

R.M.D ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

**PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND
ENTREPRENEURSHIP**

HAZARDOUS AREA MONITORING FOR INDUSTRIAL POWER PLANT BY IoT

NALAIYA THIRAN PROJECT REPORT 2022

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CHAPTER 1

1. INTRODUCTION

Project Overview

Since technological growth is a continuous process, we must be prepared and aware of any new advances. Because of these technological advancements, daily life has become more convenient. The necessity for automation has become essential. All systems and data are now accessible over the internet, and web technology is constantly developing. Using a web-based embedded system, a network interface provides remote management and control of embedded devices. Web control is used to manage Internet of Things (IoT) devices. The most popular technique of web development in the world uses a software stack called a web controller. For data monitoring, administration, and handling, distributed network control systems made with web technologies are used instead of massive server systems. The industrial monitoring system connects itself with the open-source SMS for admin. IBM Iot platform connected to the Node Red for develop the web application .Then IBM Watson platform connected to the Python software. We have sent the random values for input as temperature. In software to check the temperature that person, SMS sent to admin using API KEY when the temperature value high compared to the threshold temperature value. API KEY also provides by the IBM Watson. SMS sent by Fast to SMS that is connected to the Node Red. Sometimes you are developed the app with help of MIT app inverter.

Purpose

The parallel-connected heat can also be included in this SMS system. The microcontroller serves as the brain of this SMS system, managing all activities.

The monitoring system used by the SMS system allows it to locate and identify the area that is on fire. It is capable of showing the results from every sensor in the monitoring system.

In order to keep the temperature level as well as employees health, and SMS systems in safe, dependable, and effective operating condition, the systems must undergo inspection, testing, and maintenance.

With the use of temperature sensors, each employees health issues that happens in the industry can be detected. To protect people for any health issues . To use a SMS alarm to warn people if an diseases occurs and to use IOT to do so.

CHAPTER 2

2. LITERATURE SURVEY

TITLE : IoT based temperature and humidity monitoring framework

AUTHOR: Rafizah Ab Rahman,Ummi Raba' ah Hashim,Sabrina Ahmad.

YEAR :2019

In order to understand the relationship and variation between temperature and humidity with respect to the various locations of measurements, this study investigated the use of Internet of Things (IoT) in monitoring the temperature and humidity of a data centre in real-time using a basic monitoring system. Utilizing the suggested architecture, a system for monitoring temperature and humidity was developed and put into use at the Politeknik Muadzam Shah data centre. There, readings were recorded and forwarded to an AT&T M2X IoT platform where they were stored. The information was then downloaded and analysed, revealing that the temperature and humidity recorded at various places varied significantly. X Extreme temperature and humidity variations were successfully detected by the monitoring system.

TITLE : Smart Weather Monitoring And Real Time Alert System Using IoT

AUTHOR: Yashaswi Rahut,Rimsha afreen, Divya Kamini

YEAR : 2018

The proposed system employs IoT to make its real-time data freely accessible over a very broad range and is an advanced solution for weather monitoring. The system uses a number of sensors to monitor many aspects of the weather and climate, including temperature, humidity, wind speed, wetness, light intensity, UV radiation, and even airborne carbon monoxide levels. The data from these sensors is transmitted to the website, where it is shown as graphical statistics. Anywhere in the world can readily access the data that has been uploaded to the website. These web pages' data collection can also be utilised as a future reference. The concept even includes an app that sends alerts as a reliable alarm system to inform users of sudden and unexpected.

TITLE : AIR POLLUTION MONITORING SYSTEM WITH IOT

AUTHOR : Vivekanand Prakash Rachure, Dr.Vasudev, B.Virulkar

YEAR : 2019

- We are developing an IOT-based air pollution monitoring system in which we will monitor the air quality via a web page using a WI-Fi module and the internet. The system will sound an alarm when the air quality drops below a certain point, i.e., when enough dangerous gases, such as CO₂, CO, smoke, CH₄, and benzene, are present in the air. It will display the air quality in PPM and in the percentage on the LCD and as well as on the webpage in PPM so that we can easily monitor it and make a graphical presentation on the webpage.

TITLE: Air and Sound Pollution Monitoring System Using IOT

AUTHOR: Ms.Aarthi,etal.

YEAR:2018

One of the significant problems today is the rising air and sound pollution. As pollution worsens, more diseases are emerging as a result. Controlling pollution is now necessary in order to ensure healthy living and a brighter future. Everyone who is interested in the pollution level can access the Air and Sound Pollution Monitoring gadget. A mobile application that displays the pollution level can be used to install the device. This device has the ability to detect fires in the surrounding area and report them to the appropriate authorities so that they can take the appropriate action and contain the fire to minimise damage. This system employs an IOT, or Internet of Things, technique.

TITLE : IoT based Environmental Monitoring and Control System

AUTHOR: GhulamRubabMirza, Etal

YEAR:2019

Due to climatic changes that increased the importance of environmental monitoring, IoT plays a significant role in gathering data from the sensing unit around our surroundings. Using the Node MCU, DHT11 sensor, ACS712 current sensor, Thing Speak (Open IoT analytics service), and Blynk application, this paper describes the building of a real-time environmental monitoring and control system. Thing Speak's primary responsibility is to continuously monitor parameters (such as humidity, temperature, and power consumption) using real-time sensors. Thing Speak has an API (application programming interface) that collects sensed data and allows users to view the monitored data in graphs at intervals of every 15 seconds. This technology is also intended to allow users to control home appliances from anywhere in the world.

TITLE : Study and Development of Temperature & Humidity monitoring system through Wireless Sensor Network (WSN) using Zigbee module.

AUTHOR:Hemalata Tomer,Kapil Mangla.

YEAR:2015.

Given that they are now frequently utilised as the main monitoring system in a variety of applications, wireless sensor networks have become a crucial component of every developing nation. The risks associated with wiring systems are eliminated by wireless sensor networks, which also significantly simplify and reduce the cost of data monitoring and measurement. Wireless networks are best suited for various process plants, industries, and remote & rural communication due to its decentralised architecture and flexibility of deployment. In this study, wireless sensor

network applications are made for online measurement and monitoring of reaction chambers, furnaces, and other industrial measurement targets.

TITLE: Weather Monitoring Station: A Review

AUTHOR: Mr.DipakV.Sose,Dr.Ajij,D.Sayyad,

YEAR: 2018

Since weather monitoring is crucial to human life, it is important to research the weather system. There are now two different types of weather monitoring stations: wired and wireless. The popularity of wireless systems nowadays is due to their benefits over wired ones. In weather monitoring, the characteristics typically include temperature, humidity, air pressure, light intensity, rainfall, etc. There are numerous ways that have been used with various processors, including PIC, AVR, and ARM. The analogue output of the sensors is fetched using an analogue to digital channel. The GSM, FM channel, Zigbee, RF, and other wireless technologies used in weather monitoring have their own protocols.

TITLE:IOT BASED INDUSTRIAL MONITORING SYSTEM

AUTHOR: Hemlata Yadav, Etal,

YEAR: 2022

A new industry called the Internet of Things (IoT) seeks to connect "things," "people," and "machines" to the internet. IoT-based industrial monitoring solutions are at the forefront of the global modernization and automation that is taking place. To ensure that the products are safe and effective, it is critical to evaluate the state of the sector. An IoT-based industrial monitoring system with intelligent sensors is what this study aims

to build. Big data integration allows the Blynk app to be utilised from anywhere on the earth to check on status. IoT monitoring is now simpler thanks to streamlined data analysis. The manufacturing industry might benefit from the proposed technology. Any industrial industry that incorporates technology will guarantee workers' security and welfare.

TITLE: Real-time monitoring system for weather and air pollutant measurement with HTML-based UI application.

AUTHOR: Prisma Megantoro, Brahmanty Aji Pramudita, Vigneshwaran Pandi

YEAR: 2021

In this post, it is discussed how to create an HTML web-based application and an IoT system to track meteorological variables and airborne gas pollution. The following weather variables are measured: wind direction and speed, precipitation, air temperature and humidity, barometric pressure, and UV index. On the other hand, ammonia, hydrogen, methane, ozone, carbon monoxide, and carbon dioxide were all measured. In this article, a method for sending full parameter data is introduced. Each sensor's read parameters are all converted to strings, then all of the strings from all of the sensors are combined into a string dataset, which is periodically sent to the server. The dataset that was obtained from the server is parsed for processing on the UI side before being presented. Google Firebase serves as the real-time database server for this system.

Existing Problem

Two curation systems make up the suggested system. The first is curation that is based on machines, and the second is curation that is based on users. These curative systems are set up to offer an intelligent and uncontrollable feedback to the existing environment. The latter requires the user to actively manage the reaction that the hardware provides, whereas the former is more of a predictive system designed on hardware. The curation done by the device is referred to as "Direct Machine Based Curation" and is based on the sensor data it gets from its end points (sensory hardware units). Additionally, the gadget and cloud server offer a hybrid machine-based curation service that uses Weather Forecast data along with sensor data from it.

Reference

1. Zhao Hongzhuang, Li Weidong, Zhou Pinggen, et al. For geological disaster monitoring and early warning of intelligent multimedia sensor network, Science and Technology Consulting Herald, 2012(2):29~30.
2. Lin Liangjun, Fang Cheng, Li Xiaojie, et al. Preliminary analysis of the Wenchuan earthquake disaster area geological disaster, Hydrogeology and Engineering Geology, 2008,35(4):129~132.
3. WANG Xin, LIU Xiaoying, QI Shi, LAN Jingtao, LIU Dan. Monitoring and Prediction of Landslide and Debris Flow in Japan, Journal of Anhui Agri Sci, 2009, 37(14): 6503-6505.

