HAZARDOUS AREA MONITORING FOR INDUSTRIAL PLANT POWERED BY IoT

A PROJECT REPORT

Submitted by

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in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

UNIVERSITY VOC COLLEGE OF ENGINEERING,THOOTHUKUDI

ANNA UNIVERSITY:: CHENNAI 600025

NOV 2022

BONAFIDE CERTIFICATE

Certified that this project report **"HAZARDOUS AREA MONITORING FOR INDUSTRIAL PLANT POWERED BY IoT"** is the bonafide work of "SAJITHRA CHANDRAVTHY.S (953219106027), KRISHNA GEETHA.S (953219106301)**,** MAANU SRI DURGA.K(953219106017),SAPARNIGA.P (953219106031) who carried out the project work under my supervision.

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CONTENTS

INTRODUCTION:

1.1 PROJECT OVERVIEW:

The Internet of Things (IoT) represents a general concept of network devices' ability to sense and collect data from the world around us, and then share that data on the Internet, where the data is available. can be processed and used for a variety of practical purposes. aspects of life. The reach of IoT-based systems in industrial zones is still limited, but its potential is huge. In this project, we are creating an IoT-based hazard system monitoring system specifically designed for the requirements of the mining, refining and manufacturing industries.

The system actively records, processes and analyses ambient temperature, noise level, gas leakage and radiation which is an important safety parameter in areas where molten metal is handled, fabricated or welded. In addition, it monitors high levels of harmful gases present in the environment (LPG/Natural Gas). If a setting is violated, the system sends an immediate notification to a set of user lists present on their smartphone, and continues to log and monitor the data for further analysis to recommend improvements to industry security regulations. The sensors used in this prototype can be modified according to industry requirements (e.g. a more powerful temperature sensor may be needed under very harsh conditions) whenever the need arises.

1.2 PURPOSE:

We merge technology with hazardous area monitoring to effectively create a safe environment. Rely on IoT technology and data to create more effective industry surveillance. This project helps industries track the rise and fall of temperature, noise level, gas leakage and radiation. The notification is received when the above parameters exceed the normal limit.

In the event of an emergency, the administrator will be notified at the same time that the worker is alerted. In web applications, administrators can view sensor settings. Therefore, hazardous area monitoring provides us with the most optimal way to effectively monitor the industry using IOT technology.

2 LITERATURE SURVEY:

2.1 EXISTING PROBLEM:

Every day synthetic and toxic chemicals are released into the environment. It affects our water, soil and air. These pollutants can cause serious health effects such as birth defects, developmental disabilities, breathing problems, cancer, and in some cases, death. In addition, it can also have adverse effects on wildlife and the

environment. The main polluting industries in India where harmful gases are emitted are wastewater treatment plants, tanneries, coal mining, textile dye processing and pesticide pollution.

2.2 REFERENCE:

S.NO	TITLE	AUTHORS	DESCRIPTION
1.	IOT Based Industrial Monitoring and Fault Detection System(Research Journal)	Akshara Viju,Prathamesh Shukla,Aditya Pawar,Prathame sh Sawant	This system is an advanced solution for the supervision level of the factory where in most cases only SCADAs and alarms based on variable values are considered Advantage: Predictive maintenance is stability to provide useful information to the human supervisor showing what the real state of a plant or machine is and helping him in the planning of the factory operation.
2.	Indoor Industrial Monitoring System	Mahesh.S.Kholg ade and et al [2017IEEE]	The Ideology is mainly used for detection of hazardous leakage of liquid petroleum gas by using MQ6 sensor.

3.	A Hazardous Area Personal Monitoring System for Operators in Storage Tanks	Elia Landi, Lorenzo Parri*, Ada Mugnaini,Valerio Vignoli, Dinesh Tamang, Marco Tani	This work describes a smart monitoring system detection of flammable gas residues, toxic gases, oxygen concentrations. The proposed system aims at reducing therisk of fires and explosions, thus increasing the safety of workers engaged in maintenance or inspection of gas storages.
4.	IOT Based Industrial Parameter Monitoring System(Research journal)	Prof. Nitin Ahirel , Shreya Bandodkar2 Kanchan Gupta3 , Yasar Farooqui4	If there is the presence of any harmful gas like carbon mono-oxide in the surrounding, the gas is detected by the sensor and the "gas detected". It is necessary to record the appropriate voice audio note for each parameter respectively. Thus, this prototype can be very beneficial for workers in industries, power plants, etc for the prevention of a hazard that might destroy machinery as well as can risk the life of the workers.

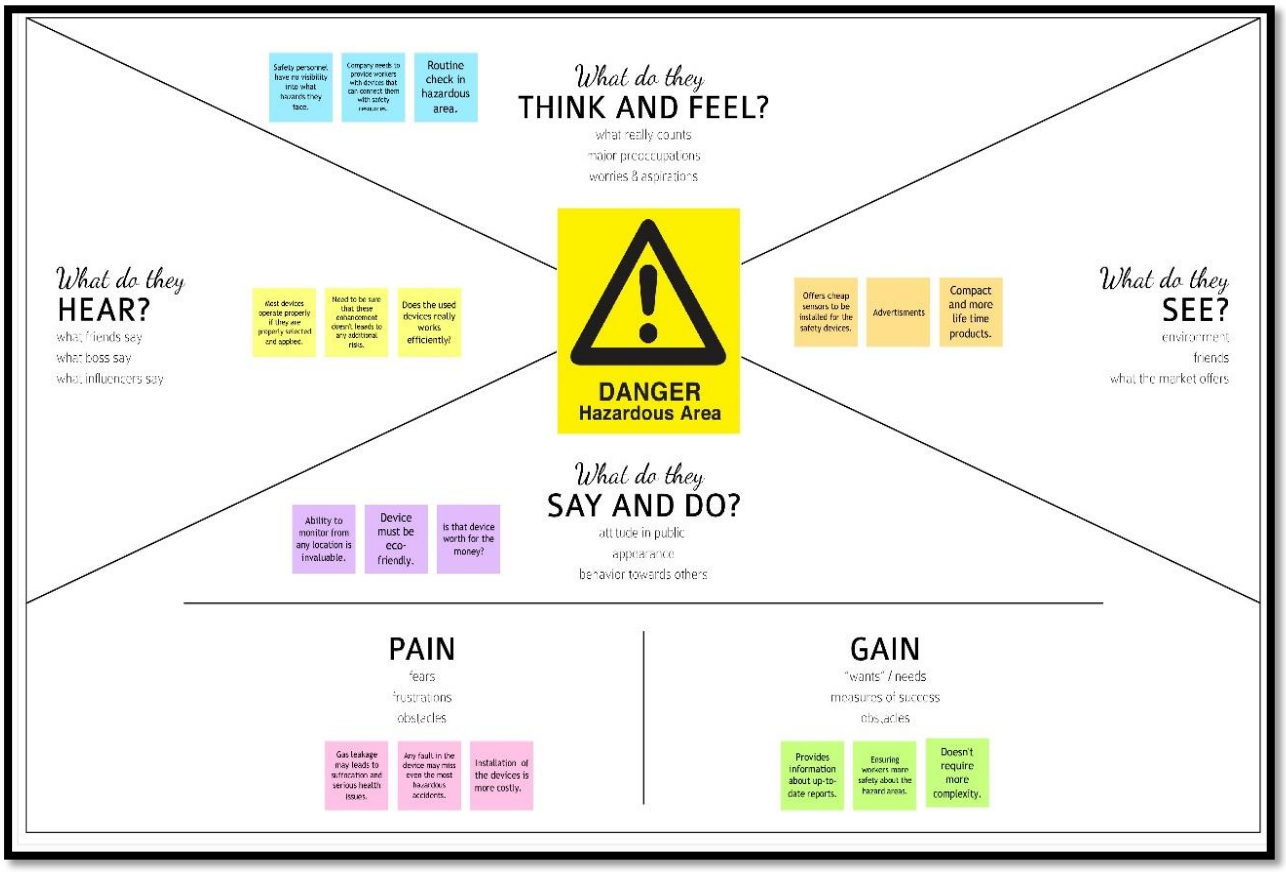
5.	Monitoring of Hazardous in Process Industries Through Internet	P.Raghavi,Dr. K.R.Valluvan	The existing detection system are available to sense only a particular gas and they use GSM technology to indicate the critical situations.

6.	IOT Based Industrial Monitoring System	Hemlata Yadav,Naomi Oyiza,Sarfaraz Hassan,Dr.Suman Lata,K.Jaya Chitra	Main Objectives is to adapt the Internet control system to the Internet Of Things ,allowing users to access the application over the internet from anywhere in the globe.Sensors like smoke sensors,humidity,and temperature sensors are used to monitor the surroundings of the machine
7.	A Survey On Toxic Environment Monitoring Using Sensors	R.Rajalakshmi, J.Vidhya	This paper presents for safety monitoring of dangerous gases in the industrial plants. A single artificial neural network is used for determination of the gas concentrations based on sensor array measurements, performing at the same time compensation of the temperature and humidity influence

8.	IOT Based Temperature and Humidity Monitoring Framework	Rafizah Ab Rahman,Ummi Raba'ah Hashim,Sabrina Ahmad	The Monitoring System was also helpful in detecting extreme changes in temperature and humidity and automatically send a notification to IT personal via E-mail ,short messaging service (SMS) and mobile push notification for further process.

