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ABSTRACT

In many industrial plants, there are many areas which are need to be continuously monitored time to time sometimes the conditions may become very critical which may causes loss of property and also human loss. We can monitor these conditions by integrating smart devices in the areas which are need to be monitored. Every integrated device will be acting as a beacon scanner which are connected to temperature senors for the monitoring the temperature of the environment and workers body condition. The temperature data is broadcast along with the location of a particular area through the beacon scanners. The persons who monitor these places will be provided with a wearable device which will act as a beacon scanner. It helps him to view the required characteristics and parameters to get alerted whenever he enters the desired range those information are sent to cloud. Through monitoring these parameters we are able to avoid accidents and lives. An industry is always located at a place where it is very safe for inhabitants of the region, but it is very difficult to ensure the safety of the workers, by implementing these beacons we are able to monitor the environment of the industry. The major constituents of these mishaps are explosion and fire. Depending upon the cause and environment it can be termed as ‘Incident’ and ‘Accident’, these can be monitored and measures can be taken immediately to avoid the loss.

CHAPTER - 1

INTRODUCTION

PROJECT OVERVIEW:

The Industrial Monitoring System project is built on the Internet of Things (IoT). Through this, we can monitor the temperature parameters of the hazardous areas in industrial plants. The area is integrated with smart beacon devices which will be broadcasting the temperature of that particular area. Every person working in those areas will be given smart wearable devices which will be acting as beacon scanners. Whenever the person goes near the beacon scanners he can view the temperature on his wearable device and if the temperature is high, he will receive the alerts to the mobile through email. Through this wearable device, the data is sent to the cloud and through the dashboard, the admins of that particular plant can view the data and take necessary precautions if required. Arduino is used to control various sensors (using humidity and temperature sensors) providing complete control over the industry. The Internet of Things (IoT) is used in this project to deliver data to the user. The Internet of Things (IoT) is a network of 'things' that allows physical items to communicate data by using sensors, electronics, software, and networking. These systems are self-contained and do not need to interact with humans . The system feeds signals from several sensors, such as the temperature, and humidity sensors, to the Arduino microcontroller. The data is subsequently sent to the IoT module via the microcontroller(ESP32). It detect the presence of humidity and temperature changes and send the information to the Arduino. the information then is transmitted through ESP32 to the . MIT app inventor is a free tool where you can connect your IoT module to your phone screen, and helps you control the project and its activities virtually. The temperature and humidity values are also displayed on the MIT app inventor, informative messages would be displayed on the app for manual control

PURPOSE:

Temperature monitoring is the goal of the project which in done with a wireless sensor network. There is an increase in productivity of automation and a decrease in data rate failure by using technologies in wireless sensor network Arduino and wireless communication is used in the project for industrial process monitoring. Wireless multi-sensory networks have met their applications in medical, military, industrial, agricultural and environmental monitoring; current voltage, temperature and water level are the traceable parameters. Humidity is the amount of water vapors in the air, the sensor monitors the amount of humidity in the surroundings inside a plant and then alerts the workers regarding the changes in humidity which can lead to high pressure in the atmosphere.

CHAPTER - 2

LITERATURE REVIEW

2.1 EXISTING PROBLEM:

In the list of most threatening causes that led to global warming are fire hazards. Hazards can be resolved by the adaption of new and growing technologies which also help in better living. Applications in monitoring and control are performed by the wireless multi-sensory network are characterized by small, low power and cheap devices which are integrated with limited computation, sensing, and remote communication. It impacts enormously on fire emergency. Temperature sensors are installed in fire endangered areas which allow a person to manually provide temperature information on fire extinguishing website email or landline number. The process of accessing information from the website may be time-consuming and it may cause some amount of delay in the response to the fire extinguisher. IOT is a wireless technology. Use of IOT is in combination with fire fighting for hazard source monitoring, fire fighting rescue, fire early warning, preventing and early disposal. It is effectively used for the enhancement of fire brigade fire fighting and emergency rescue capabilities. In hazardous areas like industries the environmental temperature plays a very important role for the safety and health condition of workers. When the temperature exceeds a limit it affects both the yield and body condition of the workers. The high temperature may cause explosion or affects the health condition. Hence it is necessary to analyses and monitor the environmental factors like temperature and humidity. It is possible for the sudden increase in the environmental factors may leads to accidents causes a large casualties. As a short term effects it includes explosion and accidents, the long term effects includes changes in body health conditions.

2.2 REFERENCES (SURVEY WORK)

Paper 1 : Wireless Sensors Network for Environmental Radiation Monitoring using IOT

The main objectives of the proposed work are to provide low cost effective environmental radiological monitoring system. To develop an early warning system in Nuclear Power plants and submarines.Whenever the nuclear radiation is released to the open environment, due to presence of radioactive elements present in the radiation, environmental parameters such as temperature, pressure, sound, smoke and carbon monoxide levels various rapidly. Due to breakdown of radioactive elements temperature increases rapidly and humidity decreases. By these variations we can detect the presence of nuclear radiation. All these variations of atmospheric parameters are sensed by the incorporated sensor module and it's displayed by things speak web server. So radiation leakage in nuclear power plant can be detected. By the tremendous variation of atmospheric parameters, all the operators can be easily came to know about the radiation leakages. The Architecture of sensor module , abstract architecture of sensor nodes used in wireless Sensor network .

Author : Ashwini S R , Dr. Shivashankar , Karthik R , Harish B R , Karan D Bafna .

Year : 2018

Paper 2: Internet of Things for Flame Monitoring PowerStation Boilers

The method uses the concept of within class mean (the mean value for the flame images within the same combustion category), between class mean (the mean value of the flame images between the categories of combustion) and the global mean. The relations between discriminant analysis and multi layer

perceptrons has been addressed by considering the number of patterns and feature size (Foley 1972). A linear mapping is used to map an n- dimensional vector space onto a two dimensional space. Some of the linear mapping algorithms are principal component mapping, generalized de-clustering mapping, least squared error mapping and projection pursuit mapping. The flame video is captured from NLC and segregated into frames. The intensity of the flame colour in the captured frame varies with respect to temperature and combustion quality. The features are extracted and then reduced using FLD. The reduced feature set is used as an input to the BPN classifier and finally the classification performance is validated with certain performance measures.

Author : K. Sujatha, Nallamilli.P.G Bhavani , T.Kalpalatha Reddy, K.S. Ram Kumar .

Year : 2017

Paper 3: IoT Based Industrial Parameter Monitoring System

Arduino module is fully equipped with inbuilt peripherals and bridging devices for communicating with sensors or another platform. This module operates with solar energy and using of battery charger circuit it is operating night time also. The figure shows the interfacing of physical parameters like Temperature, Light intensity, Water level identifier, voltage and current in this module. Data acquired from each parameter is collected in the Arduino module is displayed in (16x2 LCD) which is used as our output module. The in-built analog to digital (ADC) converter is used to measure the voltage and current. The water pump releases when there is fire. The voice module gives voice output of various requirements. The LED glows when there is some gas leak or some problem. In this section receiver, a personal computer can be used. Receiver collects the data

from the transmitter and sends to the personal computer through a serial cable. If any fluctuations in the parameters then it will be shown on LCD for example if the fire will be detected then work pump will ON or voice module will give emergency alerts like don't use lift etc. Voice module has 8 voices. If the fire is present then the voice sound is "Fire is present". While using IOT it sends the message to the server room if any sensor limit is raised.IOT has two parts that are a sender and receiver.

Author : Prof. Nitin Ahire, Shreya Bandodkar, Kanchan Gupta, Yasar Farooqui

Year : 2019

Paper 4: IoT Based Industrial Monitoring System

The Industrial Monitoring System project is built on the Internet of Things (IoT). Arduino is used to control various sensors (using smoke and temperature sensors) providing complete control over the industry. The Internet of Things (IoT) is used in this project to deliver data to the user. The Internet of Things (IoT) is a network of 'things' that allows physical items to communicate data by using sensors, electronics, software, and networking. These systems are self-contained and do not need to interact with humans . The system feeds signals from several sensors, such as the smoke, temperature, and humidity sensors, to the Arduino Mega micro- controller. The data is subsequently sent to the IoT module via the micro-controller (ESP8266). The ESP8266 is a chip that allows micro-controllers to connect to a Wi-Fi network, establish TCP/IP connections, and deliver data. In case a fire takes place, the smoke sensor and the temperature sensor would detect the presence of smoke and temperature changes and send the information to the Arduino. the information then is transmitted through ESP8266 to the Blynk app. Blynk app is a free app on the play store where you

can connect your IoT module to your phone screen, and helps you control the project and its activities virtually. The IoT module, four LED's, one fan, and an LCD are all connected to the microcontroller. LED's represent different pieces of machinery that can be as a symbol. At the same time, informative messages would be displayed on the LCD for manual control. The Wi-Fi module must be linked to a Wi-Fi zone as a prerequisite for this project. This project can as well be implemented using the GSM module instead of the IoT module. Instead of the Blynk app, youcan also create your app through MIT app inventor as well.

