PROJECT-BASED LEARNING (NAAN MUDHALVAN)

ON

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

PROJECT REPORT

Team ID	NM2023TMID01942
Project Name	Remote Gas Pipeline Tunnel Temperature Monitoring System

S.NO	**Team Mates**	**Name**	**Register number**
1.	Team leader	Vanmathi. S	420420104057
2.	Team Member-01	Sakthiuma. S	420420104040
3.	Team Member-02	Jayashree. K	420420104307
4.	Team Member-03	Madhumitha. G	420420104030

In partial fulfillment of the award of the degree of

in

BACHELOR OF ENGINEERING

COMPUTER SCIENCE AND ENGINEERING

ADHIPARASAKTHI ENGINEERING COLLEGE

MELMARUVATHUR-603 319

ANNA UNIVERSITY: CHENNAI 600 025

MAY 2023

ANNA UNIVERSITY : CHENNEI 600 025

BONAFIDE CERTIFICATE

The project report titled **"REMOTE GAS PIPELINE TUNNEL TEMPERATURE MONITORING SYSTEM",** is the bonafide work of **VANMATHI.S (420420104057), SAKTHIUMA.S, (420420104040), JAYASHREE.K 420420104307), MADHUMITHA.G (420420104030)** who carried out the project work under my supervision.

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1. INTRODUCTION

1.1 PROJECT OVERVIEW:

The Internet of Things (IoT) has revolutionized the way we monitor and manage gas pipeline tunnel temperature monitoring. By leveraging IoT technologies, remote gas pipeline tunnel temperature monitoring systems can provide advanced capabilities for real-time monitoring, data analysis, and proactive maintenance. This introduction will explore how IoT enhances the effectiveness of such systems.

A remote gas pipeline tunnel temperature monitoring system using IoT incorporates IoT-enabled sensors, devices, and connectivity to collect, transmit, and analyze temperature data from gas pipeline tunnels. These systems leverage the power of IoT to enable seamless communication, remote access, and intelligent data processing. By combining IoT with temperature monitoring, the system gains enhanced capabilities for monitoring accuracy, data analytics, and timely decision-making.

1.2 PURPOSE:

The purpose of implementing a remote gas pipeline tunnel temperature monitoring system using IoT is to achieve the following objectives:

1. Real-time Monitoring:
   IoT enables continuous, real-time monitoring of temperature conditions within gas pipeline tunnels. IoT sensors deployed at various points in the tunnel can capture temperature data with high precision and transmit it instantly to the central control system. This real-time monitoring helps operators identify temperature fluctuations, detect anomalies, and respond promptly to critical situations.
2. Remote Accessibility:
   IoT connectivity allows remote access to temperature data and monitoring systems. Operators and maintenance personnel can access the monitoring system from anywhere, using mobile devices or computers. This remote accessibility ensures that relevant stakeholders can monitor temperature conditions, receive alerts, and make informed decisions even when they are not physically present at the pipeline site.
3. Enhanced Safety and Compliance:
   IoT-based temperature monitoring systems contribute to improved safety and compliance with regulatory standards. By continuously monitoring temperatures, operators can promptly identify hazardous conditions, such as excessive heat or temperature fluctuations that may compromise pipeline integrity. This allows for timely intervention, reducing the risk of accidents and ensuring compliance with safety regulations.

4. Cost Optimization:

   The implementation of IoT in temperature monitoring systems can lead to cost optimization. Real-time monitoring and data-driven insights enable efficient resource allocation, optimized energy consumption, and reduced maintenance costs. By addressing issues proactively, operators can prevent costly failures and mitigate the impact of temperature-related incidents.

2. IDEATION AND PROPOSED SOLUTION

2.1PROBLEM STATEMENT:

To Develop a Remote Gas Pipeline Tunnel Temperature Monitoring System Using Quantitative and qualitative algorithms is being used to detect and monitor anomalies, leaks, and temperatures in gas Pipelines. This IoT Based System Assists in Monitoring Temperature Levels in the Confined Space of Tunnels to Avoid the Human and Property Loss.

Figure: 2.1

Constraints of the problem statement.

