

# Anna University Regional Campus, Madurai Nalaiya Thiran

**executed by**



# Industry-specific intelligent fire management system Project ID : PNT2022TMID47453

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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.

## Purpose

* + - The 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 Industry and fire department.
    - To not to recklessly endanger the life of the fire workers. This can be done by taking the control measures automatically.

## LITERATURE SURVEY

* 1. **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) 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 this, they discussed about the modern technology that can be used to reduce extremely unfortunate accidents caused by fire. We designed the whole system and calculated its effectiveness.

(2) Ondrej Krejcar proposed a model for location enhancement and personnel tracking using Wi-Fi networks. In this, he 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 We have studied this 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.

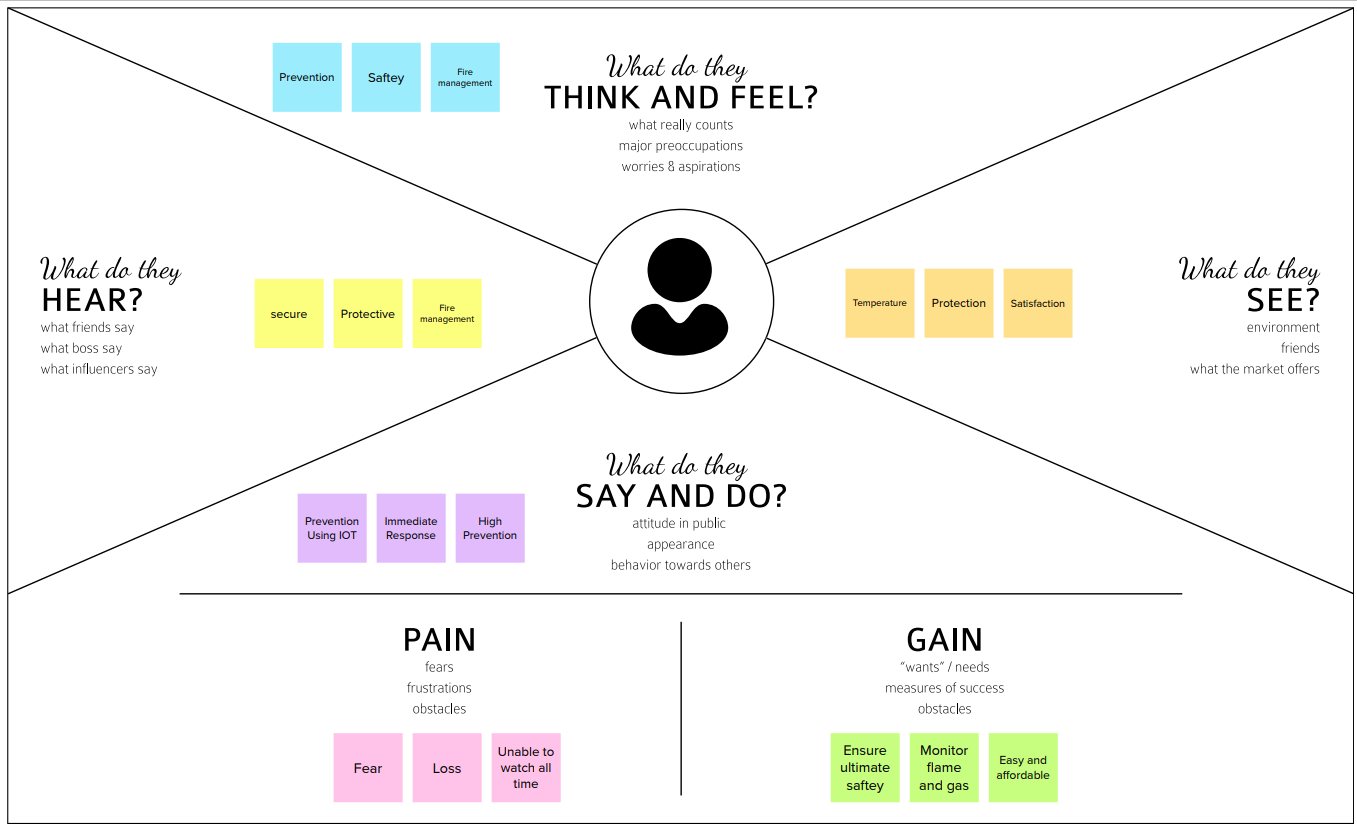
## Problem Statement Definition

Safety is a crucial consideration in the design of residential and commercial buildings to safeguard against the loss of life and damage to property. The existing fire alarm system on market nowadays is too complex in terms of its design and structure. Since the system is too complex, it needs regular maintenance to be carried out to make sure the system operates well. Meanwhile, when the maintenance is being done to the existing system, it could raise the cost of the system. Safety is significant in this day and age and it is vital that acceptable wellbeing framework be executed in spots of Structural Health Monitoring of structures. This system is used in building and home dwellings for the fire detection and prevention purpose. And it should be implemented in all the establishments where the risk of fire accidents is very high .The sensor nodes are placed in important areas of the building, which we create a network and the monitored data is transmitted to control unit through wireless sensor network and if the temperature