4. CUI Zhongxin. Development of a Field Automatic Measuring System For Landslide—An Brief Introduction on a Field Automatic Measuring System For Landslides Had Created by Hisashi TSUCHIYA and others, Bulletin of Soil and Water Conservation, 1994,14(5): 1- 7.
5. U.S. Geological Survey. Landslide Hazards Program 5-Year Plan 2006-2010, 2005. <http://landslides.usgs.gov>
6. ZHE Lun. Landslide Hazards Program of the U.S. Geological Survey, Resources and living environment, 2009,(17).42-46.
7. WANG Zhuoni. Enlightenment and progress of the USGS landslide research and service, Advances in Meteorological Science and Technology, 2013,3 (suppl):62-69.
8. Liu Chuanzheng, Yang Bing. A new thought of surveying, evaluating, monitoring and forecasting for the geologic hazards in the threegorges on changjiang river, Journal of Engineering Geology, 2001, 9(2) 121~126
9. Atzori L, Iera A, Morabito G. The Internet of Things: A survey, Computer Networks, 2010(15):2787-2805.
10. Domingo MC. An overview of the Internet of Things for people with disabilities, Journal of Network and Computer Applications, 2012(2): 584-596.
11. Kortuem G, Kawsar F, Fitton D et al. Smart objects as building blocks for the Internet of Things, Internet Computing, IEEE 2010(1):44~51.
12. Hong-hui Wang, Xian-guo Tuo, Gui-yu Zhang, Feng-ling Peng. Panzhihua airport landslide (Oct. 3rd 2009) and an emergency monitoring

and warning system based on the internet of things, Journal of Mountain Science, 2013,10(05): 873~884.

13. Sun Enji, Zhang Xingkai, Li Zhongxue. The Internet of Things (IoT) and cloud computing (CC) based tailings dam monitoring and prealarm system in mines, Safety Science, 2012(4):811~815.

14. Zhu Yonghui, Bai Zhengdong, Guo Jingjun, et al. A new wireless system for geological disasters monitoring based on Beidou, Bulletin of Surveying and Mapping, 2010(2):5~7.

Problem Statement

Generally in industrial plants there are some areas which are to be monitored time to time. Sometimes the conditions may become critical which may leads to loss of life and property.

Here in industrial plants EXPLOSION and FIRE are the two major constituents of these mishaps. Depending up on the environment these can be termed as ACCIDENTS or NEAR MISSES.

Here FIRE means a rapid oxidation reduction reaction which results in the production of heat and generally visible light

And EXPLOSION is a violent and sudden expansion of gasses produced by rapid combustion then strong forces when shunt in small space and create a loud sound sharp noise and shock waves.



Problem Statement (PS)	I am	I'm trying to	But	Because,	Which makes me feel
PS-1	Fire accident detector	Detect fire accidents	Small amount of sparkle also leads to become fire accident	They are flammable and act as high source of ignition	It affect materials and endanger to humans if in case of rapid fire accident occurred
PS-2	Fire accident detector	To hire careful/ <u>experience</u> employees in industry	Careless mistakes will affect whole industry	They are flammable and act as high source of ignition	If we done a work with careless method, it affect whole industry and their <u>surroundings</u>

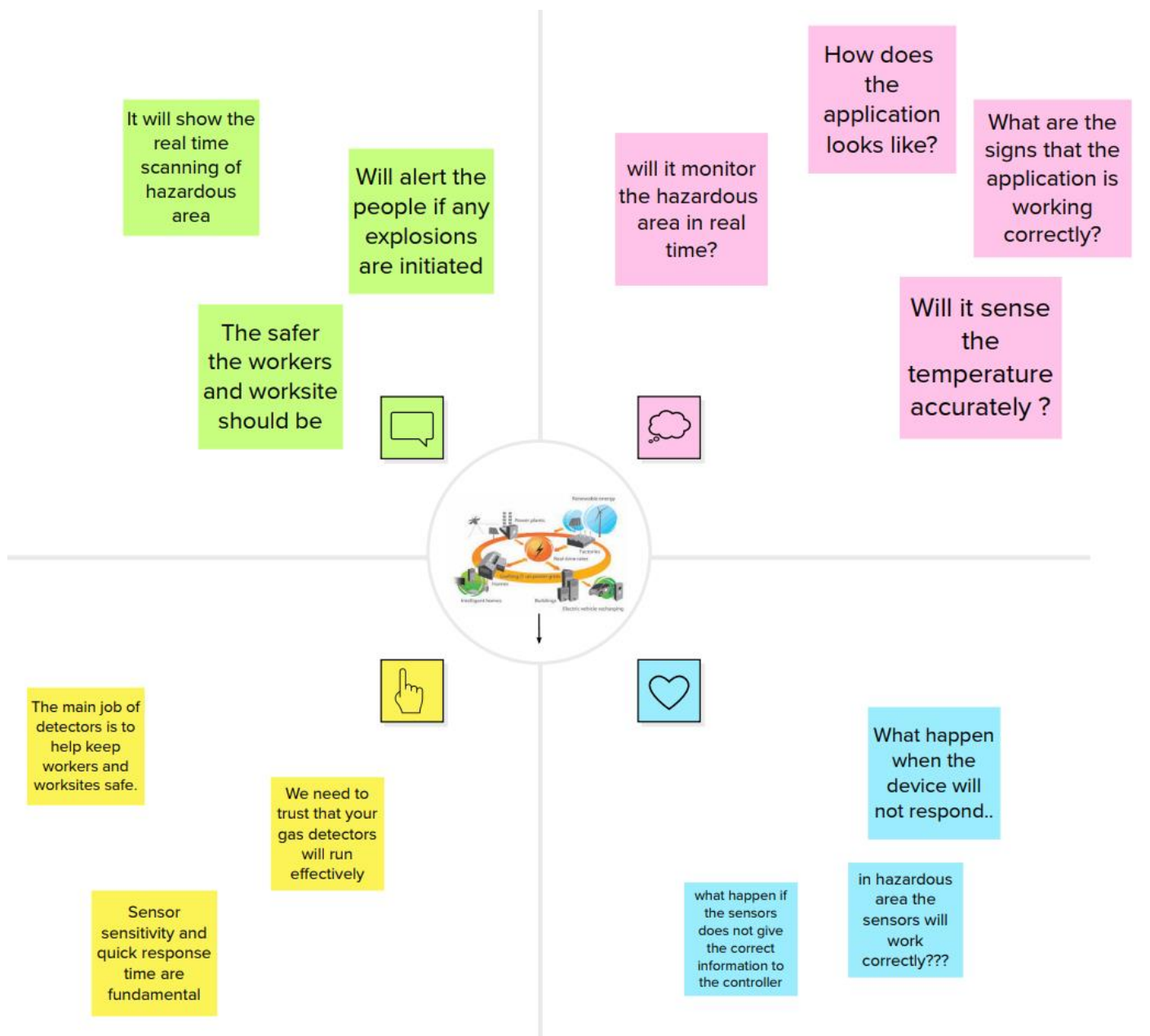
CHAPTER 3

3. IDEATION & PROPOSED SYSTEM

Empathy Map Canvas

An empathy map is a straightforward, simple-to-understand picture that summarises information about a user's actions and views. It is a helpful tool that enables teams to comprehend their users more fully. It's important to comprehend both the actual issue and the person who is experiencing it in order to develop a workable solution. Participants learn to

think about situations from the user's perspective, including goals and challenges, through the exercise of creating the map.



Ideation & Brainstorming:

NAVYASREE SIRAM

Hazardous Area
Monitoring it is
a device which
is useful for
industrial plants

*This
monitoring
system is
based on
sensors*

cost
effective

By monitoring
we can improve
productivity
and quality

SOWMIYA

Effective time
management
As manual
observation is
time consuming

It may also
cause lack
of security

With this
device risk
reduces

It improves
efficiency

SRAVANI

The hazardous area
is any area with an
atmosphere
containing Gas
leakages

The gases,
vapors, dust
which are
flammable and
explosive

Manual
surveillance
leading to health
issues can be
prevented

This device
monitors
temperature
and humidity

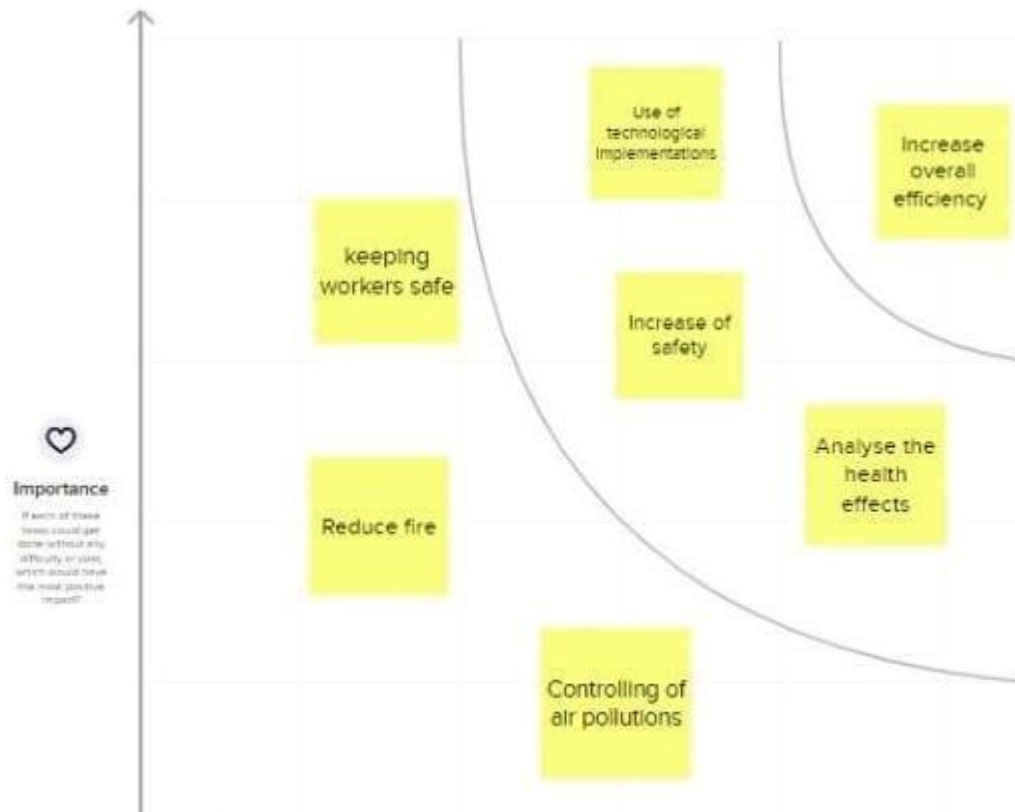
VAISHNAVI

Hygrometer is
used to
measure
humidity
levels

It is simple in
construction
and easy to
use

It provide
better
security

We use python
as software for
recording data



Proposed Solution:

1.	Problem Statement (Problem to be solved)	Hazardous Area Monitoring for Industrial Plant powered by IoT
2.	S.No.	Parameter
3.	Novelty / Uniqueness	<p>* A hazardous area is any area with an atmosphere containing, or potentially containing, gases, vapor or dust that is flammable or explosive. These areas are rigorously analyzed with condition monitoring when installing equipment to minimize the risk to individuals and assets. It is crucial that equipment operating in these conditions are efficiently monitored to pre-empt any issues before they occur. Unlike most industries, these issues not only result in downtime but also present a significant safety risk.</p> <p>* Condition monitoring is integral in industrial operations to avoid downtime, to implement maintenance and to reduce the risk of failure. Remote condition monitoring has previously been limited in hazardous areas due to the lack of effective and easy to install solutions – and the often-challenging environments in which this equipment exists. For example, equipment used in subsea applications or on offshore operations cannot be monitored as frequently as equipment on land.</p>
4.	Social Impact / Customer Satisfaction	1) To prevent pollution 2) Real-time plant monitoring 3) Reduced risks of disasters 4) Automated detection 5) Excellent customer experience
5.	Business Model (Revenue Model)	Raspberry Pi 3 Temperature Sensor - DS18B20 Gas Sensor - MQ 5/9 Breadboard Raspbian OS (Running on Rpi-3) Simple push API Thing speak Cloud Platform
6.	Scalability of the Solution	This system can be deployed in many industrial areas like mining, underground factories, metal refineries, welding factories and even heavy parts production lines. It will help to provide a safe and efficient working environment, while also opening new paths to improve the safety parameters of these places.

Problem Solution Fit:

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. kids <div>Industries</div>	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices. <div>Spending Power Internet Communication</div>	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. own and paper is an alternative to digital <div> Available Solution – Fire Alarms Job Done - It alerts employees through buzzer after fire impact Pros - Reduces damage of resources Cons - Causes Delay </div>	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. <div> To avoid explosions - incase of high temperature fluctuations To avoid health issues –incase of leakage of poisonous gases </div>	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations. <div> If any explosions or poisonous gasses released in hazardous areas leads to loss of many human life and property. Here this device will help to reduce the dangerous explosions in industries and saves many human life by alerting them. </div>	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? i.e. Directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace) <div> By installing better temperature sensors, Gas Sensors, Humidity Sensors it compares readings with threshold values and helps in reducing time delay. </div>	
4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design. <div>Threatened > Secured</div>	It is used to detect hazardous areas in industries <div> *instead of using normal alerting systems this device will alert the people before impact *based on changes in hazardous values the device will work *if temperature increases beyond threshold values then it will alert before impact this real time may helps to save the human lives *similarly if any poisonous gasses releases then here our device will detect and alert the people in the area to save human lives </div>	3. OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. <div> Online : the customer need to track the device to check the hazardous areas. Offline: need to take help of fire services </div>	Identify strong TR & EM	

4. REQUIREMENT ANALYSIS

Functional Requirements:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Data Gathering	The smart beacon must be able to detect and the temperature of a particular area in real.
FR-2	Location Detection	The smart beacon must be able to detect when a wearable device has entered an area near it.
FR-3	Beacon Data Syncing	The smart beacon must be able to share its stored data with both the wearable device and admin dashboard through the cloud.
FR-4	Wearable Device Display	The wearable device must be able to display the temperature of the area where the worker is currently present.
FR-5	SMS Notification	If the temperature of the area is found to reach dangerous levels, the worker should be informed via SMS to their phone instructing them to leave the area.
FR-6	Admin Dashboard	If the temperature of the area is found to reach dangerous levels the admin is informed via the dashboard and must take the necessary precautions.

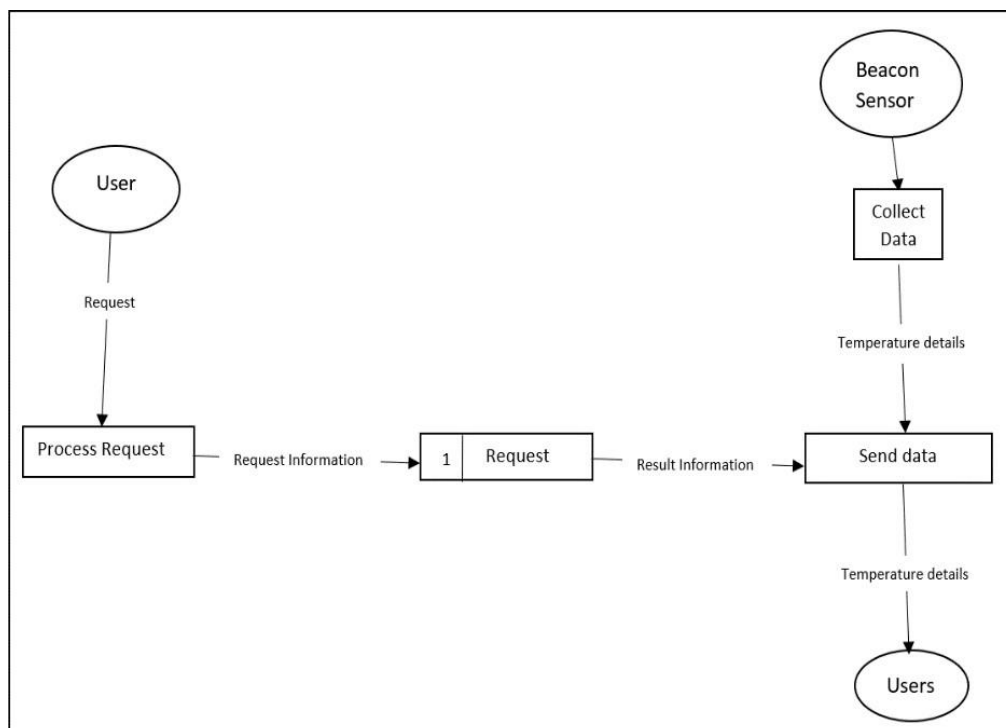
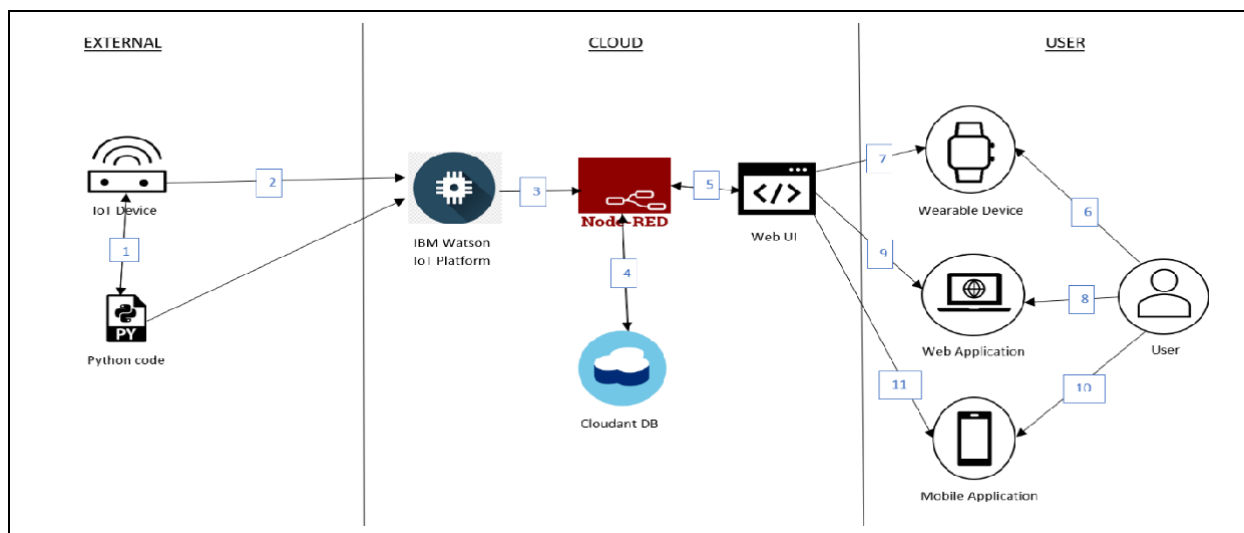
Non-Functional Requirements:

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	<p>The wearable device should be slim and not annoy or disturb the workers who are wearing them.</p> <p>They should also reliably display the temperature without large delays and notifications should be clear in cases of detected danger.</p>
NFR-2	Security	<p>The connection of the beacons to the cloud and wearable devices should be secure.</p> <p>The security of the database housing all the temperature data should also be bolstered.</p>
NFR-3	Reliability	<p>The wearable device should be able to function without any faults even at dangerous temperatures.</p> <p>If a fault is detected it should notify the user and the admin to be immediately repaired and replaced.</p> <p>The beacons should also be regularly maintained to ensure reliability.</p>
NFR-4	Performance	<p>The device should update temperature readings in real time and requires high end sensors and processors to do so.</p> <p>The time to send data to the cloud and other devices should also be made as small as possible.</p>
NFR-5	Availability	<p>The user should be able to check the temperature of the area no matter where or at what time they are in the plant.</p> <p>The dashboard should be constantly active so as to ensure safety precautions can be executed whenever danger is detected.</p>
NFR-6	Scalability	<p>If the area that needs to be monitored needs to be increased all one has to do is install new smart beacon devices and connect them to the same system as the previous beacons.</p> <p>It can also be replicated in different plants with different factors to be monitored giving it highly scalability.</p>