Author : Hemlata Yadav, Naomi Oyiza, Sarfaraz Hassan, Dr. Suman Lata, K. Jaya Chitra **Year** : 2022

Paper 5: IOT Based Industrial Parameters Monitoring and Controlling Systems

Safety is very paramount in any industry, especially with manufacturing, forging industries and many others .Therefore we intend to aid these problems in industries by developing a safety parameters monitoring and controlling system, and making it more capable and user friendly by inclusion of IoT. We believe that a system should be well automated so that a new user or a new employee who has no prior experience in controlling a unit should be able to get acquainted very easily. With the help of IoT, administrators will come to know the live status of a unit on which a parameters monitoring and controlling system is installed, it can be done via mails, or if a person is present there they can observe themselves. For example we can set temperature to a certain limit and if temperature exceeds beyond the set limit, the fans or other cooling system will start automatically. This system will also have gas sensors, flame sensors as well as radiation sensors. We are using Arduino UNO ATmega 328 as a controller for this system. Lastly the administrator will have records or logs of the parameters fluctuation and other activities at a particular time so it will be ready for reference in future and this will help the

administrator to take security measures.

Author : Hritik Biswas, Atharva Ghodvaidya, Madan Gughe, Utkarsh Kadu ,A.M.Suryawanshi **Year :** 2022

Paper 6: Low Cost IoT Based Emission Monitoring Systemfor Thermal Power Plants

In this, the system measures the data at a regular time interval of 30 seconds for both CO and PM. The data is measured at outside environment and is acquired initially for the 10 to 12 values. When the system measures data it send to the thing speak as well as blynk app. the serial monitor output window of Arduino IDE. It reads the data values from Node MCU through USB port. The government agency will only be having access to it. Based on that, the power plant agency can avoid emission of large volume of pollutants in air. If in case pollutants are emitted greater than or equal the standard levels then thing speak by using IFTTT sends the warning email notification . We have taken the threshold value for CO as 200ppm and PM2.5 dust density as 0.25µg/m**3**. As can be seen in thing speak graph, the value of CO is above 200, PM2.5 dust density is above 0.2 at start and hence, at that instance of time an email notification is send to the power plant agency

Author : Ayesha Samreen , P. Sathish, N.Alivelu Manga .
Year:2019

2.3 PROBLEM STATEMENT DEFINITION

Creating a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.

Our main aim is to make a web dashboard and mobile app for monitoring the environment and workers condition.

Figure 2.3 Problem Statement

CHAPTER - 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple and easy way to understand the problems about user's behavior and feelings. It is a very useful tool which helps to understand the user. By creating a effective requirement we are able to know the true problem of a person in terms of his experience and knowledge. We will approach the problem from user's perspective. We are included that how the workers and management will think and feel, things that they see, what they say and hear about our project. We are able to analyse the advantages and disadvantages of the project.