2.2 EMPATHY MAP:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it.

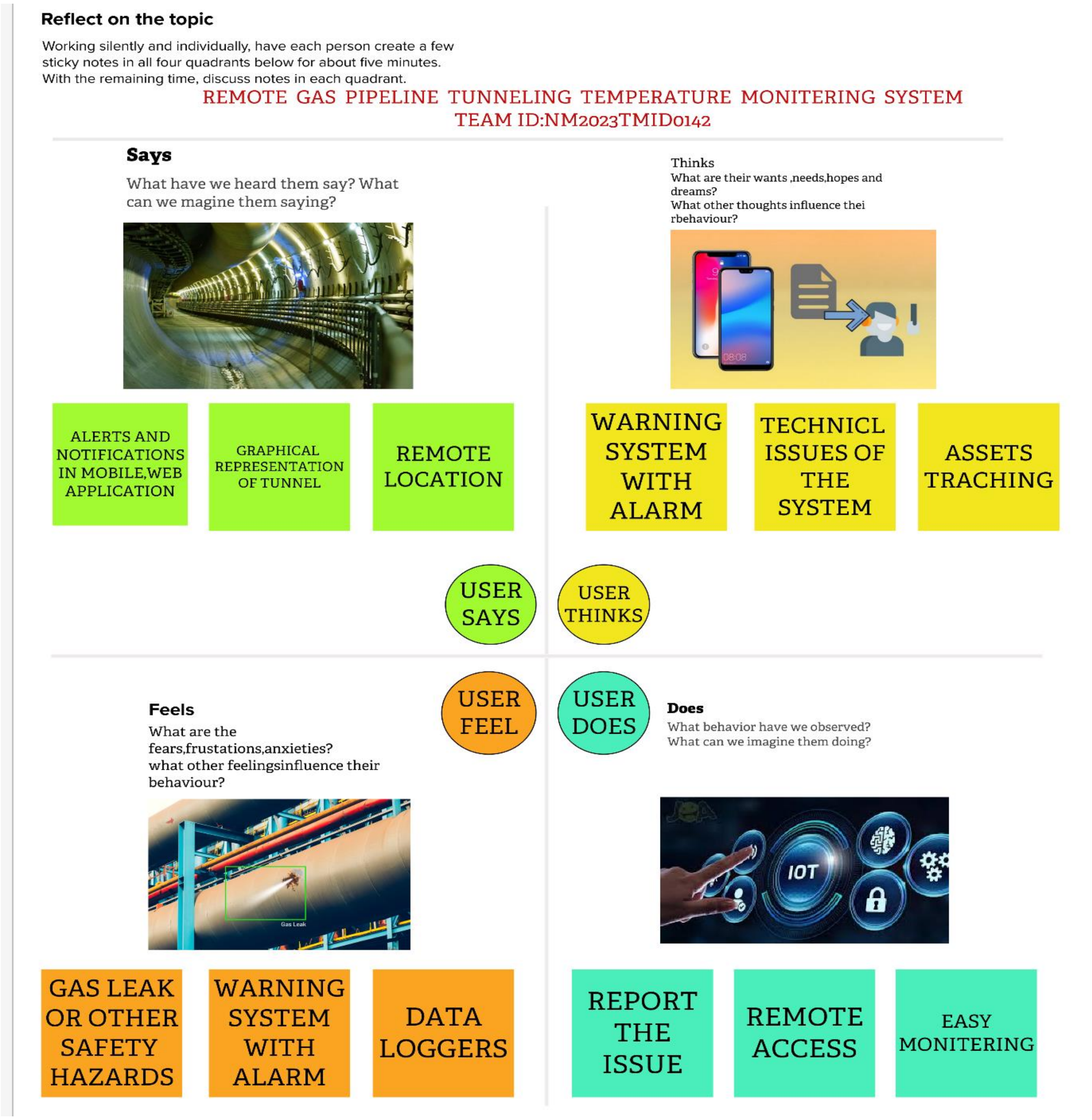


Figure:2.2

Visual representation of knowledge about the user's behavior when experiencing it.

2.3 IDEATION AND BRAINSTROME:

Step 01:

