Industrial Workers Health and Safety System based on Internet of Things

PROJECT REPORT

Submitted By

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in partial fulfilment for the award of the degreeof

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

KNOWLEDGE INSTITUTE OF TECHNOLOGY,

SALEM-637504

ANNA UNIVERSITY::CHENNAI 600 025

BONAFIDE CERTIFICATE

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ACKNOWLEDGEMENT

At the outset, we express our heartfelt gratitude to **GOD,** who has been our strength to bring this project to light.

At this pleasing moment of having successfully completed our project,we wish to convey our sincere thanks and gratitude to our beloved president **Mr. C. Balakrishnan,** who has provided all the facilities to us.

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TABLE OF CONTENTS

ABSTRACT

This abstract presents a solution for monitoring the health and safety of industrial workers using IOT technology. By integrating sensors into workers' shoes, various parameters such as temperature, pressure, and altitude can be measured. Additionally, piezoelectric sensors in the shoes enable the calculation of distance traveled by tracking the number of steps taken. The collected data from these sensors is transmitted via Bluetooth Low Energy (BLE) technology to beacon scanners strategically placed throughout the workplace. These beacon scanners then forward the data to a cloud-based platform for further processing and analysis. A mobile application is developed to visualize the collected data, providing real-time insights on workers' health and safety parameters. Furthermore, a web application is designed to allow authorities and supervisors to monitor the status of individual workers. In the case of workers operating at higher altitudes, the system generates alerts to notify the relevant personnel and prompt them to take necessary precautions.

This solution leverages IOT and cloud technologies to create a comprehensive monitoring system that enhances the health and safety of industrial workers. By providing real-time data visualization and proactive alerts, it enables authorities to take prompt action and mitigate potential risks in the work environment.

CHAPTER - 1

INTRODUCTION

1.1 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

1.2 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

IDEATION & PROPOSED SOLUTION

2.1 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 2.1 Problem Statement

2.2 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.

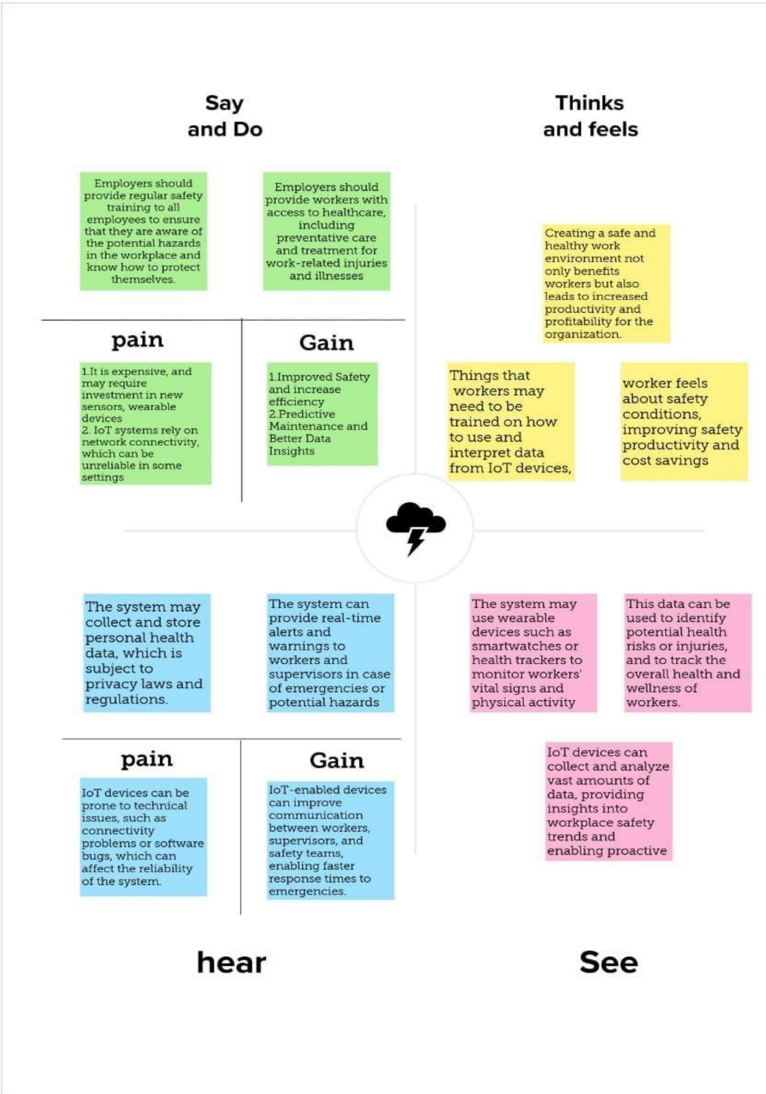


Figure 2.2 Empathy Map

2.3 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.

