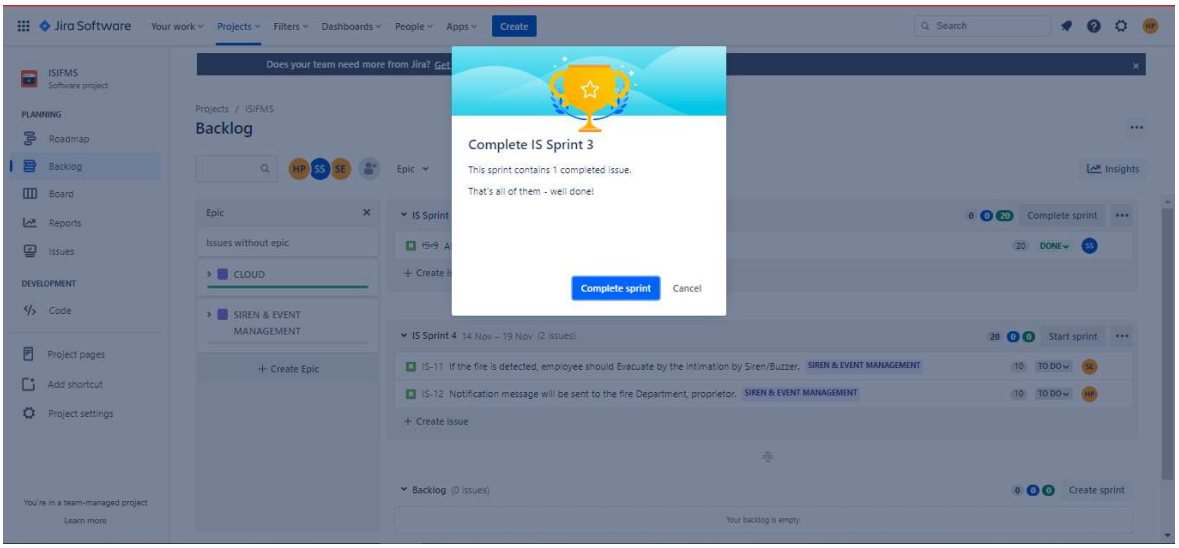
Sprint 1 Velocity Report



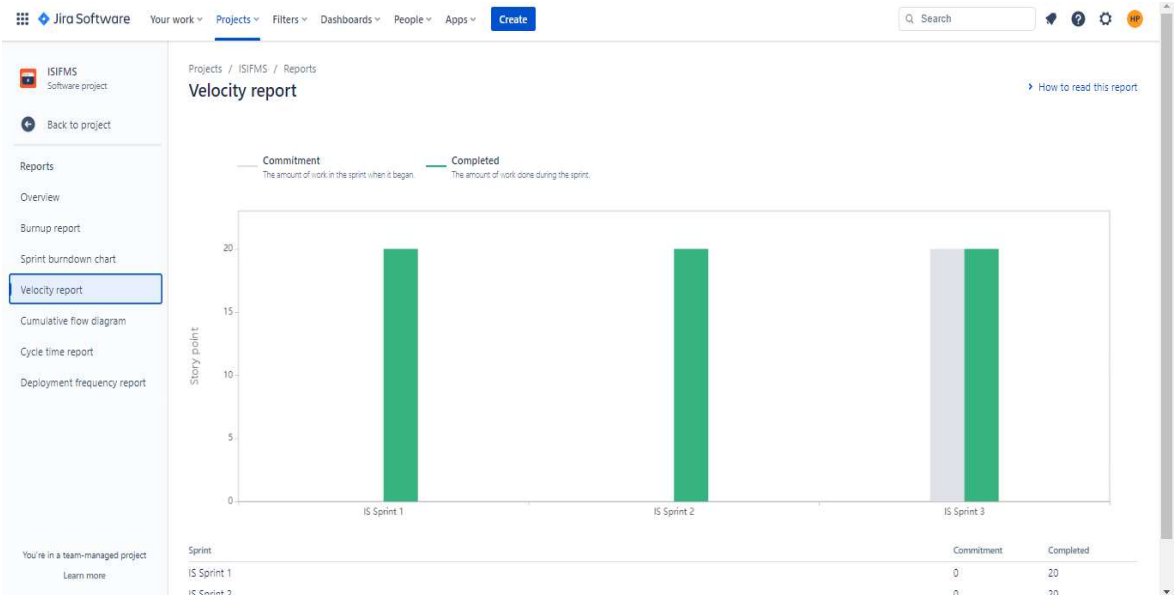
SPRINT 2 COMPLETED



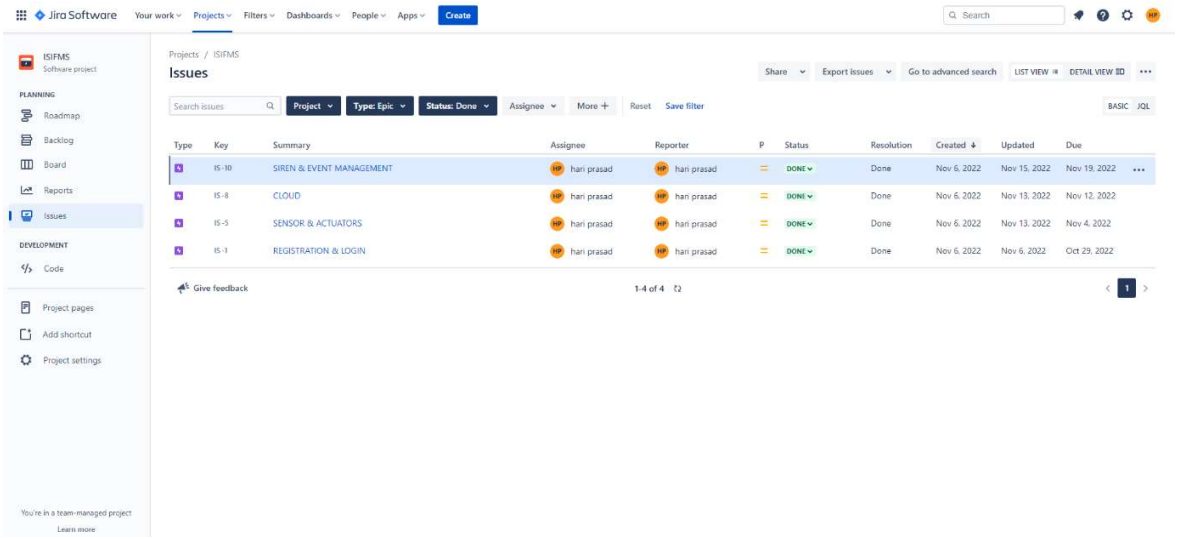
VELOCITY 2 REPORT



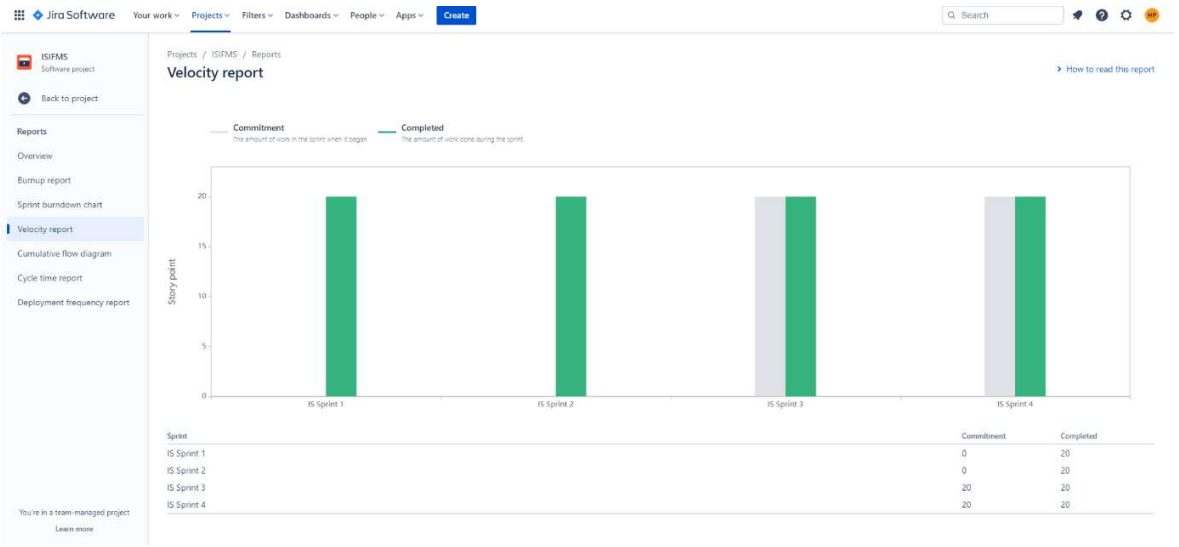
SPRINT 3 COMPLETED



VELOCITY 3 REPORT



ALL ISSUES COMPLETED



OVERALL VELOCITY REPORT

7. CODING & SOLUTION

7.1. Feature 1

To connect IBM Watson Iot Platform with code

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

import random


#Provide your IBM Watson Device Credentials

organization = "hycgw4"

deviceType = "Industry"

deviceId = "Safety"

authMethod = "token"

authToken = "6cj)4?!*u8kwo*84a6"
```

7.2. Feature 2

Publish data to IBM Watson Iot Platform

```
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 data
deviceCli.connect()
      def myOnPublishCallback():
          print ("Published Temperature = %s C" % Temperature, "Humidity = %s %%" %
Humidity, "to IBM Watson")



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


# Disconnect the device and application from the cloud
```

```
deviceCli.disconnect()
```

7.3. Feature 3

Now create Twilio SMS api for send Alert Message to higher authority

```
import os
from twilio.rest import Client
account_sid = 'ACdf538f343de5d91d1c1d2c5d79469482'
auth_token = 'f8615a53b24f4b2cb2ce3627409592b8'
client = Client(account_sid, auth_token)