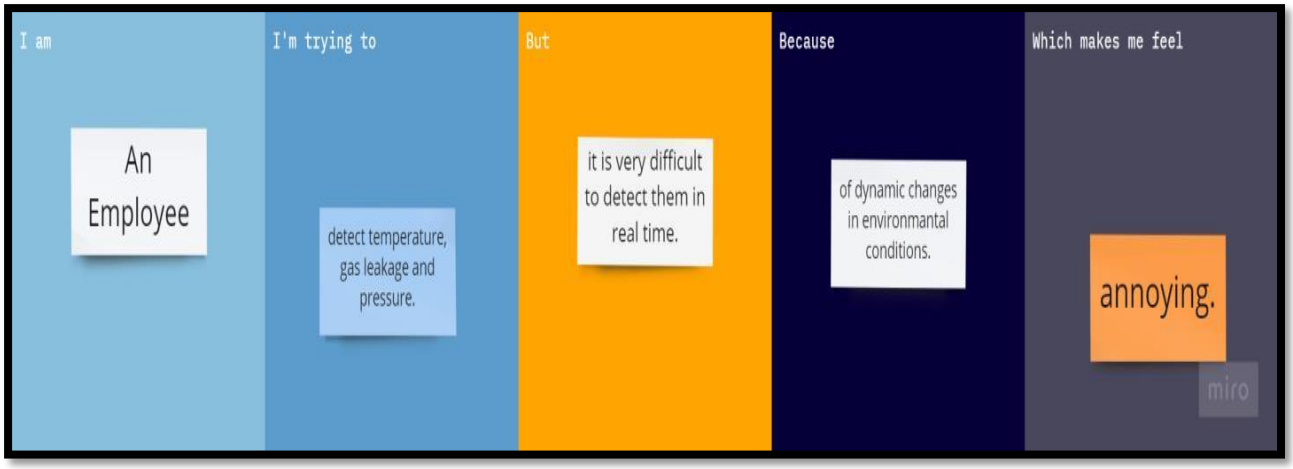
3.IDEATION AND PROPOSED SOLUTION:

3.1 EMPATHY MAP CANVAS:

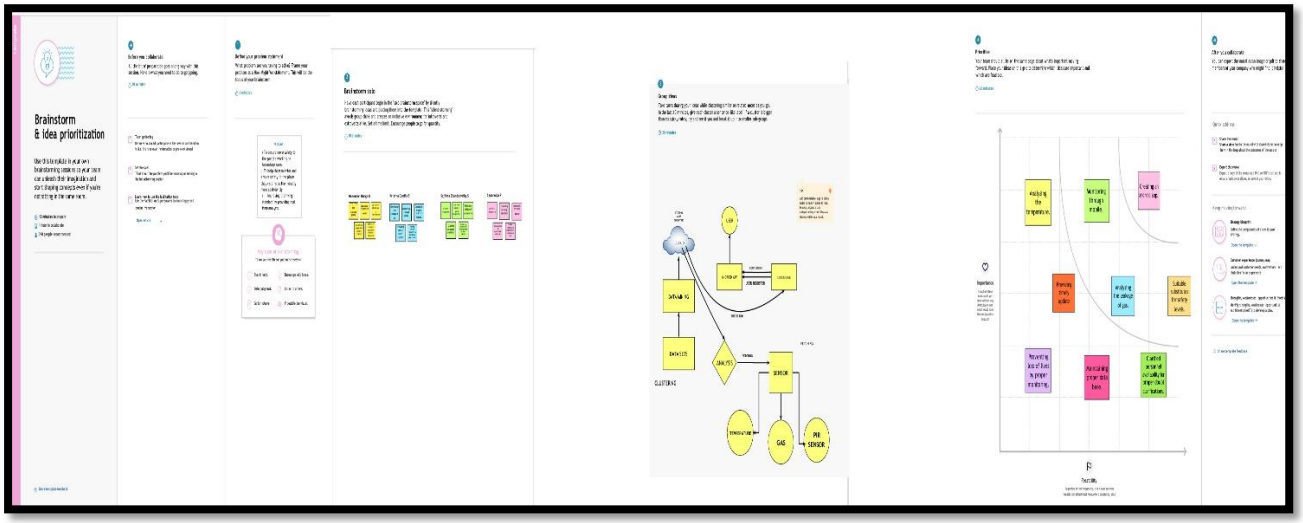


3.2 IDEATION AND BRAINSTORMING:

3.2.1 CUSTOMER PROBLEM STATEMENT:



3.2.2 BRAINSTORMING:



3.3 PROPOSED SOLUTION:

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	1)To ensure more safety to the people working in hazardous area. 2)To help them monitor and ensure safety to the place they visit inside the industry more confidently. 3)Improving the living standard by providing real time analysis.
2.	Idea /Solution description	Our product collects the data from different types of sensors and it sends the value to the main server. The ultimate decision is to shield the workers from the hazard prone area and safeguard their lives using mobile application.
3.	Novelty /Uniqueness	It depends on IOT thus eliminating the need of physical work of the employees. Online assistance providing in depth knowledge to manage hazardous waste.
4.	Social Impact / Customer Satisfaction	Awareness camps organized to teach the importance and advantages of the automation and IoT in the development of Hazardous area monitoring. Information are collected from reliable sources and hence the workers could take more precise decisions.
5.	Business Model (Revenue Model)	Hazardous area monitoring is an advanced and innovative way to keep the employees more-safe and minimize the human efforts by real time analysis.
6.	Scalability of the solution	Automatic adjustment is made feasible by integrating information such as gas and temperature monitoring. With the use of sensors, it has enabled workers to manage hazardous waste and leakage of gases.

3.4 PROBLEM SOLUTION FIT:

4.REQUIREMENT ANALYSIS:

4.1 FUNCTIONAL REQUIREMENTS:

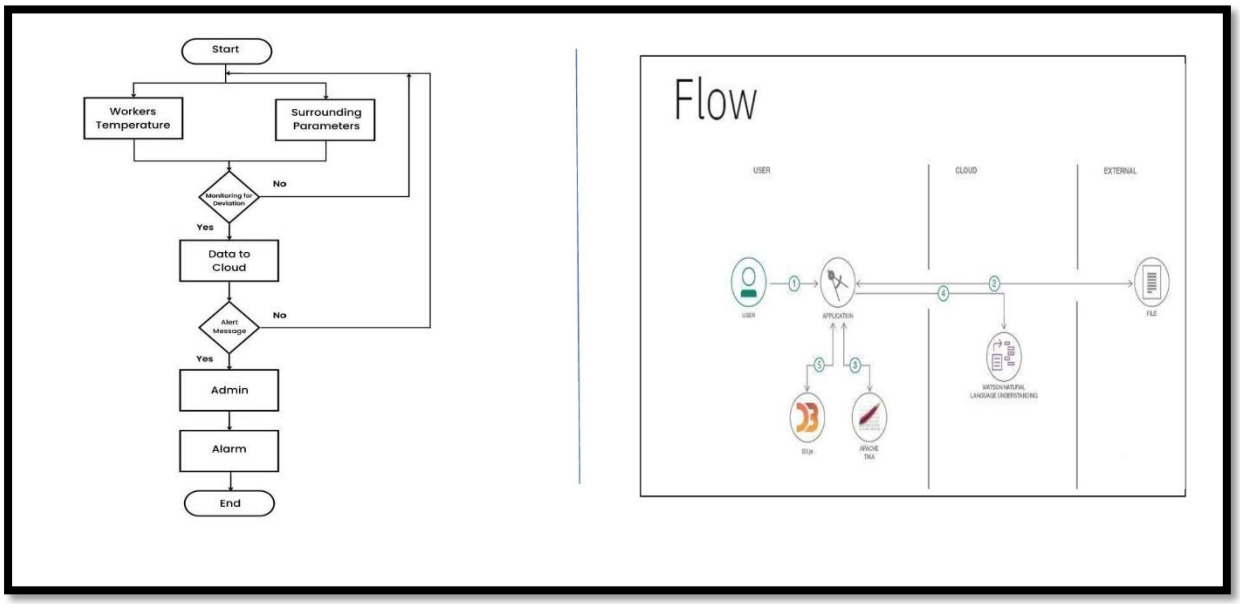
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	IBM Watson IOT platform	• Monitoring parameters such as temperature, gas leakage, noise level, radiation.
FR-2	Node-Red	• Design UI to display the monitored parameters, configure the application to receive the data from cloud
FR-3	Cloudant DB	• Publish the data to the cloud.
FR-4	Online Monitoring via Web and Application	• Mobile Application will be created and fast sms will be used to alert abnormality to the user. Websites will be created and connected with the cloud services.