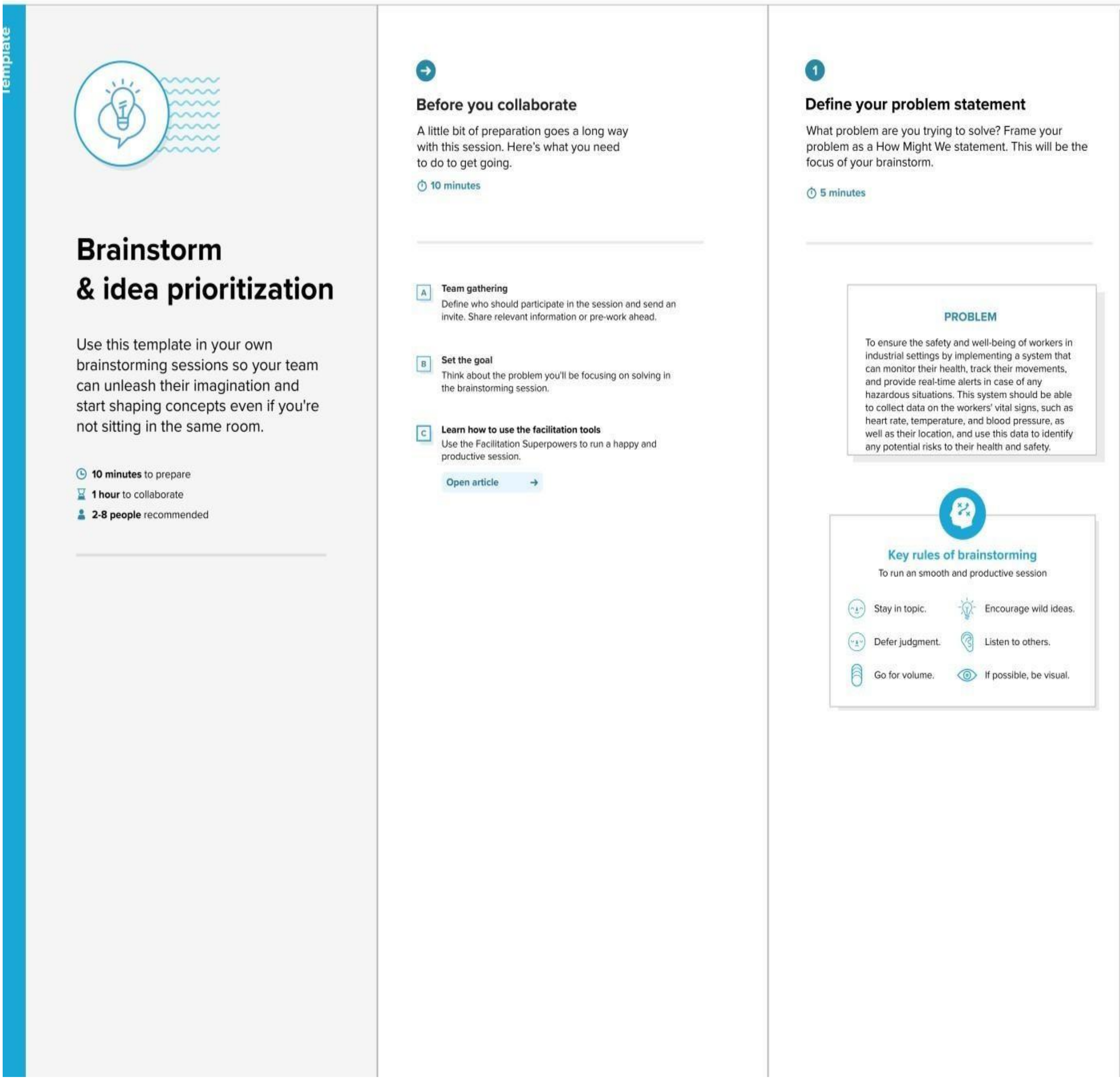


Figure 2.3 Ideation & Brainstorming

Figure 2.4 Brainstorm

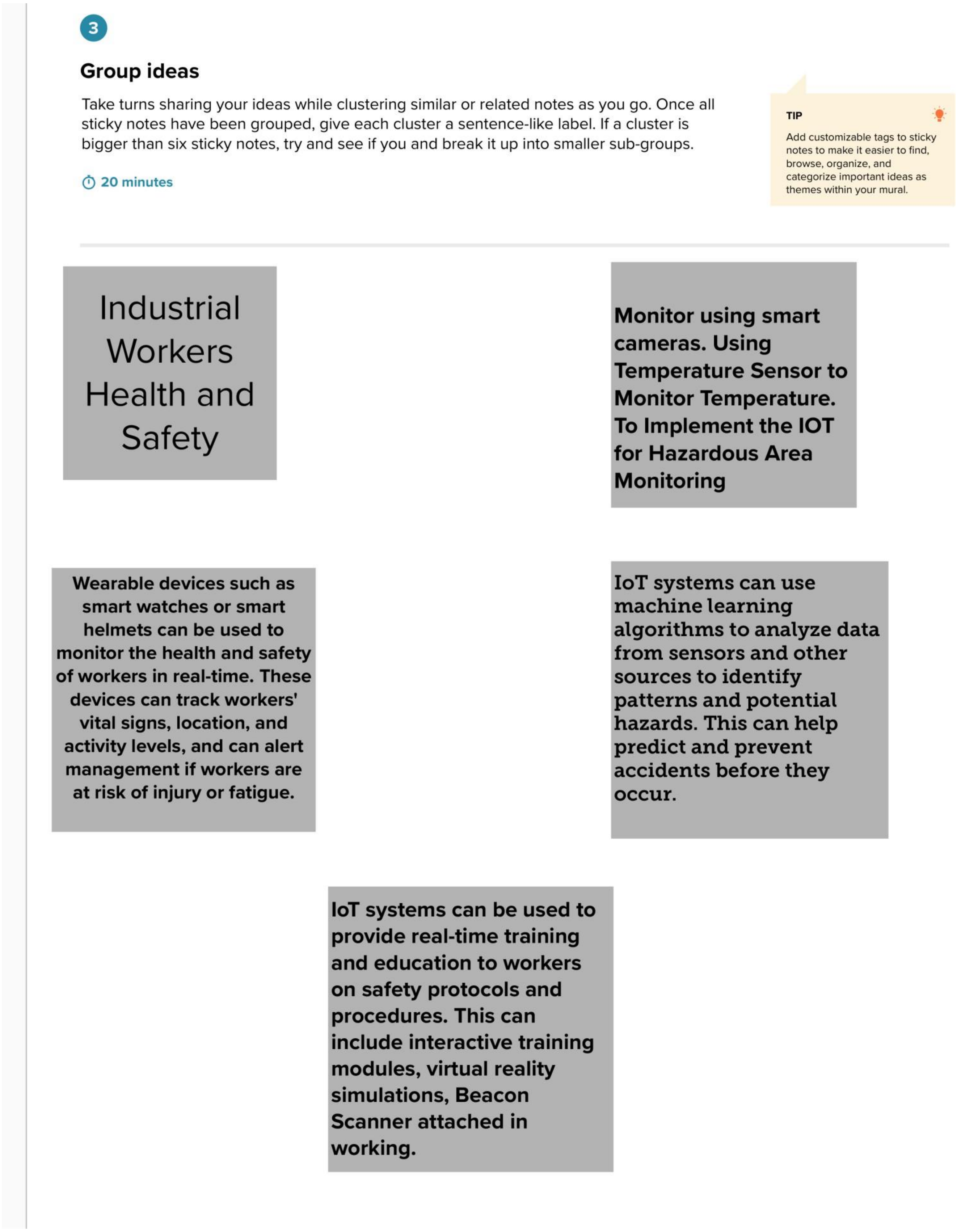


Figure 2.5 Idea Listing and Grouping

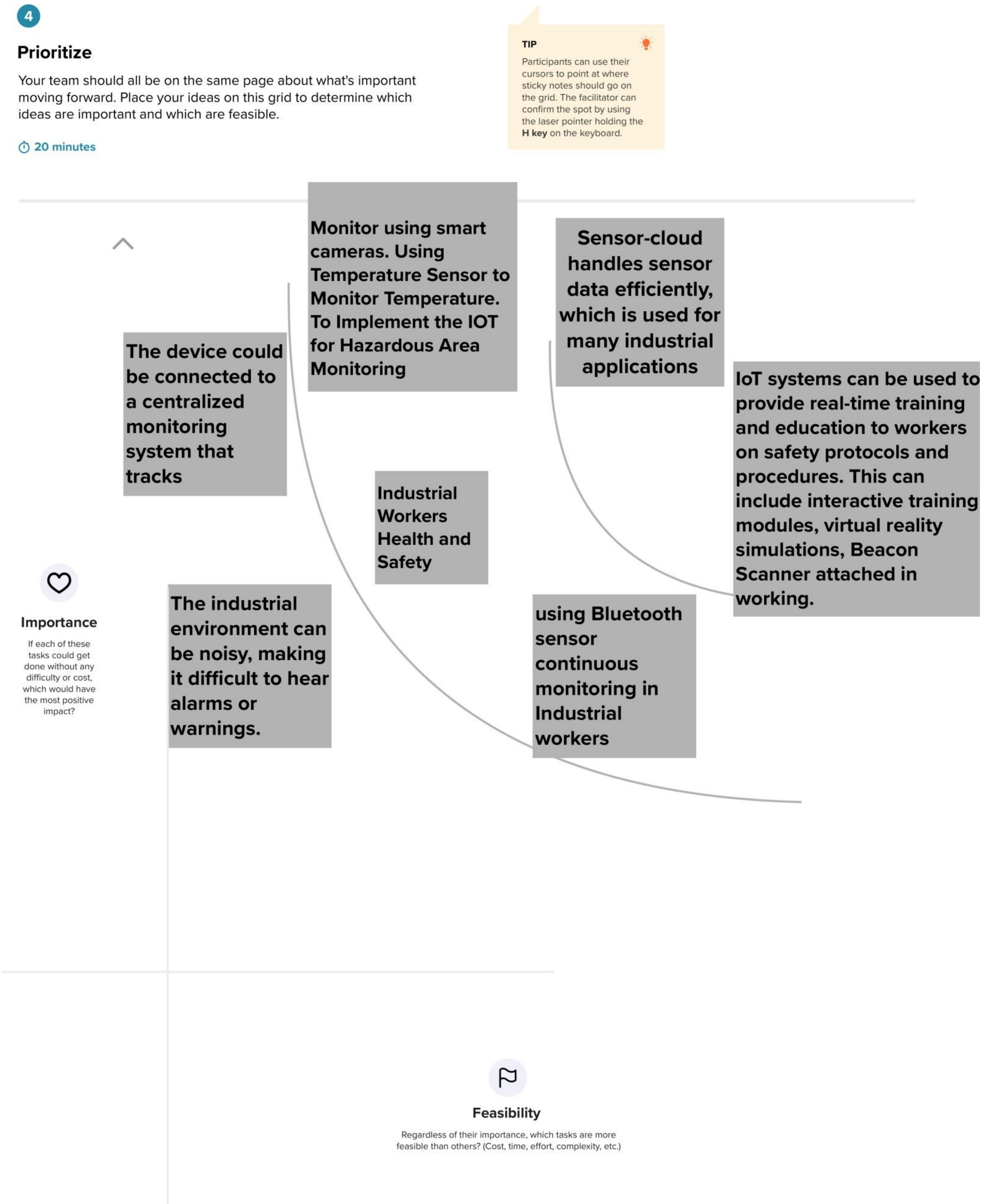


Figure 2.6 Idea Prioritization

2.4 PROPOSED SOLUTION

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

Our project aim is to detect the industrial workers health and safety. They need to be monitored in order to take some safety measures when they are in some critical conditions.