CHAPTER 5

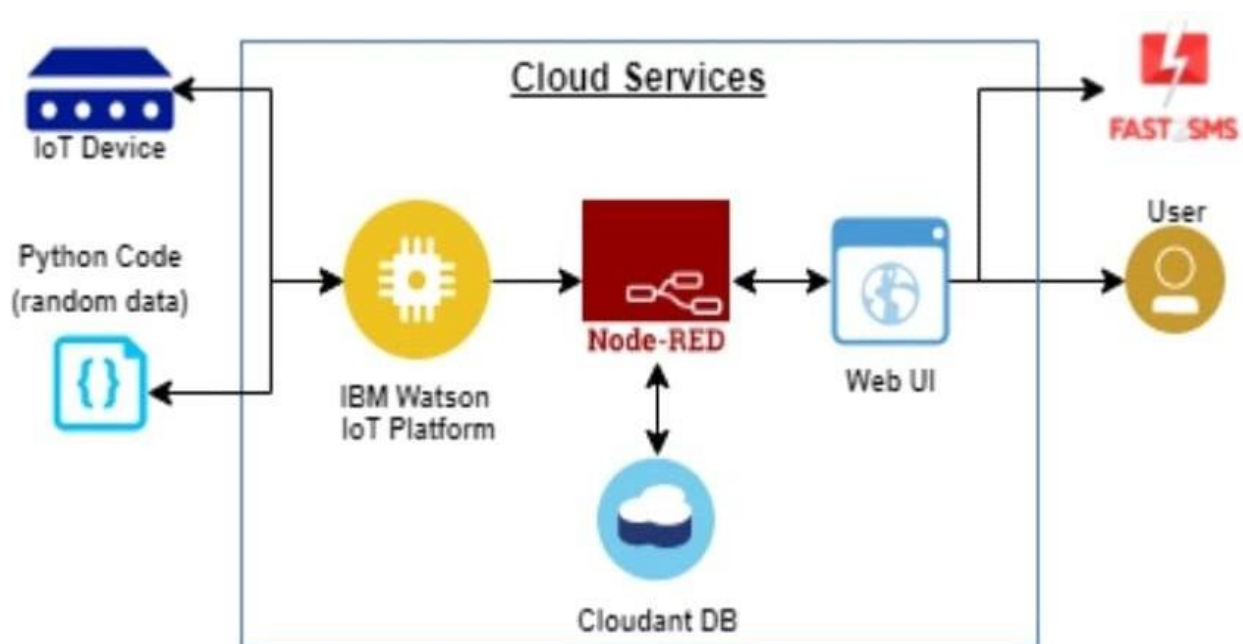
Data Flow Diagrams:

An information flow diagram can depict how data moves throughout a process. This covers data input/output, data storage, and the numerous data-moving supporting operations. Standardized symbols and notations are used to generate DFDs in order to characterize diverse entities and their relationships.



Solution & Technical Architecture:

For communication and analysis, IBM Cloud offers visualizations, exploration, dashboard reports, and tales. A view that includes visualizations, such as a graph, chart, plot, table, map, or any other type of visual representation of data, can be put together. A dashboard provides critical insights and information about your data on one or more pages or screens, allowing you to keep track of events or actions at a glance.



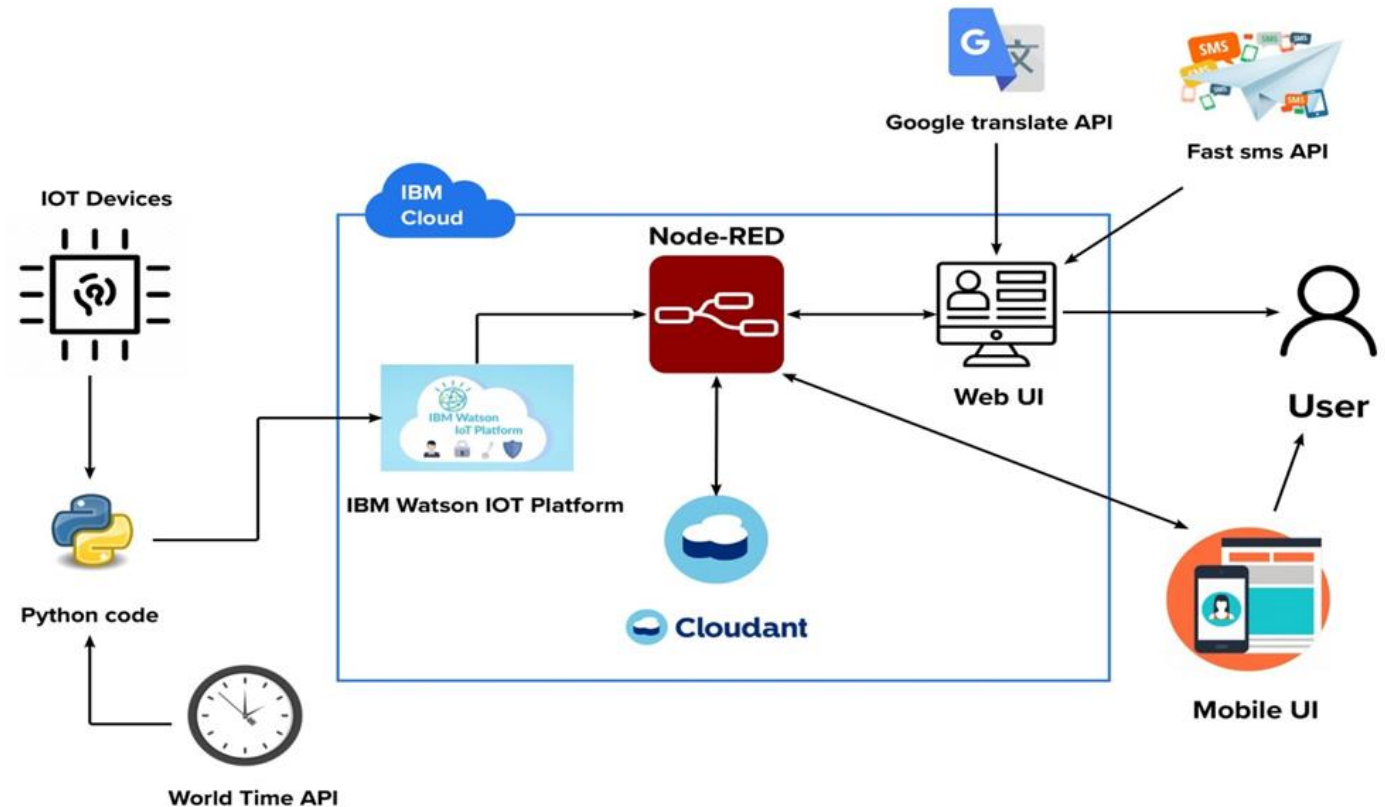
User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Technician	Installation	USN-1	The technician must install the smart beacons at points to ensure the entire area of the plant is covered.	A beacon can be found in every area of the plant.	High	Sprint-1
	Data Gathering	USN-2	The beacons obtain the temperature of their respective area using sensors.	The temperature of areas within the plant is obtained.	High	Sprint-1
	Data Sync	USN-3	The beacons send their data to the cloud in the real time which is in turn sent to nearby wearable devices and the administrators dashboard.	Data is sent to the cloud successfully and synced with other devices.	High	Sprint-1
Worker	Wearable device display	USN-4	The wearable devices should display the data sent by beacons within the area.	The user can see the temperature of the area on their device.	High	Sprint-1
	Wearable device adjustments	USN-5	The user can adjust the size of the wearable device to better suit them.	The user can make adjustments to the device to make working with it more comfortable.	Low	Sprint-2
	Wearable display customization	USN-6	The user can adjust the device display to suit their needs on the device itself.	The user can modify the display of the device to increase readability.	Medium	Sprint-2
	SMS Notifications	USN-7	The user is sent a notification to their phone from the wearable device through an API when the area they are in reaches dangerous temperatures.	The user is informed of potential danger via SMS as soon as it is detected by the beacons.	High	Sprint-1
Administrator	Admin Dashboard	USN-8	The beacons send the data through the cloud to a dashboard which is run by the administrator.	The data of all the beacons can be viewed by the administrator of the plant.	High	Sprint-1
	Dashboard Customization	USN-9	The dashboard can be customized by the admin to suit their personal requirements and priorities.	The admin can customize the UI for their dashboard.	Medium	Sprint-2

Customer Journey

1 Phases High-level steps your user needs to accomplish from start to finish	User enters an area in the industrial complex	The user checks on the temperature of their current location	The user enters an area which is at a dangerous high temperature	The admin is informed of the current state of the location
2 Steps Detailed actions your user has to perform	Smart beacon devices obtain the temperature of the area they are present in Smart beacon devices broadcast the temperature of that particular area to any nearby devices The wearable devices receive the data sent by the beacons when they enter the area	The device notifies the user that the temperature of the area has been received/updated The temperature is displayed on the wearable device	Check if the temperature of the area has reached a dangerous level Immediately inform the user via SMS using an API	All smart beacons send their data to a central database through the cloud The data is monitored by admin who take necessary precautions
3 Feelings What your user might be thinking and feeling at the moment	<div> <div>Feeling of ease knowing they will be informed in case of any risks</div> <div>Fear of entering a possible dangerous environment</div> </div>	<div> <div>Optimism upon knowing that they are currently in a safe location</div> <div>Worry in case the location suddenly becomes unsafe</div> </div>	<div> <div>Fortunate that they are informed of the danger in a timely manner</div> <div>Panic that they are currently in an unsafe area</div> <div>Fear that there are more unsafe areas</div> </div>	<div> <div>Thankful for the information to take the necessary precautions</div> <div>Stress to make the necessary announcements and changes as soon as possible</div> </div>
4 Pain points Problems your user runs into	Users don't have a quick way to know if they are in a safe environment	Users must constantly check the wearable device for signs of changes	Users being informed of the present danger suddenly with no warning	The admin having to make updates and immediate decisions to ensure a high number of users safety
5 Opportunities Potential improvements or enhancements to the experience	Make a sleek wearable device that the user can have at all times	Constantly updating the wearable device data informing the user of the current situation	Immediate warnings are sent out via SMS through an API to the users mobile device User can also be informed in case changes are happening rapidly	Admin make necessary announcements as a user is sent by them from beacons through the cloud

Technical Architecture and Stack



1: Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web UI, Mobile App, SMS service and Wearable devices	Node-RED, Fast sms and MIT App inventor
2.	Application Logic-1	Getting input from smart beacons	Embedded C and Python
3.	Application Logic-2	Process data in cloud	IBM Watson IOT platform, Cloudant DB and Node-RED
4.	Application Logic-3	Display data to the user	Web UI, Fast sms and Mobile application
5.	Database	Real time database	Cloudant DB
6.	Cloud Database	Database Service on Cloud	IBM Cloudant
7.	External API-1	To send sms to user	Fast sms API
8.	External API-2	Language for the website is written to be dynamic	Google translate API
9.	External API-3	To access time	World time API
10.	Smart Beacon	To monitor the area and update the stats in the cloud	NodeMCU and Sensors
11.	Infrastructure (Server / Cloud)	Application Deployment on Cloud	IBM Cloud