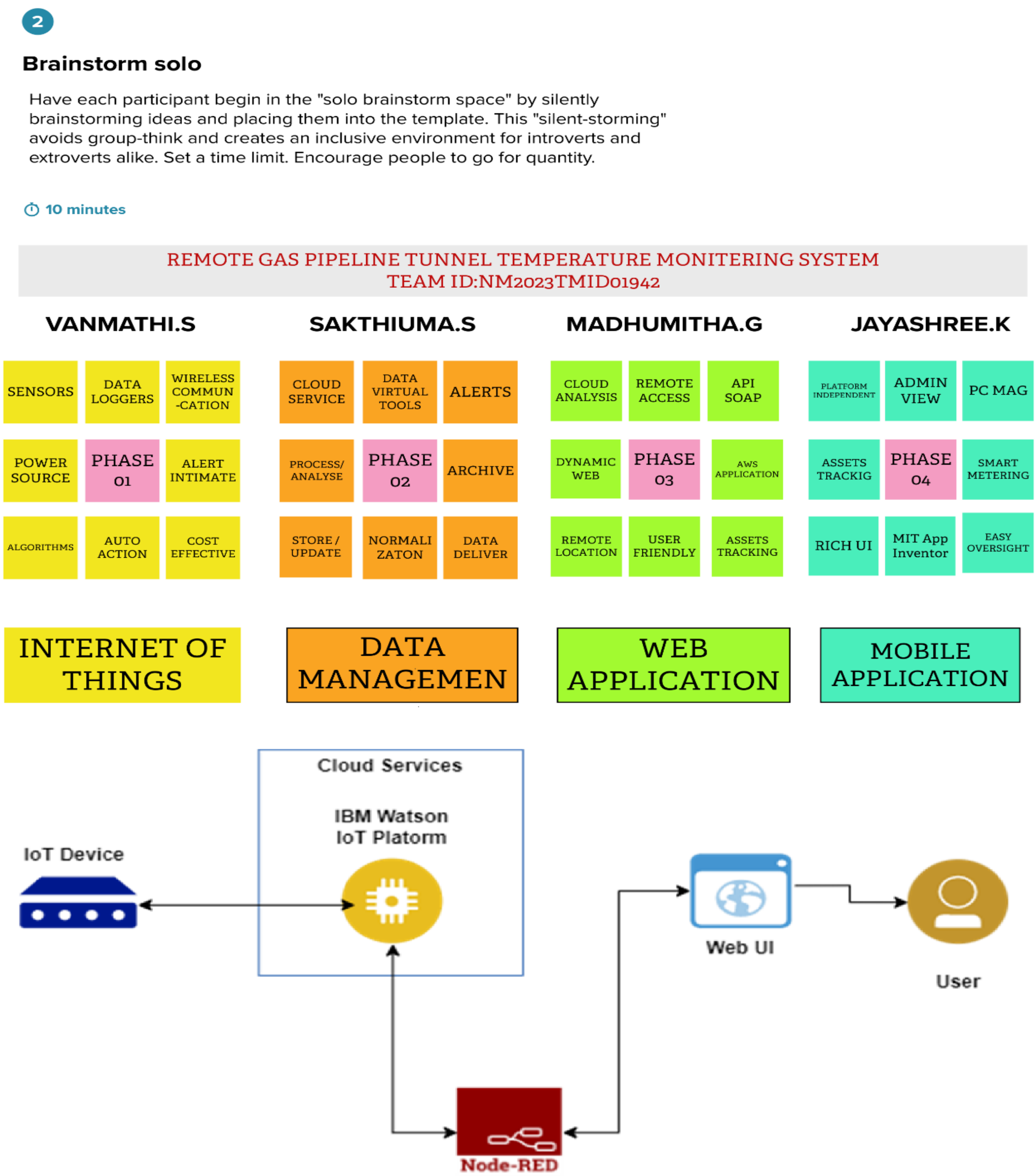
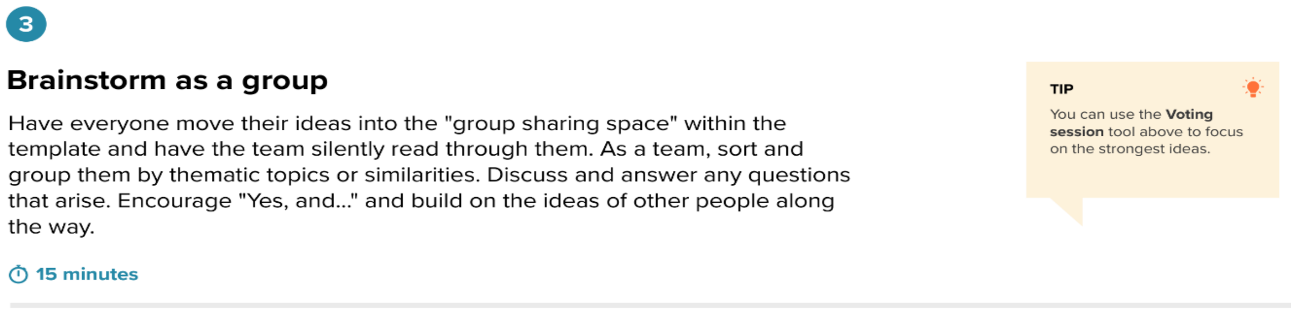


Figure:2.3

A core to the design thinking process.