2. **Idea / Solution description**

To monitor different parameters we can integrate some sensors in the workers shoes. We can get temperature, pressure and altitude parameters. Every shoe is integrated with piezoelectric sensors through which we can calculate the distance the worker has walked. These parameters are sent to the available beacon scanners in ever place through BLE technology. From beacon scanners the entire data is sent to the cloud. This data will be visualized in the mobile application and through web app the authorities can check every workers status and if someone is working at higher altitudes he may alert him with necessary precautions

3. **Novelty / Uniqueness**

Sensor-integrated shoes, BLE technology, and cloud based data processing provide a novel approach to workplace safety, enabling real-time monitoring, tracking, and analysis of vital parameters. This innovative solution empowers authorities to swiftly identify and address safety hazards, enhancing workplace safety and promoting worker well-being

4. **Social Impact / Customer Satisfaction**

Integrating sensors in workers' shoes has significant social impact, improving safety, productivity, compliance, transparency, and cost-efficiency.

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

This business model targets high-risk industries and relies on shoe sales/rentals and subscription fees. Key activities include R&D, manufacturing, and software updates, with quality sensors and cloud infrastructure as key resources. Channels include direct sales and online platforms, with partnerships formed with sensor manufacturers, beacon providers, and developers.

6. **Scalability of the Solution**

This is a scalable IOT solution that integrates sensors, beacon infrastructure, cloud infrastructure, and mobile/web applications. It efficiently stores data, optimizes erformance, and manages costs, making it suitable for use in diverse industries.

2.5 LITERTURE SURVEY

Paper 1: IOT Based Wireless Smart Shoe and Energy Harvesting System

This paper explores the increasing demand for wearable sensors and the need for independent and compact power sources. It highlights the limitations of electrochemical batteries and the environmental impact of their manufacturing process, leading to a growing interest in alternative energy sources. The paper focuses on smart energy harvesters, which convert energy produced by human motion into renewable and usable energy. Various methods of energy harvesting are mentioned, including electromagnetic, electrostatic, thermoelectric and piezoelectric methods. Among these, piezoelectric structures are considered simpler, more compact, and easier to implement. The paper then introduces a smart shoe prototype that harnesses energy from human steps using piezoelectric sensors embedded in the insole. The shoe is designed for user comfort and has a thin, durable, and high-performance structure. The harvested energy can be used to power electronic devices. The authors also discuss an application based on a pedometer implementation using the smart shoe. The system can track step count, distance covered, and calories burned by the user. This information can be used for various purposes, including fitness tracking. The related works section mentions other research papers that explore different aspects of energy harvesting, such as mechanical energy harvesting from human motion, gait monitoring systems, piezoelectric materials, and piezoelectric sensors for generating electric charge output. The proposed IOT-based system consists of a smart shoe and a mobile charging system. The smart shoe incorporates piezoelectric sensors, diodes for energy conversion, and a Node MCU for wireless communication. The system counts steps, calculates calories burned and distance traveled, and stores the data in an online database. A mobile application provides users with exercise suggestions based on their walking patterns. This paper emphasizes the potential of energy harvesting technologies, particularly in the context of wearable sensors, and presents a specific implementation using a smart shoe prototype.

Paper 2: INDUSTRY SAFETY SYSTEM USING IOT

The article "IOT based automated prevention of industrial accidents" published in the International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), Volume 7, Issue 1, January 2020, introduces a system aimed at preventing industrial accidents through the utilization of sensors, machine automation, and safety alerts using GSM technology. The system comprises four modules: intruder detection using a sonic sensor, room temperature monitoring using a thermal sensor, machine automation, and safety alerts through GSM communication. The sonic sensor employs non-contact technology to detect the presence of objects or materials without causing damage. The thermal sensor detects temperature changes and can monitor various substances across a wide temperature range. Machine automation relies on control systems and information technologies to enhance industrial processes and reduce reliance on human labor. The safety alert module incorporates a GSM modem with its own mobile number, allowing for the transmission of emergency messages to nearby hospitals. The article includes the system's architecture, a flowchart illustrating accident prevention, and experimental results demonstrating the accurate detection of humans by the sensors and successful delivery of alert messages to the hospital. In conclusion, the article emphasizes the importance of preventing industrial accidents in light of the complexities and hazards associated with modern industrial practices. The proposed IOT-based automated system offers a viable solution to mitigate risks, safeguard workers' lives, and minimize injuries.

Paper 3: Industrial Internet of Things for Safety Management Applications

The Industrial Internet of Things (IIOT) has revolutionized safety management practices in industrial environments by leveraging interconnected devices, sensors, and advanced analytics. Through real-time monitoring, predictive maintenance, and data-driven decision-making, IIOT enhances safety measures and mitigates risks. It enables continuous monitoring of workers, equipment, and environmental conditions, facilitating immediate response and accident prevention. Proactive maintenance based on IIOT data predicts equipment failures, reducing downtime and ensuring safer operations. Integration of sensors allows for the detection of hazardous conditions, triggering alerts and emergency protocols for swift response. IIOT's data analytics capabilities aid in risk assessment and decision support, prioritizing safety measures and optimizing resource allocation. The benefits of IIOT in safety management include improved worker safety, enhanced operational efficiency, and cost reduction. However, challenges such as data security, interoperability, data management, and personnel training need to be addressed. Future research should focus on developing robust security frameworks, standardizing communication protocols, and exploring edge computing and artificial intelligence for real-time decision-making. By overcoming these challenges and investing in research, IIOT can unlock its full potential as a cornerstone of safety management in industrial settings

Paper 4: IOT Based Smart Shoe

The proposed IOT-based Smart Shoe system presented in this paper aims to address the challenges faced by visually impaired individuals in navigating their surroundings independently. The system utilizes ultrasonic sensors, an arduino UNO board, GPS, GSM modules, and various other sensors and components embedded within the shoe to provide assistance and warnings to the user. The ultrasonic sensors detect obstacles in the user's path, and the system alerts the user by producing sound through a buzzer. This helps the user avoid collisions and navigate safely. Additionally, the system incorporates GPS and GSM modules to track the user's location and provide easy tracking and monitoring. The Smart Shoe system also offers additional features such as determining the user's heart rate, calculating the distance traveled, and monitoring the user's location. These functionalities enhance the overall usability and benefits of the system for visually impaired individuals. The experimental results demonstrate the effectiveness of the prototype Smart Shoe system. When obstacles are detected, the buzzer alerts the user, and the obstacle distance is sent to a guardian or caregiver through messaging. The system also calculates calories burned and heart rate, providing valuable health information to the user. In conclusion, the IOT-based Smart Shoe system presented in this paper offers a practical and cost effective solution for visually impaired individuals to navigate their surroundings independently. The integration of various sensors, microcontrollers, and communication modules enables the shoe to detect obstacles, provide warnings, track location, and monitor health parameters. Further improvements and enhancements can be made to the system, such as energy harvesting and storage, to optimize its functionality and usability for the users.