4.2 NON-FUNCTIONAL REQUIREMENTS:

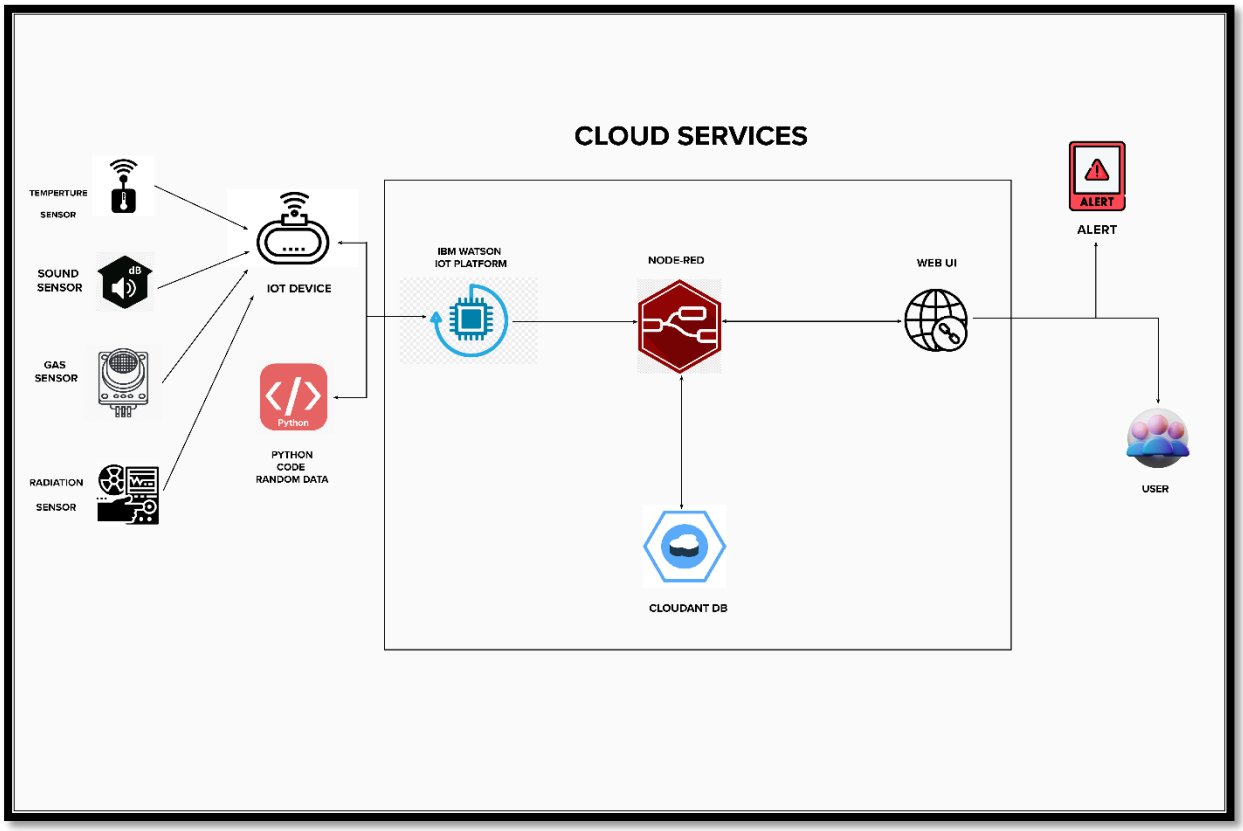
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	• Our solution is intended for wide range of workers who works in industries under hazardous area
NFR-2	**Security**	• Security is very high as we provide step by step verification code.
NFR-3	**Reliability**	• Reliability is high because of timely update. • As a result of continuous tracking accident can be predicted.
NFR-4	**Performance**	• When there is any deviation occurs, it send an alert message to admin which results in better performance
NFR-5	**Availability**	• It can be enabled at any system like laptop, PC, Smart watch, android phone and user friendly • It will meet all the requirements of the users with better services.
NFR-6	**Scalability**	• Users can access the application seamlessly without any interrupts of errors. • The sensors are used in this frame work are low budget functionalities hence they are highly scalable.

5.PROJECT DESIGN:

5.1 DATA FLOW DIAGRAMS:



5.2 SOLUTION ARCHITECTURE:



1. Necessary Python code for collecting temperature, noise, gas leakage and radiation details from IoT device is written.

2. IoT device is connected with the IBM Watson IoT platform for gathering data.

3. Next step uses Node-Red services after IoT platform is all set.

4. Cloudant DB is used for storing and retrieving data.

5. Node-Red services are used to create Web application and UI designs.

6. The user uses mobile app to receive various information and alerts.

5.3 USER STORIES:

User Type	**Functional Requirement**	**User story number**	**User story/Task**	**Priority**	**Release**
Technician	IBM Watson IOT platform	USN-1	Monitoring parameters such as temperature, gas leakage, noise level, radiation	High	Sprint-1
Technician	Node-red	USN-2	Design UI to display the monitored parameters, configure the application to receive the data from cloud.	High	Sprint-2
Admin	Cloudant DB	USN-3	Publish the data to the cloud.	High	Sprint-3
Worker	Online Monitoring via Web and Application	USN-4	Mobile Application will be created and fast SMS will be used to alert abnormality to the user. Websites will be created and connected with the cloud services.	High	Sprint-4

6.PROJECT PLANNING AND SCHEDULING:

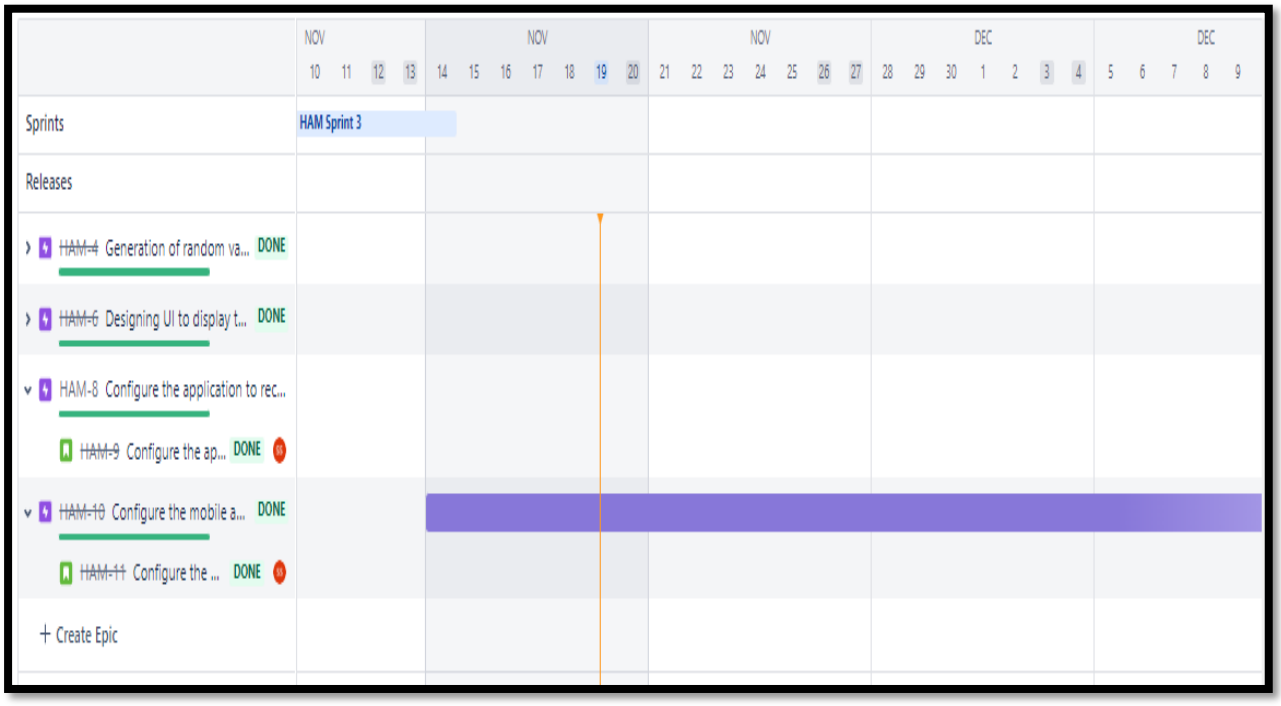
6.1 SPRINT PLANNING AND ESTIMATION:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	IBM Watson IOT platform	USN-1	Monitoring parameters such as temperature, gas leakage, noise level, radiation	15	High	Sajithra Chandravathy S Krishna Geetha S Maanu Sri Durga K Saparniga P
Sprint-2	Node-Red	USN-2	Design UI to display the monitored parameters, configure the application to receive the data from cloud	20	High	Sajithra Chandravathy S Krishna Geetha S Maanu Sri Durga K Saparniga P
Sprint-3	Python-IDLE 3.7	USN-4	Publish the data to the cloud	20	High	Sajithra Chandravathy S Krishna Geetha S Maanu Sri Durga K Saparniga P
Sprint-4	Online Monitoring via Web and Application	USN-3	Mobile Application will be created and fast sms will be used to alert abnormality to the user. Websites will be created and connected with the cloud services.	20	High	Sajithra Chandravathy S Krishna Geetha S Maanu Sri Durga K Saparniga P