Step 02:

IDEATION GROUPING:



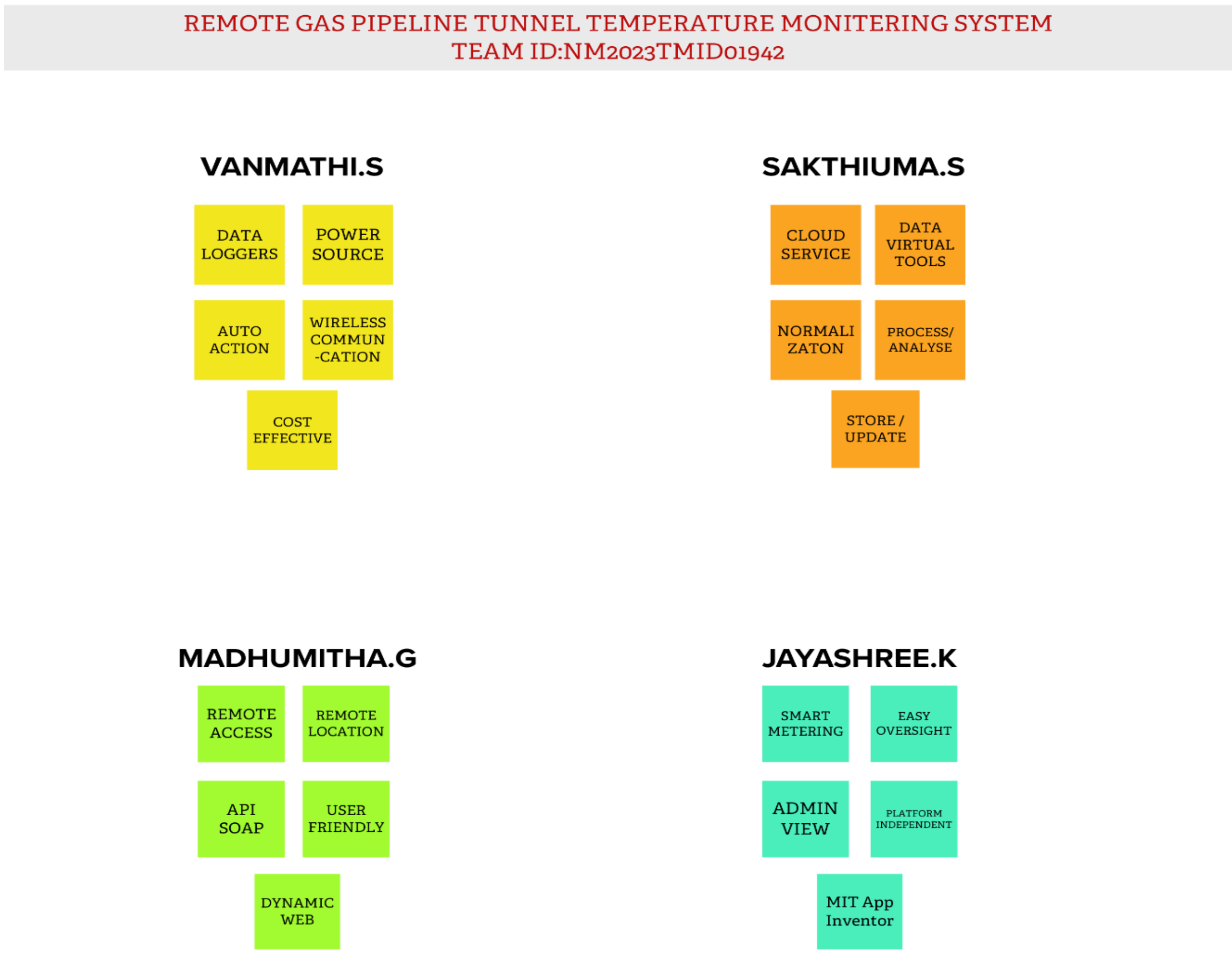


Figure:2.3.1

The collective thinking of a group.

Step 03:

IDEA PRIORITIZATION:

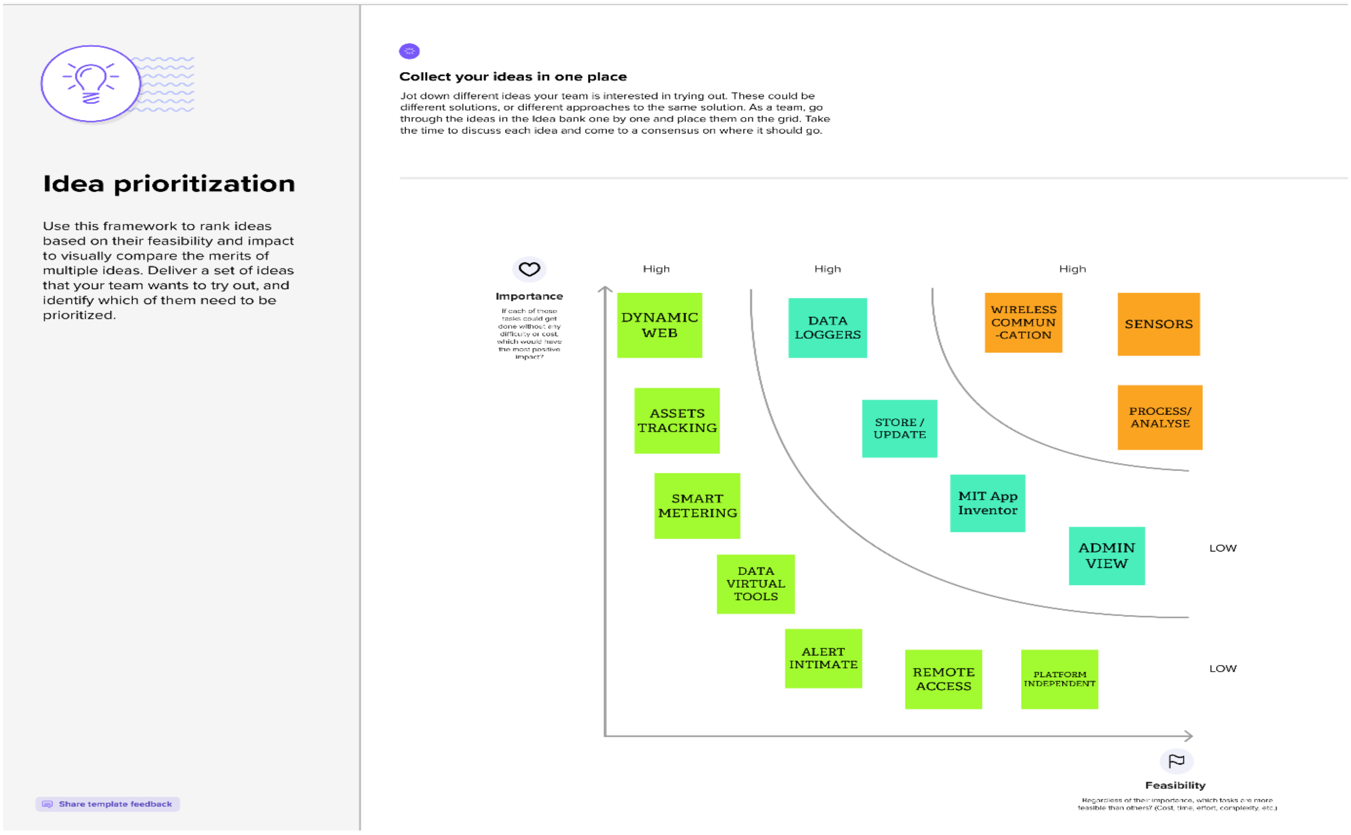


Figure:2.3.2

Idea prioritization based on the feasibility.

2.3.1 LITERATURE SURVEY:

1.

Paper title	An energy-aware and Q-learning Based area coverage for oil pipeline monitoring systems using sensors& Internet of Things.
Year of Publication	2022
Methodology/Algorithm	Q-learning algorithm is used.
Advantages	COWSN improves the network lifetime by 9.55%,32.94%, and 36.32% in comparison with Rahmani et al, CCMRL, and CCArespectively.

2.

paper title	IOT-based Intelligent gas leakage Detection and fire protection system.
Year of Publication	2022
Methodology/Algorithm	Quantitative and qualitative algorithm.
Advantages	Detecting gas and fire in the early stage. The system can operate automatically anytime.
Disadvantages	The power supply cannot be compromised in certain scenarios and would need more development in cases of the power supply to the system remaining switched on 24*7

3.

Paper title	Pipeline Monitoring System: A Feasibility Study
Year of Publication	2021
Methodology/Algorithm	Machine learning techniques
Advantages	Involve simple calculations based on approximate model. Provide accurate estimation of states and parameters.
Disadvantages	Humans and dogs cannot effectively monitor pipelines for more than 120 minutes. It is inadequate for off-shore

4.

Paper title	The IoT-based real-time monitoring system of LPG pipeline leakage in the smart city (RTMLPL)
Year of Publication	2021
Methodology/Algorithm	Systematic quantitative or qualitative techniques.
Advantages	It is scalable. It is flexible and hence open to physical partitions.
Disadvantages	The power supply cannot be compromised in certain scenarios and would need more development in cases of the power supply to the system remaining switched on 24*7

2.4 PROPOSED SOLUTION

The slide potentiometer measures the position of physical barriers, the servo motor controls the movement of mechanisms like air vents, and the biaxial stepper motor enables precise positioning of sensors for temperature monitoring.

