

PROJECT NAME - Hazardous Area Monitoring for Industrial Plant
powered by IoT

TEAM ID:PNT2022TMID39426

PROJECT REPORT submitted by

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PROJECT REPORT

1.INTRODUCTION

1.1 Project Overview

Industrial hazard is the danger or chance of accidental injury to the worker while engaged at his accustomed work in the plant. In industrial areas fire accidents can prevent by fire detection using temperature, gas and flame sensors with automatic water sprinkler, Harmful or toxic gas leakages can identify by monitoring harmful gases and intimate alert message to safety control board of industry, Machine overheating can reduce by cooling machine with compressor, control the humidity and temperature instantaneously in order to have stable, controllable atmospheric conditions. Identifying industrial hazards allows employers to protect their worker from accidents, injuries, and fatalities.

1.2 Purpose

Safety stands as the foremost priority in most of today's technology-aided industrial processes. By using continuous monitoring and detecting of hazardous signs, major problems will be prevented at the initial stages. Thus, minor problems can prevent easily in order to prevent major problems. For preventing the kind of accidents resulting in the seizing of work and loss of the production. By controlling the hazard to the minimal level, accidents in the industry can be avoided.

2. LITERATURE SURVEY

2.1 Existing Problem

2.1.1 Problem-1

A Smart Fire Detection System using IOT Technology With Automatic Water Sprinkler.

Hamood Alqourabah, Amgad Muneer, Suliman Mohammed Fati et al.(2020) proposed a "A Smart Fire Detection System using IOT Technology With Automatic Water Sprinkler". This paper has been developed to solve the slow response issue of fire accidents. Temperature, gas, and flame sensors are inputs. Output like LED and Buzzer indicate a fire. Water system launched with 12V water pump powered by Arduino and control by a 5v relay. The sprinkler head is the outer of the water output. An ultrasonic sensor is used to measure the tank level and inform the need for refilling. By analyzing the result, we can easily identify the sense of fire accident.

2.1.2 Problem-2

Gas monitoring and power cut-off system for underground mines.

A. Kumar, H. Kumar, V. N. Pandey, D. K. P. Singh and S. K. Chaulya et al. (2012) proposed a "Gas monitoring and power cut-off system for underground mines". This mechanism detect several hazardous gases from burning smoke, fumes (soldering) in the field of mining domain. This work includes designing and implementation of a system that continuously monitors the concentration of methane (CH₄) and carbon-monoxide (CO) gas in the underground mines, which automatically cuts off the power supply of the particular zone in an underground mine, when the concentration of CH₄ exceeds more than the permissible limit decided by the user. By analyzing this paper, The proposed gas monitoring system place a vital role in detecting the gases in mines.

2.1.3 Problem-3

Monitoring temperature, humidity and Controlling system in industrial fixed room storage based on IoT.

M.T.A.Seman, M.N.Abdulllah, M.K.Ishak et al.(2020) proposed a "MONITORING TEMPERATURE, HUMIDITY AND CONTROLLING SYSTEM IN INDUSTRIAL FIXED ROOM STORAGE BASED ON IOT". this paper was proposed new features that can detect, notify, record and control the humidity and temperature instantaneously in order to have stable, controllable atmospheric conditions. The temperature and humidity sensor is the input used to get the surrounding temperature and humidity inside the room. The NodeMCU works as the brain of the system that

receives data from DHT- 11 sensor and upload them to the database. The data and information from DHT-11 sensor will be analysed graphically on Blynk platform using NodeMCU. Humidifier triggered when the reading of temperature and humidity is less than 20% and more than 80%. The system is capable of obtaining the temperature and humidity of a space, thus providing a real time temperature and humidity monitoring either using an application in a smartphone via WIFI over IoT, a LCD display embedded in the system or a computer interface.

2.1.4 Problem-4

Toxic gas detection and monitoring utilizing internet of things.

Dr. Chalasani Srinivas, Mohan Kumar.Ch et al. (2017) proposed a “Toxic gas detection and monitoring utilizing internet of things”. This project intended to avoid industrial accidents and to monitor harmful gases and to intimate alert message to safety control board of industry using ArduinoUno R3 and internet of things. Arduinio Uno R3 board is used as central microcontroller which is connected with sensor which can continuously monitor respective environment parameters. An alarm is produced instantly if the level of the gases goes above the normal level means indication through the internet specific receiver section. Data received by sensor is stored in internet which can be used for further processing and it can be analyzed for improving safety regulations. This model can be future extended for providing better living environment for people in and around industries with a pollution controlled environment.

2.2 References

2.2.1 Problem-1

A Smart Fire Detection System using IOT Technology With Automatic Water Sprinkler.

Hamood Alqourabah, Amgad Muneer, Suliman Mohammed Fati et al, 2020.

2.2.2 Problem-2

Gas monitoring and power cut-off system for underground mines.

A. Kumar, H. Kumar, V. N. Pandey, D. K. P. Singh and S. K.Chaulya et al, 2012.

2.2.3 Problem-3

Monitoring temperature, humidity and Controlling system in industrial fixed room storage based on IoT.

M.T.A.Seman, M.N.Abdulllah, M.K.Ishak et al, 2020.

2.2.4 Problem-4

Toxic gas detection and monitoring utilizing internet of things.

2.3 Problem Statement Definition

2.3.1 Person1 (Industrial Worker)

I'm trying to manage to control catastrophic condition, but it causes disorders in human health and cause to death. Because of leakages in toxic gases which makes me feel that don't have safety while working in an industries.

2.3.2 Person2 (Industrial Worker)

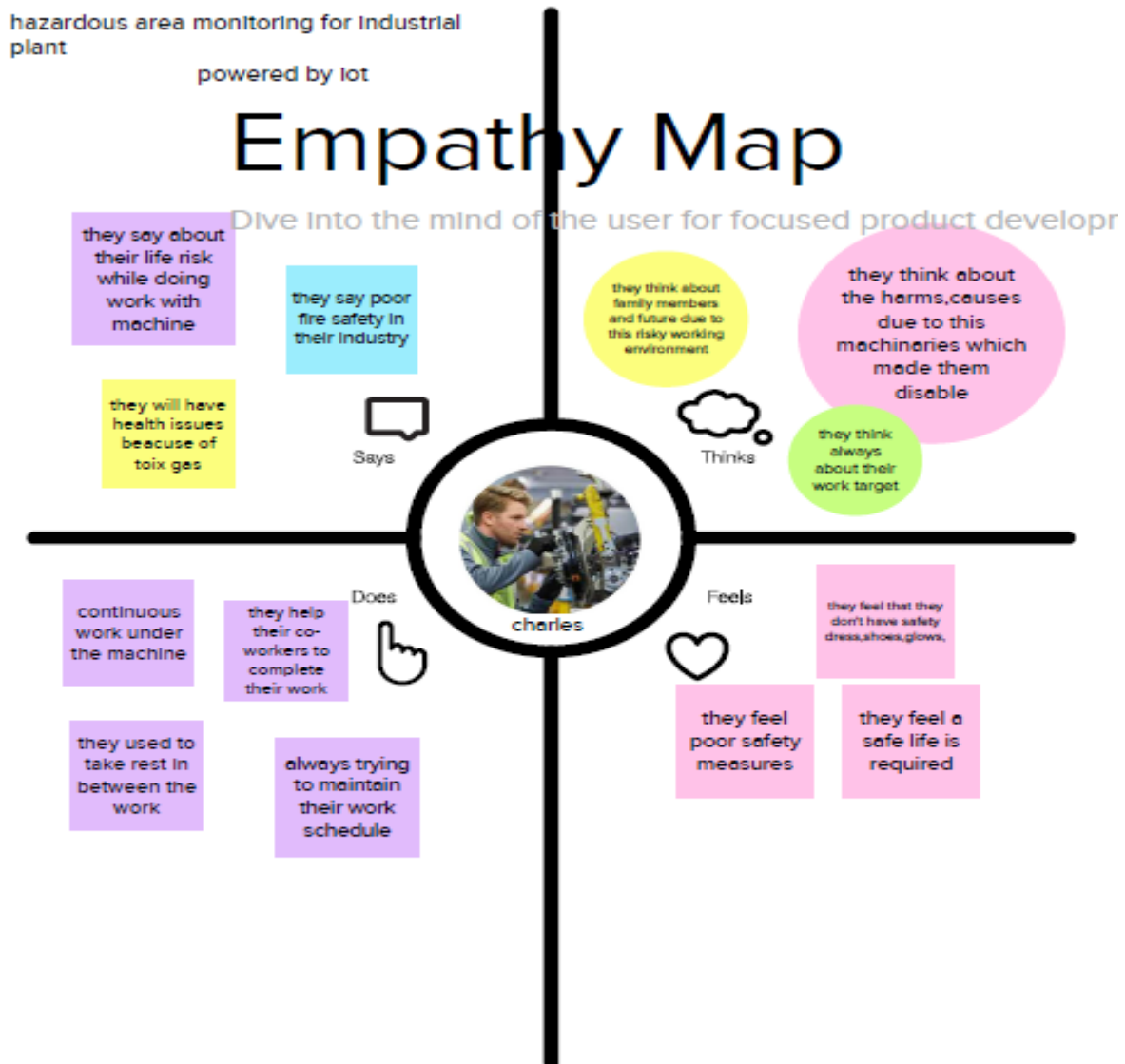
I'm trying to control the initial stage of fire hazard, but it causes extreme danger for humans and machines in industries. Because of Defective in products, Flammable Liquids, Gas explosions.