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	2 Days	1 Nov 2022	2 Nov 2022	2	11 Nov 2022
Sprint-2	20	2 Days	3 Nov 2022	05 Nov 2022	2	11 Nov 2022
Sprint-3	20	5 Days	07 Nov 2022	12 Nov 2022	6	11 Nov 2022
Sprint-4	20	5 Days	14 Nov 2022	19 Nov 2022	6	18 Nov 2022

6.3 REPORTS FROM JIRA:



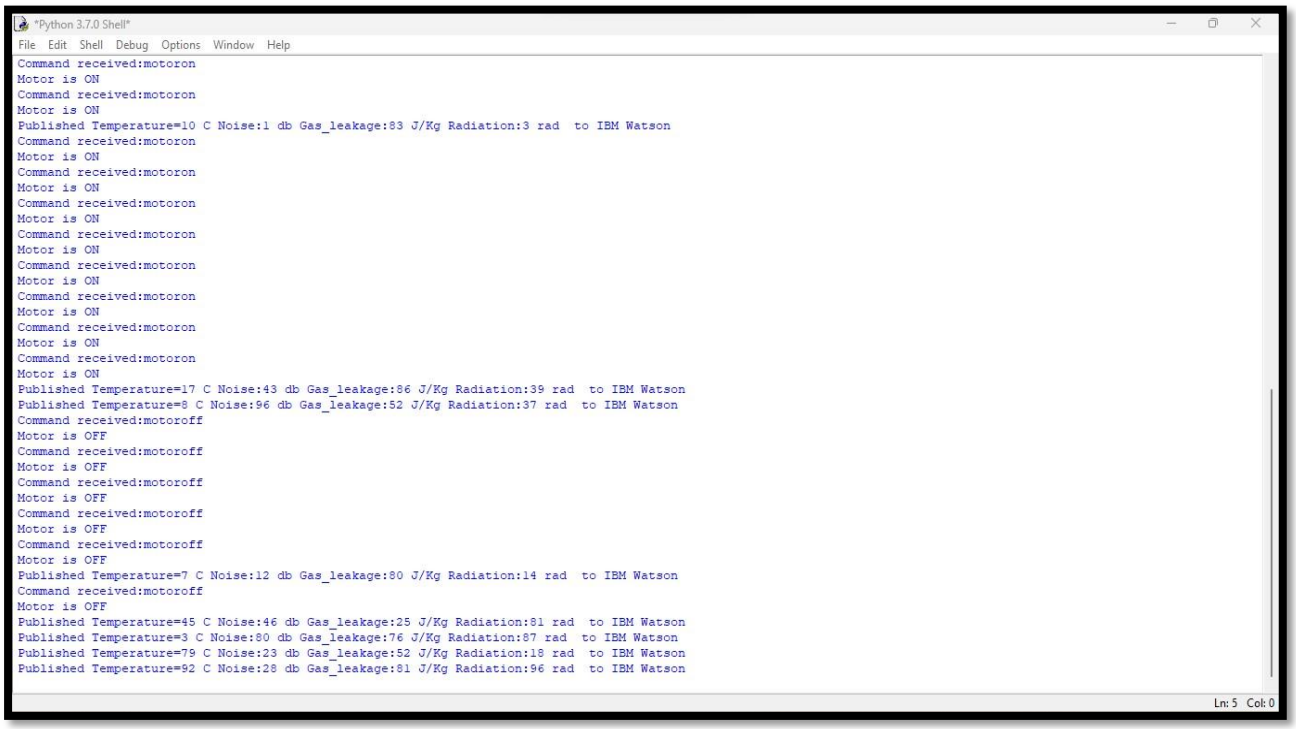
7.CODING AND SOLUTIONING:

7.1 FEATURE 1 (CODING AND RESULT):

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization="pyflre"
deviceType="hazard"
deviceId="231099"
authMethod="token"
authToken="zHP+8fjUb*HmxvADd8"
def myCommandCallback(cmd):
    print("Command received:%s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print("Motor is ON")
    else:
        print("Motor is OFF")
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()
deviceCli.connect()
while True:
    temp=random.randint(0,100)
    noise=random.randint(0,100)
    Gas=random.randint(0,100)
```

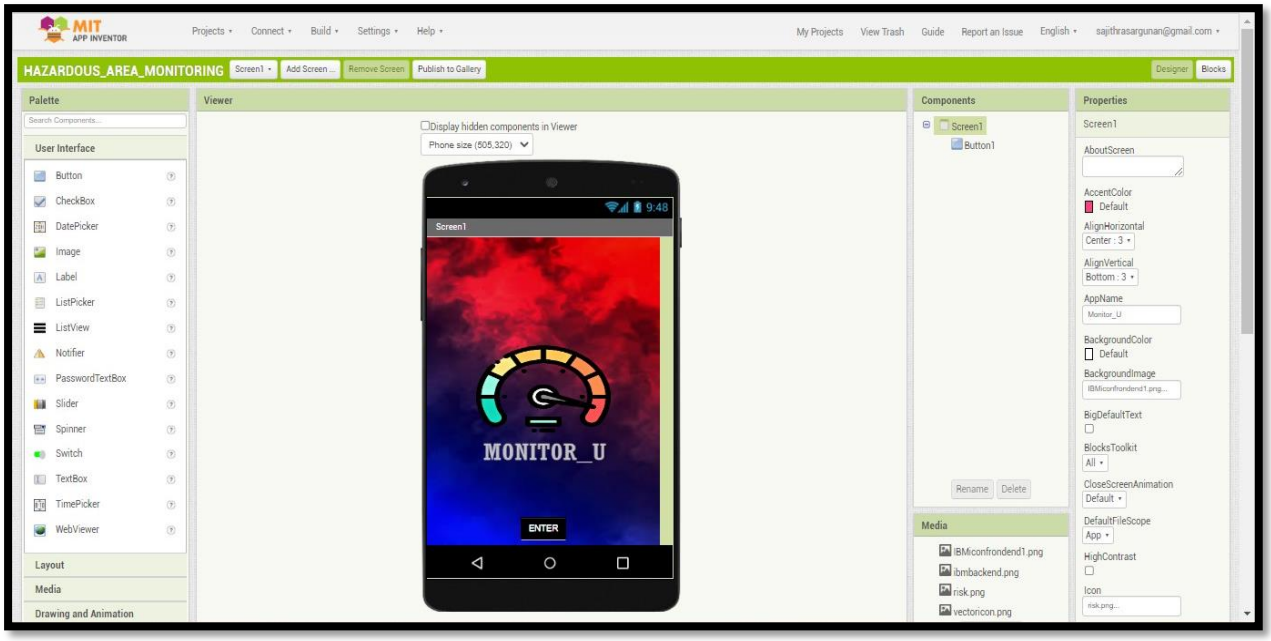
```
    radn=random.randint(0,100)
    data={'Temperature' :temp,'Noise':noise,'Gas_leakage':Gas,'Radiation':radn}
    def myOnPublishCallback():
        print("Published Temperature=%s C" %temp,"Noise:%s db" %noise,"Gas_leakage:%s J/Kg" %Gas,"Radiation:%s rad "%radn,"to IBM Watson") success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(1)
    deviceCli.commandCallback=myCommandCallback
deviceCli.disconnect()
```

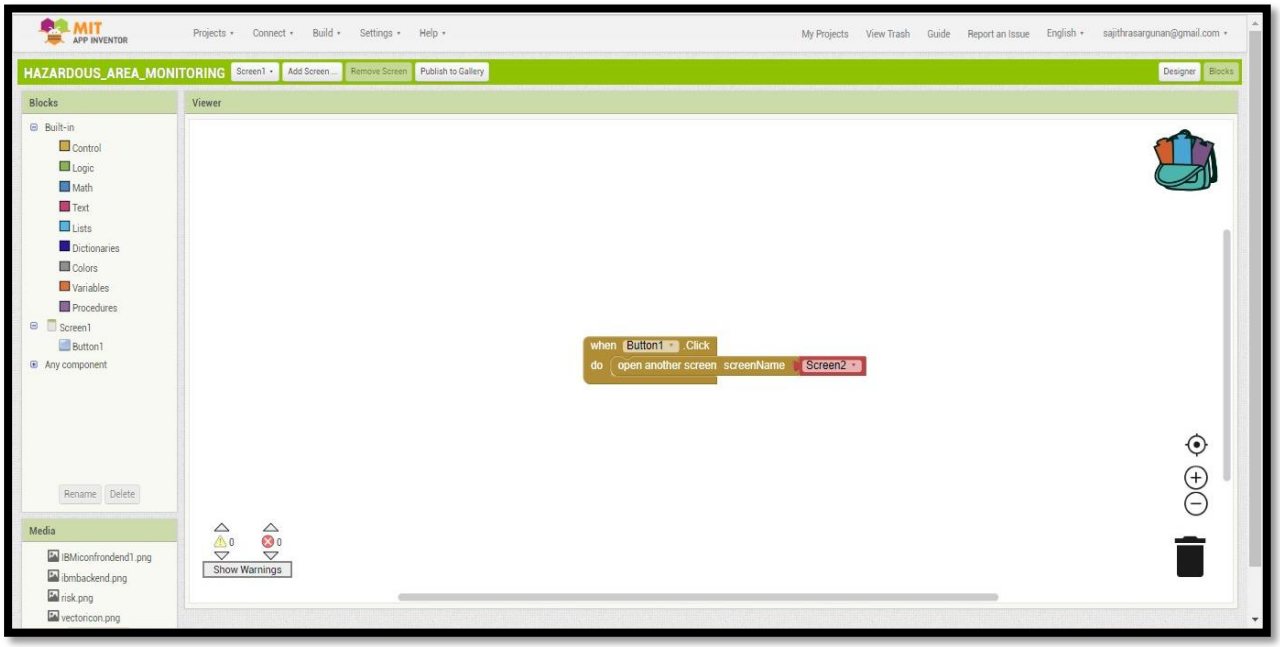
7.1.2 OUTPUT:



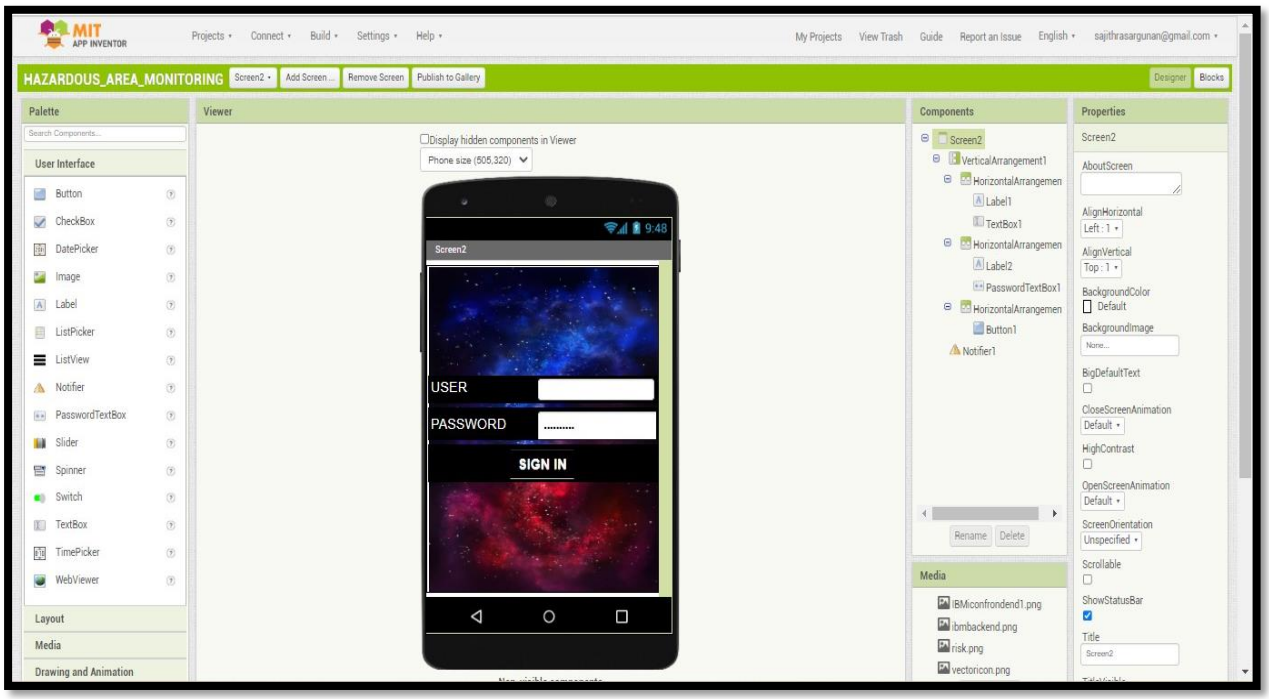
7.2 FEATURE 2(MIT APP INVENTER):

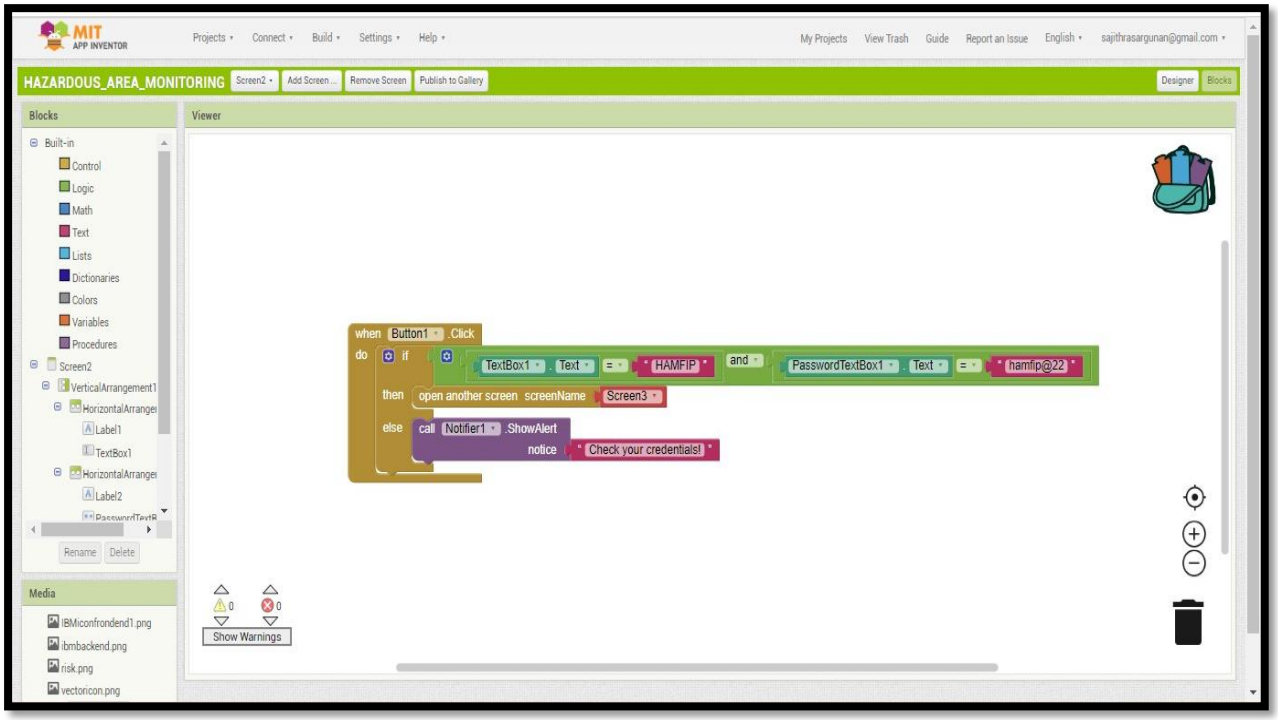
SCREEN 1:



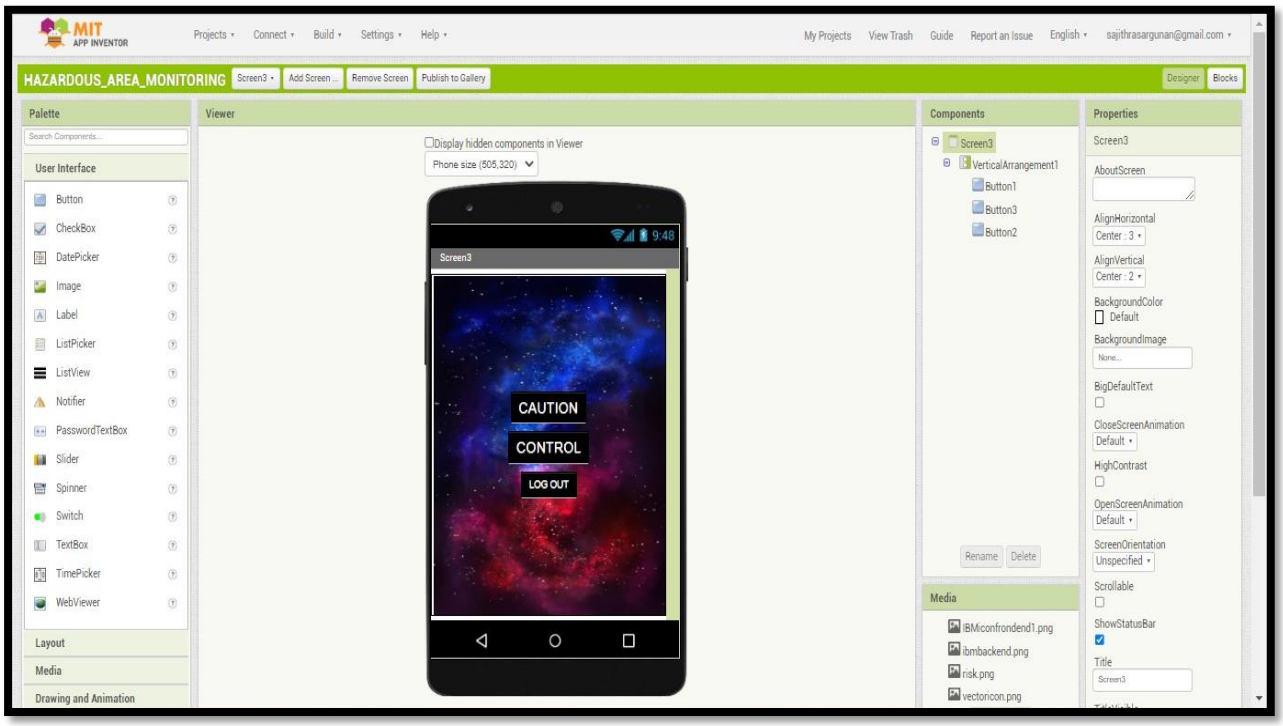


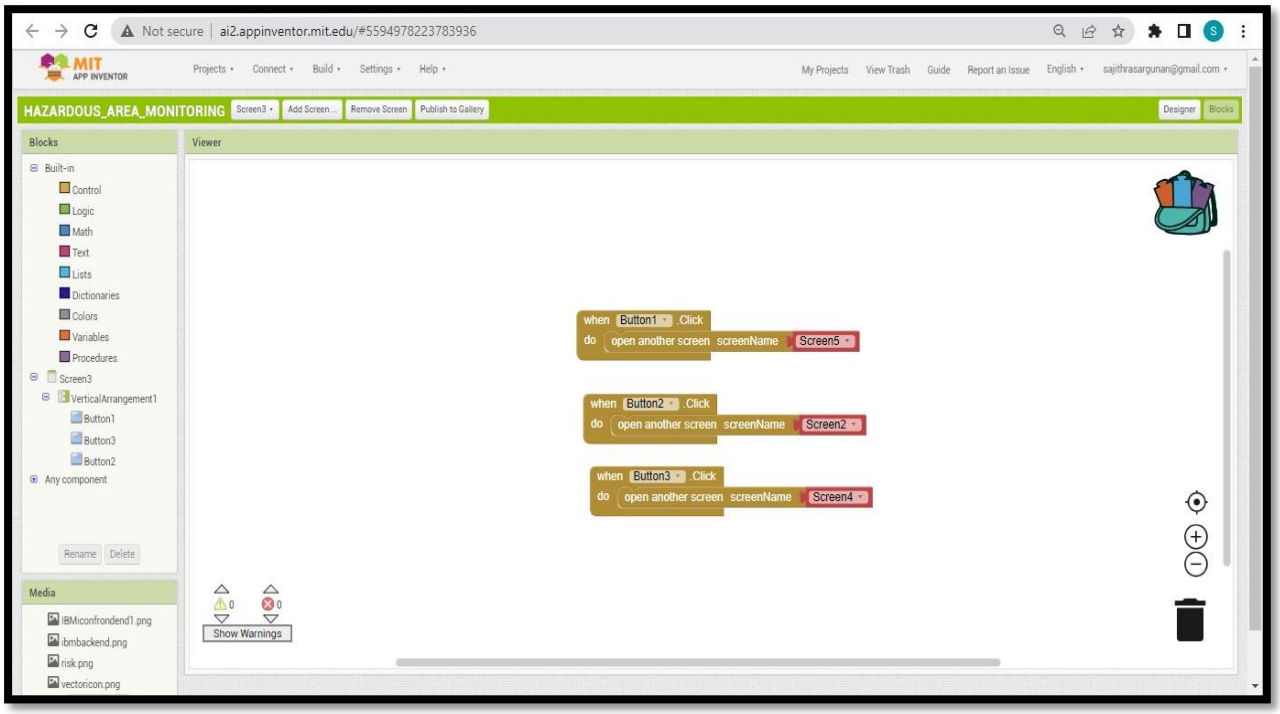
SCREEN 2:


MIT APP INVENTOR
HAZARDOUS_AREA_MONITORING
Palette
Viewer
Components
Properties
Screen2
USER
PASSWORD
SIGN IN

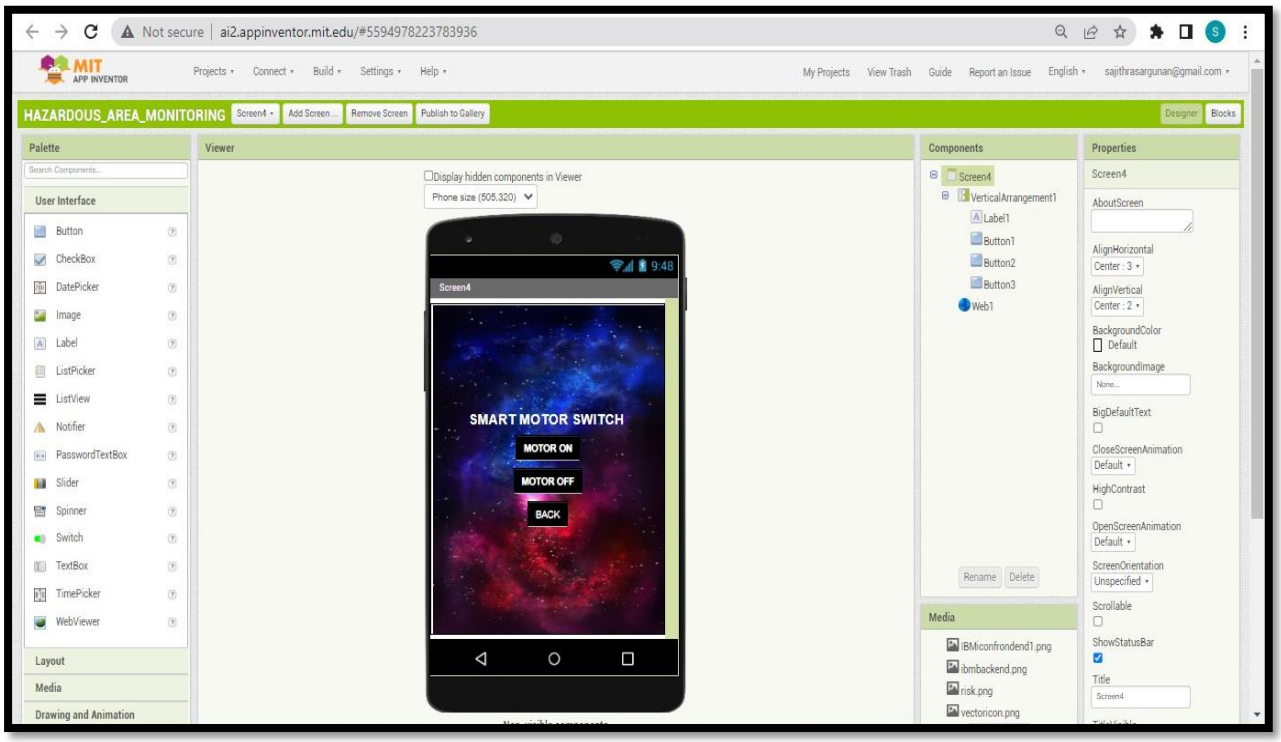

MIT APP INVENTOR
HAZARDOUS_AREA_MONITORING
Blocks
Viewer
when Button1 .Click