        message = client.messages \
        .create(
        from_ =  '+19789615397',
        body='Emergency!!',
        to = '+917502272799')
        print(message.sid)
```

8. TESTING

Testing is the process of evaluating a system or its component with the intent to find whether it satisfies the specified requirements or not. In simple words, testing is executing a system in order to identify any gaps, errors, or missing requirements in contrary to the actual requirements.

8.1. Test cases

Count	Inputs	Outputs	Results
1	Temperature:70 Humidity:30	Sprinkler & Exhaust fan Off	Normal condition
2	Temperature:90 Humidity:20	Sprinkler & Exhaust fan Off	Normal condition
3	Temperature:100 Humidity:5	Sprinkler & Exhaust fan ON and alert Message send	Critical condition
4	Temperature:50 Humidity:35	Sprinkler & Exhaust fan Off	Normal condition
5	Temperature:99 Humidity:9	Ready to Sprinkler & Exhaust fan On	Critical condition
6	Temperature:80 Humidity 25	Sprinkler & Exhaust fan Off	Normal condition
7	Temperature:50 Humidity:35	Sprinkler & Exhaust fan Off	Normal condition
8	Temperature:65 Humidity 39	Sprinkler & Exhaust fan Off	Normal condition
9	Temperature:98 Humidity:9	Ready to Sprinkler & Exhaust fan On	Critical condition
10	Temperature:40 Humidity:36	Sprinkler & Exhaust fan Off	Normal condition

8.2. User Acceptance Testing

Defect Analysis

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By design	12	5	3	20	40
External	5	3	12	10	30
Fixed	8	2	0	20	30
Not Reproduced	3	7	8	15	25
Skipped	3	5	2	1	11
Won't Fix	2	1	7	5	15
Totals	33	23	32	71	159

Test Case Analysis

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

Section	Total cases	Not Tested	Fail	Pass
Client Application	4	0	0	4
Security	2	0	0	2
Exception Reporting	11	0	0	11
Final Report Output	5	0	0	5

9. RESULTS

9.1. Performance Metrics

CPU usage

The Python V3.7.0 is make the best use of the CPU. For every loop the program runs in O(1) time, neglecting the network and communication. The program sleeps for every 1 second for better communication with MQTT. As the program takes O(1) time and the compiler optimizes the program during compilation there is less CPU load for each cycle. The upcoming instructions are on the stack memory, so they can be popped after execution.

Memory usage

The sensor values, networking data are stored in sram of the ESP32 . It's a lot of data because ESP32 has only limited amount of memory (520 KB) .For each memory cycle the exact addresses are overwritten with new values to save memory and optimal execution of the program

Garbage collection

In the server-side garbage collection is done by the Node framework. In the IoT device, python does not have any garbage collection features. But it is not necessary in this scenario as the memory is used again for storing the data. Any dangling pointer or poorly handled address space is not allocated.

10. ADVANTAGES & DISADVANTAGES

Advantages

- All device status can be shown in a dashboard
- Automatic alerting of admin as well as fire authorities using SMS
- Automatically turning on/off sprinkler as well as exhaust fan when the temperature reach a threshold value.

- Authentication is required to turn on/off of sprinkler and exhaust fan as well as sending SMS alert manually
- Users can see the dashboard using a web application as well as MIT app inventor

Disadvantages

- Need large database since many data is stored in cloud database every second.
- If the physical device is damaged the entire operation is collapsed.
- Always need to connect with the internet.

11. CONCLUSION

This project depicts the necessity and an efficient solution for fire safety. Internet of Things was the main concept used and the project mainly builds on the techniques which are already presents and also it has overcome many obstacles present in the previous systems. But still there are few tweaks and remodelling required to get a more efficient and working model.

12. FUTURE SCOPE

The existing devices can be modified to work in different specialized environment as well as scale to house use to big labs Since fire accidents can cause major loss in human lives in homes to big industries as well as it can be used in public places , vehicles.

13. APPENDIX

Source Code

```
import time

import sys

import ibmiotf.application

import ibmiotf.device
```

```
import random

import os

from twilio.rest import Client

account_sid = 'ACdf538f343de5d91d1c1d2c5d79469482'

auth_token = 'f8615a53b24f4b2cb2ce3627409592b8'
```

#Provide your IBM Watson Device Credentials

```
organization = "hycgw4"

deviceType = "Industry"

deviceId = "Safety"

authMethod = "token"

authToken = "6cj)4?!*u8kwo*84a6"
```

 # Initialize

```
def myCommandCallback(cmd):

    print("Command received: %s" % cmd.data['command'])

    status=cmd.data['command']
```

```
    if status=="Sprinkler On":
        print ("Sprinkler is on")
    elif status=="Sprinkler Off":
        print ("Sprinkler is off")
    elif status=="Exhaust On":
        print ("Exhaust is on")
    else :
        print ("Exhaust is 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 data
deviceCli.connect()

while True:
        #Get Sensor Data from DHT11

        Temperature=random.randint(60,100)
        Humidity=random.randint(0,50)
        data = { 'Temperature' : Temperature, 'Humidity': Humidity }
        #print data
        def myOnPublishCallback():
          print ("Published Temperature = %s C" % Temperature, "Humidity = %s
%%" % Humidity, "to IBM Watson")
```

```
        success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(10)
        if Temperature==100:
          print("Sprinkler is ON")
          client = Client(account_sid, auth_token)

          message = client.messages \
          .create(
          from_ =  '+19789615397',
          body='Emergency!!',
          to = '+917502272799')
          print(message.sid)

        else :
```

```
        print(" ")



    deviceCli.commandCallback = myCommandCallback


# Disconnect the device and application from the cloud

deviceCli.disconnect()
```

GitHub Link: https://github.com/IBM-EPBL/IBM-Project-21422-1659780050

Project Demo Link: https://drive.google.com/file/d/1OP9YRk-8vQLYeHt35EBrZeoeA0lwjdDx/view?usp=sharing