CHAPTER 6

6. PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

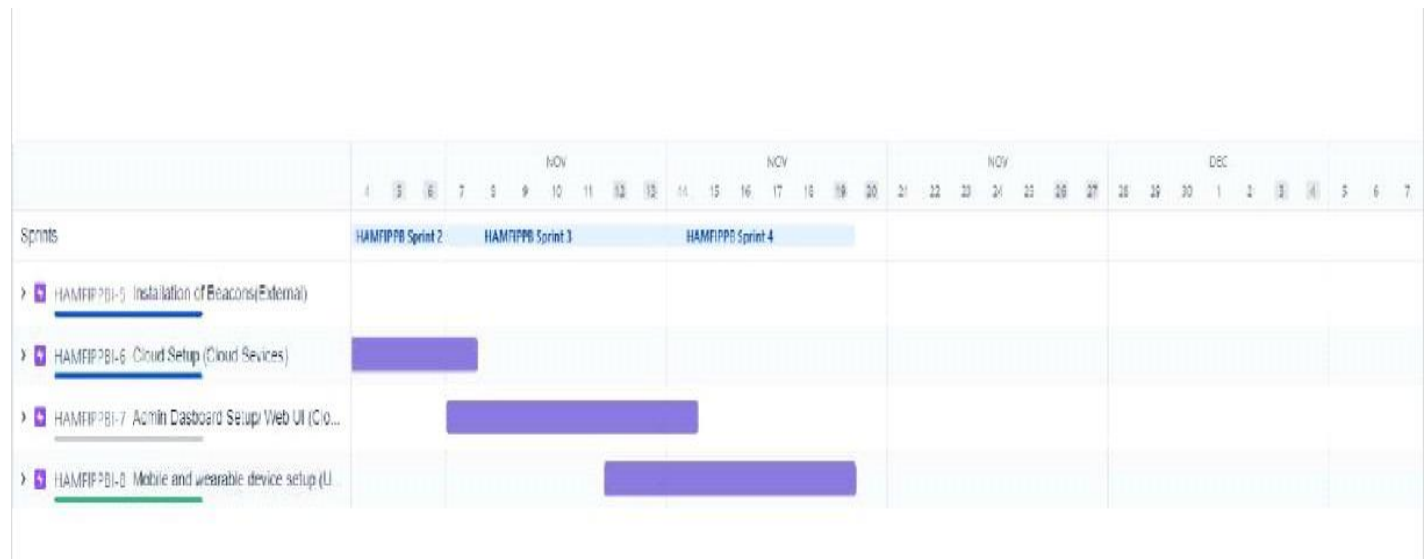
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Installation of Beacons	USN-1	First the Admin will be installing smart beacons at necessary places.	15	High	Navyasree S, Sowmiya, Sravani, Vaishnavi
Sprint-1	Providing Wearables	USN-1	The Admin will be providing everyone at the Industry a wearable device.	5	Medium	Navyasree S, Sowmiya, Sravani, Vaishnavi
Sprint-2	Cloud Setup	USN-2	The smart Beacons will connect with the cloud services. Where we can get the realtime data from the wearable	20	High	Navyasree S, Sowmiya, Sravani, Vaishnavi
Sprint-3	Online Monitoring via Web	USN-3	Websites will be created and connected with the cloud services.	20	High	Navyasree S, Sowmiya, Sravani, Vaishnavi
Sprint-4	Monitoring via Mobile	USN-4	Mobile Application will be created and fast sms will be used to alert abnormality to the user.	20	High	Navyasree S, Sowmiya, Sravani, Vaishnavi

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	10 Days	06 Nov 2022	15 Nov 2022	20	15 Nov 2022
Sprint-2	20	10 Days	16 Nov 2022	25 Nov 2022	20	25 Nov 2022
Sprint-3	20	10 Days	26 Nov 2022	05 Dec 2022	20	05 Dec 2022
Sprint-4	20	10 Days	06 Dec 2022	15 Dec 2022	20	15 Dec 2022

Reports From JIRA :

Jira brings teams together for everything from agile software development and customer service to start-ups and companies. Jira assists teams in planning, assigning, tracking, reporting, and managing work



CHAPTER 7

7. CODING & SOLUTIONING

Feature 1:

To share your insights and analysis, IBM Cloud offers dashboards and stories. A view that includes visualisations, such as a graph, chart, plot, table, map, or any other type of visual representation of data, can be put together.

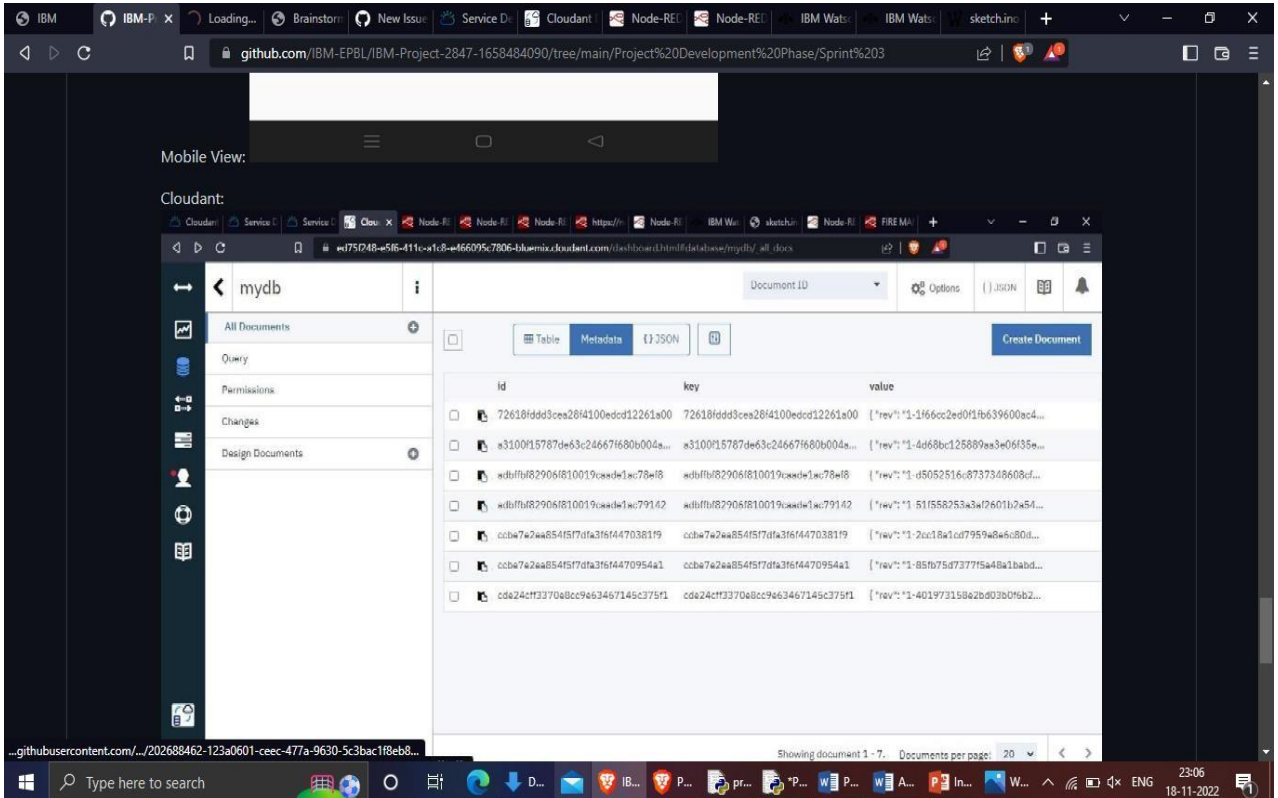
Feature 2:

Discover trends and correlations that have an impact on your business by exploring sophisticated visualisations of your data in the IBM cloud. By presenting critical insights and analyses about your data on one or more pages or screens, a dashboard enables you to keep track of events or actions at a glance.

The modules in our work are as follows:

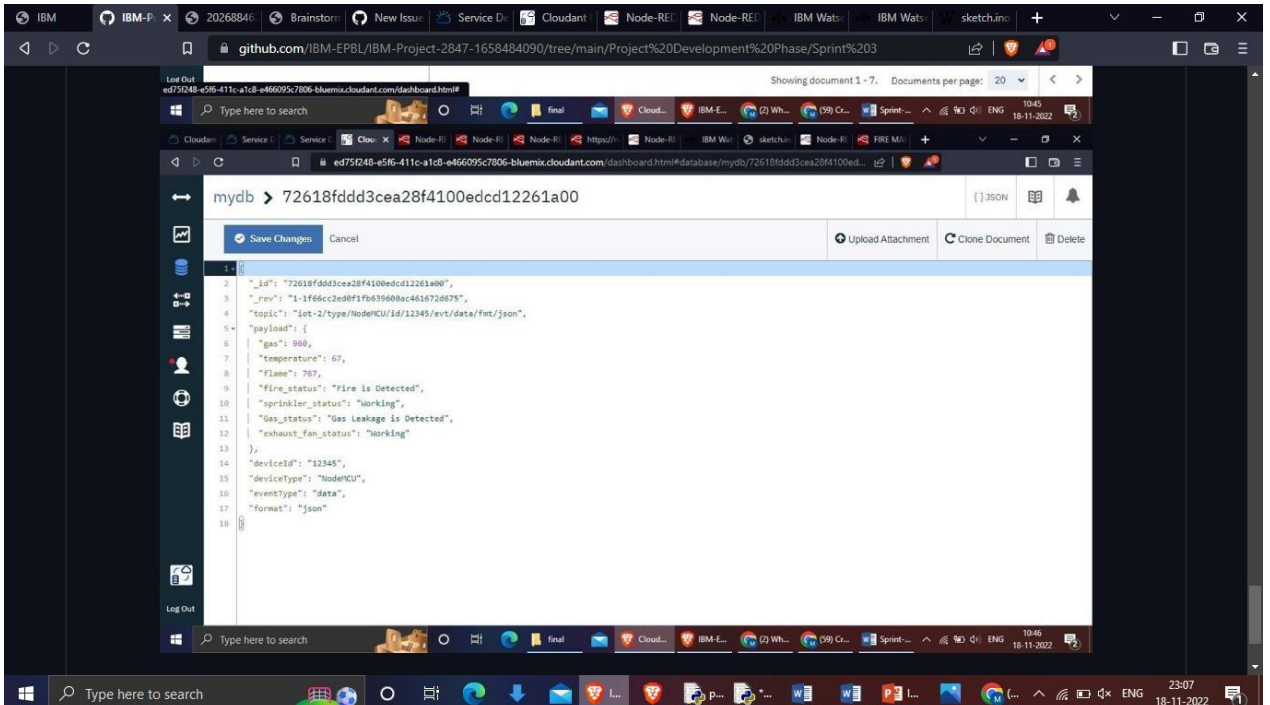
1. Working with the data set
2. Creating charts for data visualization
3. Building the dashboard