or pressure reach above the threshold value and building damage is detected automatically, alerts the surroundings and take necessary precautions to prevent the disaster. This, safet,y system that can be used in any Constructing and constructed environments. The sensor nodes detects the maximum level that it can withhold, in the mean time it calculates where the damage is occurring and remaining time that the building can offer further resistance to damage.

**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.Emergency alerts are notified to the authorities and Fire station. So that the authorities and Fire Fighters can control the situation.

## IDEATION & PROPOSED SOLUTION

* 1. **Empathy Map Canvas**

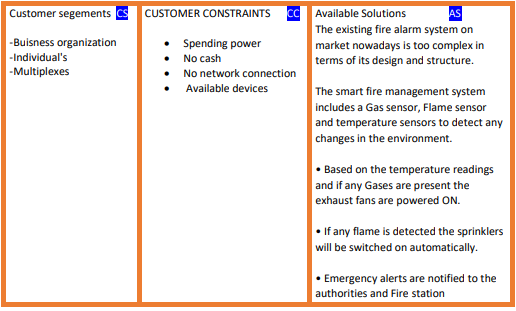


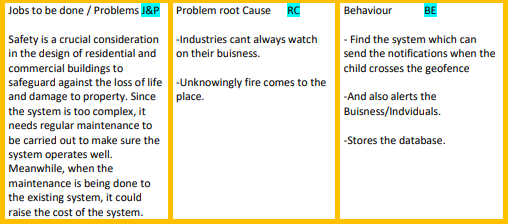
* 1. **Proposed Solution**

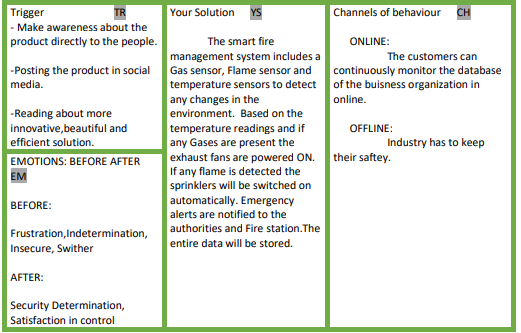
|  |  |  |
| --- | --- | --- |
| **S.N**  **o.** | **Parameter** | **Description** |
| 1. | Problem Statement  (Problem to be solved) | This system can perform different parameter  measurements early detection of building fires |
| 2. | Idea / Solution description | This fire alarm system incorporates 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 NODE RED device which was programmed with receives gas smoke ,the temperature from the sensors . The sensor is connected to the input of the python code . 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 Node Red gadget which was modified with an Dashboard 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







1. **REQUIREMENT ANALYSIS**

## Functional requirement

Following are the functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| FR-1 | User visibility | Emergency alerts via Fast SMS. |
| FR-2 | User reception | The data like amount of gas levels, smoke content and temperature are received via SMS. |
| FR-3 | User Understanding | Based on the data, the user understands that if any of the data is above the threshold value, then there is a fire burst. |
| FR-4 | User action | In case of fire bursts, the user needs to take actions like find the best escape route, evacuate the workers and take necessary actions to control the fire. |

