

Project Report Format

Date	20 May 2023
Team ID	NM2023TMID09251
Project Name	Industrial Workers Health and Safety System based on Internet of Things

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1. INTRODUCTION :

1.1 Project Overview:

With the help of sensors attached to the shoes of the workers, the information such as the temperature measure, altitude parameters, the total distance walked is recorded and sent to the cloud for storage. This data will be visualised in the mobile application and through a web application, the authorities can check every worker's status. If someone is working on the higher altitudes, important and required precautions are sent to them, thus increasing their safety.

1.2 Purpose:

In some industrial areas and coal mines there are many things which are need to be monitored in order to take some safety measures when there are some critical conditions. 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 precaution

2. IDEATION & PROPOSED SOLUTION:

2.1 Problem Statement Definition:


Create 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. A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

I am	Describe customer with 3-4 key characteristics - who are they?	Describe the customer and their attributes here
I'm trying to	List their outcome or "job" the care about - what are they trying to achieve?	List the thing they are trying to achieve here
but	Describe what problems or barriers stand in the way – what bothers them most?	Describe the problems or barriers that get in the way here
because	Enter the "root cause" of why the problem or barrier exists – what needs to be solved?	Describe the reason the problems or barriers exist
which makes me feel	Describe the emotions from the customer's point of view – how does it impact them emotionally?	Describe the emotions the result from experiencing the problems or barriers

Problem Statement (PS)	I am (Customer)	I’m trying to	But	Because	Which makes me feel
PS-1	owner	To monitor the workers safety	I need devices to monitor the workers safety	I can easily monitor in anywhere at 24/7 hours	fear

2.2 Empathy Map Canvas:

Template



Empathy map

Use this framework to develop a deep, shared understanding and empathy for other people. An empathy map helps describe the aspects of a user's experience, needs and pain points, to quickly understand your users' experience and mindset.

[Share template feedback](#)

Build empathy

The information you add here should be representative of the observations and research you've done about your users.

Says

What have we heard them say?
What can we imagine them saying?

workers safety is needed

It should minimum cost

Date should access in anywhere

SAYS

Thinks

What are their wants, needs, hopes, and dreams? What other thoughts might influence their behavior?

Cost should minimum

How the product will safety for the workers

its usefull for ours

THINKS

Does

What behavior have we observed?
What can we imagine them doing?

Collecting the temperature readings

collecting the humidity readings

DOES

Feels

What are their fears, frustrations, and anxieties? What other feelings might influence their behavior?


Fear about worker

Trusted

Confusion

FEELS

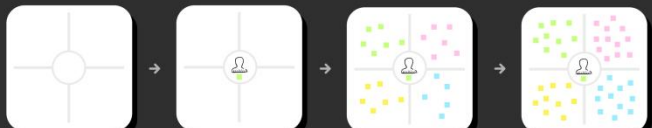
USER



Need some inspiration?

See a finished version of this template to kickstart your work.


Open example



Reference: <https://app.mural.co/t/iot7678/m/iot7678/1684331861410/35ef3e04525d1bb88c111d8b9740c502d12c0b8c?sender=u3123f66c8abe1ac662872156>

2.3 Ideation & Brainstorming

Template



Brainstorm & idea prioritization

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

[10 minutes](#) to prepare
[1 hour](#) to collaborate
[2-8 people](#) recommended

[Share template feedback](#)

Before you collaborate

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

[10 minutes](#)

A

Team gathering

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

B

Set the goal

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

C

Learn how to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#)

1 Define your problem statement

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

[5 minutes](#)

PROBLEM

How might we [your problem statement]?

Key rules of brainstorming

To run an smooth and productive session

Stay in topic.


Defer judgment.

Go for volume.

Encourage wild ideas.

Listen to others.


If possible, be visual.



Need some inspiration?

See a finished version of this template to kickstart your work.

Open example



2

Brainstorm

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

10 minutes

Tip

You can select a sticky note and in the panel (click to select) for easy sharing

vijayasharma

data can be uploaded in cloud

data can be seen in our mobile phone

data can be uploaded in cloud

can we use node red

can we use esp32 module

dh11 sensor use

praveen kumar

data can be uploaded in cloud

data can be seen in our mobile phone

data can be uploaded in cloud

can we use node red

can we use esp32 module

dh11 sensor use

prakash raj

data can be uploaded in cloud

data can be seen in our mobile phone

data can be uploaded in cloud

can we use node red

can we use esp32 module

dh11 sensor use

vetri raja

data can be uploaded in cloud

data can be seen in our mobile phone

data can be uploaded in cloud

can we use node red

can we use esp32 module

dh11 sensor use

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

Tip

Add a comment to sticky notes to make it easier to find, discuss, organize and categorize important ideas as sharing with your team.

data can be uploaded in cloud

data can be seen in our mobile phone

data can be uploaded in cloud

can we use node red

can we use esp32 module

dh11 sensor use

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4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

Tip

Participants can use their cursor to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the **H** key on the keyboard.