Database Schema:



The screenshot shows the IBM Cloudant dashboard for a database named 'mydb'. The interface includes a sidebar with navigation options like 'All Documents', 'Query', 'Permissions', 'Changes', and 'Design Documents'. The main area displays a table of documents with columns for 'id', 'key', and 'value'. The table contains seven rows of document data, each with a unique ID and a JSON payload. The bottom status bar indicates 'Showing document 1 - 7. Documents per page: 20'.

id	key	value
72618fddd3cea28f4100edcd12261a00	72618fddd3cea28f4100edcd12261a00	{ "rev": "1-1f66cc2ed0f1fb639600ac4..." }
a3100f15787de63c24667f680b004a...	a3100f15787de63c24667f680b004a...	{ "rev": "1-4d68bc125889ea3e06135a..." }
adbff82906f810019caded1ac78a18	adbff82906f810019caded1ac78a18	{ "rev": "1-d5052516c8737348608cf..." }
adbff82906f810019caded1ac79142	adbff82906f810019caded1ac79142	{ "rev": "1-51558253a3a72601b2a54..." }
ccba7e2aa854f57dfa3f6447038119	ccba7e2aa854f57dfa3f6447038119	{ "rev": "1-2cc18a1cd7959a8a6c8d..." }
ccba7e2aa854f57dfa3f64470954a1	ccba7e2aa854f57dfa3f64470954a1	{ "rev": "1-85fb75d7377f5a48a1bad..." }
cd624cf3370a8cc9a63467145c375f1	cd624cf3370a8cc9a63467145c375f1	{ "rev": "1-401973158a2b03b0f6b2..." }



The screenshot shows the IBM Cloudant dashboard for a specific document in the 'mydb' database. The document ID is '72618fddd3cea28f4100edcd12261a00'. The interface includes a sidebar with navigation options like 'Save Changes', 'Cancel', 'Upload Attachment', 'Clone Document', and 'Delete'. The main area displays the document's JSON payload, which includes fields for 'id', 'rev', 'topic', 'payload', 'deviceid', 'eventType', and 'format'. The bottom status bar indicates 'Showing document 1 - 7. Documents per page: 20'.

```
{
  "id": "72618fddd3cea28f4100edcd12261a00",
  "rev": "1-1f66cc2ed0f1fb639600ac4616720675",
  "topic": "iot-2/type/NodeMCU/id/12345/evt/data/fmt/json",
  "payload": {
    "gas": 960,
    "temperature": 67,
    "flame": 767,
    "fire_status": "Fire is Detected",
    "sprinkler_status": "Working",
    "gas_status": "Gas Leakage is Detected",
    "exhaust_fan_status": "Working"
  },
  "deviceid": "12345",
  "eventType": "NodeMCU",
  "eventtype": "data",
  "format": "json"
}
```

8. Testing

Test Cases:

Testing is done to look for mistakes. Testing is the process of looking for any flaws or weaknesses in a piece of work. It offers a means of testing whether parts, sub-assemblies, assemblies, and/or a finished product perform properly. It is the process of testing software to make sure that it satisfies user expectations and meets requirements without failing in an unacceptable way. Different test types exist. Every test type responds to a certain testing requirement.

User Acceptance Testing :

Acceptance by users Any project's testing phase is crucial and necessitates the end user's active involvement. Additionally, it makes sure the system satisfies the functional specifications. At this step, all test cases are executed to make sure the software is accurate and complete.

Before the customer will accept the programme, the test must be successfully done. After customer personnel have verified that the preliminary production statistics load is accurate and that the test suite has been completed flawlessly, the customer formally accepts the delivery of this system.

9. RESULTS

Performance Metrics:

Python Code:

To create and execute the python program for the purpose of identify , detect and prevent the workers and their surrounding against fire accident. It send the detection of information to IBM Watson Cloud.

```

sowmya.py - E:\sowmya.py (3.7.0)
File Edit Format Run Options Window Help

import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization = "67yg8w"
deviceType = "Modemcu"
deviceId = "123"
authMethod = "token"
authToken = "12345678"
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="critical stage":
        print ("critical stage")
    elif status == "no problem":
        print ("no problem")
    else:
        print ("Please send proper command")
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()
deviceCli.connect()
while True:
    temp=random.randint(90,110)
    if temp>97:
        temp_status="temperature is high"
    else:
        temp_status="temperature is not high"
    data = {'temp' : temp, 'temp_status':temp_status}
    def myOnPublishCallback():
        print("Published Temperature = %s C" % temp, "to IBM Watson")
        print(temp_status)
    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0)
    if not success:
        print("Not connected to IoT")
    time.sleep(10)

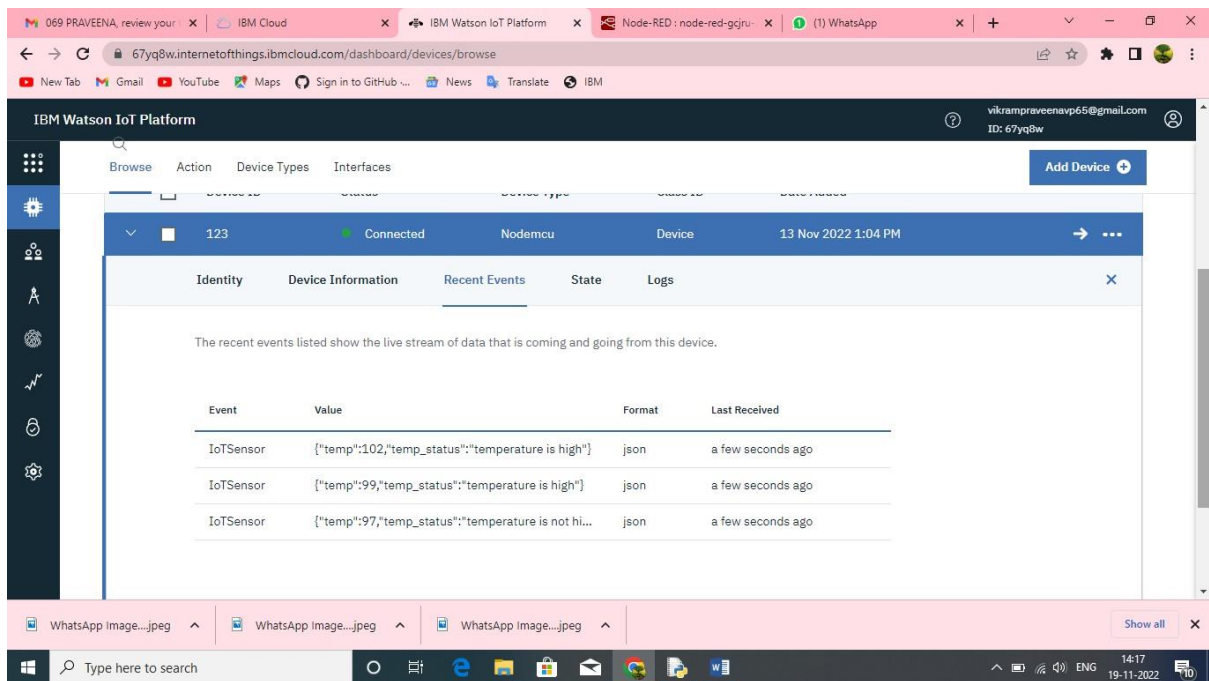
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help

temperature is high
Published Temperature = 97 C to IBM Watson
temperature is not high
Published Temperature = 108 C to IBM Watson
temperature is high
Published Temperature = 105 C to IBM Watson
temperature is high
Published Temperature = 105 C to IBM Watson
temperature is high
Published Temperature = 106 C to IBM Watson
temperature is high
Published Temperature = 95 C to IBM Watson
temperature is not high
Published Temperature = 90 C to IBM Watson
temperature is not high
Published Temperature = 94 C to IBM Watson
temperature is not high
Published Temperature = 104 C to IBM Watson
temperature is high
Published Temperature = 96 C to IBM Watson
temperature is not high
Published Temperature = 104 C to IBM Watson
temperature is high
Published Temperature = 100 C to IBM Watson
temperature is high
Published Temperature = 95 C to IBM Watson
temperature is not high
Published Temperature = 102 C to IBM Watson
temperature is high
Published Temperature = 102 C to IBM Watson
temperature is high
Published Temperature = 103 C to IBM Watson
temperature is high
Published Temperature = 91 C to IBM Watson
temperature is not high
Published Temperature = 96 C to IBM Watson
temperature is not high
Published Temperature = 93 C to IBM Watson
temperature is not high