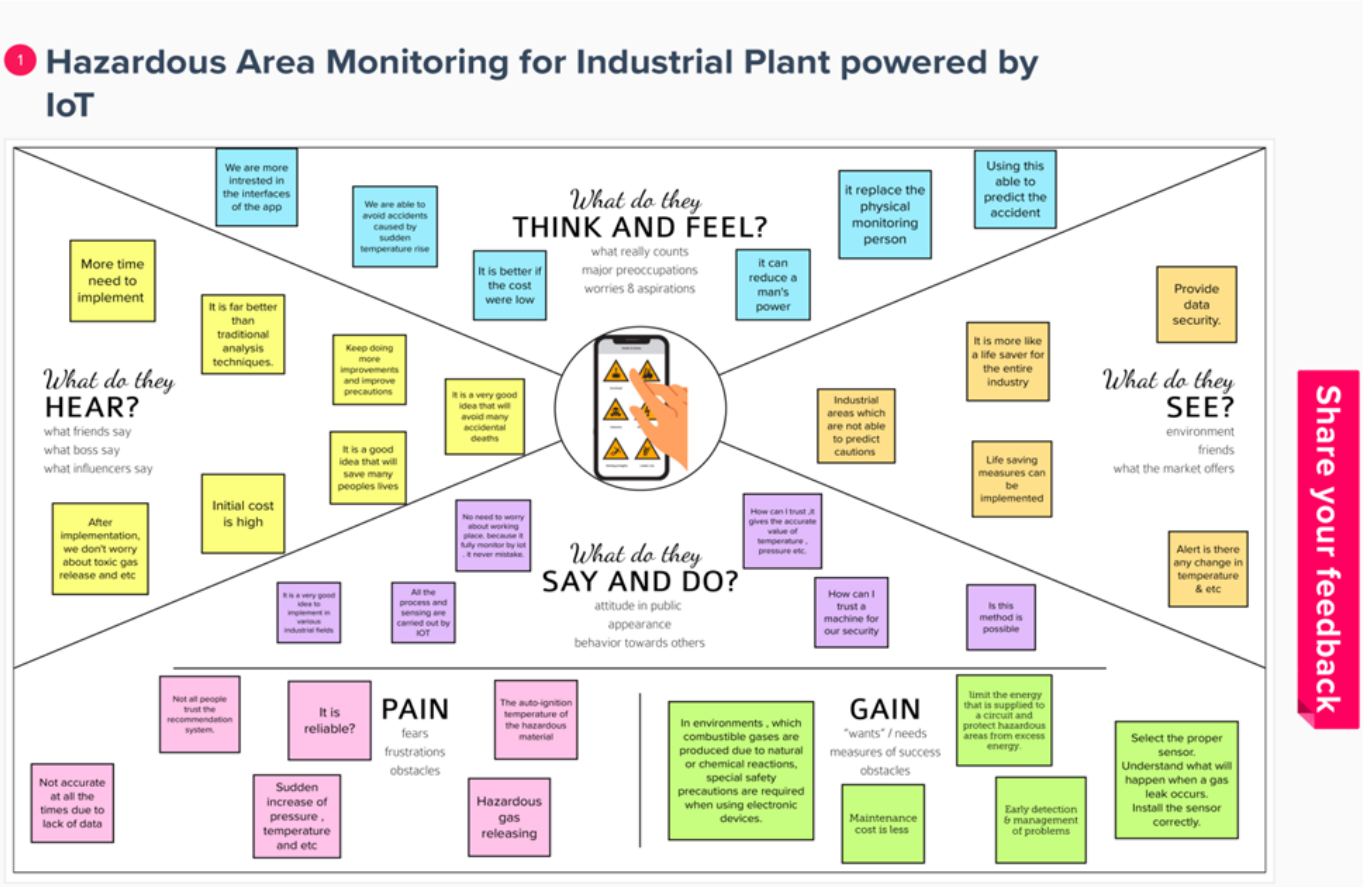

Figure 3.1 Empathy Map

3.2 IDEATION & BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich number of creative solutions.

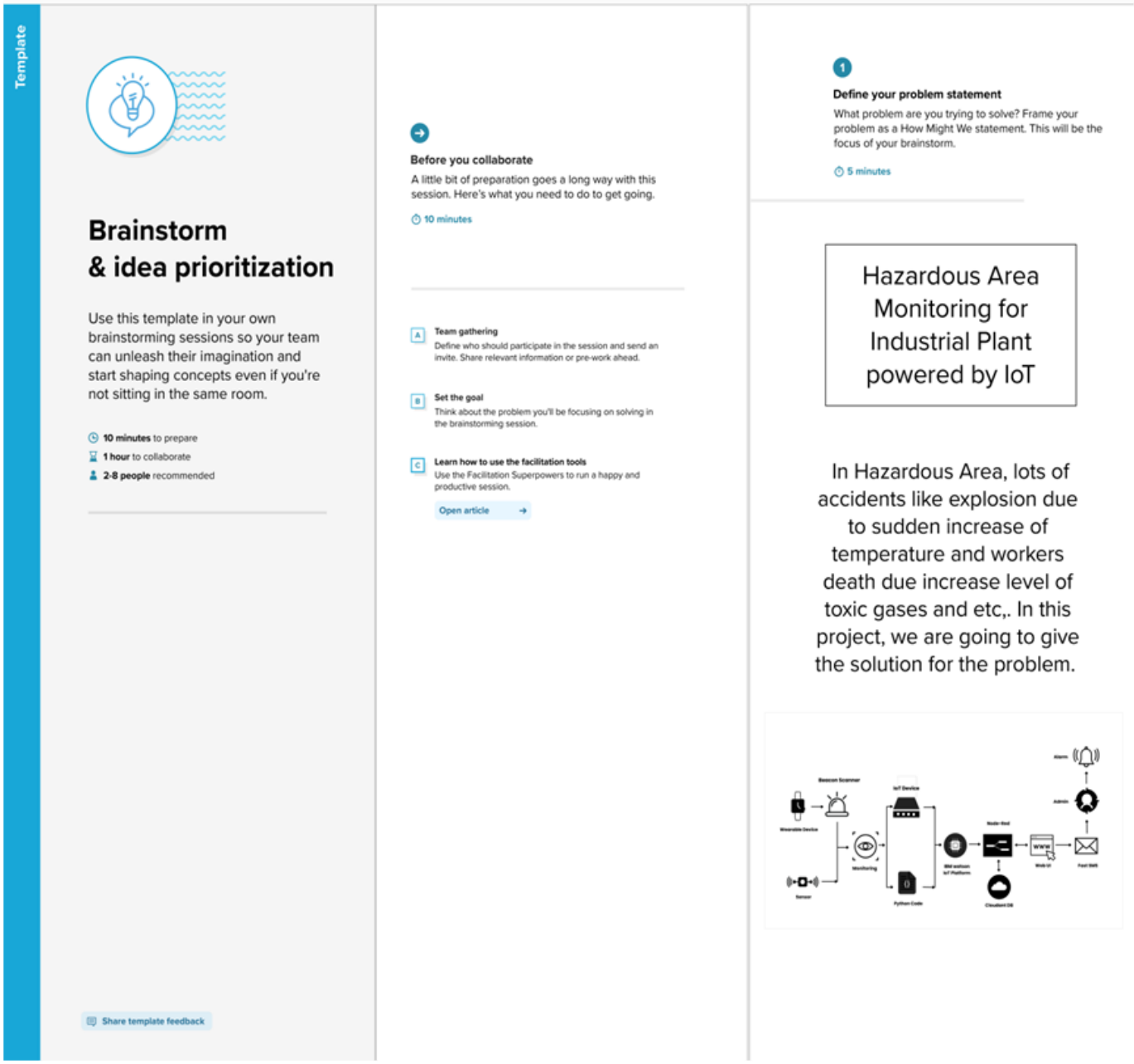

Figure 3.2.1 Ideation & Brainstorming

Figure 3.2.2 Brainstorm

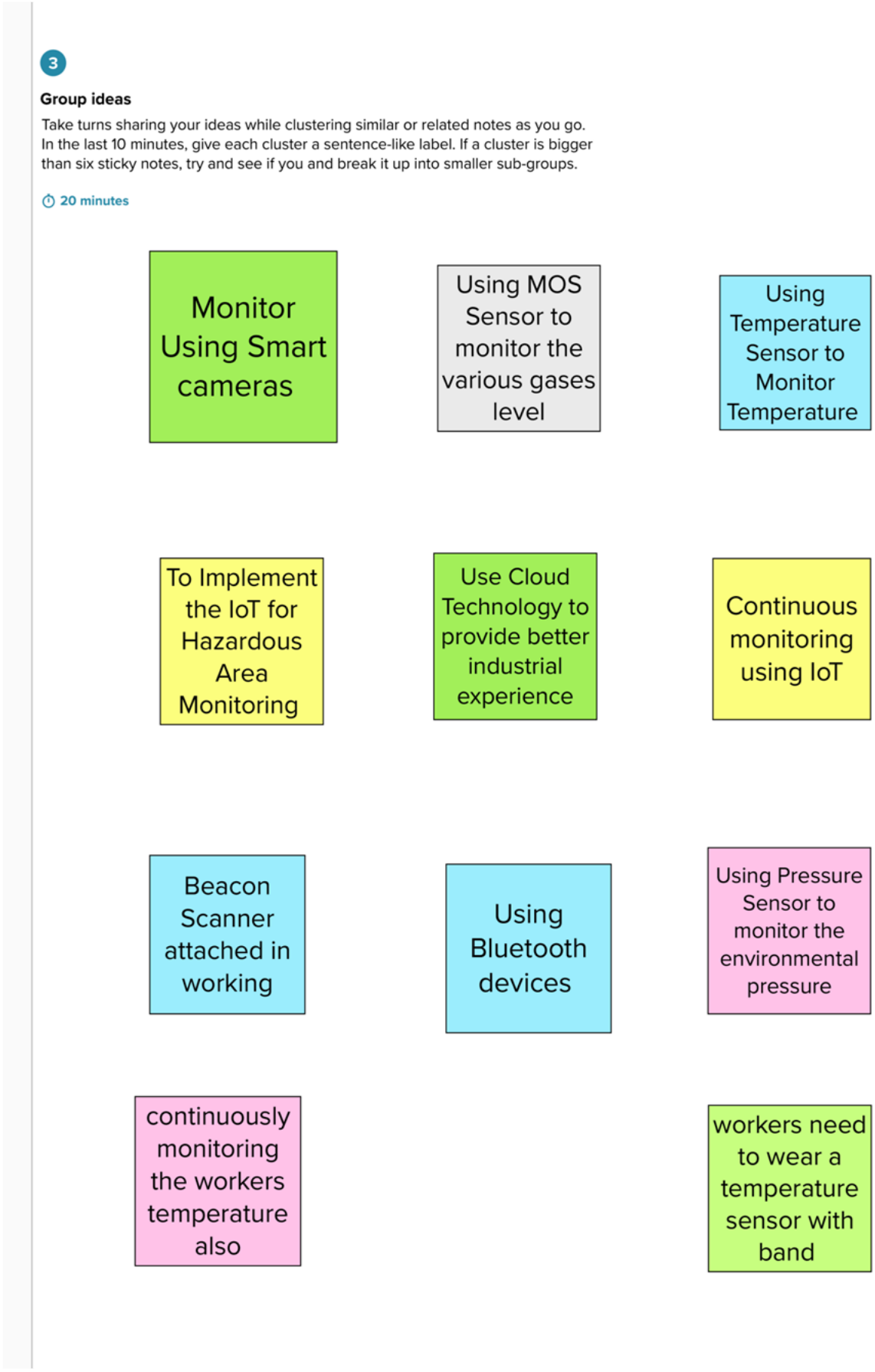

Figure 3.2.3 Idea Listing and Grouping

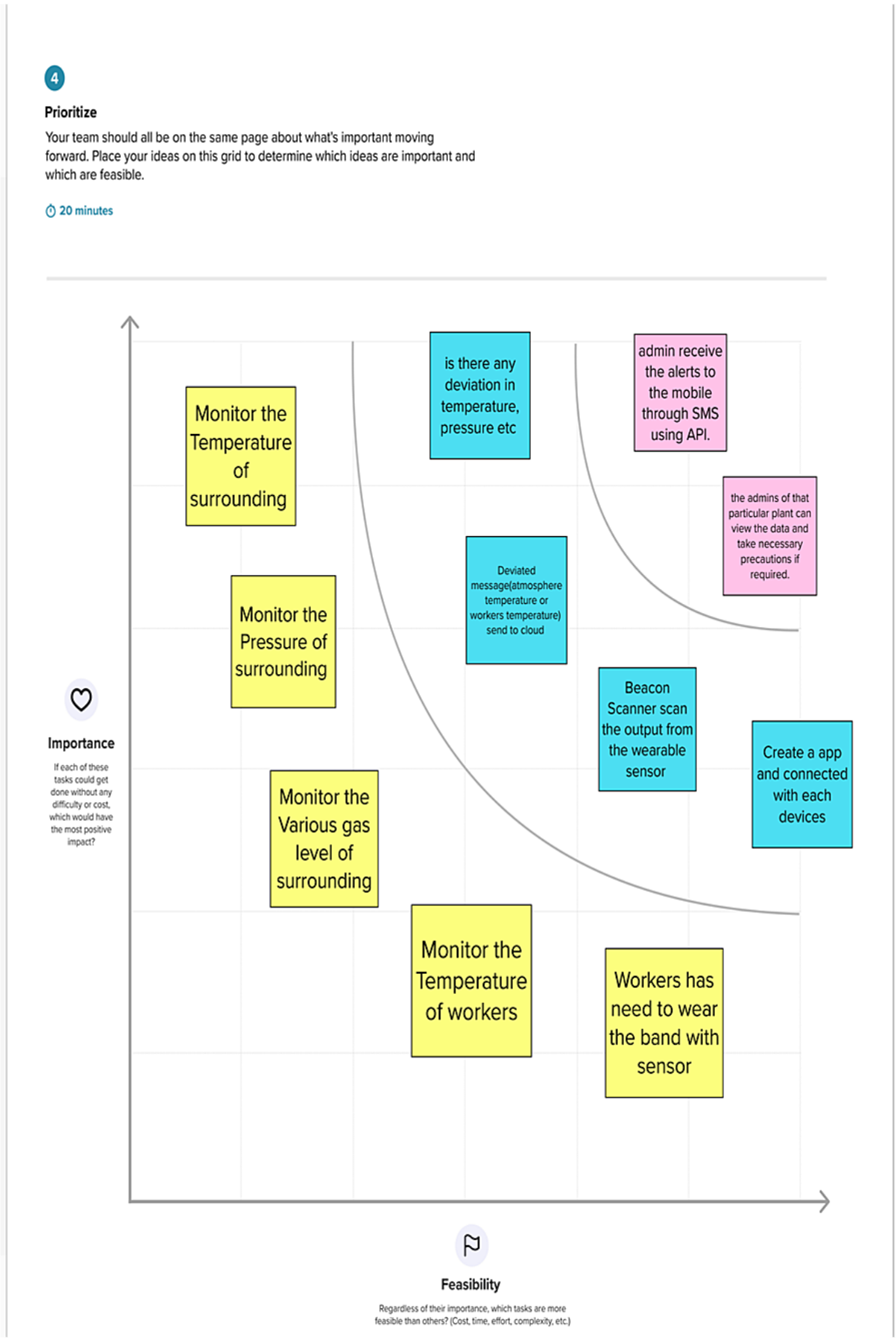

Figure 3.2.4 Idea Prioritization

3.3 PROPOSED SOLUTION

1. **Problem Statement (Problem to be solved)**

Workers are the pillar of the company, while working in hazardous areas it is very difficult to avoid accidents, hence we need to ensure the safety of the workers.

2. **Idea / Solution description**

This problem can be overcome by using IoT. By implementing IoT, we are able to monitor the surroundings of the workers as well as their body condition.

3. **Novelty / Uniqueness**

The uniqueness of our application is, by using our application we will get live updates of temperature and humidity of the workers and environment using IoT.

4. **Social Impact / Customer Satisfaction**

It is best suited for the industries which are located in hazardous environments like sudden temperature rise. The admin can able to track the data of the workers environment.When the environmental factors exceeds a certain limit admin alert the workers for evacuation.

5. **Business Model (Revenue Model)**

We are introducing a product-based approach to earn a good revenue.The more number of features attracts the end users to use our application efficiently.

6. **Scalability of the Solution**

Our application is best suited for companies which located in Hazardous area. We use IBM Watson cloud server to collect the live data from the workers who are working in hazardous environment to ensure the safety of the workers.

3.4 PROBLEM SOLUTION FIT