2.3.3 Person3 (Industrial Worker)


I'm trying to reduce the heat by using smart compressor, but it creates more faults in machinaries. Because of improper maintainence which make me feel storage of production.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy map canvas



3.2 Ideation & Brainstorming



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

🕒 10 minutes to prepare
🕒 1 hour to collaborate
👥 2-8 people recommended

➔

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕒 10 minutes

A Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

C Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) ➔

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

PROBLEM

Industrial hazard in the danger or chance of accidental injury to the worker with in the plant. Identifying industrial hazards allows employers to protect their workers from accidents, injuries and fatalities. Safety in simple terms means freedom from the occurrence of risk on injury or loss. Industrial safety refers to the protection of workers from the danger of industrial accidents when they work in the factories.

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Defer judgment.
- Go for volume.
- Encourage wild ideas.
- Listen to others.
- If possible, be visual.

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

TIP: You can select a sticky note and hit the pencil (switch to sketch) icon to start drawing!

Person 1

detection of overheating in machines

smart switch board control

using a lone worker alarm to protect solo employees

industrial iot bot

Person 3

Emergency shutdown system

fluid level indicators and controller

Fire detection alarm and automatic water flushing

End-Effectors and control logic for robot

Person 2

Toxic gas detection in industrial areas

Temperature monitoring at tanks in industries

Detecting minor faults in machines

Continuous monitoring of valves at tanks in industries

Person 4

Human entry detection in dangerous areas

Smart glove like control devices using the sensors and ESPRESSO

Feel the heat with arduino and cayenne

Industrial fiber follower for supplying materials

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 can break it up into smaller sub-groups.

🕒 20 minutes

1. Detection of toxic gases in industry environmental places

2. Fire detection alarm and automatic water flushing system.

3. Human entry detection in dangerous area

4. detection of overheating in machines

5. Smart switch board control.

6. Temperature monitoring at tanks in industries

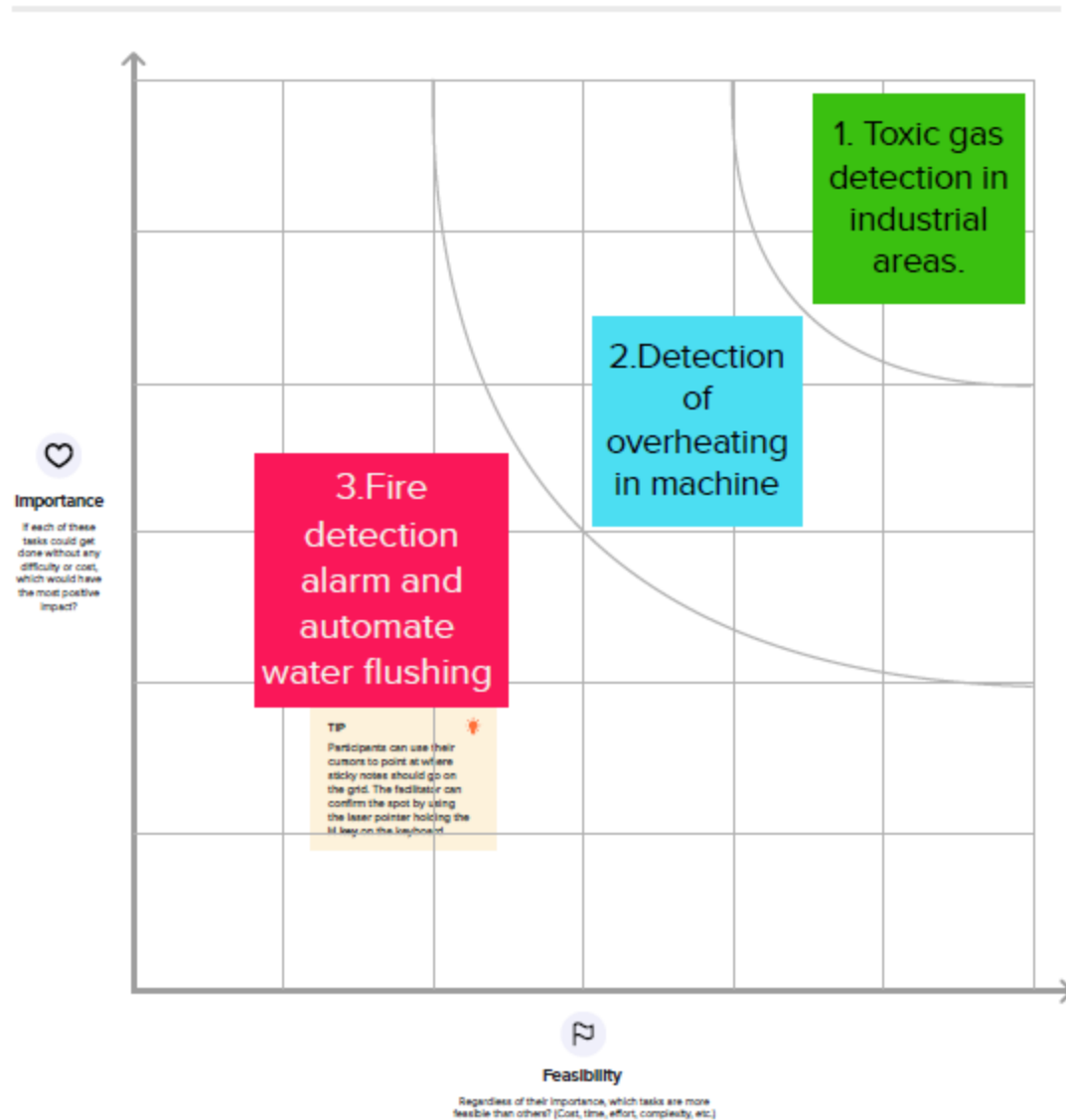
TIP: Add custom labels to sticky notes to make it easier to find, organize, organize, and categorize important ideas as they're within your mind.

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Industrial hazard is the danger or chance of accidental injury to the worker while engaged at his accustomed work in the plant. The most occurring problems in industries are fir accidents, harmful gas leakages, overheating in machines, electrical explosions, accidents due to improper operating conditions and faults in systems. Identifying industrial hazards allows employers to protect their worker from accidents, injuries, and fatalities.
2.	Idea / Solution description	In industrial areas fire accidents can prevent by fire detection using temperature, gas and flame sensors with automatic water sprinkler, Harmful or toxic gas leakages can identify by monitoring harmful gases and intimate alert message to safety control board of industry, Machine overheating can reduce by cooling machine with compressor, control the humidity and temperature instantaneously in order to have stable, controllable atmospheric conditions.
3.	Novelty / Uniqueness	Safety stands as the foremost priority in most of today's technology-aided industrial processes. By using continuous monitoring and detecting of hazardous signs, major problems will be prevented at the initial stages. Thus, minor problems can prevent easily in order to prevent major problems. For preventing the kind of accidents resulting in the seizing of work and loss of the production. By controlling the hazard to the minimal level, accidents in the industry can be avoided.

4.	Social Impact / Customer Satisfaction	<p>With the help of employee's safety, a working environment having greater motivation and satisfaction of the manpower can be created. Broadly, having a safer working environment for performing the operations is expected by a worker from their employer. There are some specific advantages that can be obtained from an accident-free plant. Huge cost savings, high legal and moral grounds, improved productivity are some of the important benefits. Greater job satisfaction and higher motivation can be obtained by the workers if their expectations of safety from hazards are fulfilled by the industrial working environment.</p>
5.	Business Model (Revenue Model)	<p>To meet industrialists explaining about the problem-solving solutions for the hazards in industries by proposing the ideas that using IoT technology. For the further development of problem solutions into products collecting funds from the industries as per the need cost. There are some specific advantages that can be obtained from an accident-free plant. Huge cost savings, high legal and moral grounds, improved productivity are some of the important benefits.</p>
6.	Scalability of the Solution	<p>By taken the investigations based on the solutions found there will be more possibilities to make the ideas in to applicable.</p> <p>The ideas proposed are possible by locating IoT sensors and sensing hazards by continuously monitoring the stability conditions in industrial environment. This mechanism is feasible because it is easy to setup, user friendly, wireless detector, predicts the risk, in beforehand, affordable etc., in today's technology application of these kind of sensor are very successful, trustworthy and easily accessed in many fields of work.</p>