## Non-functional Requirements:

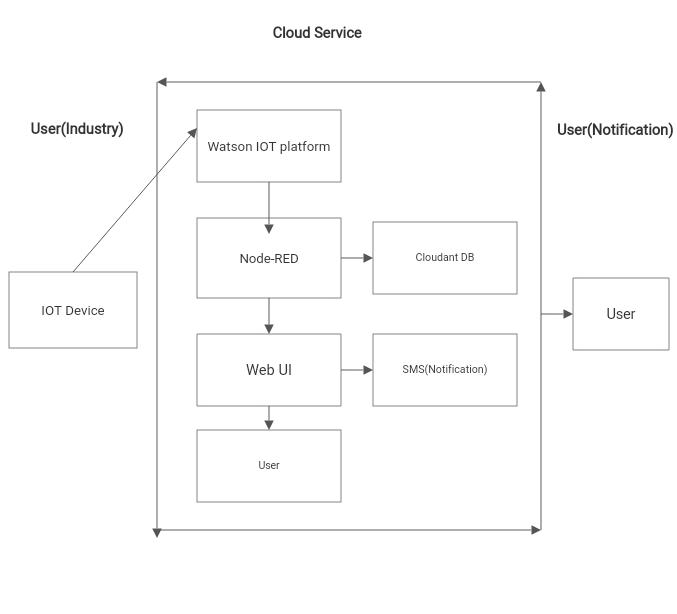
Following are the non-functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
| NFR-1 | **Usability** | It ought to have the option to caution inhabitants of the structure the utilization of every perceptible and apparent alert. |
| NFR-2 | **Security** | It ought to be utilized to guarantee the insurance of both important properties, as well as human existence. |
| NFR-3 | **Reliability** | It might have a capacity to recognize the smoke accurately and doesn't give a false caution or signal. |

|  |  |  |
| --- | --- | --- |
| NFR-4 | **Performance** | It ought to have Programmed fire sprinklers combined with identification which distinguishes the flames, yet in addition smother the flames in the underlying stage itself. |

|  |  |  |
| --- | --- | --- |
| NFR-5 | **Availability** | It could be accessible for day in and day out hours so it tends to be useful for individuals. |
| NFR-6 | **Scalability** | The sensors and boards utilized in this framework ought to have the option to effortlessly change overhaul concurring to change and need in requirements |