1. Slide Potentiometer: A slide potentiometer, also known as a linear potentiometer, is used to measure the position or linear displacement of an object. In the context of the temperature monitoring system, the slide potentiometer can be used to monitor the opening or closing of a physical barrier, such as a valve or gate, inside the pipeline tunnel. It can provide feedback on the position of the barrier, which can be used to control the flow of gas or adjust the ventilation system based on temperature readings.

2. Servo Motor: A servo motor is a type of motor that is designed for precise control of the angular position. In the temperature monitoring system, a servo motor can be utilized to control the movement of a mechanism, such as an adjustable air vent or damper, within the pipeline tunnel. By receiving signals from a controller or temperature monitoring system, the servo motor can adjust the position of the mechanism to regulate the airflow and maintain the desired temperature inside the tunnel.

3. Biaxial Stepper Motor: A biaxial stepper motor refers to a stepper motor with two axes of rotation. Stepper motors are known for their ability to move in discrete steps, which makes them suitable for precise positioning tasks. In the context of the gas pipeline tunnel temperature monitoring system, a biaxial stepper motor can be employed to control the orientation of sensors or monitoring devices. For example, it can be used to rotate an infrared temperature sensor to scan different areas within the tunnel, enabling comprehensive temperature measurements.

4. The IoT device communicates with the Watson Cloud Account, which stores the temperature data and processes it using IBM Watson services.

5. The User (Monitor) interacts with the Web Application and/or Mobile App to monitor the temperature of the gas tunnel, receive notifications if the temperature exceeds a certain threshold, and take corrective autonomous actions if necessary (e.g. adjust the cooling system, evacuate the tunnel).

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	To build an efficient IOT-based Remote gas pipeline tunnel temperature monitoring system to curb.The following constraints: Using qualitative and quantitative algorithms being used to detect and monitor anomalies, leaks, and temperatures in gas pipelines. • This IOT-based system assists in monitoring temperature levels in the confined space of tunnels to avoid human and property loss.
2.	Idea / Solution description	• Monitor the tunnels with limited or without instrumentation. • Detect leaks quickly and reliably. Push-based tag update architecture delivers real -time monitoring at a reduced network load
3.	Novelty / Uniqueness	• Programmable logic controllers, while others use cellular IOT-powered units for remote monitoring. • Cloud SCADA systems can also be used to monitor pipeline integrity and reduce operating costs.
4.	Social Impact / Customer Satisfaction	• By improving safety and reducing the risk of accidents. • Customer satisfaction can be evaluated based on facts such as gas amount, reliability, and flexibility of the monitoring system. • Wireless sensor technology can also be cast effective and reliable for detecting leaks and reducing fluid loss. • Prevent accidents and ensures the safety of workers and the public.
5.	Business Model (Revenue Model)	•This system helps in monitoring the temperature levels of the working space through sensors with information being sent to the mobile application over the cloud. •With this facility the workers will be able to know when the temperature raises sharply through an alarm from the application.
6.	Scalability of the Solution	• Real-time tunnel temperature monitoring to provide early excessive heat warnings. • Data acquisition and system management with SCADA system, Ethernet data acquisition system, but with efficient, cost-effective wiring.

2.4.1 SOME EXISTING SOLUTIONS:

1. Siemens IoT Solutions: Siemens provides IoT solutions for various industries, including gas and oil. Their remote monitoring systems offer temperature sensing capabilities for gas pipeline tunnels, wi data transmission to cloud platforms for analysis and monitoring.

2. Schneider Electric EcoStruxure: Schneider Electric's EcoStruxure platform includes solutions for remote temperature monitoring in gas pipeline tunnels. Their system collects temperature data using IoT-enabled sensors and provides analytics and reporting functionalities.

3. Yokogawa Pipeline Monitoring System: Yokogawa offers a pipeline monitoring system that includes temperature monitoring capabilities for gas pipelines. Their system integrates IoT sensors, data transmission, and cloud-based analytics to provide real-time temperature insights and trend analysis.

3. REQUIREMENT ANALYSIS

3.1 FUNCTIONAL REQUIREMENTS:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Real-time monitoring	The system should be able to provide real-time monitoring of the temperature in the gas pipeline tunnel to ensure any abnormal temperature changes are detected quickly.
FR-2	Remote accessibility	The system should be remotely accessible from a control room or other monitoring personnel to access and analyze temperature data without having to physically be at the site.
FR-3	Accurate temperature measurement	The system should be able to measure the temperature accurately and precisely to ensure reliable and accurate monitoring of the pipeline's thermal conditions.
FR-4	Alarm notification	The system should be able to send out an alarm notification when the temperature exceeds a predefined threshold value to alert operators about potential pipeline problems.
FR-5	Redundancy	The system should be able to continue functioning in the event of any component failures, such as power supply or network connectivity loss.
FR-6	Data storage and analysis	The system should be able to store the temperature data for long-term analysis and trending,which can help identify potential issues before they become significant problems.