CHAPTER- 3
REQUIREMENT ANALYSIS

3.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirements (Epic)	Sub Requirements (Story / Sub-Task)
FR-1	User registration and authentication	This may involve username/password authentication, biometric authentication, or other secure authentication methods.
FR-2	Notifications and Reminders	Notifications can be sent through the mobile application or via email/SMS
FR-3	Data Collection	The integrated sensors should collect accurate and reliable data for temperature, pressure, altitude, and distance walked by the worker.
FR-4	Historical Data Analysis	The mobile application and web app should allow users to access and analyze historical data to identify patterns, anomalies, and potential risk factors. This can help in making informed decisions and implementing preventive measures.

3.2 NON - FUNCTIONAL REQUIREMENTS

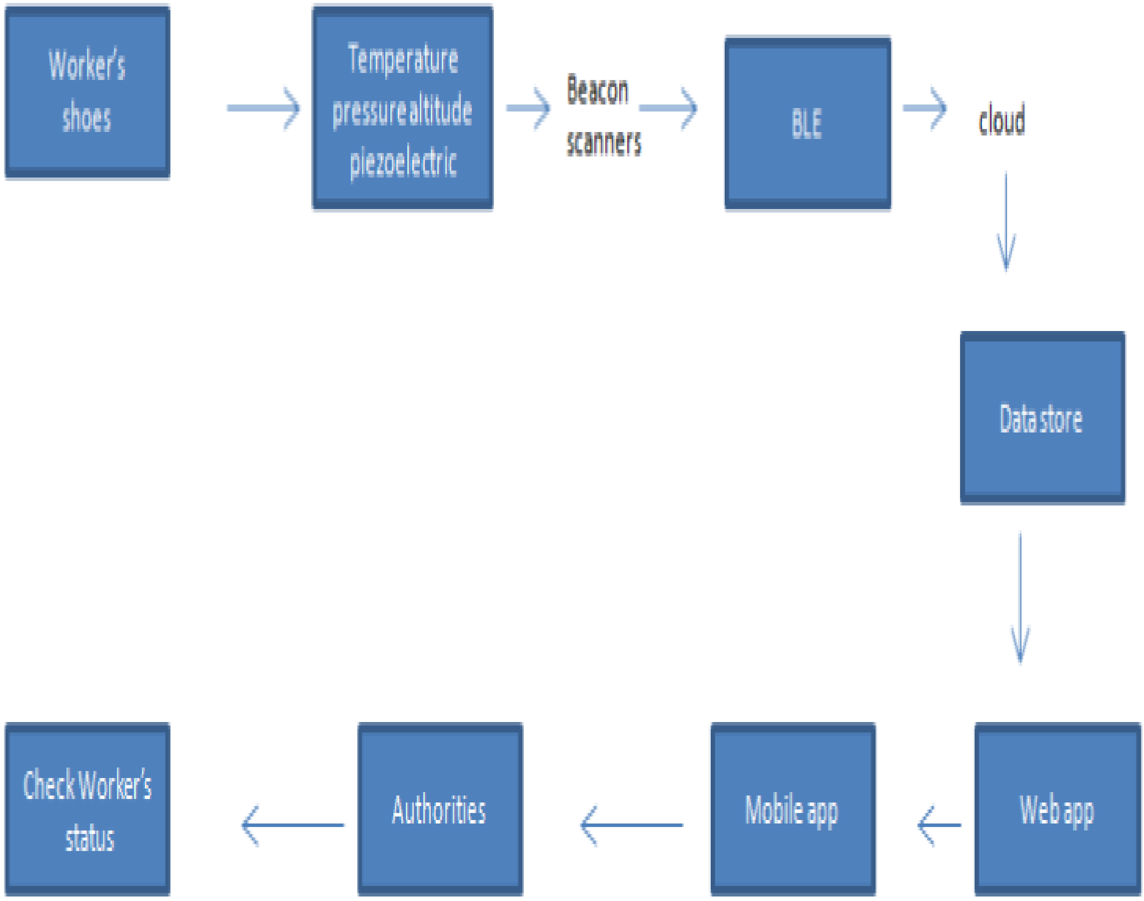
FR No.	Non-Functional Requirements	Description
NFR-1	Usability	The user interface should be intuitive, easy to navigate, and responsive across different devices and screen sizes. It should accommodate users with different levels of technical expertise.
NFR-2	Security	It should employ encryption techniques, secure data transmission, and secure storage practices to protect the workers' data from unauthorized access.
NFR-3	Reliability	The sensors, communication infrastructure, and data visualization components should be designed to minimize errors and maintain data integrity.
NFR-4	Performance	This enables authorities to efficiently monitor workers' parameters, make informed decisions, and enhance workplace safety.

NFR-5	Availability	The system should be highly reliable and available to ensure continuous monitoring and data visualization. Downtime should be minimized, and provisions such as backup systems and redundancy should be in place to mitigate any potential failures.
NFR-6	Scalability	The solution should be scalable to accommodate a large number of workers and sensor data. It should be able to handle the increasing volume of data as the number of workers and monitoring locations grow.