3.4 Problem Solution fit

Define CS, fit into	1. CUSTOMER SEGMENT(S) CS <ul style="list-style-type: none"> Industrial worker 	6. CUSTOMER CONSTRAINTS CC <ul style="list-style-type: none"> Unsafe workplace and equipments Lack of available devices Spending power and network connections in the restricted power consumption areas. 	5. AVAILABLE SOLUTIONS AS <ul style="list-style-type: none"> Provide proper personal protective equipment Select the best team for specialist tasks Turn data into information, information into insight Mark walkways and roadways clearly Focus on the equipment frequently used in industrial area 	Explore AS.
	2. JOBS-TO-BE-DONE / PROBLEMS J&P <ul style="list-style-type: none"> Toxic gases leakages Overheating in machines Electrical exposure 	9. PROBLEM ROOT CAUSE RC <ul style="list-style-type: none"> Accidents due to improper operating conditions and faults in system. Machine overheating due to frequent starts and stops, poor power condition and effective service factors. Fire accidents due to spillages of flammable and combustible materials, electrical short Circuiting and overheating of bare surfaces 	7. BEHAVIOUR BE <ul style="list-style-type: none"> Intimate alert message to safety control board of industry. To protect workers during nonroutine operations and emergencies. 	Focus on J&P, tap into BE, understand
Identify strong TR & EM	3. TRIGGERS TR <p>By controlling the hazard to the minimal level, accidents in the industry can be avoided.</p>	10. YOUR SOLUTION <ul style="list-style-type: none"> In industrial areas fire accidents can prevent by fire detection using temperature, gas and flame sensors with automatic water sprinkler. Harmful or toxic gas leakages can identify by monitoring harmful gases and intimate alert message to safety control board of industry. Machine overheating can reduce by cooling machine with compressor, control the humidity and temperature instantaneously in order to have stable, controllable atmospheric conditions. SL 	8. CHANNELS of BEHAVIOUR CH <p>ONLINE: Using Mobile applications, To pass the alert messages through notifications when problems occurs.</p> <p>OFFLINE:</p> <ul style="list-style-type: none"> Managers, supervisors, and employees are trained to understand and deal with worksite hazards. Management Commitment and Employee Involvement Using alarm sound when accident or problem occurs. 	Extract online & offline CH of BE
	4. EMOTIONS: BEFORE / AFTER EM <ul style="list-style-type: none"> They feel that they don't have safety clothes shoes, gloves They feel poor safety measures They feel a safe life is required Ensuring safe practices are employed working in confined spaces or Working at heights. Working alone may cause injuries from tools and equipments 			

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story/ Sub-Task)
FR-1	Detection of Hazard	Reporting the hazard to control node. Control the humidity and temperature instantaneously in order to have stable environment.
FR-2	Air monitoring	Identifying harmful gas leakages by Air monitoring sensors and transmitting message to user (industrial workers).
FR-3	Emergency Shutdown system	Shut down the entire system in case of peak situations for example: Machine over heating with cooling compressor.
FR-4	Fire and smoke detection	Fire detection using temperature, gas and flame sensors with automatic water sprinkler.
FR-5	End Users (Industrial workers)	Using cloud Service (Audio and visual notifications).

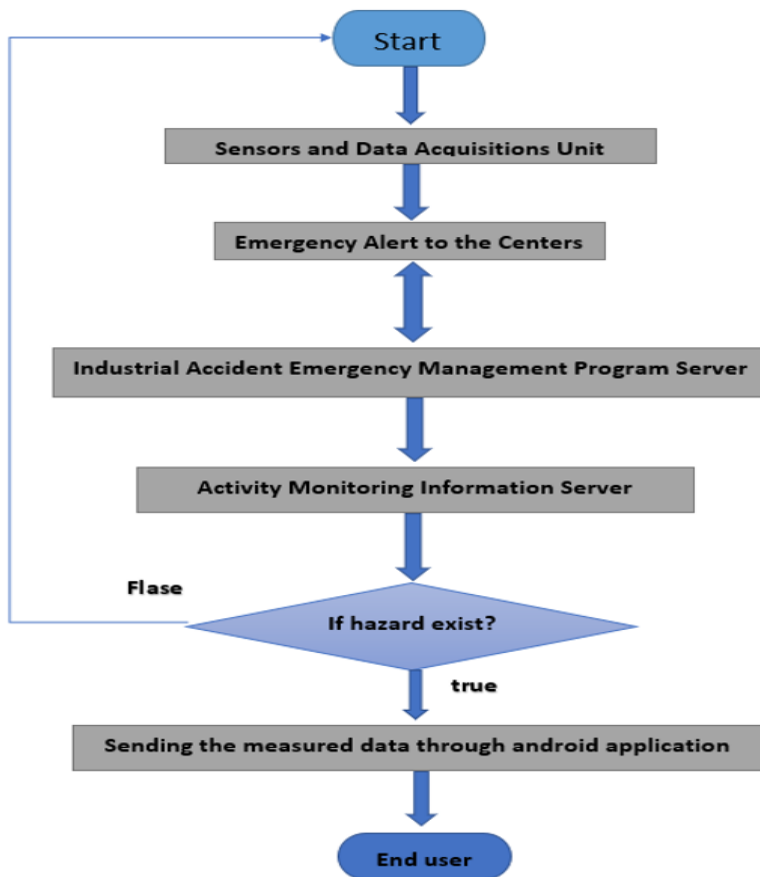
4.2 Non-Functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Huge cost savings, Greater job satisfaction and higher motivation can be obtained by the workers if their expectations of safety from hazards are fulfilled by the industrial working environment.
NFR-2	Security	By using continuous monitoring and detecting of hazardous signs, major problems will be prevented at the initial stages.
NFR-3	Reliability	High speed, not cost effective and controlling the hazard at minimal level.
NFR-4	Performance	When problem occurs, the investigations based on the problems found there will be more possibilities to make the idea into applicable.

NFR-5	Availability	This mechanism is feasible and it is easy to set up. Trust worthy and easy to access in many fields.
NFR-6	Scalability	This mechanism is feasible because it is easy to setup,user friendly, wireless detector, predicts the risk, in beforehand, affordable