Importance

If each of these ideas could get done without any difficulty or cost, which would have the most positive impact?

data can be uploaded in cloud

data can be seen in our mobile phone

data can be uploaded in cloud

can we use node red

can we use esp32 module

dh11 sensor use

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

5

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

Share the mural

Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

Export the mural

Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint

Define the components of a new idea or strategy.

Open the template →

Customer experience journey map

Understand customer needs, motivations, and obstacles for an experience.

Open the template →

Strengths, weaknesses, opportunities & threats

Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.

Open the template →

Share template feedback

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Reference:

<https://app.mural.co/t/iot7678/m/iot7678/1684335143201/3a603a676d5118b6b68411d21bf12fd3e2760e0a?sender=u3123f66c8abe1ac662872156>

2.4 Proposed Solution:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Workers health issues
2.	Idea / Solution description	To check the temperature and humidity to safe the workers
3.	Novelty / Uniqueness	Using iot devices
4.	Social Impact / Customer Satisfaction	Gives more health consciousness,Easy implements iot device on low cast
5.	Business Model (Revenue Model)	It has moderate business profit but very use workers
6.	Scalability of the Solution	In iot easy to implement

3. REQUIREMENT ANALYSIS:

3.1 Functional requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP

3.2 Non-Functional requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Mobile support. Users must be able to interact in the same roles and on the same tasks on computers and mobile devices where practical, given mobile capabilities.
NFR-2	Security	Data security. All persisted data requires secure access.Device security. Devices must register and communicate securely, such as by using transport layer security (TLS). Unauthorized devices are prohibited.
NFR-3	Reliability	Its easy to use
NFR-4	Performance	Function offload to the edge. The system must have a centralized configuration with offload to the edge for rules-based decision-making and streaming analytics.Hybrid cloud. It must be possible to deploy the platform layer on premises, in the cloud, or part on premises and part in the cloud.

NFR-5	Availability	High availability (HA). Some IoT solutions and domains demand highly available systems for 24x7 operations. That said, this type of system isn't a <i>critical production</i> application, which means that operations or production don't go down if the IoT solution is down
NFR-6	Scalability	Horizontal scalability. The system must handle expanding load and data retention needs that are based on the upscaling of the solution scope, such as extra manufacturing facilities and extra buildings.

4. PROJECT DESIGN:

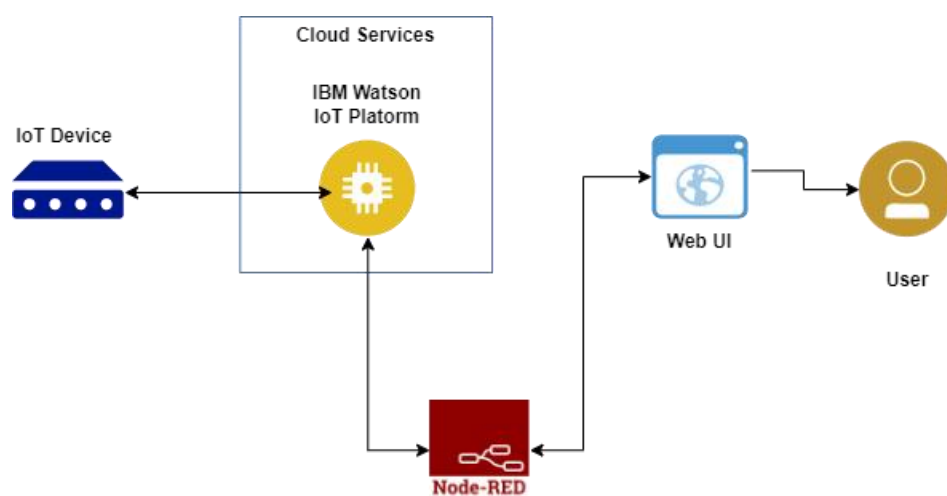
4.1 Data Flow Diagrams:

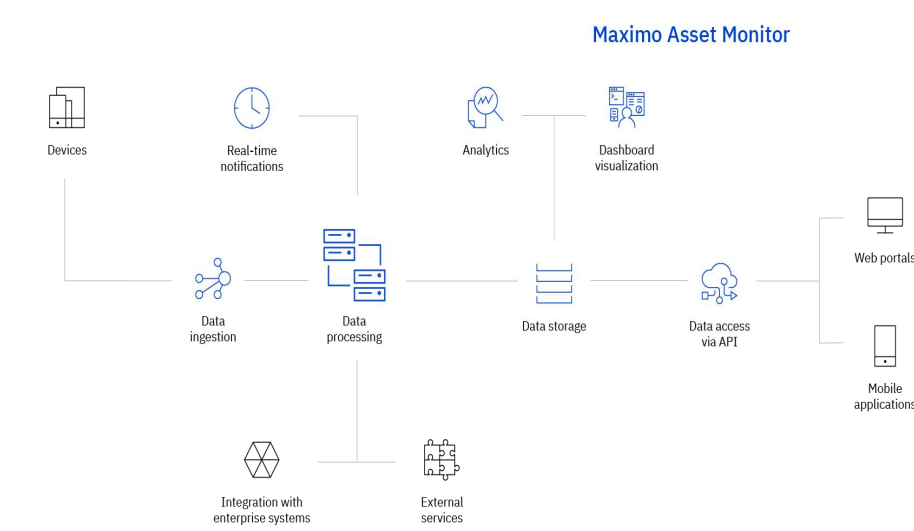
Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

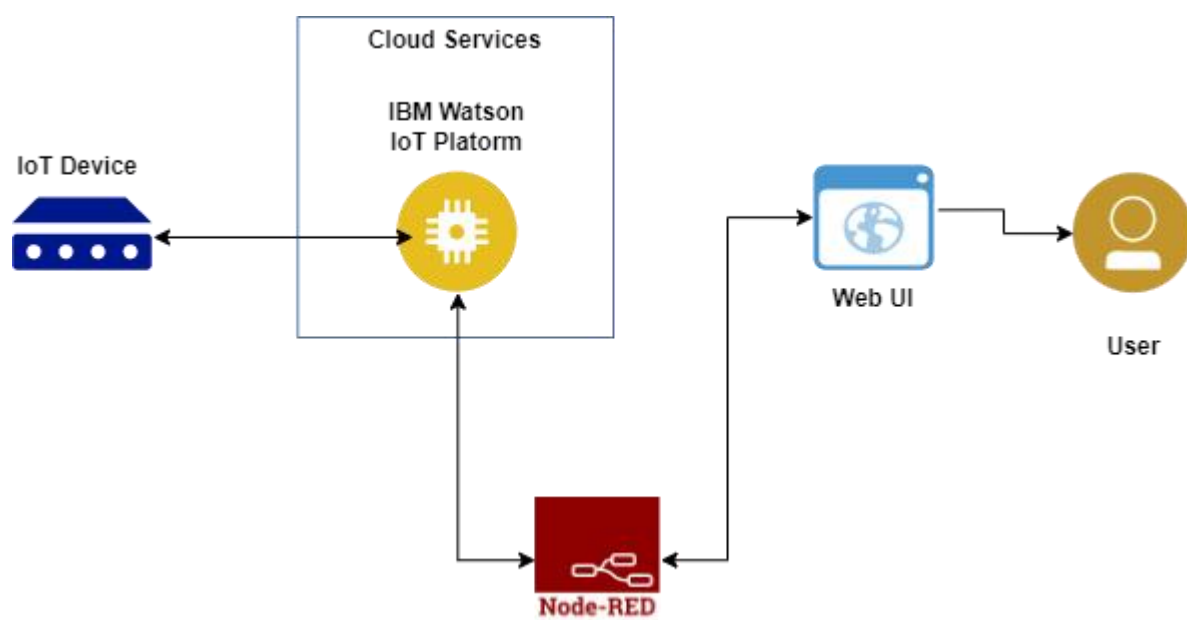
Architecture

Gain knowledge of Watson IoT Platform
 Explore Wokwi Platform
 Explore the devices and its simulation of the wokwi platform.
 Explore the libraries present in Wokwi.
 Will be able to code to connect the devices across the cloud platform.
 Connecting the devices on wokwi to the IoT platform device to exchange the sensor data.
 Gain knowledge of creating devices and platforms using IBM Watson IoT Platform.
 Gain knowledge of web application development through node-red.





4.2 Solution & Technical Architecture:



S.No	Component	Description	Technology
7.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js / React Js etc.
8.	Application Logic-1	Logic for a process in the application	Java / Python
9.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
10.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
11.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
12.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
13.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
14.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
15.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
16.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
17.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

4.3 User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Team Member
Customer	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	Prakash raj
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Praveen kumar
		USN-3	As a user, I can register for the application through Gmail		Medium	vijayasharma
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Vetri raja
	Dashboard	USN-5	User can the see data of the devices from cloud		high	Prakash raj

5. CODING & SOLUTIONING:

5.1 Feature 1:

A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors).