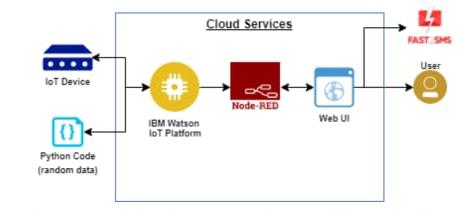
## PROJECT DESIGN

* 1. **Data Flow Diagrams**

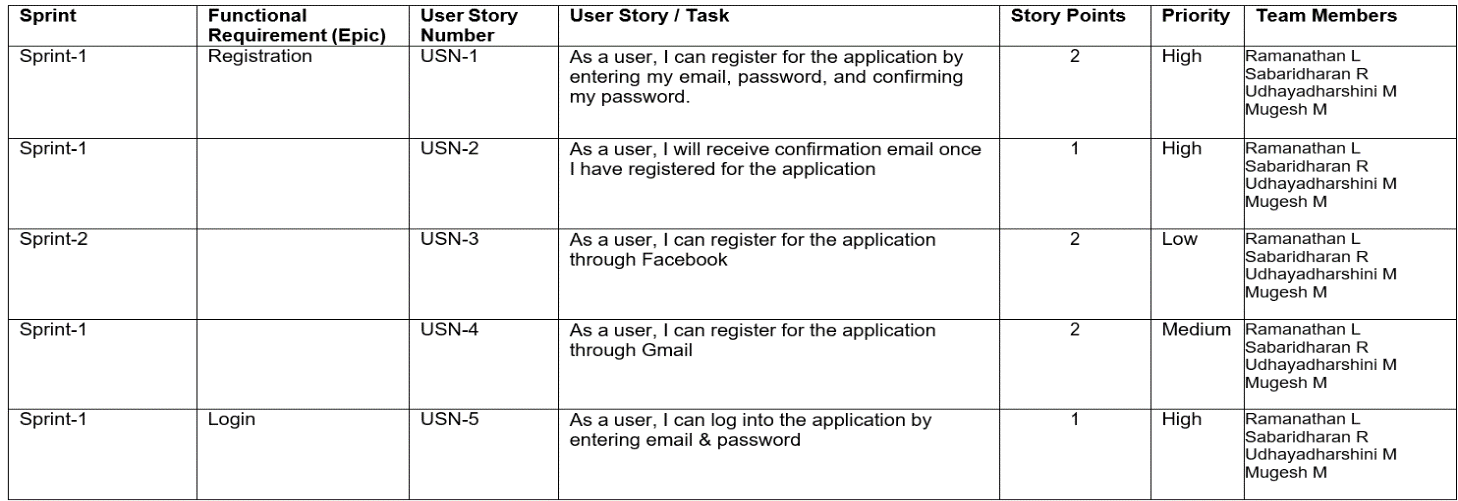
## Solution & Technical Architecture

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

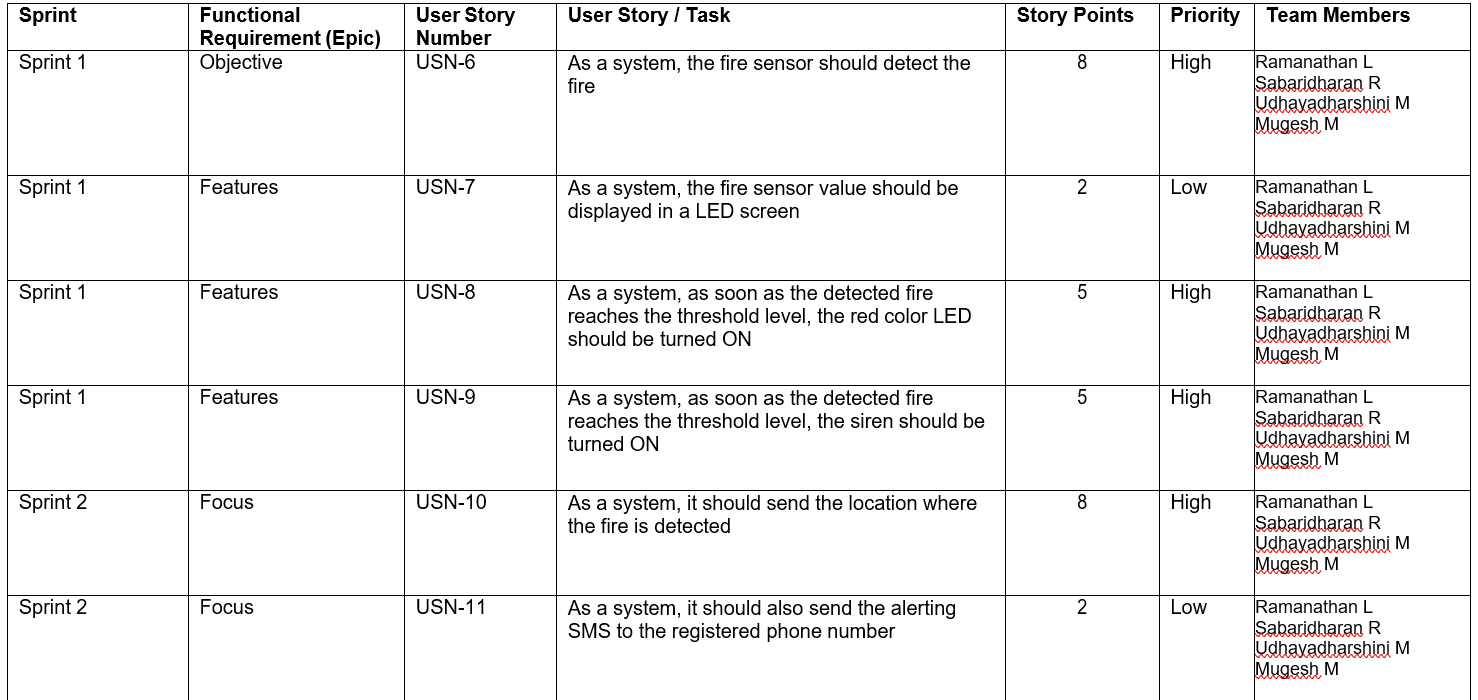
* Find the best tech solution to solve existing business problems.
* Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
* Define features, development phases, and solution requirements.
* Provide specifications according to which the solution is defined, managed, and delivered