CHAPTER - 4

PROJECT DESIGN

4.1 DATA FLOW DIAGRAM



4.2 SOLUTION & TECHNICAL ARCHITECTURE

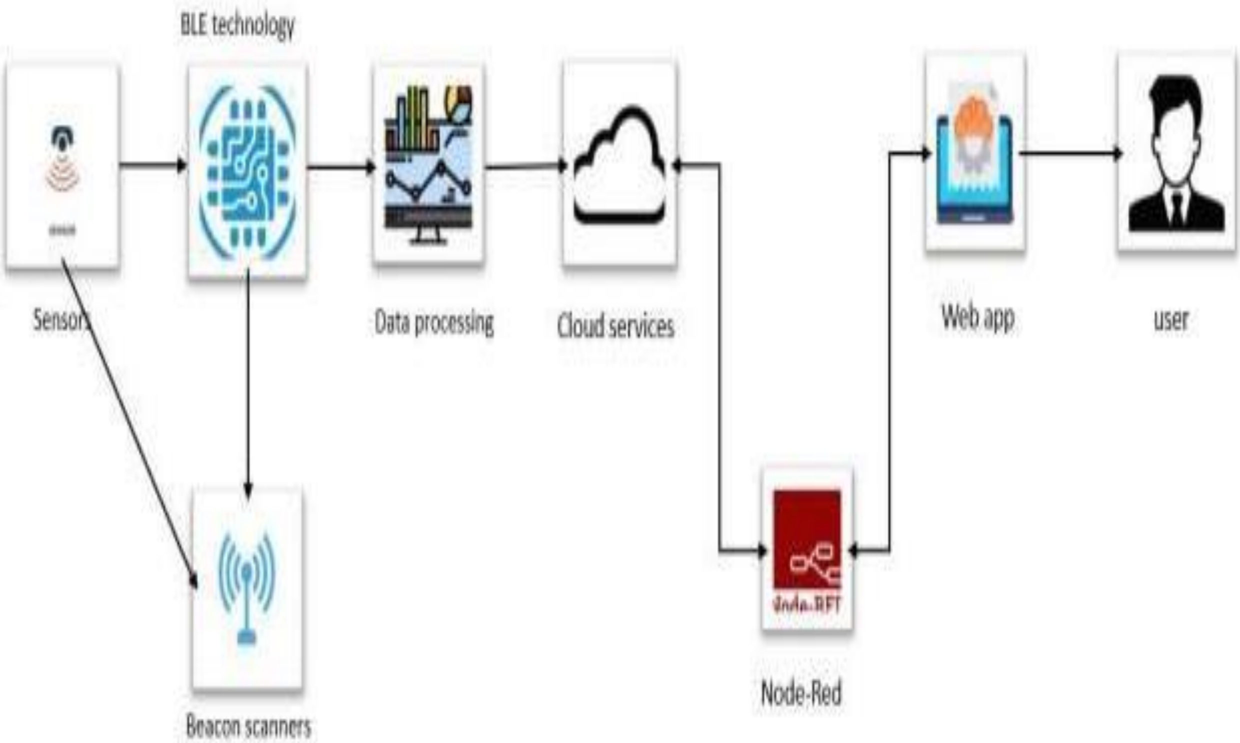


Figure 4.2 Technology Architecture

4.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority
Workers	Monitoring	USN-1	Workers wear sensor-integrated shoes, monitoring parameters like temperature, pressure, altitude, and distance walked. They use the mobile app to view real-time data, receive alerts, and prioritize their safety during work activities	The mobile app provides real-time data updates and timely alerts to workers, enabling them to make informed decisions and prioritize their safety during work activities.	High
Authorities/ Supervisors	Supervision	USN-2	Authorities/Supervisors use the mobile/web app to monitor worker status and real-time data. They make informed decisions, identify risks, and take precautions to ensure worker safety, including issuing alerts when necessary.	The mobile/web app provides real-time worker status and accurate data updates for effective monitoring.	High
System Administrator	Maintenance	USN-3	System Administrators are responsible for managing and maintaining the system infrastructure. Their tasks include setting up and maintaining beacon scanners, managing cloud storage and data processing, ensuring system functionality, handling user access rights and security measures, and performing system upgrades and maintenance.	The system administrators successfully set up and maintain the beacon scanners, ensuring they accurately receive data from the sensor-integrated shoes.	Medium

CHAPTER - 5

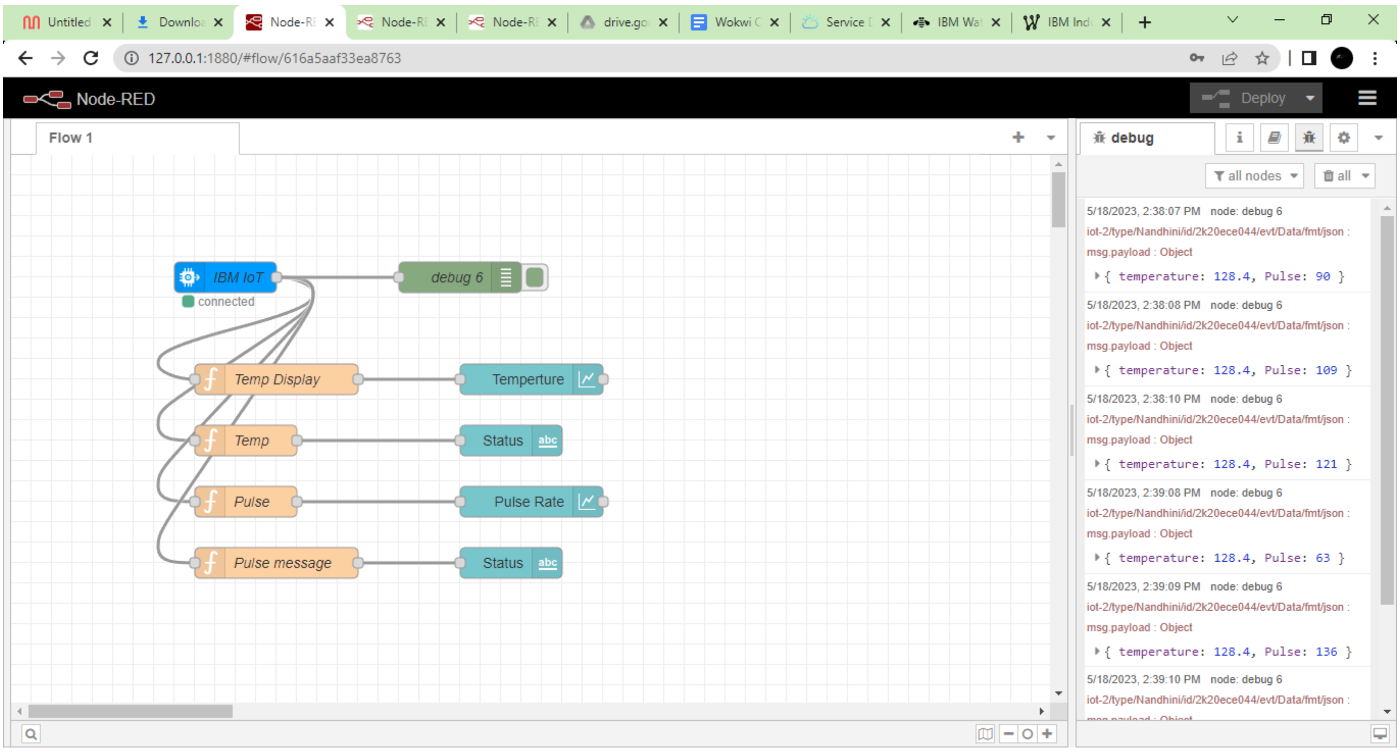
CODING & SOLUTIONING

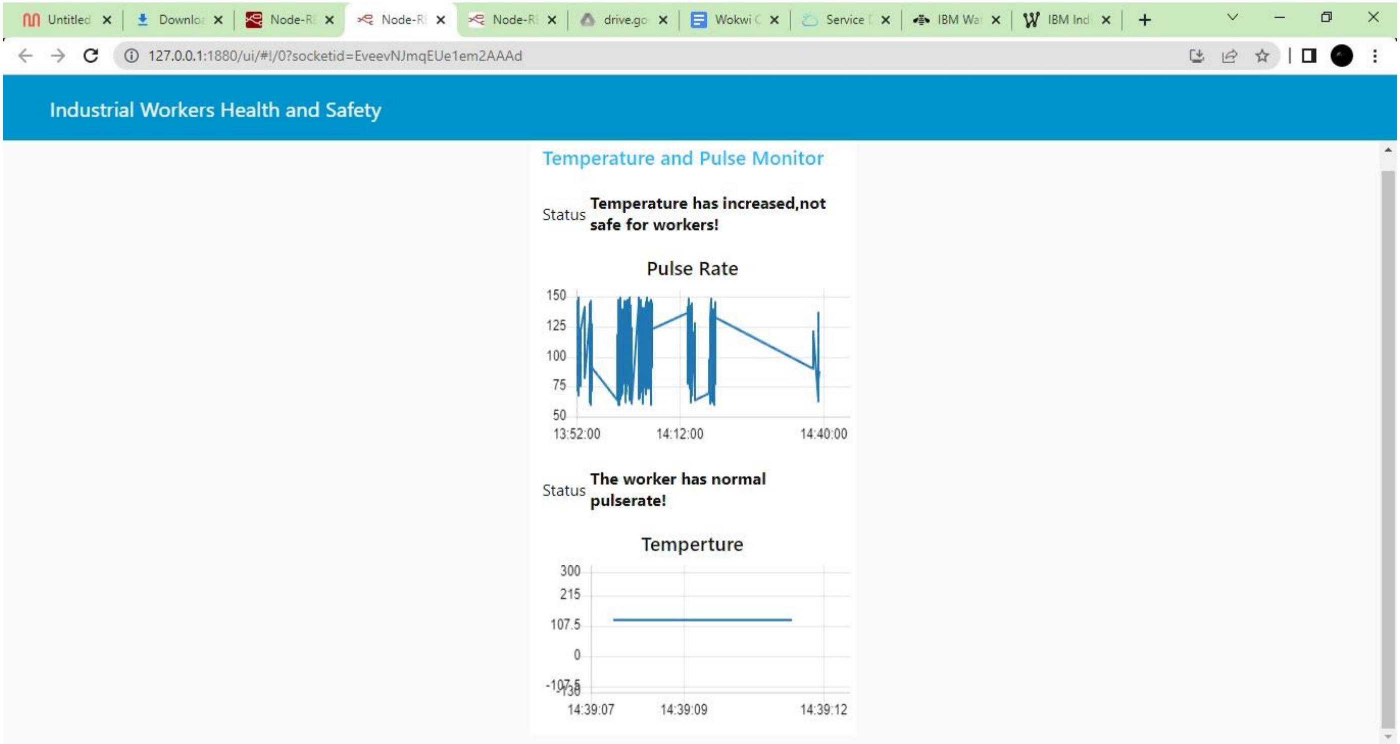
5.1 FEATURE 1:

Features of Node-Red:

Node-RED provides a powerful set of features for your solution. With its visual flow-based programming, extensive library of nodes, and BLE integration, you can easily design and manage data flows from the sensors in workers' shoes to the cloud. The data can be processed and transformed using dedicated nodes, and then seamlessly integrated with popular cloud platforms for storage and analysis. Node-RED's visualization and dashboard nodes enable you to create interactive displays of the sensor data in mobile and web applications, while its alerting and notification capabilities allow you to trigger alerts for higher altitude situations. With scalability and deployment options, Node-RED provides a comprehensive solution for monitoring worker parameters, ensuring safety, and empowering efficient management.

Output :




127.0.0.1:1880/ui/#!/0?socketid=EveevNJmqEUe1em2AAAd
Industrial Workers Health and Safety
Temperature and Pulse Monitor
Status
Temperature has increased,not safe for workers!
Pulse Rate
150
125
100
75
50
13:52:00
14:12:00
14:40:00
Status
The worker has normal pulserate!
Temperture
300
215
107.5
0
-107.5
-130
14:39:07
14:39:09
14:39:12

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:

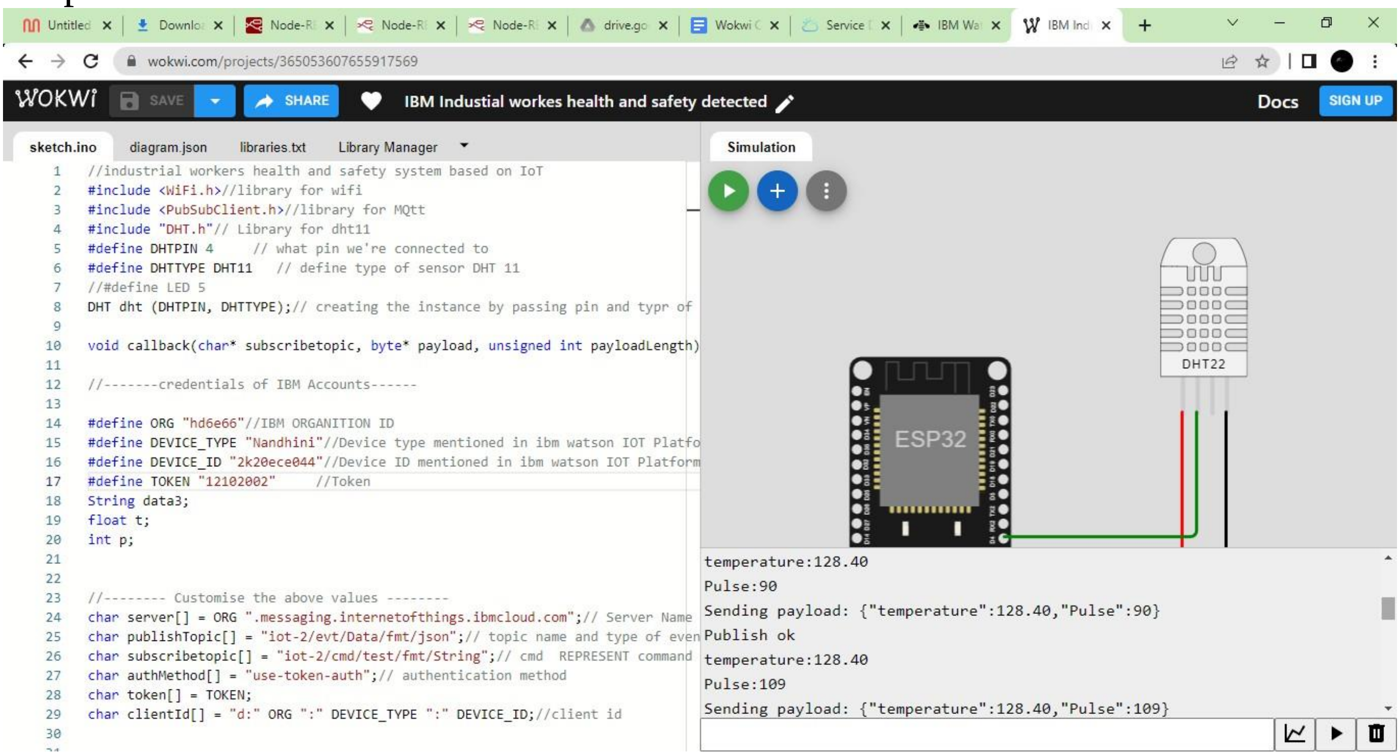
```
#include "DHT.h"// Library for dht11
#define DHTPIN 15     // what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 22
void PublishData(float temp, float humid) {
mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update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

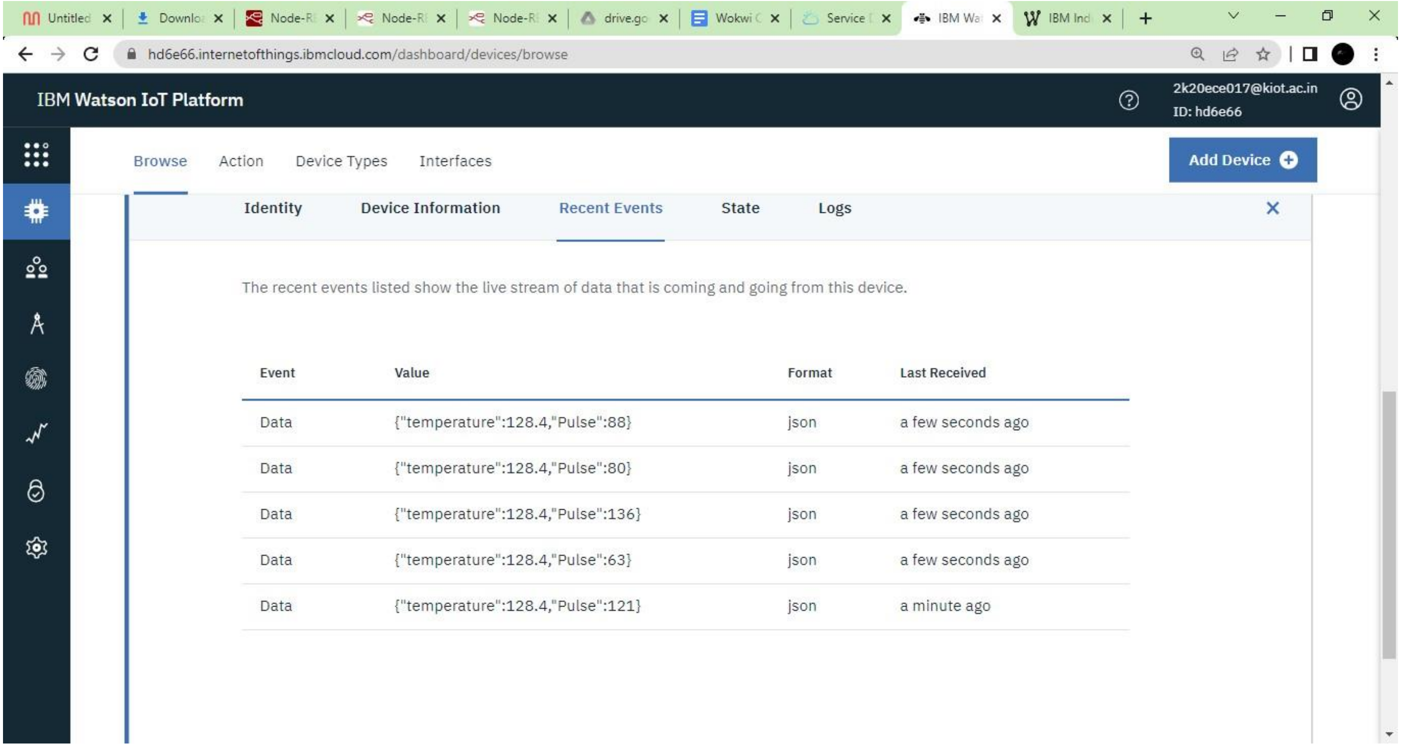
```
  payload += temp;
  payload += "," "\"pulse\":";payload
  += pulse;
  payload += "}";