Code:

```
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 type of dht connected
void setup() // configuring 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();
}
}

```

dig

5.2 Feature 2 :

[Cloud computing](#) benefits organizations in many ways. In fact, the benefits are so numerous that it makes it almost impossible not to consider moving business operations to a cloud-based platform. And yet many organizations rely on outdated and inefficient processes because they don't understand the benefits.

We using cloud to access a data anywhere in the world, having the cloud account they gives a token id, device name, token authentication id etc, if you wants to see a data authorized persons only can see data.

code:

```

//-----credentials of IBM Accounts-----

#define ORG "96ei56"//IBM ORGANITION ID
#define DEVICE_TYPE "worker"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "0104"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "04012023" //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
/*.....retrieving to Cloud.....*/

void PublishData(float temp, int pulse) {
  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);

  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="";
}

```

6. RESULTS:

6.1 Performance Metrics:

- Gain knowledge of Watson IoT Platform
- Explore Wokwi Platform
- Explore the devices and its simulation of the wokwi platform.
- Explore the libraries present in Wokwi.
- Will be able to code to connect the devices across the cloud platform.
- Connecting the devices on wokwi to the IoT platform device to exchange the sensor data.
- Gain knowledge of creating devices and platforms using IBM Watson IoT Platform.
- Gain knowledge of web application development through node-red.

7. ADVANTAGES & DISADVANTAGES:

Advantage:

The Internet of Things (IoT) is a network of physical objects that are embedded with sensors and other technologies to share data with other devices over the Internet. Evolution took place due to the convergence of multiple technologies, machine learning, embedded systems, commodity sensors, and real-time analytics. Traditional wireless sensor networks, control systems, and others enable the Internet of Things.

IoT in a working environment is one of the most advanced ways to increase safety that a company could implement. It has managed to help companies worldwide by improving working conditions, data collection, streamlining operations, and increasing productivity.

The introduction of training programs for employees would be an added advantage. It would enable identifying any potential threats to their safety. Therefore, it allows the implementation of IoT, which would monitor and maintain records and a safe working environment.

Disadvantage:

Privacy of Data. Privacy is the biggest challenge with IoT, as all the connected devices transfer data in real-time. Personal data can be hacked if this end-to-end connection is not secure. Accuracy. Accuracy issues may come due to handling such massive data in real-time, Cost, Data siphoning. The transmission of information by endpoint devices can be intercepted via an eavesdropping attack. Device hijacking. Distributed denial-of-service.

8. CONCLUSION

Smart offices offer several growth opportunities to businesses. From speeding up work with office automation using IoT to efficient energy consumption, organizations can gain value. It is up to you to decide if the benefits it offers outweigh the concerns. Regardless, rapid technological advancement is certain. Organizations that adopt smart offices now might just stand a chance of future-proofing their business and gaining a competitive edge. If you need IoT smart office solutions for your company, [contact Relevant](#). We can help you with the professional IoT development services you need for your project. IoT has changed the way people look at healthcare and hospitality systems. Adoption of these technologies will improve product development and will bring a long-term effect by bringing those minor change. The Internet of Things (IoT) has the potential to make workplaces safer by providing real-time monitoring, predictive maintenance, safety alerts, remote access control, location tracking, inventory management, wearable devices, vehicle tracking, process automation, safety data analysis, and data collection.

9. FUTURE SCOPE:

Safety report management: It is the duty of the workers to observe all the recommended rules. Any faulty equipment, improper maintenance and any suspicion of breaking the safety law must be reported and documented. A safety manager should be held responsible to maintain and keep all the safety report up-to-date.

Financial Responsibility: It is a legal requirement for employers to have insurance and also to plan for uninsured costs with their consequences. This will reduce the financial liability towards loss of property, equipment and productivity.

Important considerations for Industrial Safety:

- Health & Safety Management Systems
- Managing Risk
- Risk Assessment
- Monitoring & measuring Health & Safety
- Manage workplace health & safety

10. APPENDIX:

Source code:

```
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void callback(char* subscribtopic, byte* payload, unsigned int payloadLength);
//-----credentials of IBM Accounts-----
#define ORG "96ei56" //IBM ORGANITION ID
#define DEVICE_TYPE "worker" //Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "0104" //Device ID mentioned in ibm watson IOT Platform
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String data3;
float t;
int p;
//----- Customise the above values -----
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char publishTopic[] = "iot-2/evt/Data/fmt/json"; // topic name and type of event perform and format in which data to be send
char subscribtopic[] = "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, port and wificredential
void setup() // configureing the ESP32
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    //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();
    }
}
/*.....retrieving to Cloud.....*/
void PublishData(float temp, int pulse) {
    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);

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="";
}

```