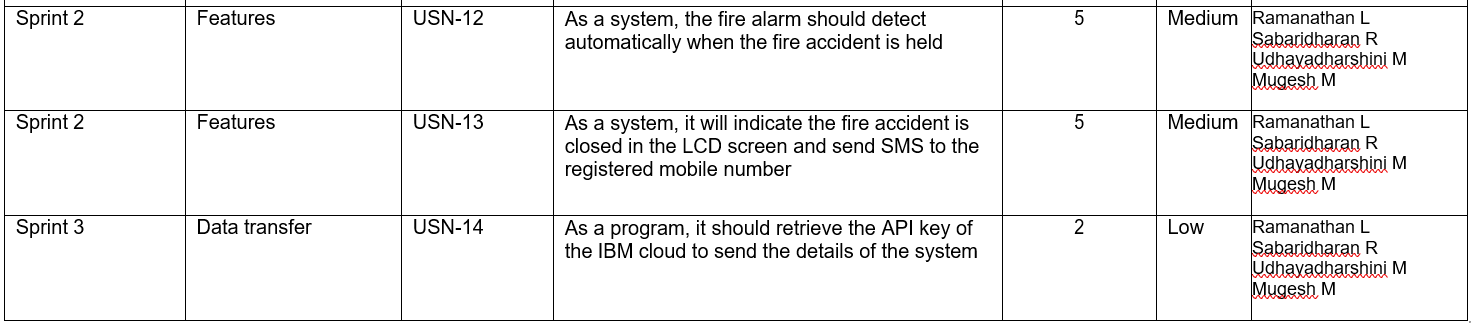
## User Stories

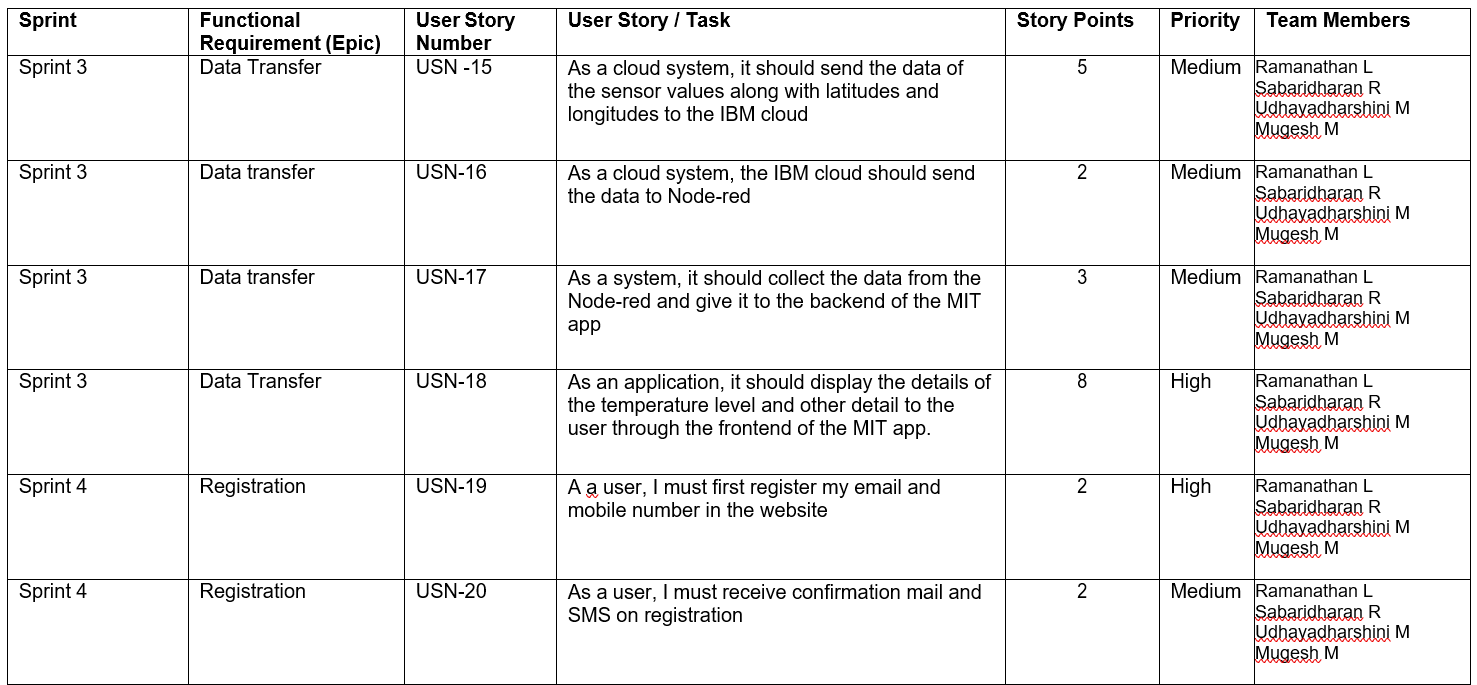


1. **PROJECT PLANNING & SCHEDULING**

## Sprint Planning & Estimation





****

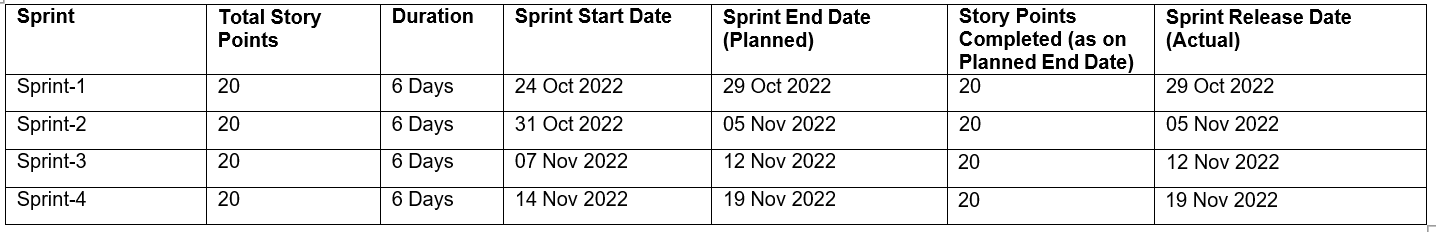
**Graphical user interface, application, table

Description automatically generated**