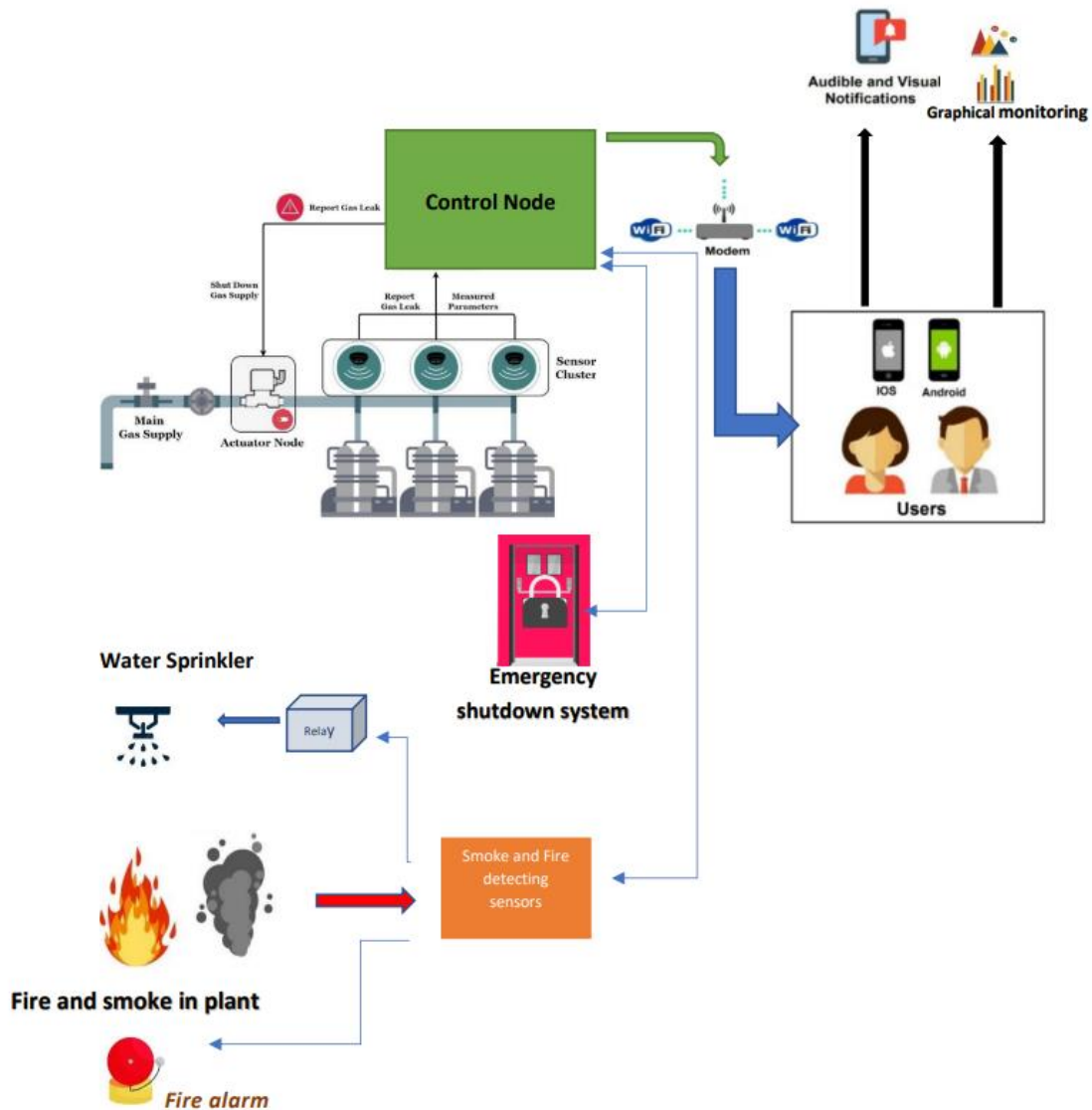
5. PROJECT DESIGN

5.1 Data Flow Diagrams

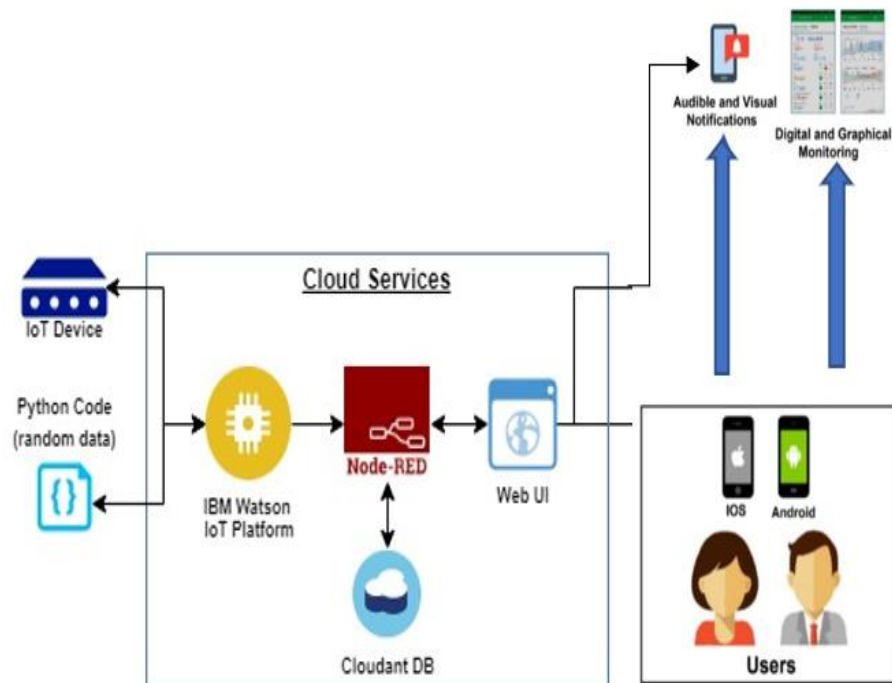


5.2 Solution & Technical Architecture

5.2.1 Solution Architecture



5.2.2 Technology Architecture



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release

Customer (Industrial worker)	Detection of hazard	USN-1	As a worker, I will receive information from control node when hazard reported	I can aware myself by receiving information from control node	High	Sprint-1
		USN-2	As a worker, I can monitor the humidity and temperature to have stable environment	I can notify the environmental changes via mobile application	Medium	Sprint-1
	Air monitoring	USN-3	As a worker, I can identify harmful gas leakages through mobile notifications	I can identify the harmful gas leakages in the field	High	Sprint-2
	Emergency shutdown system	USN-4	As a worker, I can measure the machine condition and shut down the entire system in the case of peak condition	I can shutdown the system in emergency situation	Medium	Sprint-3

	Fire and smoke detection	USN-5	As a worker, I can detect fire using temperature, smoke and flame sensors with automatic water sprinkler	I can detect fire by using sensors with water sprinkler	High	Sprint-4
End user	Alerting through message	USN-6	As a worker, I can receive the message in the form of audio, visual notification and graphical notification	I can detect the hazard and get notification	Low	Sprint-5

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Detection of hazard	USN-1	As a worker, I will receive information from controlnode when hazardreported.	4	High	D.Keerthana S.Anandhi B.Hemaranjan iM.Yogasri
		USN-2	As a worker, I can monitor the humidity and temperature to have stableenvironment	3	Medium	D.Keerthana S.Anandhi B.Hemaranjan iM.Yogasri

Sprint-2	Air monitoring	USN-3	As a worker, I can identify harmful gas leakages through mobile notifications	4	High	D.Keerthana S.Anandhi B.Hemaranjan iM.Yogasri
Sprint-3	Emergency shutdown system	USN-4	As a worker, I can measure the machine condition and shut down the entire system in the case of peak condition	3	Medium	D.Keerthana S.Anandhi B.Hemaranjan iM.Yogasri

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Fire and smoke detection	USN-5	As a worker, I can detect fire using temperature, smoke and flame sensors with automatic water sprinkler	4	High	D.Keerthana S.Anandhi B.Hemaranjan iM.Yogasri
	Alerting through message	USN-6	As a worker, I can receive the message in the form of audio, visual notification and graphical notification.	3	Low	

6.2 Sprint Delivery Schedule

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	3 Days	05 Nov 2022	07 Nov 2022	20	07 Nov 2022
Sprint-2	20	3 Days	08 Nov 2022	10 Nov 2022	20	10 Nov 2022
Sprint-3	20	3 Days	11 Nov 2022	13 Nov 2022	20	13 Nov 2022
Sprint-4	20	3 Days	14 Nov 2022	17 Nov 2022	20	17 Nov 2022

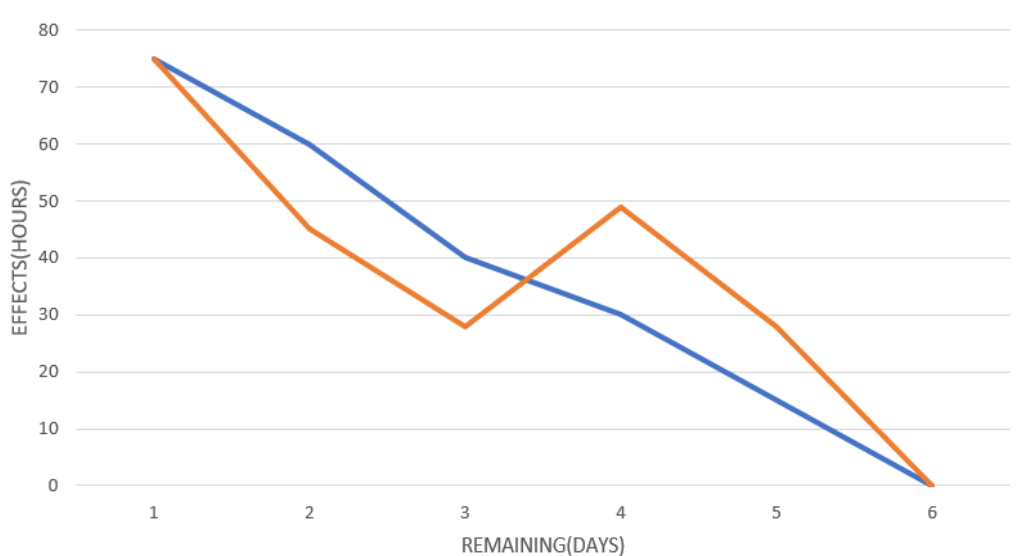
Velocity:

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

$$AV = \text{Sprint Duration} / \text{Velocity}$$

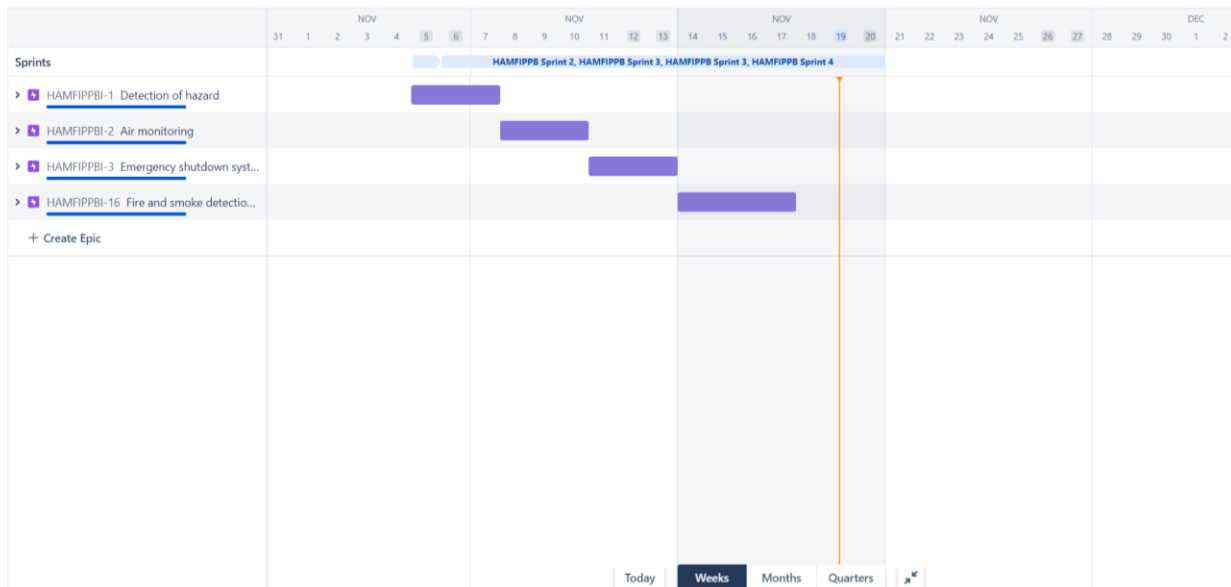
$$= 20 / 3 = 6.66$$

Burndown chart:



6.3 Reports from JIRA

Road map:



Backlog:

The image shows the Jira Software interface for a project named 'Hazardous Area Monitoring for Industrial Plant Powered by IoT'. The interface includes a top navigation bar with 'Jira Software', 'Your work', 'Projects', 'Filters', 'Dashboards', 'People', 'Apps', and a 'Create' button. A search bar is also present. The left sidebar shows the project name and a list of views: 'Roadmap', 'Backlog' (selected), 'Board', 'Code', 'Project pages', 'Add shortcut', and 'Project settings'. The main area displays the 'Backlog' for the project. At the top of the backlog, there is a banner that says 'Does your team need more from Jira? Get a free trial of our Standard plan.' Below this, the backlog is organized into two sprints. The first sprint is 'HAMFIPPB Sprint 1 5 Nov - 7 Nov (1 issue)', which is marked as 'Complete sprint'. It contains one issue: 'HAMFIPBI-5 As a worker, I will receive information from control node when hazard reported. As a worker, I can monitor the hum...' with a status of 'IN REVIEW'. The second sprint is 'HAMFIPPB Sprint 2 8 Nov - 10 Nov (1 issue)', which is also marked as 'Complete sprint'. It contains one issue: 'HAMFIPBI-6 As a worker, I can identify harmful gas leakages through mobile notifications' with a status of 'IN REVIEW'. Each sprint has a '+ Create issue' button at the bottom.