3.2 NON-FUNCTIONAL REQUIREMENT:

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The system should be easy to use,with a user-friendly interface and clear visualizations of temperature data,to help operators quickly identify potential problems and make informed decisions.
NFR-2	Security	The system should be highly secure,with robust access controls,encryption,and other security features to prevent unauthorized access,data breaches,or other cyber-security risks.
NFR-3	Reliability	It gives the reliability of the gas pipeline by providing Real-time data and alerts to the operator. The system is designed to reduce wiring costs by up to 15% with efficient daisy-chain topology compared to polling.
NFR-4	Performance	The system provides real-time data that can help companies react quickly and reduces damage.It improve the safety & performance of industrial assets and equipment.
NFR-5	Availability	The system should be highly available, with a minimum of downtime, as continuous monitoring is critical to ensuring pipeline safe and integrity.
NFR-6	Scalability	The system should be scalable to accommodate a growing number of temperature sensors and other monitoring devices as the pipeline infrastructure expands.

3.3 TECHNICAL ARCHITECTURE

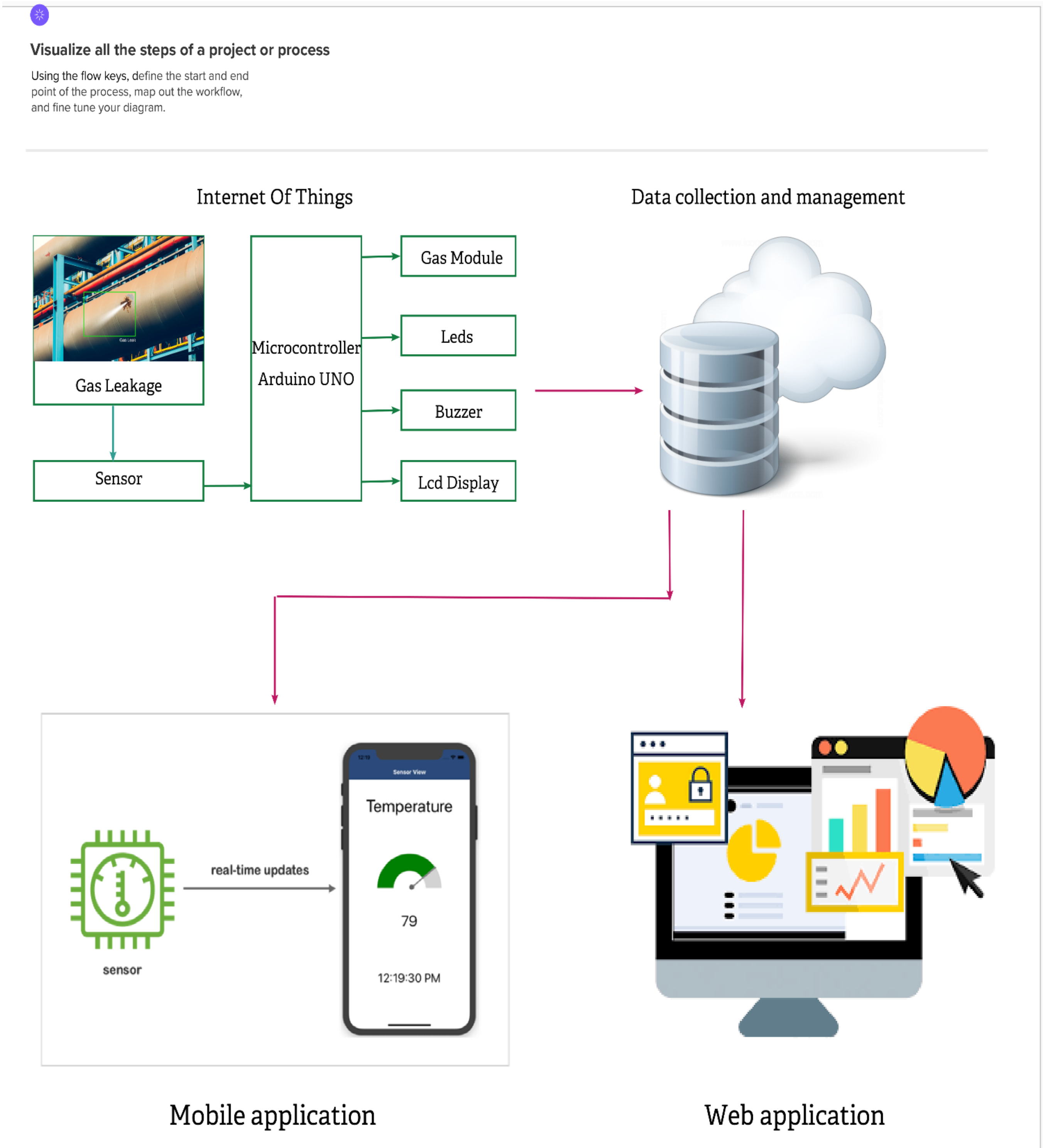


Figure-3.3

Blueprint of technical requirements of the system.