**Text

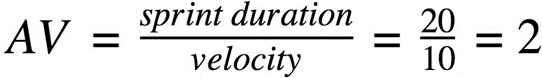
Description automatically generated**

* 1. **Sprint Delivery Schedule**



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

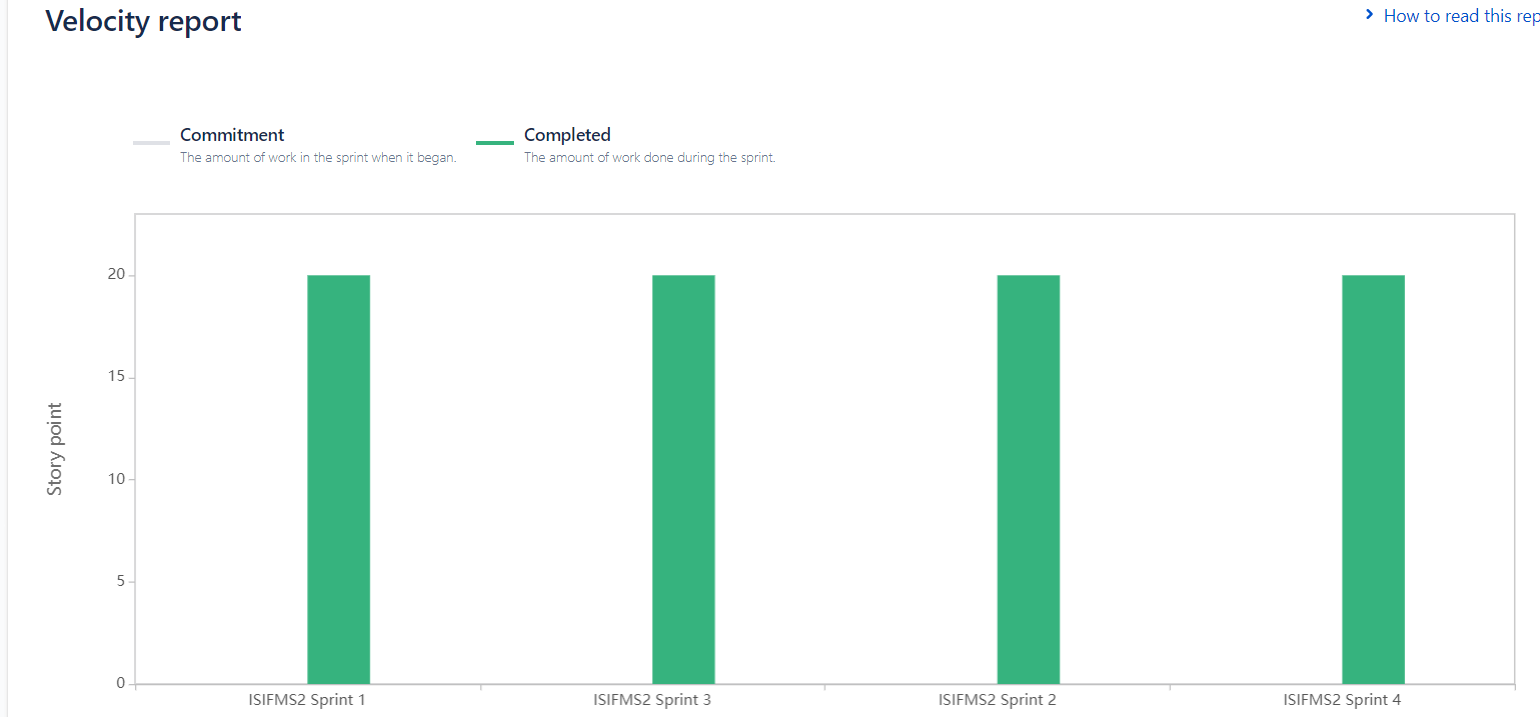
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit ( story points per day)