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Projects / Hazardous Area Monitoring for Industrial Plant Powered by IoT

Backlog

QD Y J B A Epic

INSIGHTS

HAMFIPPB Sprint 1 5 Nov - 7 Nov (1 issue) Complete sprint

To Detect the hazards using sensing devices

HAMFIPBI-5 As a worker, I will receive information from control node when hazard reported. As a worker, I can monitor the hum... DETECTION OF HAZARD IN REVIEW

+ Create issue

HAMFIPPB Sprint 2 8 Nov - 10 Nov (1 issue) Complete sprint

To monitor the air in environment

HAMFIPBI-6 As a worker, I can identify harmful gas leakages through mobile notifications AIR MONITORING IN REVIEW

+ Create issue

Jira Software

Your work

Projects

Filters

Dashboards

People

Apps

Create

Q Search

KD

Hazardous Area Monit...

Software project

PLANNING

Roadmap

Backlog

Board

DEVELOPMENT

Code

Project pages

Add shortcut

Project settings

You're in a team-managed project

Learn more

Does your team need more from Jira? Get a free trial of our Standard plan.

X

Projects / Hazardous Area Monitoring for Industrial Plant Powered by IoT

Backlog

...

Q

KD Y A HB

...

Epic

Insights

▼ HAMFIPB Sprint 3 11 Nov – 13 Nov (1 issue)

0 0 0 Complete sprint ...

To shutdown the entire system in emergency situations

■

HAMFIPBI-14 As a worker, I can measure the machine condition and shut down the entire system in the case of peak co...

EMERGENCY SHUTDOWN SYSTEM

IN REVIEW

...

+ Create issue

▼ HAMFIPB Sprint 4 14 Nov – 17 Nov (1 issue)

0 0 0 Complete sprint ...

To detect fire and smoke and to alert through messages or notifications

■

HAMFIPBI-17 As a worker, I can detect fire using temperature, smoke and flame sensors with automatic water sprinkl...

FIRE AND SMOKE DETECTION, ALE...

IN REVIEW

...

+ Create issue

▼ Backlog (0 issues)

0 0 0 Create sprint

Quickstart

X

Board:

Jira Software

Your work

Projects

Filters

Dashboards

People

Apps

Create

Q Search

KD

Hazardous Area Monit...

Software project

PLANNING

Roadmap

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Code

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Add shortcut

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X

Projects / Hazardous Area Monitoring for Industrial Plant Powered by IoT

All sprints

...

Q

KD Y A HB

...

Epic

Sprint

GROUP BY None Insights

TO DO

IN PROGRESS

IN REVIEW 4 ISSUES

DONE ✓

As a worker, I will receive information from control node when hazard reported. As a worker, I can monitor the humidity and temperature to have stable environment

DETECTION OF HAZARD

■ HAMFIPBI-5

...

As a worker, I can measure the machine condition and shut down the entire system in the case of peak condition

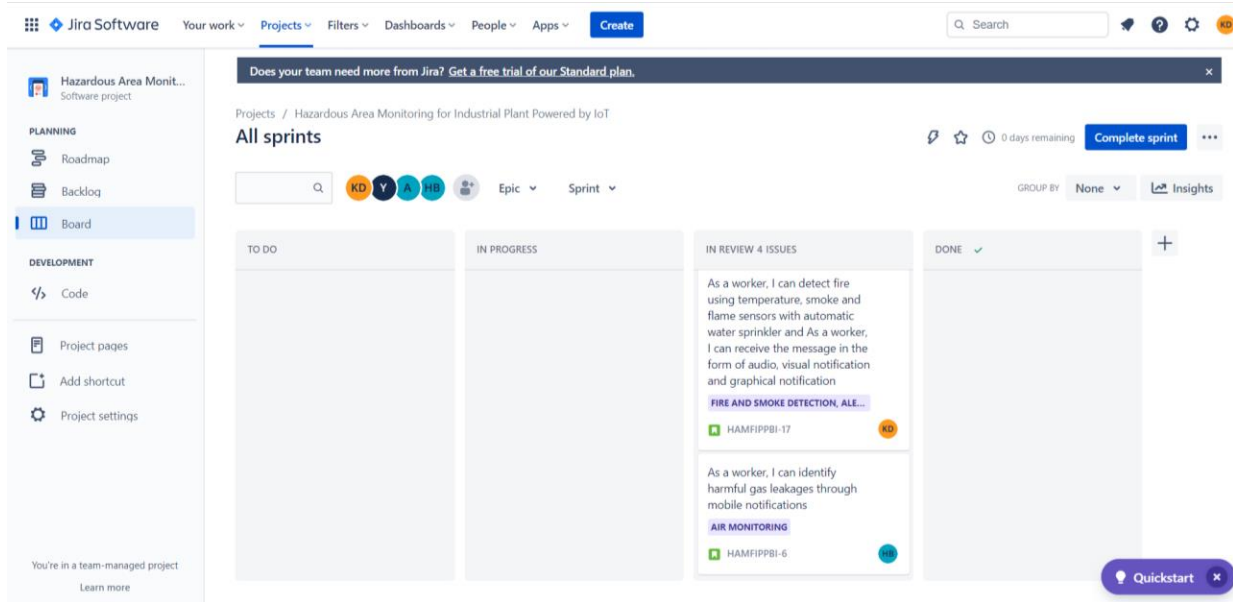
EMERGENCY SHUTDOWN SYSTEM

■ HAMFIPBI-14

...

Quickstart

X



7. CODING & SOLUTIONING

7.1 Feature-1

7.1.1 Python script to connect ibm watson IoT platform to get data from Cloud.

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

#Provide your IBM Watson Device Credentials
organization = "f7gdph"
deviceType = "Abcd"
deviceId = "204527"
authMethod = "token"
authToken = "8778766443"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
```

```

status=cmd.data['command']
if status=="shutdown":
    print ("machine off")
else :
    print ("machine on")
#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()

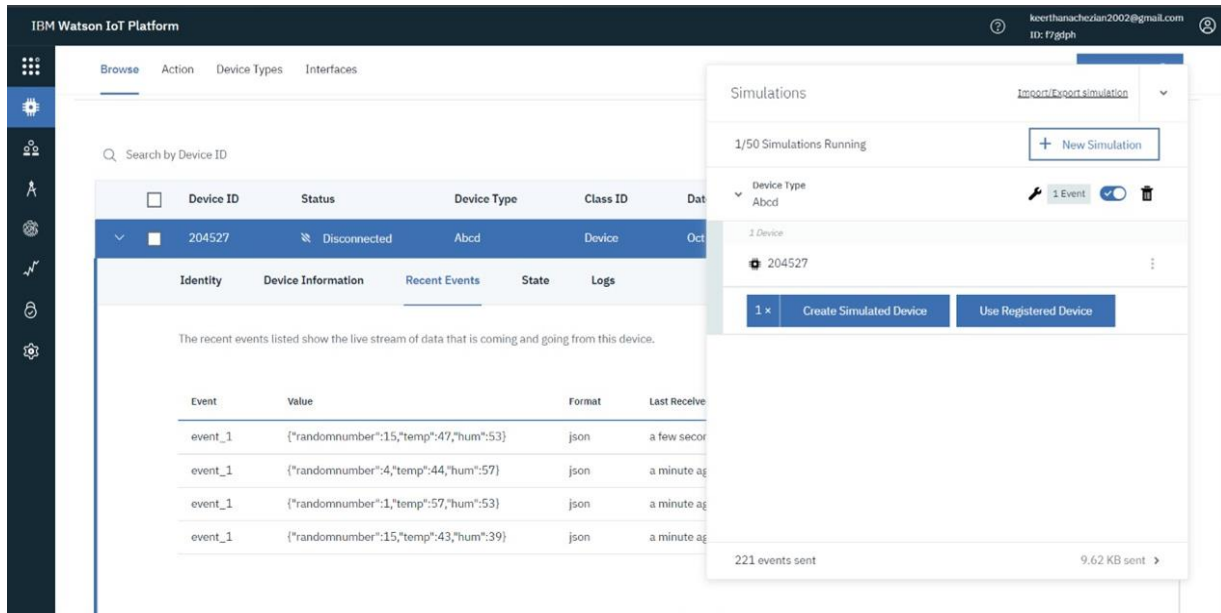
# Connect and send a datapoint "hello" with value "world" into the
cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:
    #Get Sensor Data from DHT11
    temp=random.randint(0,100)
    Humid=random.randint(0,100)
    data = { 'temp' : temp, 'Humid': Humid }
    #print data
    def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity =
%s %" % Humid, "to IBM Watson")
    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoT")
    time.sleep(1)

```

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

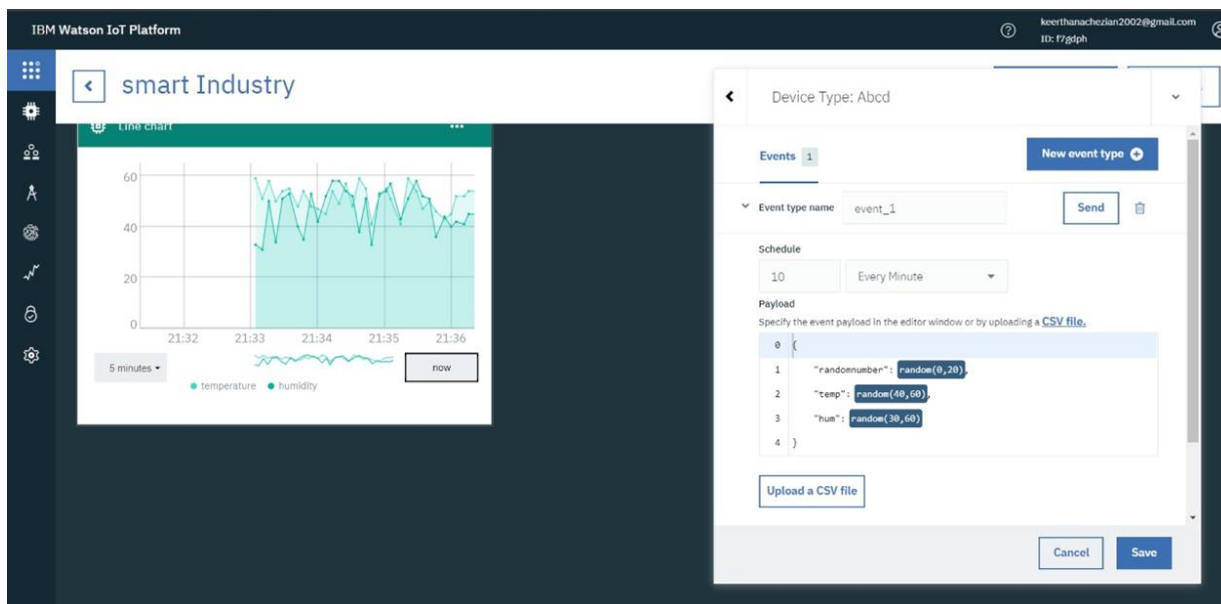
7.1.2 IBM Simulation



The screenshot shows the IBM Watson IoT Platform interface. The 'Simulations' panel is open, displaying '1/50 Simulations Running'. Below this, there's a table of recent events for device 204527. The events table has columns for Event, Value, Format, and Last Received. The events are as follows:

Event	Value	Format	Last Received
event_1	{"randomnumber":15,"temp":47,"hum":53}	json	a few seconds ago
event_1	{"randomnumber":4,"temp":44,"hum":57}	json	a minute ago
event_1	{"randomnumber":1,"temp":57,"hum":53}	json	a minute ago
event_1	{"randomnumber":15,"temp":43,"hum":39}	json	a minute ago

7.1.3 Line chart IBM watson IoT platform board



The screenshot shows the IBM Watson IoT Platform interface. The 'smart Industry' board is selected, displaying a line chart for temperature and humidity. The chart shows data points over time, with a 5-minute interval. The configuration panel for device type 'Abcd' is open, showing event type 'event_1' with a schedule of 'Every Minute' and a payload of random values.

Event type name: event_1

Schedule: 10 Every Minute

Payload:

```
{
  "randomnumber": random(0,20),
  "temp": random(40,60),
  "hum": random(30,60)
}
```

7.1.4 Installing IBM IoT using Command prompt window


```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 10.0.19045.2130]
(c) Microsoft Corporation. All rights reserved.

C:\Users\DHARANIDHANA>pip install ibmiotf
Requirement already satisfied: ibmiotf in c:\users\dharanidhana\appdata\local\programs\python\python37\lib\site-packages
(0.4.0)
Requirement already satisfied: iso8601>=0.1.12 in c:\users\dharanidhana\appdata\local\programs\python\python37\lib\site-
packages (from ibmiotf) (1.1.0)
Requirement already satisfied: pytz>=2017.3 in c:\users\dharanidhana\appdata\local\programs\python\python37\lib\site-pac
kages (from ibmiotf) (2022.6)
Requirement already satisfied: paho-mqtt>=1.3.1 in c:\users\dharanidhana\appdata\local\programs\python\python37\lib\site
-packages (from ibmiotf) (1.6.1)
Requirement already satisfied: requests>=2.18.4 in c:\users\dharanidhana\appdata\local\programs\python\python37\lib\site
-packages (from ibmiotf) (2.28.1)
Requirement already satisfied: requests_toolbelt>=0.8.0 in c:\users\dharanidhana\appdata\local\programs\python\python37\
lib\site-packages (from ibmiotf) (0.10.1)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\dharanidhana\appdata\local\programs\python\python37\lib
\site-packages (from requests>=2.18.4->ibmiotf) (1.26.12)
Requirement already satisfied: idna<4,>=2.5 in c:\users\dharanidhana\appdata\local\programs\python\python37\lib\site-pac
kages (from requests>=2.18.4->ibmiotf) (3.4)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\dharanidhana\appdata\local\programs\python\python37\
lib\site-packages (from requests>=2.18.4->ibmiotf) (2.1.1)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\dharanidhana\appdata\local\programs\python\python37\lib\si
te-packages (from requests>=2.18.4->ibmiotf) (2022.9.24)
You are using pip version 10.0.1, however version 22.3.1 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.

C:\Users\DHARANIDHANA>
```

7.1.5 Node-RED on IBM Cloud

Node-RED on IBM Cloud

Node-RED

Flow-based programming for the Internet of Things

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.

This instance is running as an IBM Cloud application, giving it access to the wide range of services available on the platform.

More information about Node-RED, including documentation, can be found at nodered.org.

[Go to your Node-RED flow editor](#)

[Learn how to customise Node-RED](#)

7.1.6 Run Python code with connection of IBM Cloud and Node-RED.

```
ibmiotpublish.py - C:\Users\DHARANIDHAN\AppData\Local\Programs\Python\Python37\...
File Edit Format Run Options Window Help
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

#Provide your IBM Watson Device Credentials
organization = "f7gdph"
deviceType = "Abcd"
deviceId = "204527"
authMethod = "token"
authToken = "s778766443"

# Initialize GPIO

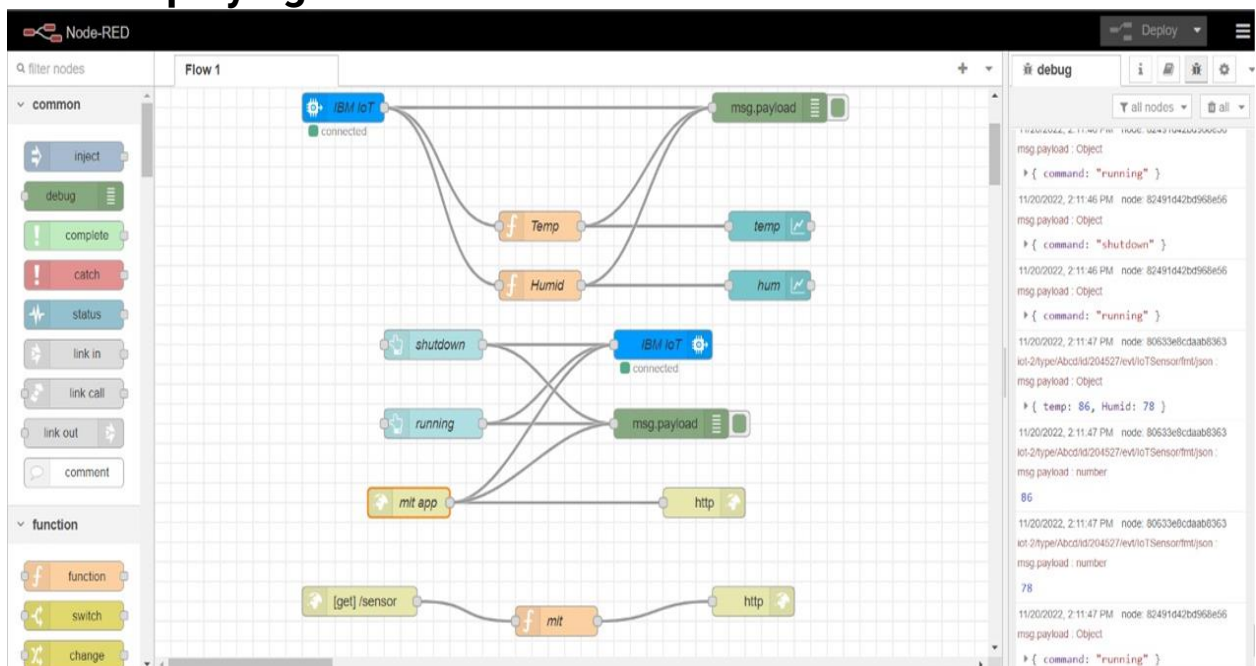
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="shutdown":
        print ("machine off")
    else :
        print ("machine on")
    #print(cmd)

try:
    deviceOptions = {"org": organization, "type": deviceType, "id": deviceId}
    deviceCli = ibmiotf.device.Client(deviceOptions)
    #.....
except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()