The problem-solution fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem.It helps entrepreneurs ,marketing and corporate innovators identify behavioral patterns and recognize what would work and why.

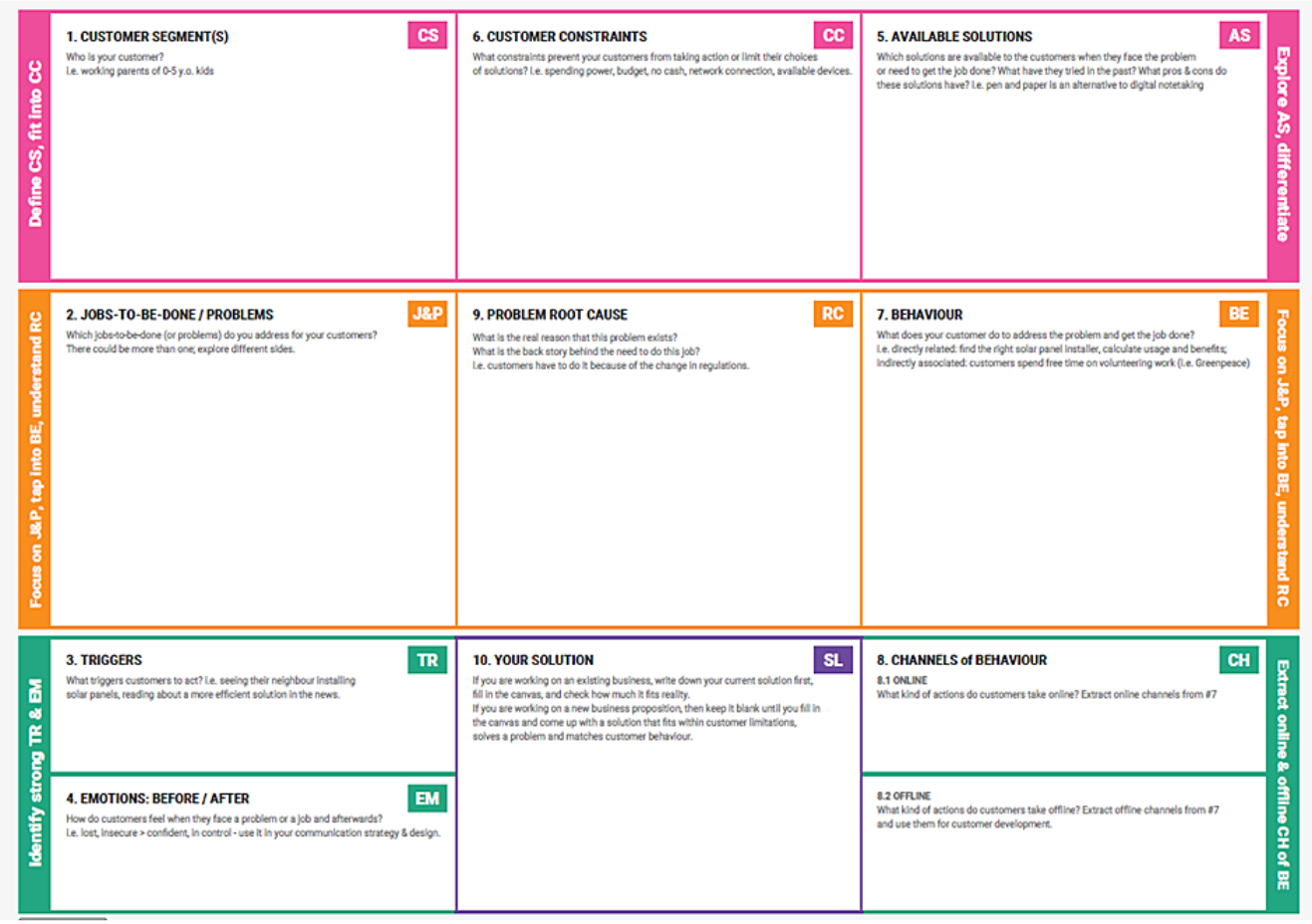

Figure 3.4 Solution Fit

CHAPTER- 4
REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirements (Epic)	Sub Requirements (Story / Sub-Task)
FR-1	User Registration	1. Registration through Form 1. Registration through Gmail
FR-2	User Confirmation	1. Confirmation via Email 1. Confirmation via OTP
FR-3	Cloud Registration	1. Registration through Gmail
FR-4	Cloud Confirmation	1. Confirmation via OTP and Email
FR-5	User Login	1. Login using credentials
FR-6	User testing	1. Only verify any alert messages
FR7	User action	1. There is any alert message, admin alert the workers
FR8	Authentication	1. Through OTP verification 1. Through Strong passwords
FR9	Administration functions	1. Preventing and monitoring each and every second. There is any deviation Admin send an alarm to workers.

4.2 NON - FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirements	Description
NFR-1	Usability	Our solution is intended for wide range of users including industries which work under the hazardous area.
NFR-2	Security	Security is high because we attached step by step verification code.
NFR-3	Reliability	Reliability is high because of the continuously tracking to predict the accidents caused due to environmental factors.
NFR-4	Performance	Regarding the continuous monitoring of the environmental parameters as well as workers body condition, when There is any deviation detected, Send an alert message to admin. Which results in better performance.
NFR-5	Availability	This application is available to use online and also 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 and the sensors are used in this framework are low budget functionalities, Hence they are highly scalable