do if TextBox1 . Text = " HAMFIP " and PasswordTextBox1 . Text = " hamfip@22 "
then open another screen screenName Screen3
else call Notifier1 .ShowAlert
notice " Check your credentials! "
Show Warnings

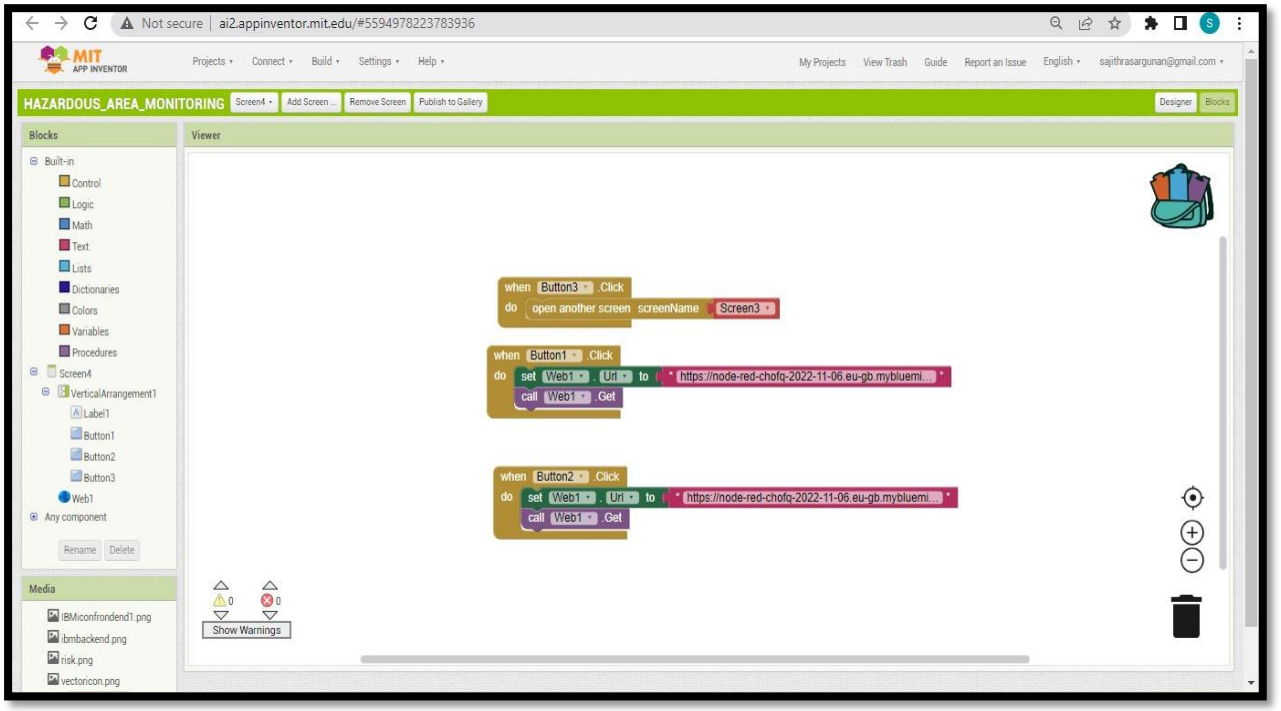
SCREEN 3:


MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
sajithrasargunan@gmail.com
HAZARDOUS_AREA_MONITORING
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Drawing and Animation
Viewer
Display hidden components in Viewer
Phone size (505,320)
9:48
Screen3
CAUTION
CONTROL
LOG OUT
Components
Screen3
VerticalArrangement1
Button1
Button3
Button2
Rename
Delete
Media
IBMiconfrondend1.png
ibmbackend.png
risk.png
vectoricon.png
Properties
Screen3
AboutScreen
AlignHorizontal
Center : 3
AlignVertical
Center : 2
BackgroundColor
Default
BackgroundImage
None...
BigDefaultText
CloseScreenAnimation
Default
HighContrast
OpenScreenAnimation
Default
ScreenOrientation
Unspecified
Scrollable
ShowStatusBar
Title
Screen3

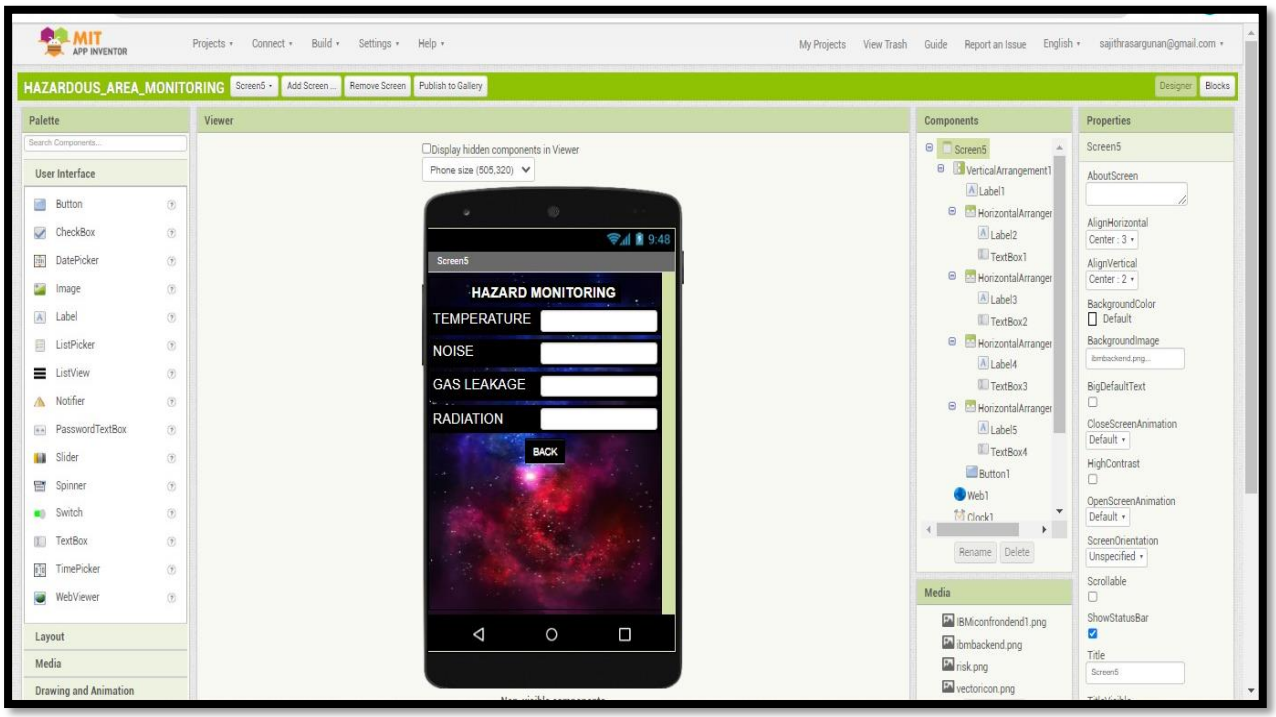

Not secure
ai2.appinventor.mit.edu/#5594978223783936
MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
sajithrasargunan@gmail.com
HAZARDOUS_AREA_MONITORING
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen3
VerticalArrangement1
Button1
Button3
Button2
Any component
Rename
Delete
Media
IBMiconfrondend1.png
ibmbackend.png
risk.png
vectoricon.png
Viewer
when Button1 .Click
do open another screen screenName Screen5
when Button2 .Click
do open another screen screenName Screen2
when Button3 .Click