```

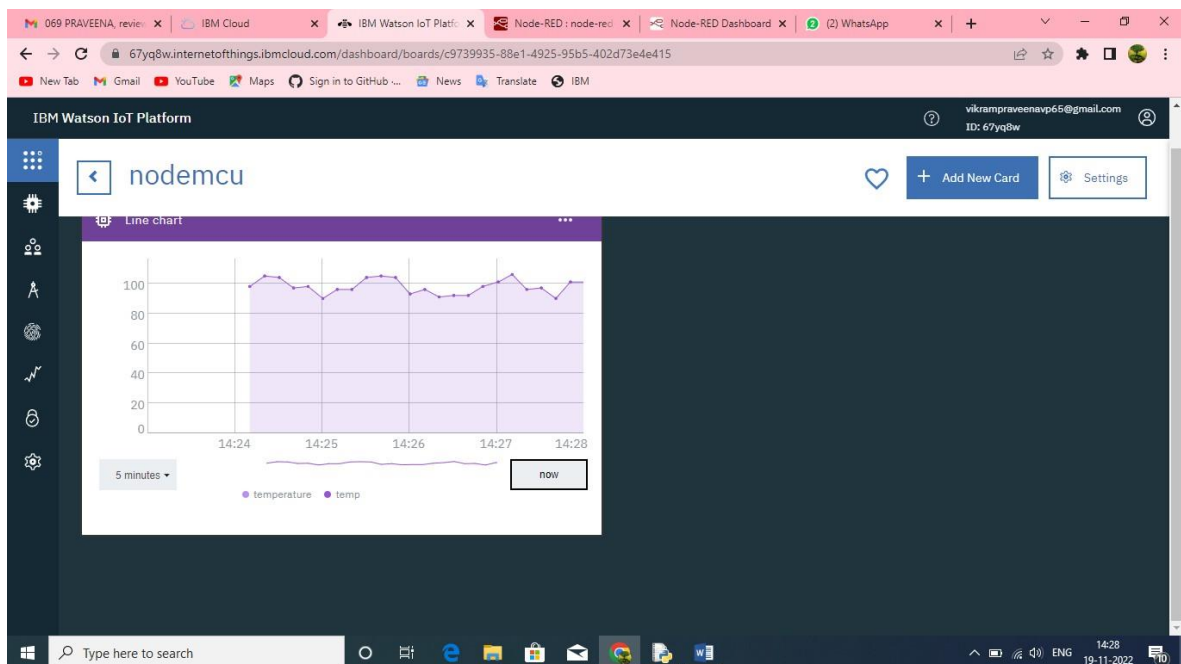
IBM Watson Output:

It is interconnect with Python code and transfer the detection of leakage output for preventing the industry and surroundings.



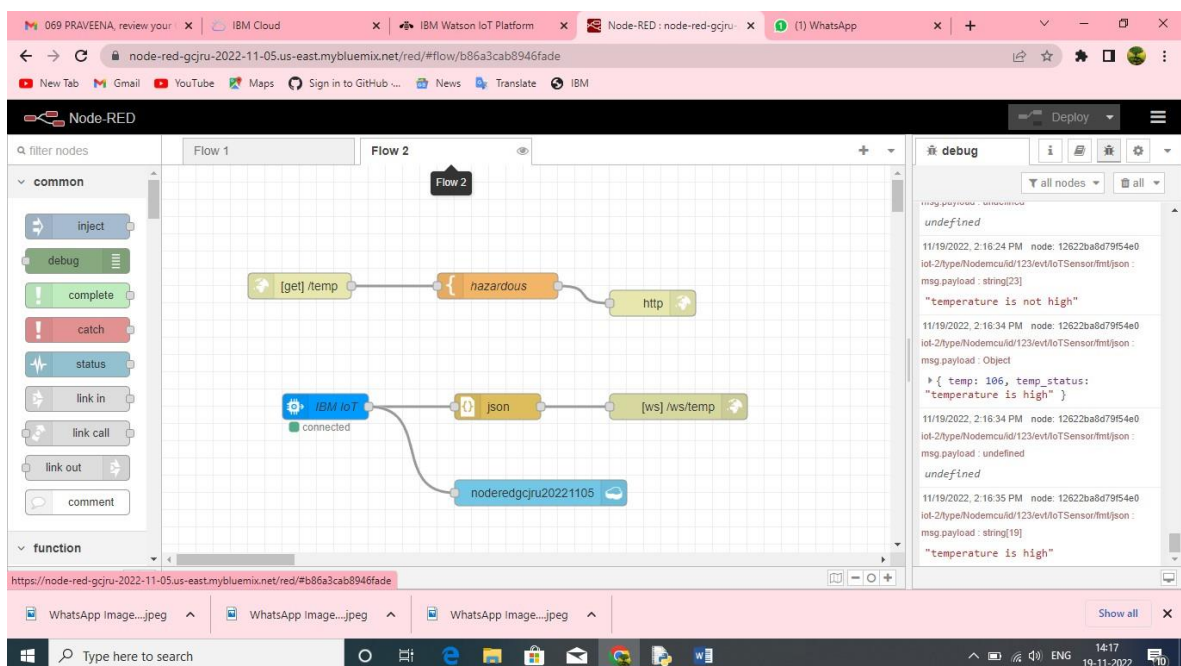
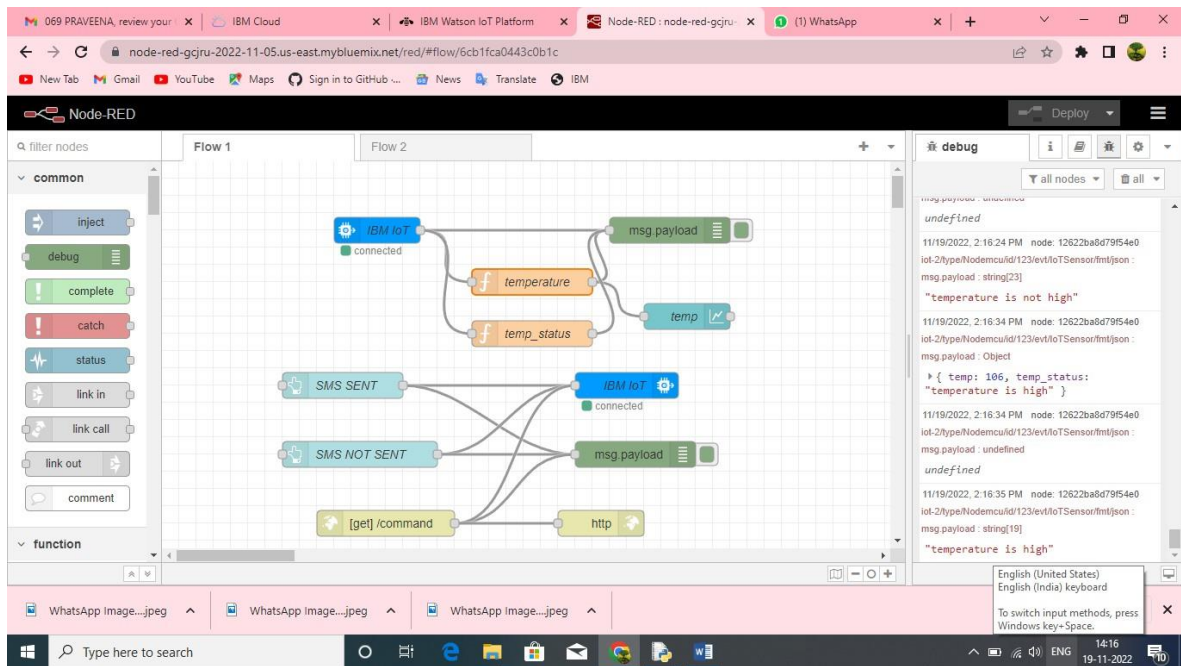
IBM Watson Dashboard :

It is used to express the output in various form like flow chart, line chart, pie chart etc..



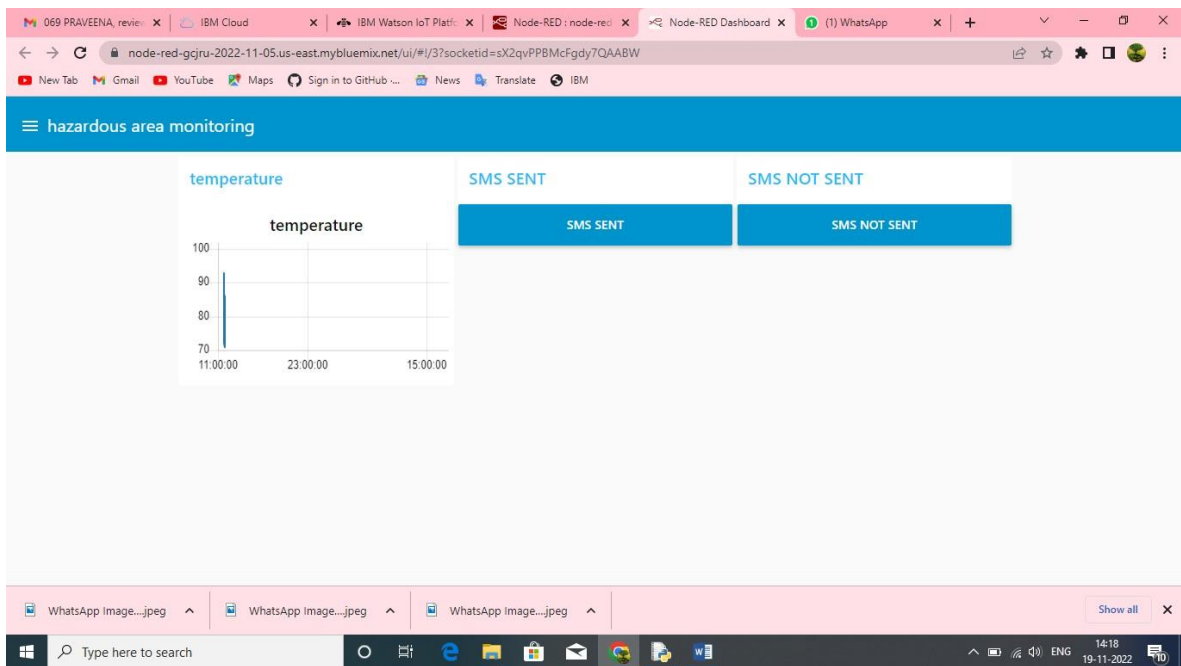
Node-Red :

It interconnect with IBM watson and used to reate functionality by wiring together flows of data between nodes using a browser