## Reports from JIRA

## Table Description automatically generated

<https://pnt2022tmid47453.atlassian.net/jira/software/projects/FMS/boards/2/backlog>



## CODING & SOLUTIONING

* 1. **Feature 1**

import time

import sys

import ibmiotf.application

import ibmiotf.device

import random

#Provide your IBM Watson Device Credentials

organization = "ilph7t"

deviceType = "910019104702"

deviceId = "910019104702"

authMethod = "token"

authToken = "-hht6G8AmqCPZN?Cgt"

# Initialize GPIO

def myCommandCallback(cmd):

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

status=cmd.data['command']

if status=="lighton":

print ("fan is on")

else :

print ("fan 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 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

temperature=random.randint(0,100)

flamesensor=random.randint(0,100)

Gassensor=random.randint(0,100)

data = { 'temperature' : temperature , 'flame sensor': flamesensor ,'Gas sensor': Gassensor }

#print data

def myOnPublishCallback():

print ("Published = temperature %s " % temperature , "flame sensor = %s %%" %flamesensor , "Gas sensor = %s %%" % Gassensor, "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

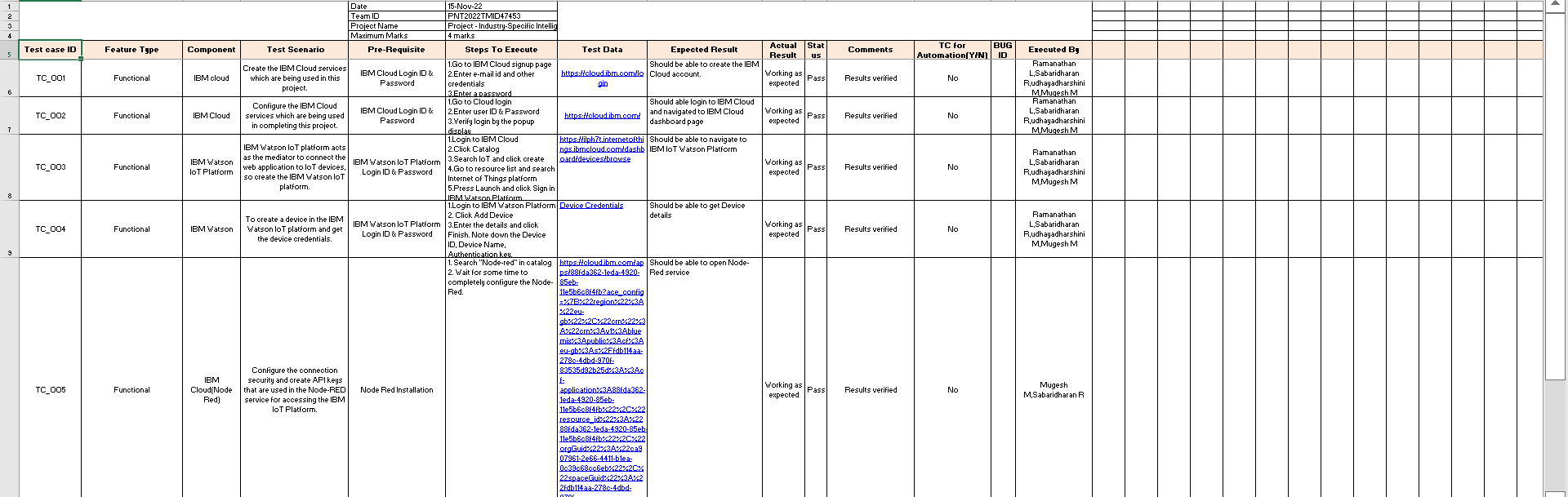
deviceCli.disconnect

## 7.2 Feature 2



1. **TESTING**

## Test Cases



A picture containing table

Description automatically generated

* 1. **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

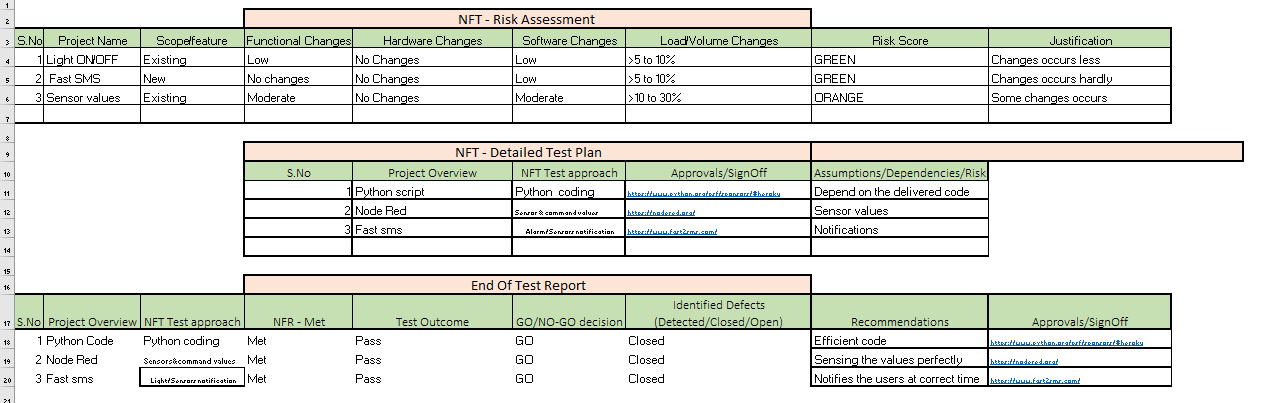
This report shows the number of test cases that have passed, failed, and untested

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 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

## RESULTS

* 1. **Performance Metrics**



1. **ADVANTAGES AND DISADVANTAGES**

The Advantages of this Industry-Speciﬁc Intelligent Fire Management system are as follows

* The user need not require expertise knowledge to control this system. This system is simple. The user can easily view the sensor values and take control actions.
* The control actions are taken automatically.