do open another screen screenName Screen4
Show Warnings

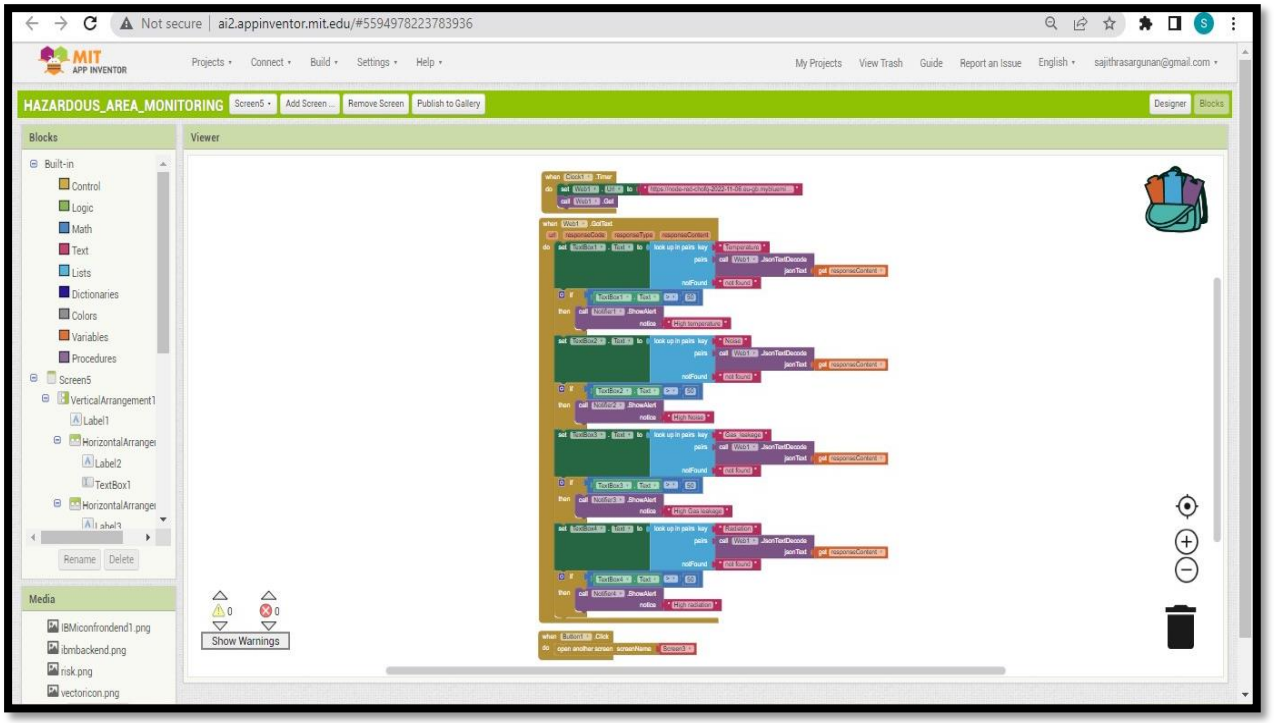
SCREEN 4:


HAZARDOUS_AREA_MONITORING
Screen4
SMART MOTOR SWITCH
MOTOR ON
MOTOR OFF
BACK

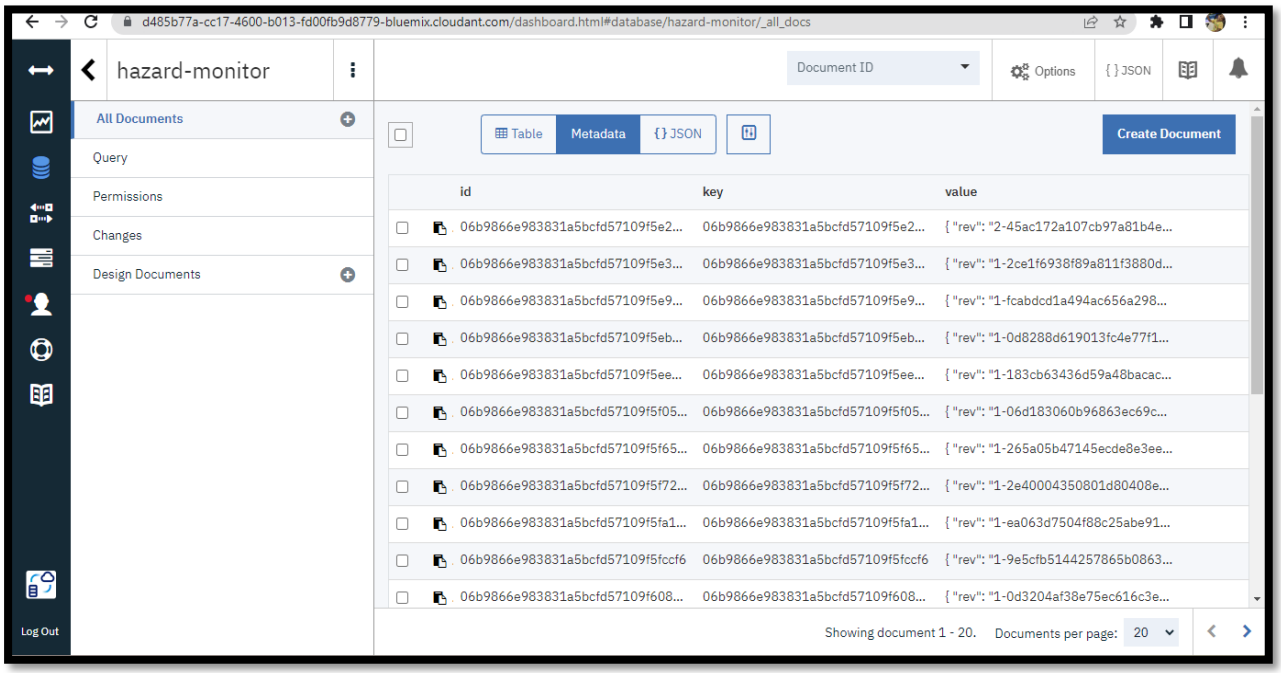

HAZARDOUS_AREA_MONITORING
when Button3 .Click
do open another screen screenName Screen3
when Button1 .Click
do set Web1 . Url to https://node-red-chofq-2022-11-06.eu-gb.mybluemi...
call Web1 .Get
when Button2 .Click
do set Web1 . Url to https://node-red-chofq-2022-11-06.eu-gb.mybluemi...
call Web1 .Get
Show Warnings

SCREEN 5:


MIT APP INVENTOR
HAZARDOUS_AREA_MONITORING
Palette
Viewer
Components
Properties
Screen5
HAZARD MONITORING
TEMPERATURE
NOISE
GAS LEAKAGE
RADIATION
BACK

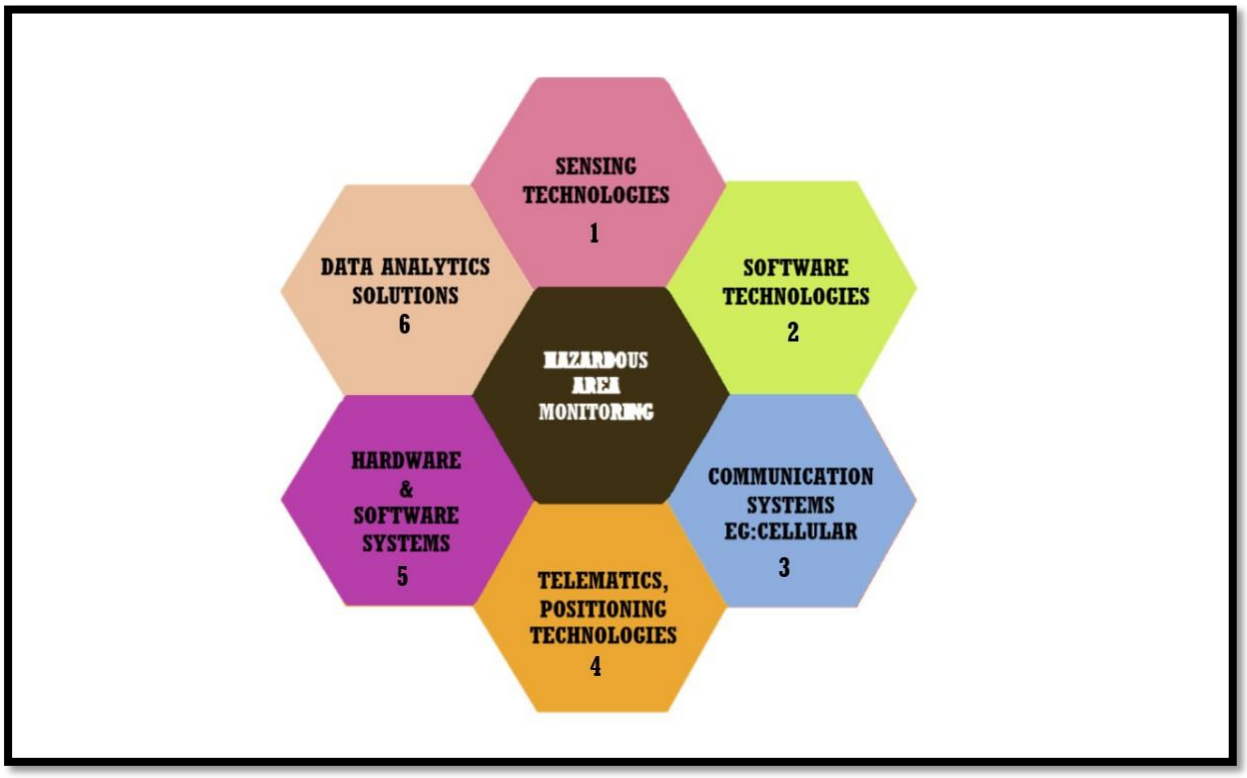

Not secure
ai2.appinventor.mit.edu/#5594978223783936
MIT APP INVENTOR
HAZARDOUS_AREA_MONITORING
Blocks
Viewer
Show Warnings

7.3 DATA SCHEMA (CLOUDANT DB):



8.RESULTS:

8.1 PERFORMANCE METRICS:



9. ADVANTAGES & DISADVANTAGES:

9.1 ADVANTAGES:

- Industries can be monitored and controlled remotely.
- Increase in convenience to the workers.
- Less labour cost.
- Better standards of living.

9.2 DISADVANTAGES:

- Lack of internet and connectivity issues.
- Added cost of internet.
- Added cost of internet gateway infrastructure.
- Workers have to adapt to the use of web app.

10.CONCLUSION:

Thus the objective of the project to implement an IoT system in order to help the workers of industries to control and monitor has been implement successfully.

11.FUTURE SCOPE:

In industry, workers are looking for ways to improve their living standards by looking for ways to reduce the loss of life. Therefore, there is a need to make better and more optimal decisions and improve livelihood management. Traditional consulting services were once based on general knowledge gained from research experiments, but there is a growing need for industry-generated information and knowledge in a region-specific context. Big Data Technologies is expected to help us better achieve these goals.

12.APPENDIX:

SOURCE CODE:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization="pyflre"
deviceType="hazard"
deviceId="231099"
authMethod="token"
authToken="zHP+8fjUb*HmxvADd8"
def myCommandCallback(cmd):
    print("Command received:%s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print("Motor is ON")
    else:
        print("Motor is OFF")
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()
deviceCli.connect()
while True:
    temp=random.randint(0,100)
    noise=random.randint(0,100)
    Gas=random.randint(0,100)
```

```
    radn=random.randint(0,100)
    data={'Temperature' :temp,'Noise':noise,'Gas_leakage':Gas,'Radiation':radn}
    def myOnPublishCallback():
        print("Published Temperature=%s C" %temp,"Noise:%s db" %noise,"Gas_leakage:%s J/Kg" %Gas,"Radiation:%s rad "%radn,"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
deviceCli.disconnect()
```

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-15300-1659596877

DEMO LINK:

https://youtu.be/qN6kxssYvXU