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

Output:




hd6e66.internetofthings.ibmcloud.com/dashboard/devices/browse
IBM Watson IoT Platform
2k20ece017@kiot.ac.in
ID: hd6e66
Browse
Action
Device Types
Interfaces
Add Device
Identity
Device Information
Recent Events
State
Logs
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
Last Received
Data {"temperature":128.4,"Pulse":88} json a few seconds ago
Data {"temperature":128.4,"Pulse":80} json a few seconds ago
Data {"temperature":128.4,"Pulse":136} json a few seconds ago
Data {"temperature":128.4,"Pulse":63} json a few seconds ago
Data {"temperature":128.4,"Pulse":121} json a minute ago

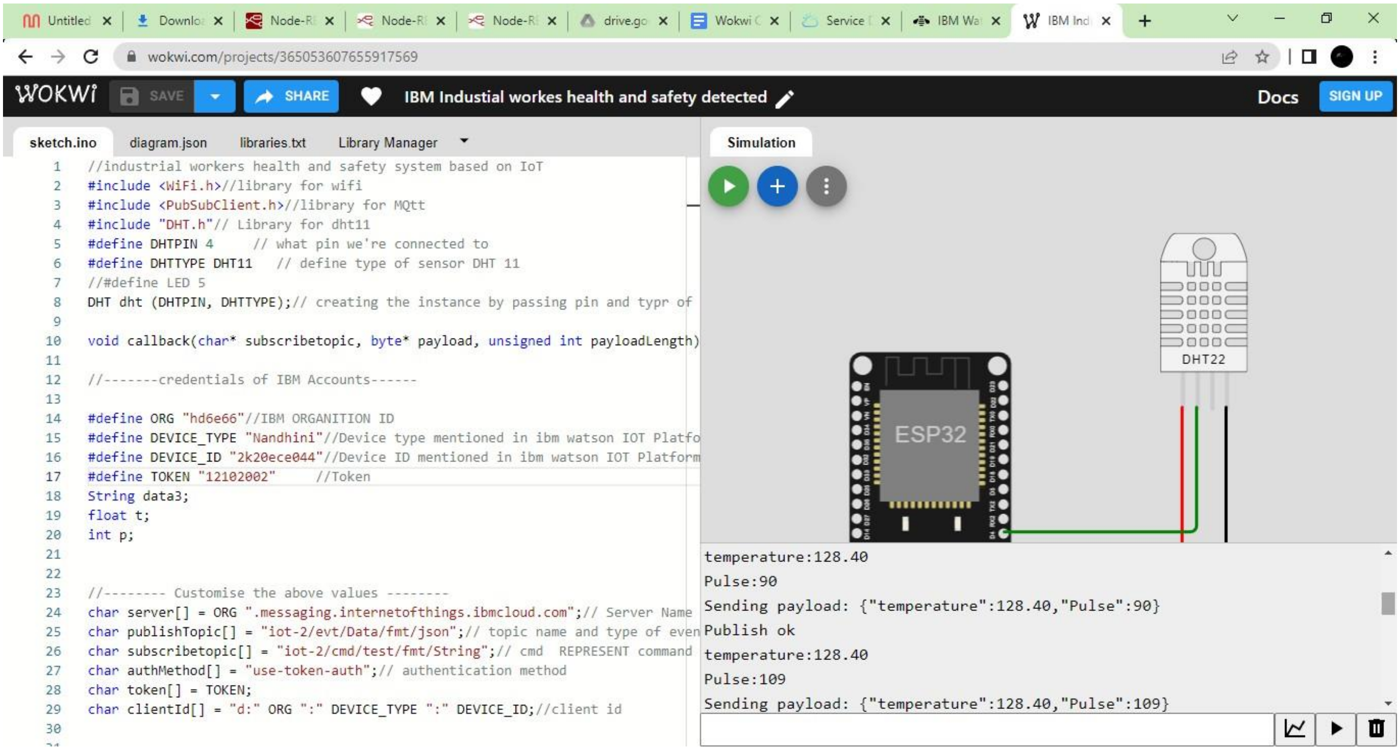
CHAPTER - 6

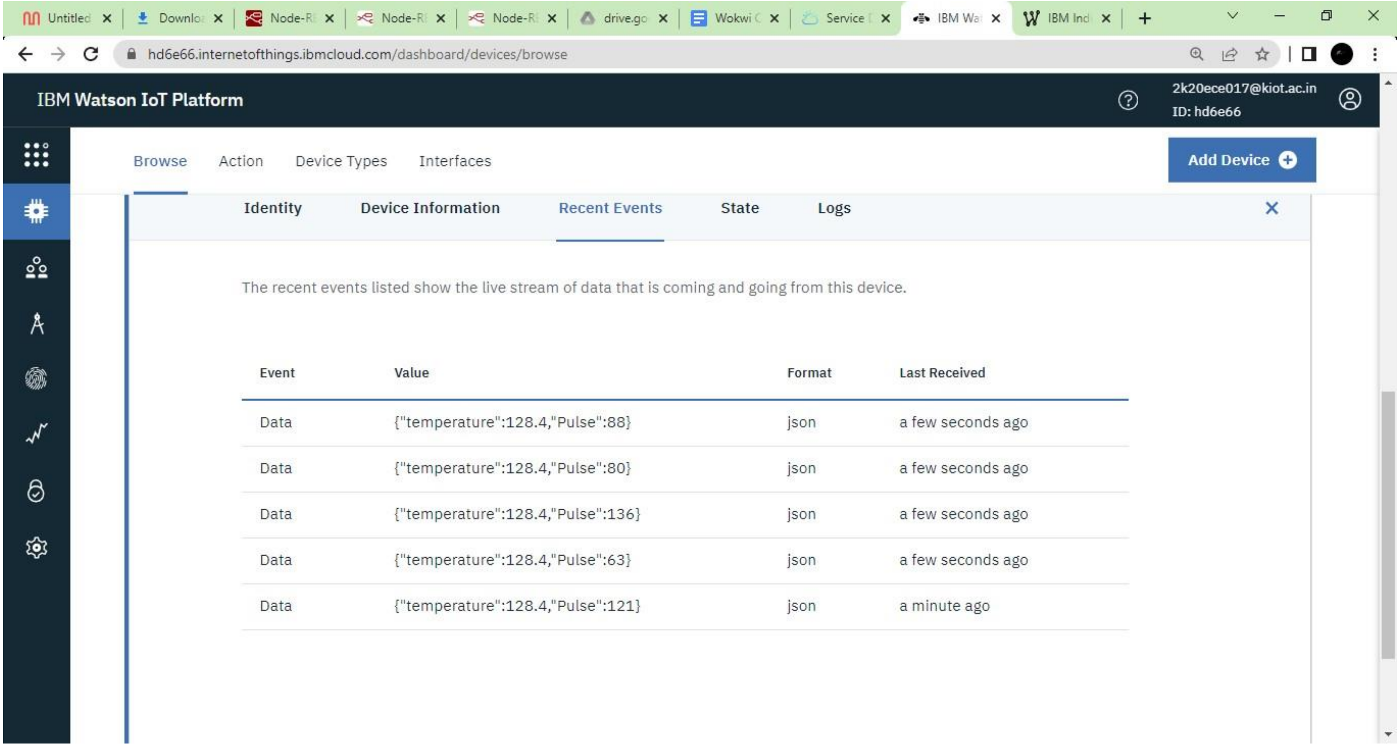
RESULT

6.1PERFORMANCE METRICS

S.NO	Project Overview	Temperature	Pulse
1.	Monitoring Web-U1	128.4	88

Output:




hd6e66.internetofthings.ibmcloud.com/dashboard/devices/browse
IBM Watson IoT Platform
2k20ece017@kiot.ac.in
ID: hd6e66
Browse
Action
Device Types
Interfaces
Add Device
Identity
Device Information
Recent Events
State
Logs
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
Last Received
Data
{"temperature":128.4,"Pulse":88}
json
a few seconds ago
Data
{"temperature":128.4,"Pulse":80}
json
a few seconds ago
Data
{"temperature":128.4,"Pulse":136}
json
a few seconds ago
Data
{"temperature":128.4,"Pulse":63}
json
a few seconds ago
Data
{"temperature":128.4,"Pulse":121}
json
a minute ago

CHAPTER-7

ADVANTAGES

Integrating sensors into workers' shoes and using BLE technology to transmit data to the cloud for monitoring purposes offers several advantages:

1. **Real-time Monitoring:** The system allows for real-time monitoring of various parameters such as temperature, pressure, altitude, and distance walked. This enables immediate detection of any anomalies or unsafe conditions that may require attention.

2. **Worker Safety**: By monitoring parameters like temperature, pressure, and altitude, the system can help ensure worker safety. For example, if a worker is operating at higher altitudes, authorities can receive alerts and take necessary precautions to prevent altitude-related health issues.

3. **Data Collection and Analysis:** By collecting data from multiple workers over time, valuable insights can be gained. Analyzing the data can help identify patterns, trends, and potential risks, enabling authorities to make informed decisions and implement preventive measures to enhance worker safety and efficiency.

4. **Cost-Effective:** Integrating sensors into shoes is a cost-effective solution compared to other wearable devices or specialized equipment. Workers can simply wear the shoes without requiring additional devices or accessories.

5. **Seamless Integration:** BLE technology allows for easy integration with existing beacon scanners, making it convenient to deploy the monitoring system in various workplaces. This integration enables data transmission to the cloud without significant infrastructure changes.

6. **Remote Monitoring:** The cloud-based system enables authorities to remotely monitor worker status and access the data from anywhere via a mobile application or web app. This flexibility allows for efficient management and supervision of workers in different locations.

7. **Early Intervention and Support:** With real-time data and alerts, authorities can identify workers who may require immediate assistance or support. For example, if a worker's temperature or pressure readings exceed safe levels, appropriate action can be taken promptly to prevent accidents or health issues.

8. **Compliance and Documentation:** The system provides a means to maintain comprehensive records of workers' activities, parameters, and conditions. This documentation can be valuable for compliance purposes, audits, or incident investigations.

DISADVANTAGES

Integrating sensors into workers' shoes for health and safety measurements has potential disadvantages that need to be considered. These include concerns about data privacy and security, reliance on sensor reliability and accuracy, maintenance and calibration requirements, potential impact on comfort and ergonomics, worker adoption and acceptance challenges, cost and implementation considerations, potential overreliance on technology, and the limited scope of parameters being monitored. Addressing these issues through careful planning, maintenance, effective communication, and a holistic approach to workplace safety is crucial to ensure the successful implementation and benefits of the monitoring system for industrial workers' health and safety.

CHAPTER-8

CONCLUSION

In conclusion, integrating sensors into workers' shoes to monitor parameters such as temperature, pressure, altitude, and distance walked offers significant advantages for industrial workers' health and safety. Through piezoelectric sensors and BLE technology, real-time data can be collected and transmitted to the cloud for visualization and analysis. This system enables early detection of hazards, improved worker safety, accurate distance tracking, remote monitoring and compliance, data-driven insights, and a cost-effective solution. Overall, it provides a comprehensive and proactive approach to ensuring worker well-being, reducing risks, and promoting a safer work environment.

CHAPTER - 9

FUTURE SCOPE

Looking to the future, the integration of sensors in workers' shoes and the utilization of cloud-based monitoring systems offer exciting possibilities for further enhancements. The future scope includes leveraging artificial intelligence and machine learning algorithms to analyze the collected data and provide more advanced insights. This can involve developing predictive models to anticipate potential risks and accidents based on patterns and trends in the sensor data. Additionally, the integration of additional sensors, such as heart rate or air quality sensors, can enable a more comprehensive monitoring of workers' health and environmental conditions. Integrating augmented reality or wearable displays can also provide real-time feedback and alerts to workers, further enhancing their safety and productivity. The continuous advancements in sensor technology, data analytics, and wearable devices open up a wide range of possibilities for the future of industrial workers' health and safety measurements.

CHAPTER -10

APPENDIX

10.1 RESOURCES

Paper 1: IOT Based Wireless Smart Shoe and Energy Harvesting System

Author : P. Vijayakumar, P. D. Selvam, N. Ashokkumar, Sharmila ,

R. Raj Priyadarshini , M. Tamilselvi,Rajashree. R, Xiao-Zhi Gao.

Year: 2019

Paper 2: Industry safety system using IOT

Author : S.Ramu, S.Pooja Sen, K.Pushpalatha.

Year: 2020

Paper 3: Industrial Internet of Things for Safety Management Applications.

Author : S. Misra, C. Roy, T. Sauter, A. Mukherjee and J.Maiti

.Year: 2022

Paper 4: IOT Based Smart Shoe .

Author : R.Ravindraiah, R.Harshitha, A.Indhu, A.Likitha, B Harshavardhan.

Year: 2022

10.2 SOURCE CODE

WOKWI

```
//industrial workers health and safety system based on IoT
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHT.h"// Library for dht11
#define DHTPIN 4     // what pin we're connected to
#define DHTTYPE DHT11  // define type of sensor DHT 11
//#define LED 5
DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr of dht connected

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
#define ORG "hd6e66"//IBM ORGANITION ID
#define DEVICE_TYPE "Nandhini"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "2k20ece044"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "12102002"     //Token
String data3;
float t;
int p;

//-------- 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/test/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(LED,OUTPUT);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
}

void loop()// Recursive Function
{

  //h = dht.readHumidity();
  p= random(60,150);
  t = dht.readTemperature();
  Serial.print("temperature:");
  Serial.println(t);
  Serial.print("Pulse:");
  Serial.println(p);

  PublishData(t, p);
  delay(1000);
  if (!client.loop()) {
    mqttconnect();
  }
}
void PublishData(float temp, int pulse) {
  mqttconnect();//function call for connecting to ibm
```

```
  String payload = "{\"temperature\":";
  payload += temp;

 payload += "," "\"Pulse\":";
  payload += pulse;
  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(500);
    }
     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(500);
    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=="lighton")
  {
Serial.println(data3);
digitalWrite(LED,HIGH);
  }
  else
  {
Serial.println(data3);
digitalWrite(LED,LOW);
```

```
  }
  */
data3="";
}
```

10.3 GITHUB & PROJECT DEMO LINK:

Content	Link
GitHub	https://github.com/STEVESATHISH/Microsoft-internship
Project Demonstration Video	https://drive.google.com/drive/u/0/folders/11LJZChQmNgVUqAQua0NlANddygN8uEWa