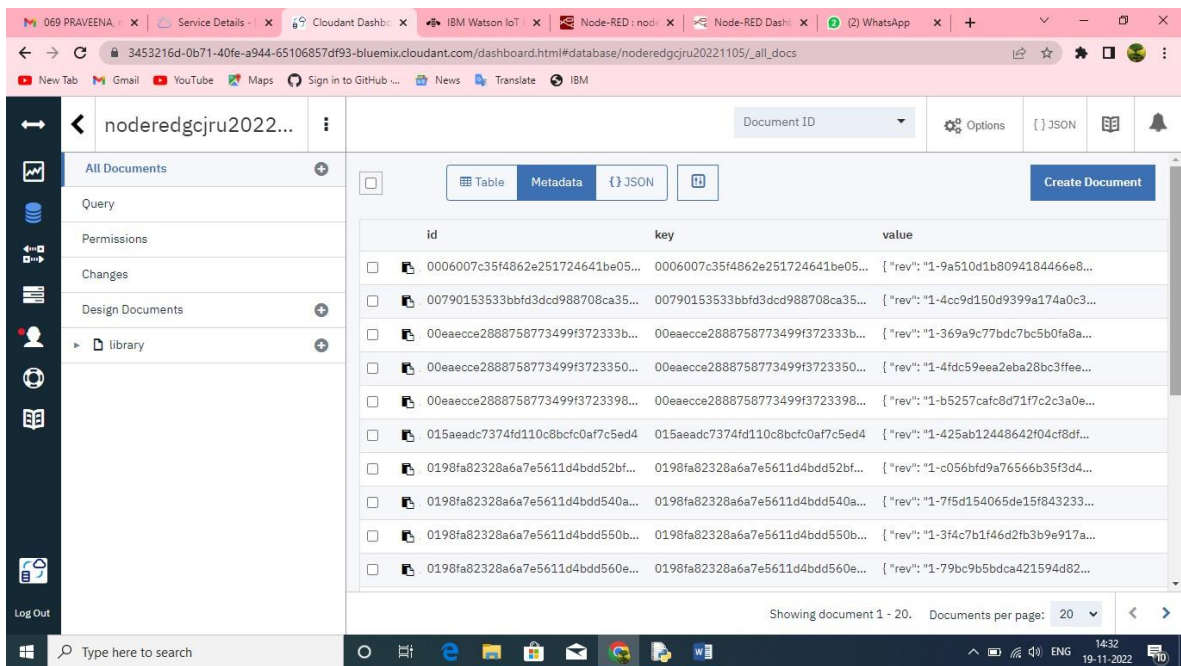
Node-Red Dashboard :

It is a module that provides a set of nodes in Node-RED to quickly create a live data dashboard. For example, it provides nodes to quickly create a user interface with buttons, sliders, charts, gauges, etc.



Cloudant :

It handles software and hardware provisioning, management and scaling, and support.



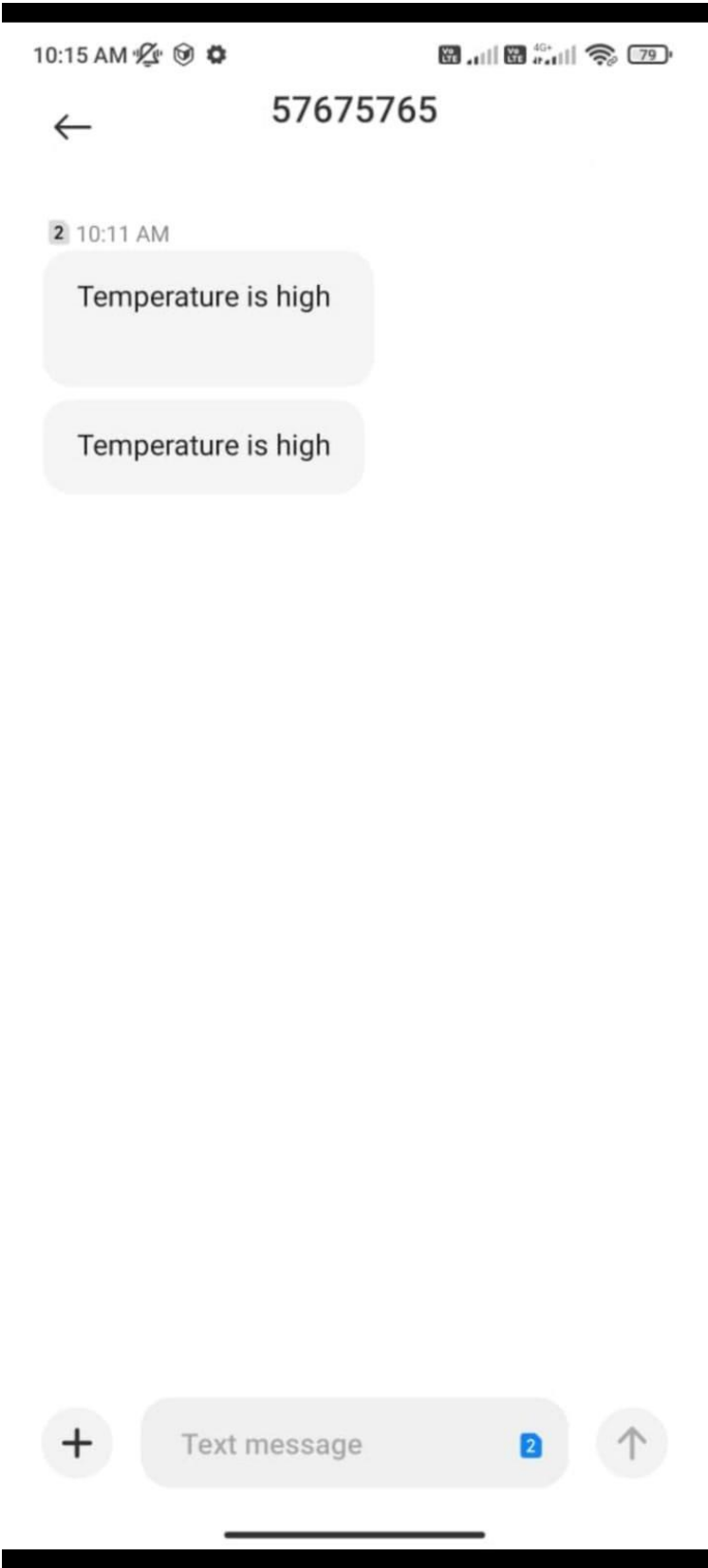
Cloudant Dashboard:

The screenshot displays the Cloudant Dashboard interface in a web browser. The browser's address bar shows the URL: `3453216d-0b71-40fe-a944-65106857df93-bluemix.cloudant.com/dashboard.html#database/noderedgcjr20221105/_all_docs`. The dashboard has a dark sidebar on the left with navigation options: All Documents, Query, Permissions, Changes, Design Documents, and a library. The main area shows a document with ID `"0006007c35f4862e251724641be05521"` in JSON format. The JSON content is as follows:

```
{
  "id": "0006007c35f4862e251724641be05521",
  "key": "0006007c35f4862e251724641be05521",
  "value": {
    "rev": "1-9a510d1b8094184466e852f919f92815"
  },
  "doc": {
    "_id": "0006007c35f4862e251724641be05521",
    "_rev": "1-9a510d1b8094184466e852f919f92815",
    "topic": "iot-2/type/Nodemcu/id/123/evt/IoTSensor/fmt/json",
    "payload": {
      "temp": 90,
      "temp_status": "temperature is not high"
    },
    "deviceId": "123",
    "deviceType": "Nodemcu",
    "eventType": "IoTSensor",
    "format": "json"
  }
}
```

At the bottom of the dashboard, it indicates "Showing document 1 - 20." and "Documents per page: 20". The Windows taskbar at the very bottom shows the time as 14:34 on 19-11-2022.

SMS Output



10.ADVANTAGES & DIS-ADVANTAGES

Advantages :

- When compared to hydroelectric producing stations, thermal power plants are less expensive to build initially.
- Compared to the hydroelectric power station, it takes up less space.
- Compared to gas, the cost of the fuel is lower.
- TPS is capable of producing a large quantity of electricity.
- Compared to diesel power plants, the cost of generating is lower.

Dis-Advantages :

- In comparison to hydro power stations, thermal power plants have higher operating costs.
- Due to the substantial smoke and fume generation, it pollutes the atmosphere.
- Cost of maintenance is higher.
- The power station needs to be built and maintained by skilled individuals.
- Storage of coal and ash requires more land.

CHAPTER 11

11. CONCLUSION

The IoT-based study can be improved even more by giving industry personnel advanced functions via an Android app to enhance industry control and monitoring. To protect workers and goods in the event of a fire or poisonous gas leak, smoke and tem sensors can also be connected to the system. Data can be used, among other things, to reduce industrial risks in well-known factories, monitor power plant production, ensure safety in fast-paced industries, and evaluate nuclear safety levels. If the information is given swiftly, time can be saved. The need for real-time monitoring systems based on physical models is necessary for accurate damage and defect identification. Through this project, we intend to obtain practical experience with the "Internet of Things" and "Embedded System" technologies that are now popular. In a number of industries, IoT-enabled industrial monitoring solutions are becoming more and more common because they raise safety standards by offering real-time monitoring of crucial characteristics as temperature, humidity, and smoke, as well as frequently informing authorities and staff. The deployment could boost industry yields in addition to being done for safety concerns. The Internet of Things (IoT) is utilized in our project to gather data and facilitate online communication. Our goal is to save lives and property from accidents and risks that industry frequently ignores by implementing our initiative in industries across India.

12. FUTURE SCOPE

In our current concept, we solely use the GSM Technology to detect gases, temperatures, and people. Therefore, we might broaden the application of this idea in another method to centralize data collection. We can utilize the IR courting at the entry gate, which is tracked by the camera and will continuously record photos of the people entering the risky areas, for that purpose. Currently, only a few gases can be detected by gas sensors; however, in the future, we can expand to more types of gases.

13.APPENDIX

Source Code :

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization = "67yq8w"
deviceType = "Nodemcu"
deviceId = "123"
authMethod = "token"
authToken = "12345678"
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="critical stage":
        print ("critcal stage")
    elif status == "no problem":
        print ("no problem")
    else:
        print ("Please send proper command")
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(90,110)
    data = {'temp' : temp,'temp_status':temp_status}

    if temp>97:
        temp_status="temperature is high"
    else:
        temp_status="temperature is not high"
    def myOnPublishCallback():
        print("Published Temperature = %s C" % temp, "to IBM Watson")
        print(temp_status)
    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(10)
deviceCli.commandCallback=myCommandCallback
deviceCli.disconnect()

```

GitHub & Project Demo Link :

GitHub Link:

<https://github.com/IBM-EPBL/IBM-Project-33984-1660230262>

Project Demo Link:

https://drive.google.com/file/d/1F6aVl_dDRS_RNpUcTPuTHR79cJNPkv_gQ/view?usp=share_link