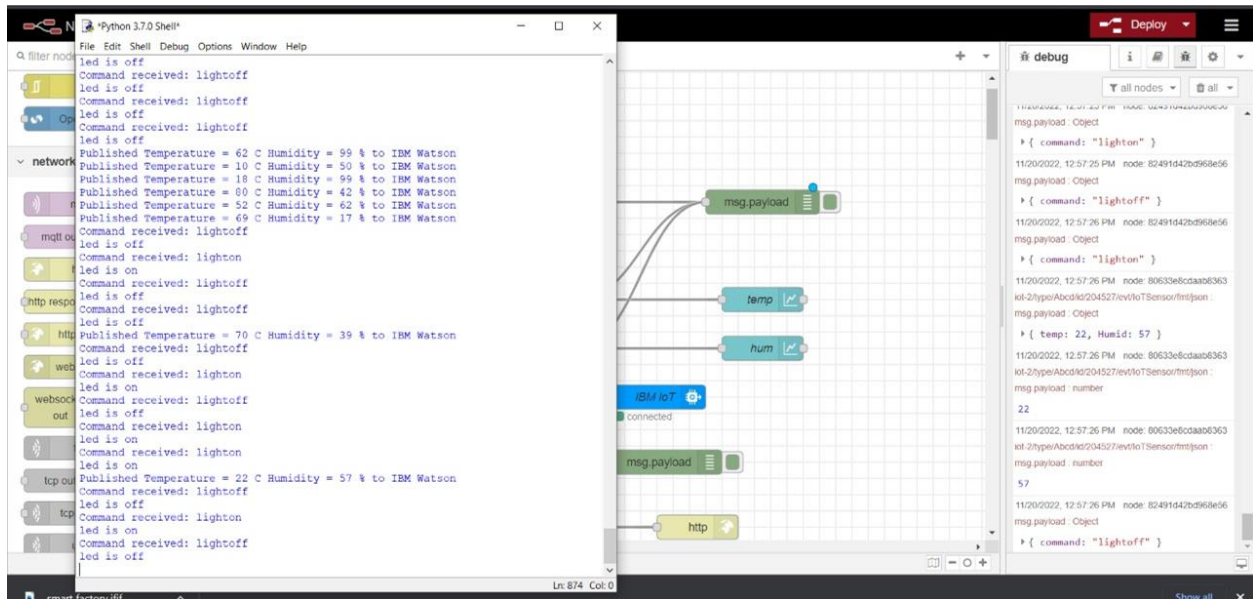
# Connect and send a datapoint "hello" with value "world" into the cloud as an e

Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Published Temperature = 26 C Humidity = 6 % to IBM Watson
Published Temperature = 44 C Humidity = 16 % to IBM Watson
Published Temperature = 45 C Humidity = 51 % to IBM Watson
Command received: shutdown
machine off
Published Temperature = 88 C Humidity = 81 % to IBM Watson
Command received: shutdown
machine off
Command received: shutdown
machine off
Published Temperature = 81 C Humidity = 33 % to IBM Watson
Command received: shutdown
machine off
Command received: shutdown
machine off
Published Temperature = 83 C Humidity = 44 % to IBM Watson
Command received: running
machine on
Command received: shutdown
machine off
Command received: shutdown
machine off
Published Temperature = 3 C Humidity = 15 % to IBM Watson
Command received: shutdown
machine off
Command received: shutdown
machine off
Command received: running
machine on
Command received: running
machine on
Command received: running
machine on
Published Temperature = 16 C Humidity = 58 % to IBM Watson
Published Temperature = 50 C Humidity = 82 % to IBM Watson
Ln: 5 Col: 0
```

7.1.7 Deploying in Node-RED

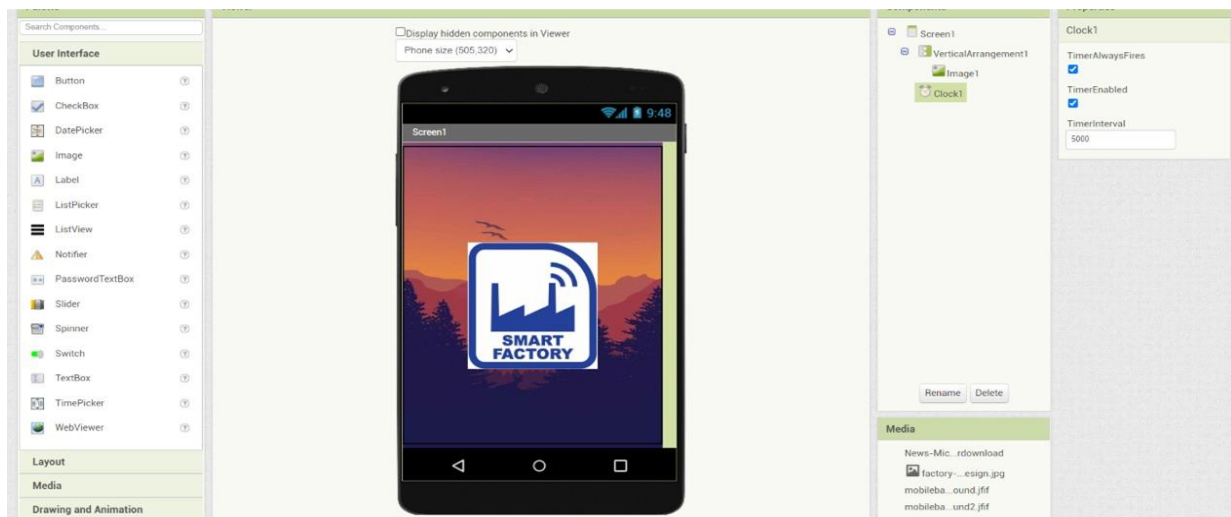


7.1.8 Simulation of Deploying Node-RED on IBM Cloud.

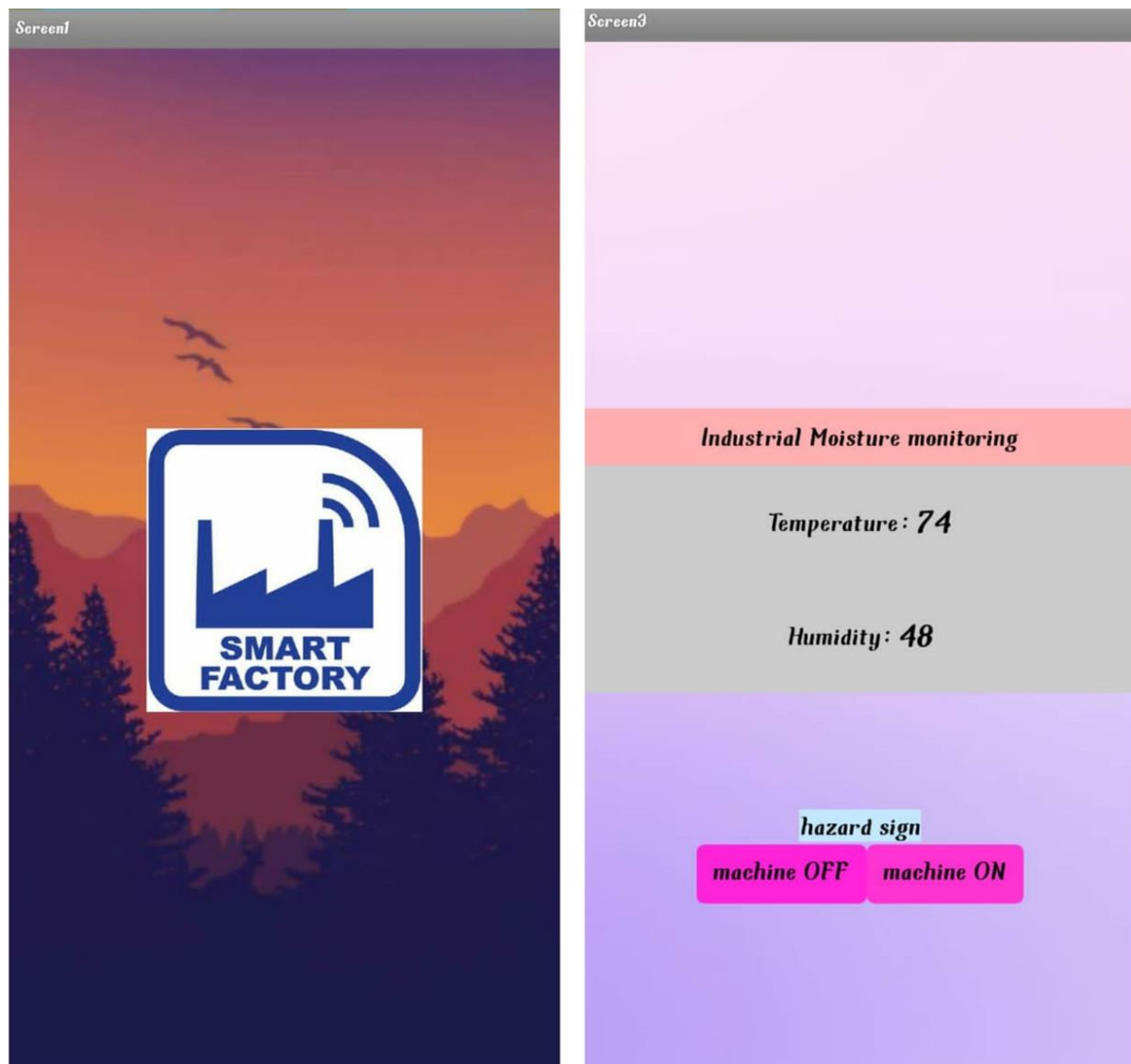


7.2 Feature-2

7.2.1 Displaying Temperature and Humidity values in Mobile Application.



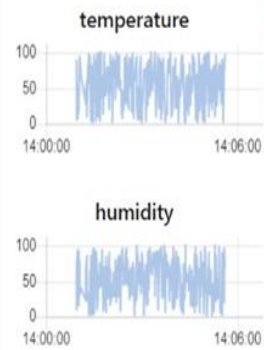
7.2.2 Detecting Temperature and Humidity through Mobile Application.



7.3 Database Schema

7.3.1 Node-RED dashboard

smart Industry



fire hazard



7.3.2 Wokwi Connection using DHT22 Sensor

WOKWI

SAVE

SHARE

sketch.ino

Docs

SIGN UP

sketch.ino

diagram.json

libraries.txt

Library Manager

Simulation

▶

+

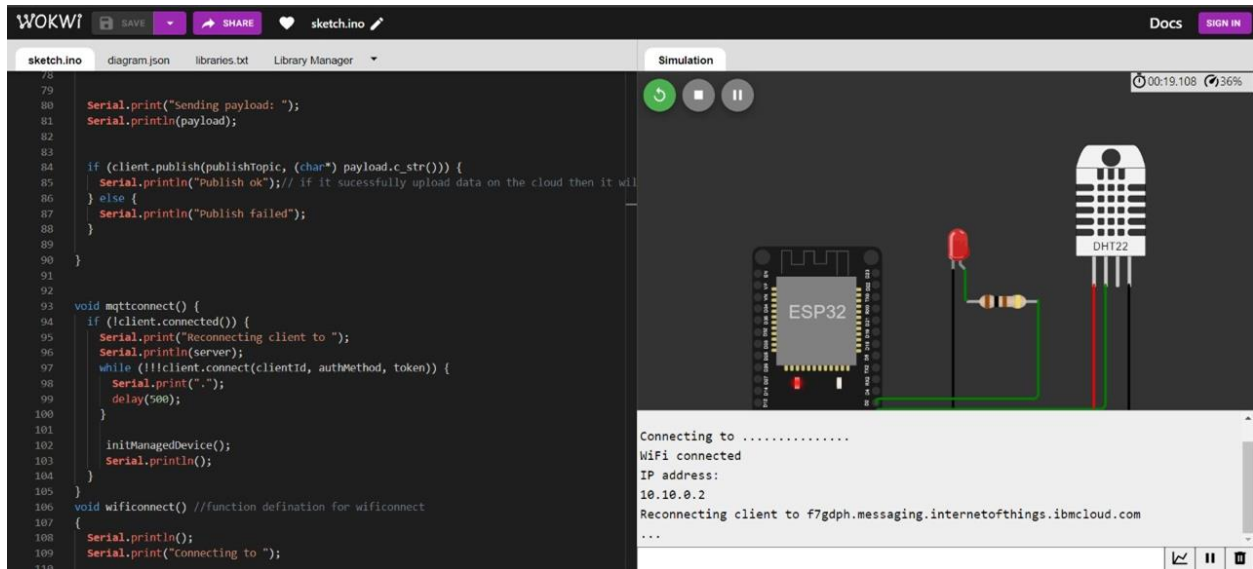
⋮