CHAPTER - 5
PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

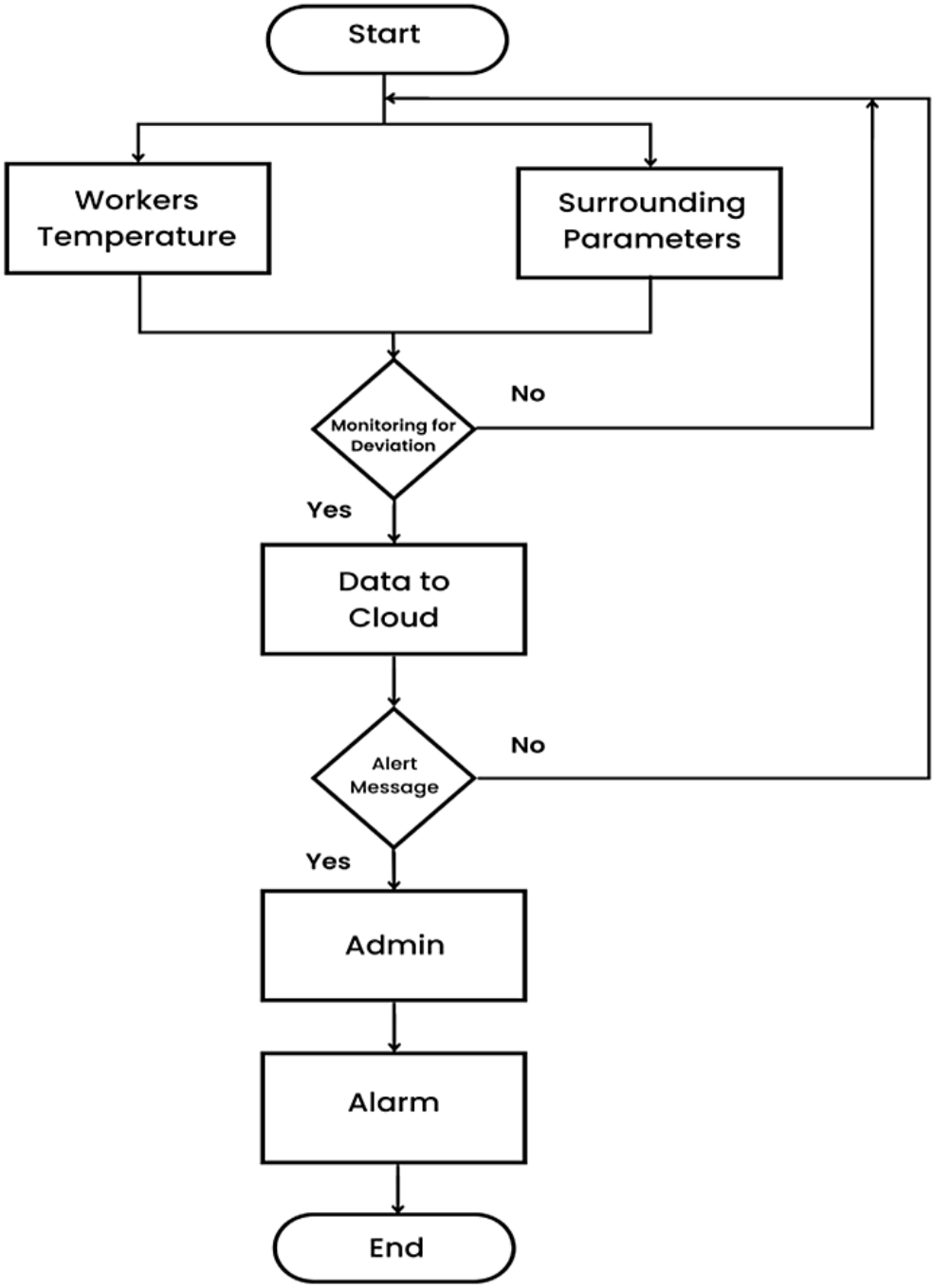

Figure 5.1.1 Data Flow Diagram 1

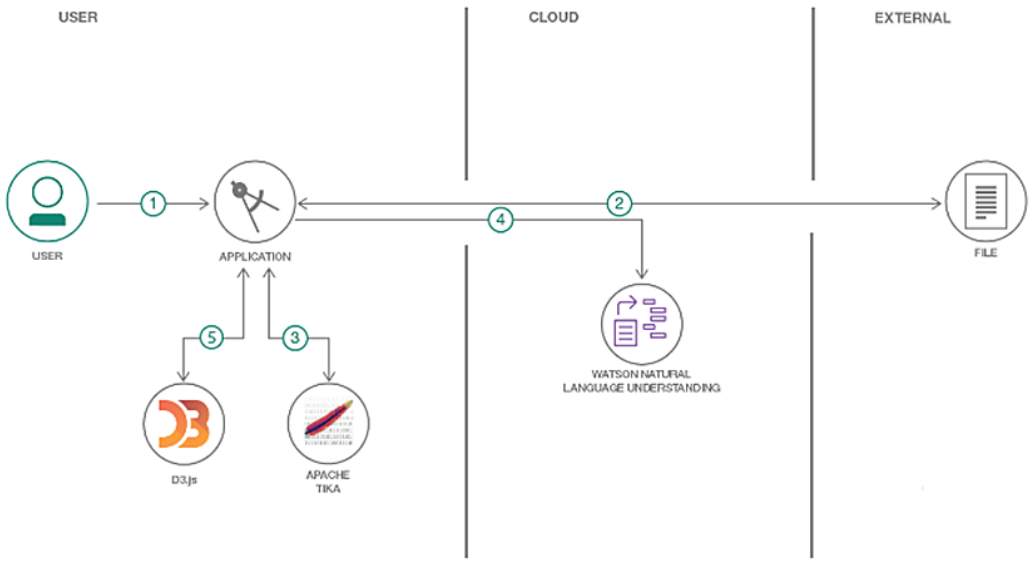

Figure 5.1.2 Data Flow Diagram 2

5.2 SOLUTION & TECHNICAL ARCHITECTURE

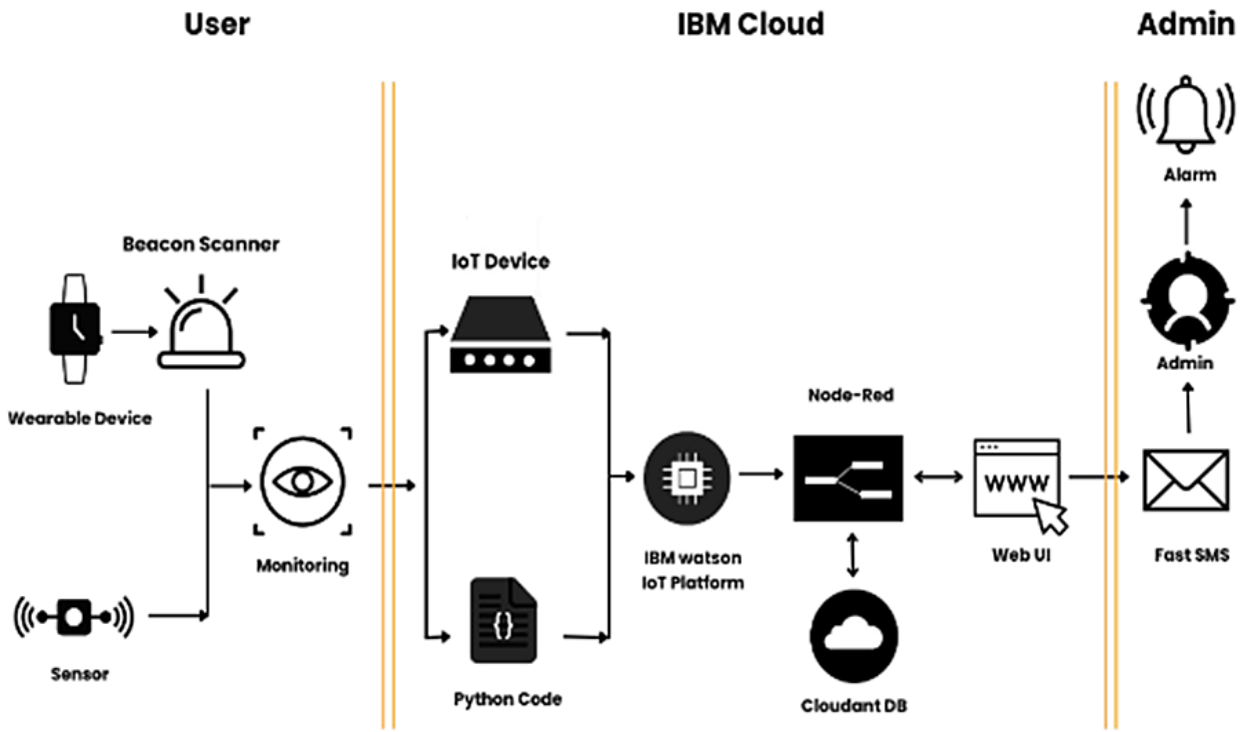

Figure 5.2 Technology Architecture

5.3 USER STORIES

User Type	Functional Requirements (Epic)	User Story Number	User Story/ Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I haveregistered for the application	I canreceive confirmation email &click confirm	High	Sprint-1
		USN-3	As a user, I can register forthe application through Facebook	I can register &access the dashboard withFacebook Login	Low	Sprint-1
		USN-4	As a user, I can register forthe application through email	I can register & access the dashboard with email Login	Medium	Sprint-2
Customer (Web user)	Login	USN-5	As a user, I can log into the application by entering email & password	I can able to get intothe dashboard	High	Sprint-3

Customer Care Executive	Iot devicesAnd Cloud services	USN-6	As a user, I can able to monitor the devicesas well as the cloudservices	I can able to access the IoT devices as well as cloud services	High	Sprint-4
Administrator	Dashboard and mobile app	USN-7	As a user, I can able to get the alert message and instant environmental parameters	I can able to get the message box aswell as the alarmsystem in our industry.	High	Sprint-5

CHAPTER - 6

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint 1

In this sprint , we gather a data from the workers who work under the hazardous area using the beacon scanner. We develop a python script under the random condition which is considered as the beacon scanner value. Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured, object-oriented and functional programming. We get the data of body temperature and heart rate of the workers and uploaded in cloud. In this program we need an library function of wiotp.sdk.device, time and random. And also link with cloud using the configuration of organization, device type, device id and authentication token and publish the data in cloud.