* If it is implemented in hardware, then the cost of implementation will be affordable.
* As we are sensing the sensor values continuously, any slight change in the environment is detected
* This system is in User-Friendly format.

The Disadvantage of this Industry-Speciﬁc Intelligent Fire Management system are as follows

* This system will not be able to detect the origin of ﬁre.
* This system will not provide the escape route if there is ﬁre outbreak.
* If the industry has speciﬁc changes in the environment, then this system will gives false alarm.

## CONCLUSION

An understanding and having Fire Management system in the industry is of utmost importance.This project is a ﬁre management system that can be user in the industry based on IOT.This system creates a simulation device credentials in IBM WATSON IOT PLATFORM.In node-red,necessary nodes are installed and used.These nodes are installed and used.These nodes are deployed and the data is collected.In the event of ﬁre, this system can issue sprinkler on,exhaust fan on.This remote user monitoring system can monitor the system status of each node in real time.This system monitors the data continuously so that the any slight change in the environment can be easily detected.This ensures good control accuracy .This Industry- Speciﬁc Intelligent Fire Management ensures the protection of property, asset and the processes are cost effective and the automatic measures are in control.

## FUTURE SCOPE

The future scope of this project is to add additional features like triggering the extinguisher automatically, predict the escape route if the ﬁre outbreaks and to implement this system in real time using hardware**.**

## APPENDIX

**Fig : Technology architecture of our project**

Source Code:

[https://github.com/IBM-EPBL/IBM-Project-6890- 1664363413/tree/main/Develop%20The%20Python%20Script](%20%20%20%20%20%20%20%20https:/github.com/IBM-EPBL/IBM-Project-6890-%20%20%20%20%20%20%20%201664363413/tree/main/Develop%20The%20Python%20Script)

GitHub & Project & DemoLink:

## <https://github.com/IBM-EPBL/IBM-Project-6890-1664363413>