```

1 #include <WiFi.h> //library for wifi
2 #include <PubSubClient.h> //library for MQTT
3 #include "DHT.h" // Library for dht11
4 #define DHTPIN 15 // what pin we're connected to
5 #define DHTTYPE DHT22 // define type of sensor DHT 11
6 #define LED 2
7
8 DHT dht (DHTPIN, DHTTYPE); // creating the instance by passing pin and type of dht connect
9
10 void callback(char* subscribtopic, byte* payload, unsigned int payloadlength);
11
12 //-----credentials of IBM Accounts-----
13
14 #define ORG "f7gdpH" //IBM ORGANIZATION ID
15 #define DEVICE_TYPE "Abcd" //Device type mentioned in ibm watson IOT Platform
16 #define DEVICE_ID "204527" //Device ID mentioned in ibm watson IOT Platform
17 #define TOKEN "8778766443" //Token
18 String data3;
19 float h, t;
20
21
22 //----- customise the above values -----
23 char server[] = ORG ".messaging.internetofthings.ibmcloud.com"; // Server Name
24 char publishTopic[] = "iot-2/evt/Data/fmt/json"; // topic name and type of event perform a
25 char subscribtopic[] = "iot-2/cmd/command/fmt/String"; // cmd REPRESENT command type AND
26 char authMethod[] = "use-token-auth"; // authentication method
27 char token[] = TOKEN;
28 char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID; //client id
29
30
31 //-----
32 WiFiClient wificlient; // creating the instance for wificlient

```

7.3.3 Wokwi Simulation



8. TESTING

8.1 Test Cases-1

NFT Test approach	load test								
step 1	Python script to connect IBM watson IoTplatform to get data from cloud								
step 2	IBM simulation								
step 3	line chart IBM watson IoT platform board								
step 4	Installing ibm iot using command prompt window and node-red on ibm cloud								
step 5	Run python code with connection of ibm cloud and deploying in node -red								
step 6	Simulation of deploying node-red on ibm cloud and then displaying temperature and humidity values in mobile application								
step 7	Detecting temperature and humidity through mobile application								
step 8	database schema node -red dashboard								

8.1.1 Test Cases-2

TEAM ID - PNT2022TMD39426									
NFT - Risk Assessment									
S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Volume Changes	Risk Score	Justification
1	Redundancy from Redundancy for Industrial Plant Powered by oil	Unfamiliar order	Low	No Changes	Moderate	NIL	>5 to 10%	YELLOW	Reporting the hazard to control made as by using cloud service
NFT - Detailed Test Plan									
S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approvals/SignOff					
1	A small operation of safety from hazard controlled by the industrial working environment	controlling the hazard at internal level	High speed, not under observation and controlling the hazard at internal level	High speed, not under observation and controlling the hazard at internal level	J. KENNEDY, LAMAR				
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	A small operation of safety from hazard controlled by the industrial working environment	controlling the hazard at internal level	This mechanism is flexible because it is easy to verify, use, transfer, transfer director, provide the risk, is foreseeable, affordable	This mechanism is flexible and it is easy to set up. Test results and easy to access to safety tests	Industrial hazard is the danger or threat of accidental injury to the worker safety engaged at this associated work in the plant. The most serious problem is to reduce the risk of accidents, harmful gas, leakage, overflowing in mechanical, electrical equipment, accidents due to improper operating conditions and faults in system. Identifying industrial hazards allow employees to protect their worker from accidents, injuries, and fatalities.	High speed, not under observation and controlling the hazard at internal level	When problem occurs, the investigation based on the problem found there will be more possibilities to make the items to be applicable	J. KENNEDY, LAMAR	

8.2.2 Test Cases-3

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	35	0	0	35
Security	2	0	0	2
Outsource Shipping	4	0	0	4
Exception Reporting	7	0	0	7
Final Report Output	8	0	0	8
Version Control	1	0	0	1

8.2 User Acceptance Testing

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	8	5	4	1	18
Duplicate	0	2	1	0	3
External	1	2	3	0	6
Fixed	12	4	2	18	36
Not Reproduced	1	0	0	0	1
Skipped	1	0	1	0	2
Won't Fix	3	5	0	1	9
Totals	20	12	14	25	71

9. RESULTS

9.1 Performance Metrics

S.NO	PARAMETERS	PERFORMANCE
1.	Response Time	0.2s (Average of 10 trials)
2.	Workload	500 users (Calculated based on Cloud Space)
3.	Revenue	Individual users while hazards occurs in an Industrial plant or Industry
4.	Efficiency	User friendly, low cost, Simple and straightforward workflow, which makes the process efficient
5.	Down Time	Almost no down time due to IBM Cloud enabled solution.

10. ADVANTAGES

- Immediate response of fire accident by detecting temperature and humidity in the work station.
- Implementation is simpler. Maintain the controllable atmospheric condition.
- Electronic Sensors have got enormous contribution towards the research in the field of mining domain.
- Prevent the workers and hazardous occurring in industries earlier by using this method.

DISADVANTAGES

- Periodic adjustment.
- Complexity in designing process.
- Continuous monitoring is required.

11. CONCLUSION

Hence, The project offers that by using continuous monitoring and detecting of hazardous signs, major problems will be prevented at the initial stage itself. Huge cost savings, Greater job satisfaction and higher motivation can be obtained by the workers if their expectations of safety from hazards are fulfilled by the industria working environment. This mechanism is feasible because it is easy to setup, user friendly, wireless detector, predicts the risk, in beforehand, affordable.

12. FUTURE SCOPE

Fire accidents can be controlled to a great extent in a places such as forests, homes, colleges, industries, trains and some other public places. Fire accidents leads to death of excess of people, by using this technique we can solve those lifes easily.

The emergency shutdown systems market is anticipated to grow at 7.2% CAGR during the forecast period. The emergency shutdown system is largely deployed in the oil & gas industry, power generating sector, manufacturing industry, and various other industries.

13. APPENDIX

Source Code

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

#Provide your IBM Watson Device Credentials
organization = "f7gdph"
deviceType = "Abcd"
deviceId = "204527"
authMethod = "token"
authToken = "8778766443"

# Initialize GPIO

def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="shutdown":
        print ("machine off")
    else :
        print ("machine on")
    #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)
    Humid=random.randint(0,100)
    data = { 'temp' : temp, 'Humid': Humid }
    #print data
    def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity = %s %" %
Humid, "to IBM Watson")

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

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

```

GitHub Link- <https://github.com/IBM-EPBL/IBM-Project-5494-1658768532>

Project Demo Link-

<https://drive.google.com/drive/folders/16ngmNYcK1jQSfHB6VoPCuM3p2tcRIUeN>