Sprint 2

In Sprint 2, we gather the data of the working environment using the sensor's. A sensor is a device that produces an output signal for the purpose of sensing a physical phenomenon. Using the ESP32, design the sensor of DHT22 with the buzzer.We get the data of temperature and humidity of the working environment. In wokwi, design the sensor's and to write the C ++ program for publish the data in the cloud In this program needed libraries are client and DHT sensor library in wokwi. And also link with cloud using the configuration of organization, device type, device id and authentication token and publish the data in cloud. To get the data of alarm on and alarm off from the user. if user give the alarm on condition, the buzzer will active automatically.

Sprint 3

In this sprint, we are using the node red for connect the beacon and sensor values in the web UI. We get the beacon values of body temperature and heart rate and sensor values of temperature and humidity from the cloud. The input data from 'Wokwi' and python is saved in IBM cloud and the data is linked with the Node-Red to create a dashboard for the Web user interface. The Web UI is provided with environmental and body temperature levels, humidity and heart rate levels. Whenever the temperature and humidity levels exceeds a given limit there will an alert message will pop up with a voice over inorder to grab the monitoring individual's attention. Then the monitoring individual is able to turn on the alarm to aware the workers who are within the range inorder to evacuvate them to a safe place or to take safety measures.

Sprint 4

In sprint 4 we are creating a mobile application for monitoring the temperature, humidity and heart rate levels using the MIT app inventor. The MIT app inventor is linked with Node-Red for processing of the data. It consist of a login page followed by the monitoring system, whenever the temperature or humidity level increases a limit then concern monitoring individual will receive a notification to take actions or precautionary measures. Every working individual is provided with a login data to monitor them separately, when the monitoring individual enters the app he is able to see the temperature, humidity, and heart rate values of the workers.

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Functional Requirements (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Installation	USN-1	The technician must install the smart beacons at points to ensure the entire area of the plantis covered.	3	Medium	Devakumar M
Sprint-1	Data Gathering	USN-2	The beacons obtain the temperature of theirrespective area using sensors.	1	Low	Devakumar M
Sprint-2	Data Sync	USN-3	The beacons send their data to the cloud in the real time which is in turn sent to nearby wearable devicesand the administrators dashboard.	3	Medium	Udhayasankar V
Sprint-2	Sensor value display	USN-4	Get the sensor values like temperature and humidity for analyzing the environment condition	1	Low	Udhayasankar V
Sprint-3	SMS Notifications	USN-5	The user is sent a notification to their phonefrom the wearable device through an API when the area they are in reaches dangerous temperatures.	4	High	ArunkumarS
Sprint-4	Admin Dashboard & Mobile UI	USN-6	The beacons send the data through the cloud to a dashboard which is run by the administrator and mobile app for displaying the sensor values.	4	High	Arvin Raj P

6.3 REPORTS FROM JIRA

BURN DOWN CHART

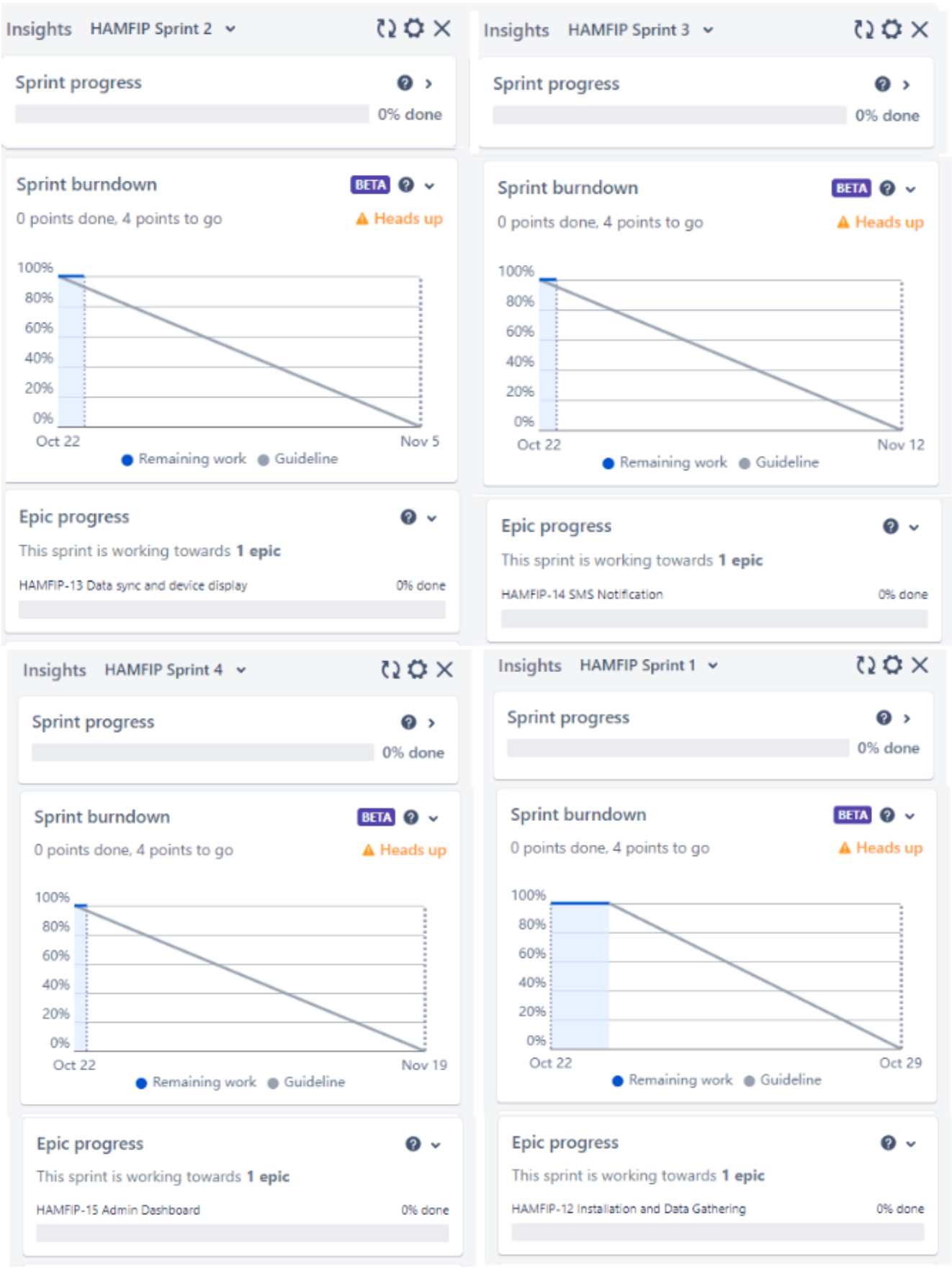

Figure 6.3.1 Burndown chart

ROADMAP

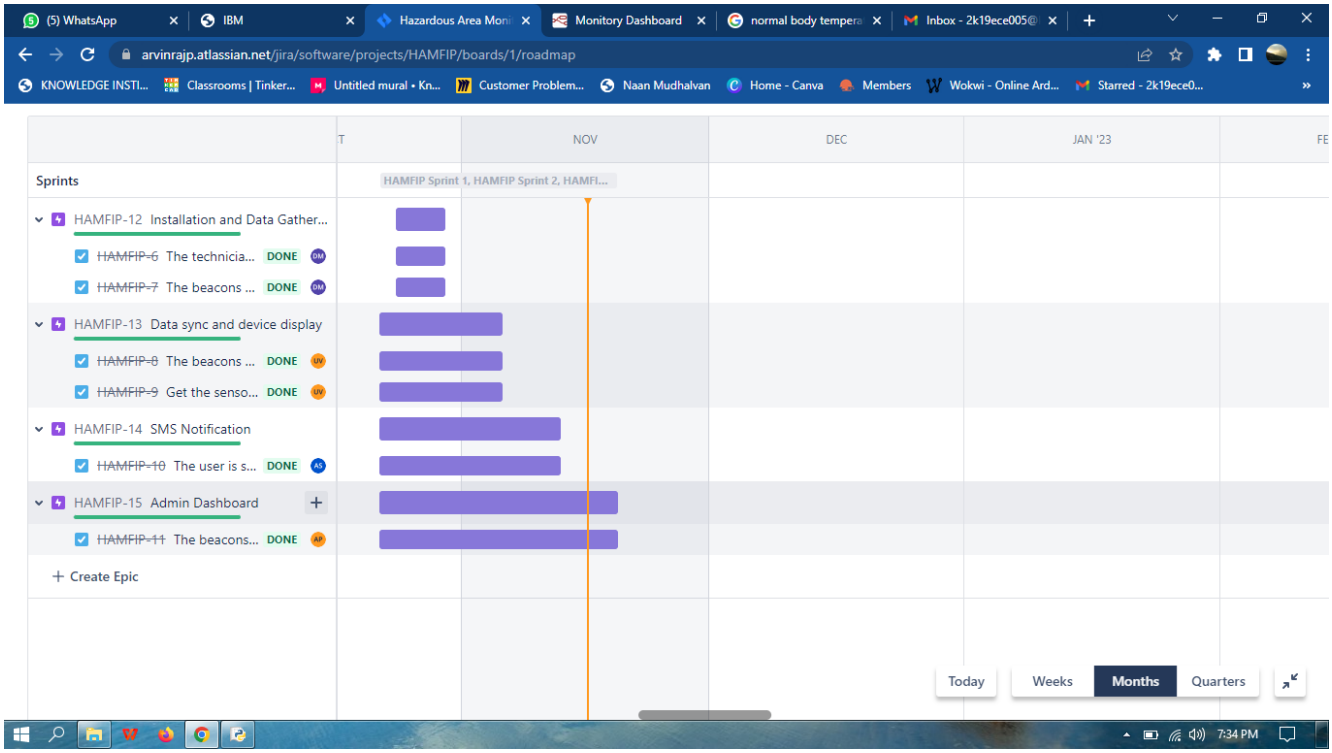

Figure 6.3.2 Road Map

CHAPTER - 7

CODING & SOLUTIONING

7.1 FEATURE 1:

Python 3.7 easier access to debuggers thanks to a new built-in breakpoint () With data classes, create simple classes Access to module properties that can be changed improved type hinting support enhanced timing capabilities.

Features of Python 3.7:

• The breakpoint () Built-In.

• Data Classes.

• Customization of Module Attributes.

• Typing Enhancements.

• Timing Precision.

CODE

```
while True:
    temp=random.randint(0,50)
    heart=random.randint(60,100)
    myData={'temperature':temp, 'heartrate':heart}
        client.publishEvent(eventId="status",msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(5)
client.disconnect()
```

7.2 FEATURE 2

Wokwi is an online Electronics simulator. You can use it to simulate Arduino, ESP32, and many other popular boards, parts and sensors. Here are some quick examples of things you can make with Wokwi: Arduino Uno "Hello World"

Features of Wokwi:

- WiFi simulation - Connect your simulated project to the internet. You can use MQTT, HTTP, NTP, and many other network protocols.
- Virtual Logic Analyzer - Capture digital signals in your simulation (e.g. UART, I2C, SPI) and analyze them on your computer.
- Advanced debugging with GDB - Powerful Arduino and Raspberry Pi Pico debugger for advanced users.
- SD card simulation - Store and retrieve files and directories from your code. Club members can also upload binary files (such as images)

CODE

```
#include "DHT.h"// Library for dht11
#define DHTPIN 15     // what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 22
#define BUZZER 2
void PublishData(float temp, float humid) {
  mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update the data to ibm cloud
  */
  String payload = "{\"Temperature\":";
```

```
  payload += temp;
  payload += "," "\"Humidity\":";
  payload += humid;
  payload += "}";


  Serial.print("Sending payload: ");
  Serial.println(payload);
}
```

CHAPTER - 8
TESTING

8.1 TEST CASES

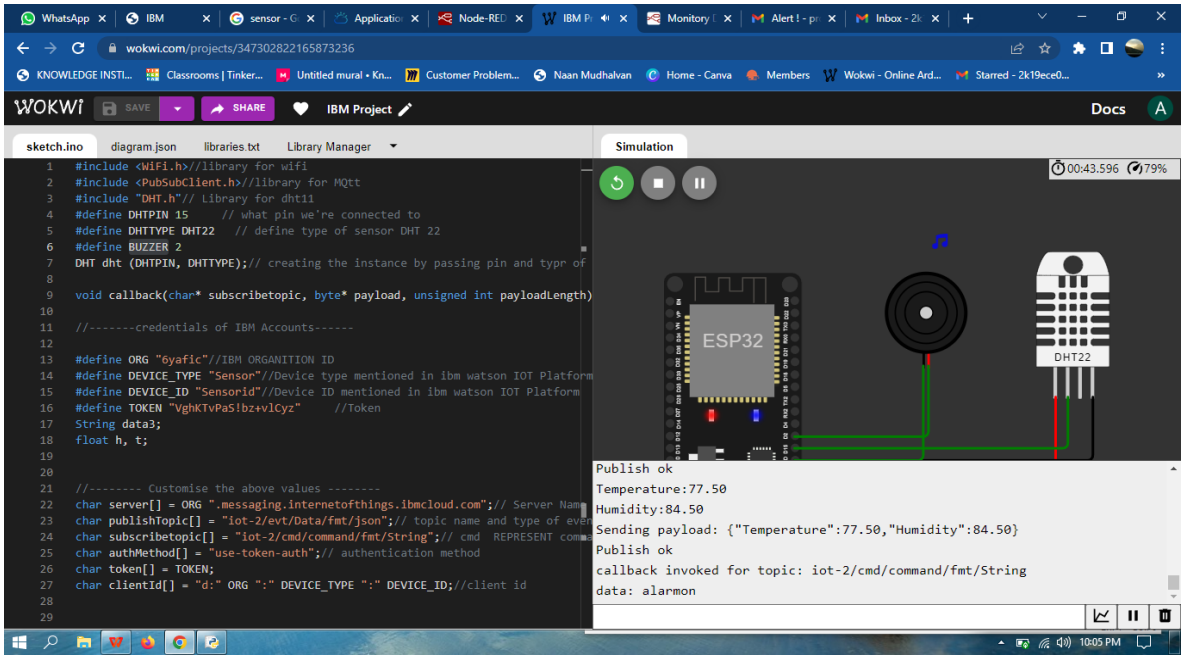

Figure 8.1 Buzzer

8.2 USER ACCEPTANCE TESTING

The temperature, humidity and heartrate values are generated continuously and a cetain limit is assigned to the program, whenever the cases exceeds a limit the monitoring individual will recieve a alert mail.

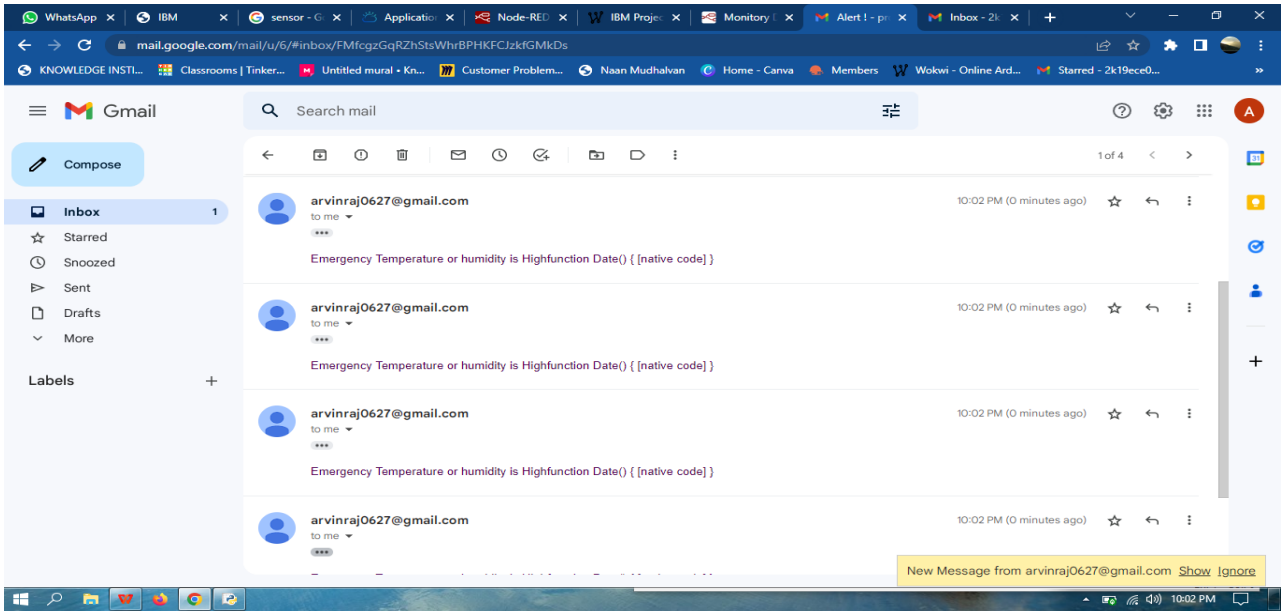

Figure 8.2 Notification

CHAPTER - 9
RESULT

9.1 PERFORMANCE METRICS

Table 9.1 NFT Detailed Test Plan

S.NO	Project Overview	NFT Test approach	Assumption Dependencies/Risks	Approval/Sign Off
1.	Monitoring Web-U1 & Mobile app	Stress	App Crash/Developer team/ Site Down	Approved
2.	Monitoring Web-U1 & Mobile app	Load	Server Crash/Developer team/ Server Down	Approved

End of Test Report

Table 9.2 End of Test Report

Project Overview	NFT Test approach	NFR - Metrics	GO/NO-GO decision	Identified Defects	Approval/ Sign Off
Monitoring Web-U1 & Mobile app	Stress	Performance	GO	closed	Approved
Monitoring Web-U1 & Mobile app	Load	Scalability	N0-GO	closed	Approved

CHAPTER - 10

ADVANTAGES

The applications of temperature monitoring systems are quite versatile. They offer exemplary benefits in terms of keeping the environmental conditions stable and controlled as per specific requirements. Below are the top 5 benefits that this solution offers:

1. **Save time with instant notifications and alerts:**

An loT system offers instant notifications in real-time. Hence, a temperature monitoring system allows a company to track the environmental parameters on a secure web/mobile-based platform. This eliminates redundant tasks like taking manual readings, thus saving time and elevating quick decision making.

2. **Productivity improvement with advanced analytics:**

The data gathered from the temperature sensors can be used to create statistical insights. These insights will include the time duration during which products deteriorate and details associated with the temperature readings. This will help the companies to improve the reliability of their warehouse and cold storage.

3. **Maintaining regulatory compliance:**

Companies must maintain the quality of their products in the entire cycle of the supply chain. The products should meet the safety and quality standards set by the authoritative regulatory bodies. Temperature monitoring allows companies to protect their products from the adverse effects of changing weather and thus meet regulatory compliance.

4. Accessibility from remote locations:

As loT encompasses advanced telemetry capabilities, remote temperature monitoring from distant locations is also. The data gathered through temperature monitoring sensors can be accessed from faraway places on application or a mobile app.

5. Creating transparency in the supply chain:

With advanced telematics capabilities, a temperature monitoring system can transfer the data to multiple profiles simultaneously in real-time. This increases the visibility between the supplier and carrier enabling them to monitor the parameters through remote locations.

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CONCLUSION

The use of temperature monitoring sensors has enabled the monitoring of change in temperature affecting the quality of the products. Their implementation in different sectors has empowered the logistics and warehousing operations of a company. The solution these sensors offers along with loT allows companies to monitor the temperature of their products in a cold chain. This is enabling companies to ensure the quality of their products while they are in transit. Currently, IoT is present and gaining more traction in a lot of fields, and one of the most important fields is industrial applications. There are a huge number of ways in which industries can make use of IoT to improve working conditions, efficiency, cutting costs and improving the overall growth of the sector. However, hazard monitoring and mitigation is often over looked in industrial areas.

CHAPTER - 12

FUTURE SCOPE

This project specifically aims to make use of IoT to actively monitor and analyse various factors in a typical heavy industrial zone like temperature and levels of humidity in the environment. If the above parameters exceed the recommended safe values, The system can track the same and issues alerts. Also, the data generated in real time can provide important information about how smoothly the work is going in different zones. This system can be deployed in many industrial areas like mining, underground factories, metal refineries, automatic welding factories and even heavy parts production lines. It will help to provide a safe and efficient working environment in such areas, while also opening new paths to improve the safety parameters of these places.

CHAPTER - 13

APPENDIX

13.1 RESOURCES

Paper 1: Wireless Sensors Network for Environmental Radiation Monitoring using IoT

.

Author : Ashwini S R , Dr. Shivashankar , Karthik R, Harish BR.

Year: 2019

Paper 2: Internet of things for Flame Monitoring Power Station boilers.

Author : K. Sujatha, Nallamilli.P.G Bhavani , T.KalpalathaReddy, K.S. Ram Kumar .

Year: 2019

Paper 3: IoT based Industrial parameter Monitoring System.

Author : Prof. Nitin Ahire, Shreya Bandodkar, KanchanGupta.

Year: 2019

Paper 4: IoT based Industrial Monitoring System.

Author : Hemlata Yadav, Naomi Oyiza, Sarfaraz Hassan, Dr. Suman Lata.

Year: 2022

Paper 5: IoT based Industrial parameters Monitoring and low cost Iot based emission Monitoring system for Thermal Power Plants.

Author : Hritik Biswas, Atharva Ghodvaidya, Madan Gughe, Utkarsh Kadu ,A.M.Suryawanshi ,

Year: 2019

Paper 6: Protection of crops from wild animals using intelligent surveillance system.

Author : Ayesha Samreen , P. Sathish, N.Alivelu Manga.

Year: 2019

13.2 SOURCE CODE

WOKWI (C++)

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHT.h"// Library for dht11
#define DHTPIN 15     // what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 22
#define BUZZER 2
DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr of dht connected
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
//-------credentials of IBM Accounts------
#define ORG "6yafic"//IBM ORGANITION ID
#define DEVICE_TYPE "Sensor"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "Sensorid"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "VghKTvPaS!bz+vlCyz"     //Token
String data3;
float h, t;
//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform and format in which data to be send
char subscribetopic[] = "iot-2/cmd/command/fmt/String";// cmd  REPRESENT command type AND COMMAND IS TEST OF FORMAT STRING
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client id
//-----------------------------------------
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client id by passing parameter like server id,portand wificredential
void setup()// configureing the ESP32
{
```

```
  Serial.begin(115200);
  dht.begin();
  pinMode(BUZZER,OUTPUT);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
}
void loop()// Recursive Function
{
  h = dht.readHumidity();
  t = dht.readTemperature();
  Serial.print("Temperature:");
  Serial.println(t);
  Serial.print("Humidity:");
  Serial.println(h);
  PublishData(t, h);
  delay(3000);
  if (!client.loop()) {
    mqttconnect();
  }
}
/.....retrieving to Cloud...../
void PublishData(float temp, float humid) {
  mqttconnect();//function call for connecting to ibm
  /* creating the String in in form JSon to update the data to ibm cloud  */
  String payload = "{\"Temperature\":";
  payload += temp;
  payload += "," "\"Humidity\":";
  payload += humid;
  payload += "}";
  Serial.print("Sending payload: ");
  Serial.println(payload);
```

```
 if (client.publish(publishTopic, (char*) payload.c_str())) {
Serial.println("Publish ok");// if it sucessfully upload data on the cloud then it will print publish ok in Serial monitor or else it will print publish failed
  } else {
    Serial.println("Publish failed");
  }
}
void mqttconnect() {
  if (!client.connected()) {
    Serial.print("Reconnecting client to ");
    Serial.println(server);
    while (!!!client.connect(clientId, authMethod, token)) {
      Serial.print(".");
      delay(3000);
    }
     initManagedDevice();
     Serial.println();
  }
}
void wificonnect() //function defination for wificonnect
{
  Serial.println();
  Serial.print("Connecting to ");
  WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish the connection
  while (WiFi.status() != WL_CONNECTED) {
    delay(3000);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
}
```

```
void initManagedDevice() {
  if (client.subscribe(subscribetopic)) {
    Serial.println((subscribetopic));
    Serial.println("subscribe to cmd OK");
  } else {
    Serial.println("subscribe to cmd FAILED");
  }
}
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)
{
  Serial.print("callback invoked for topic: ");
  Serial.println(subscribetopic);
  for (int i = 0; i < payloadLength; i++) {
    //Serial.print((char)payload[i]);
    data3 += (char)payload[i];
  }
  Serial.println("data: "+ data3);
  if(data3 == "alarmon")
  {
    pinMode(BUZZER,HIGH);
    delay(1000);
    tone(BUZZER,80);
    delay(10000);
    noTone(BUZZER);
    delay(1000);
    Serial.println(data3);
  }
  else
  {
  Serial.println(data3);
  pinMode(BUZZER,LOW);
  delay(500);
  }
```

```
data3="";
}
```

PYTHON

```
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "6yafic",
        "typeId": "Sprint1",
        "deviceId":"SprintID"
    },
    "auth": {
        "token": "sW(iQhEK*t)4!jgrjD"
    }
}
def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()
while True:
    temp=random.randint(0,50)
    heart=random.randint(60,100)
    myData={'temperature':temp, 'heartrate':heart}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(5)
client.disconnect()
```

13.3 GITHUB & PROJECT DEMO LINK

Table 13.3. GitHub & Project Demo Link

Content	Link
GitHub	https://github.com/IBM-EPBL/IBM-Project-39544-1660456952
Project Demonstration Video	https://youtu.be/xiNktqL2yp0