4. PROJECT DESIGN

4.1 DATA FLOW DIAGRAM:

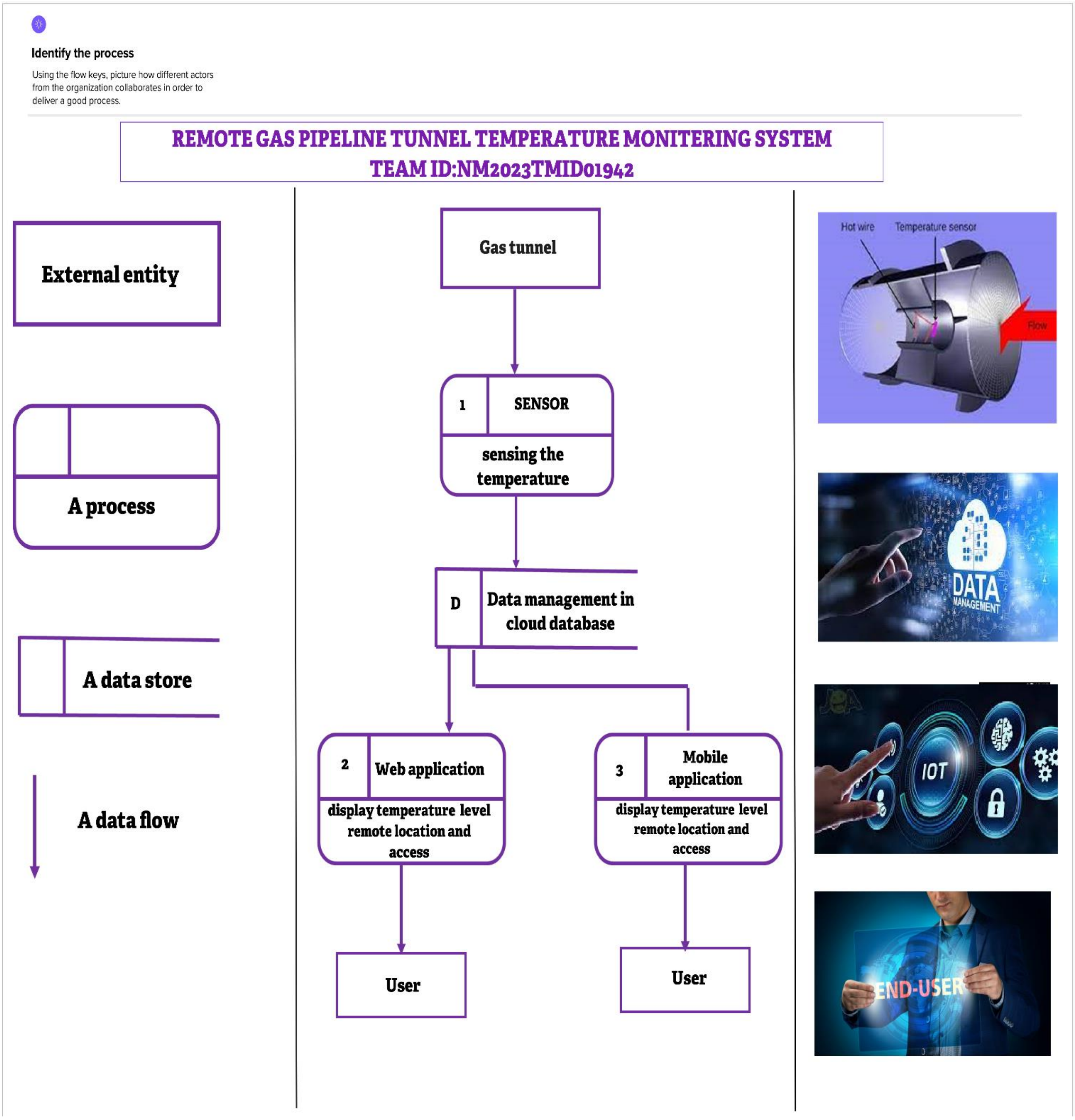


Figure: 4.1

Workflow of the system.

4.2 SOLUTION AND TECHNICAL ARCHITECTURE:

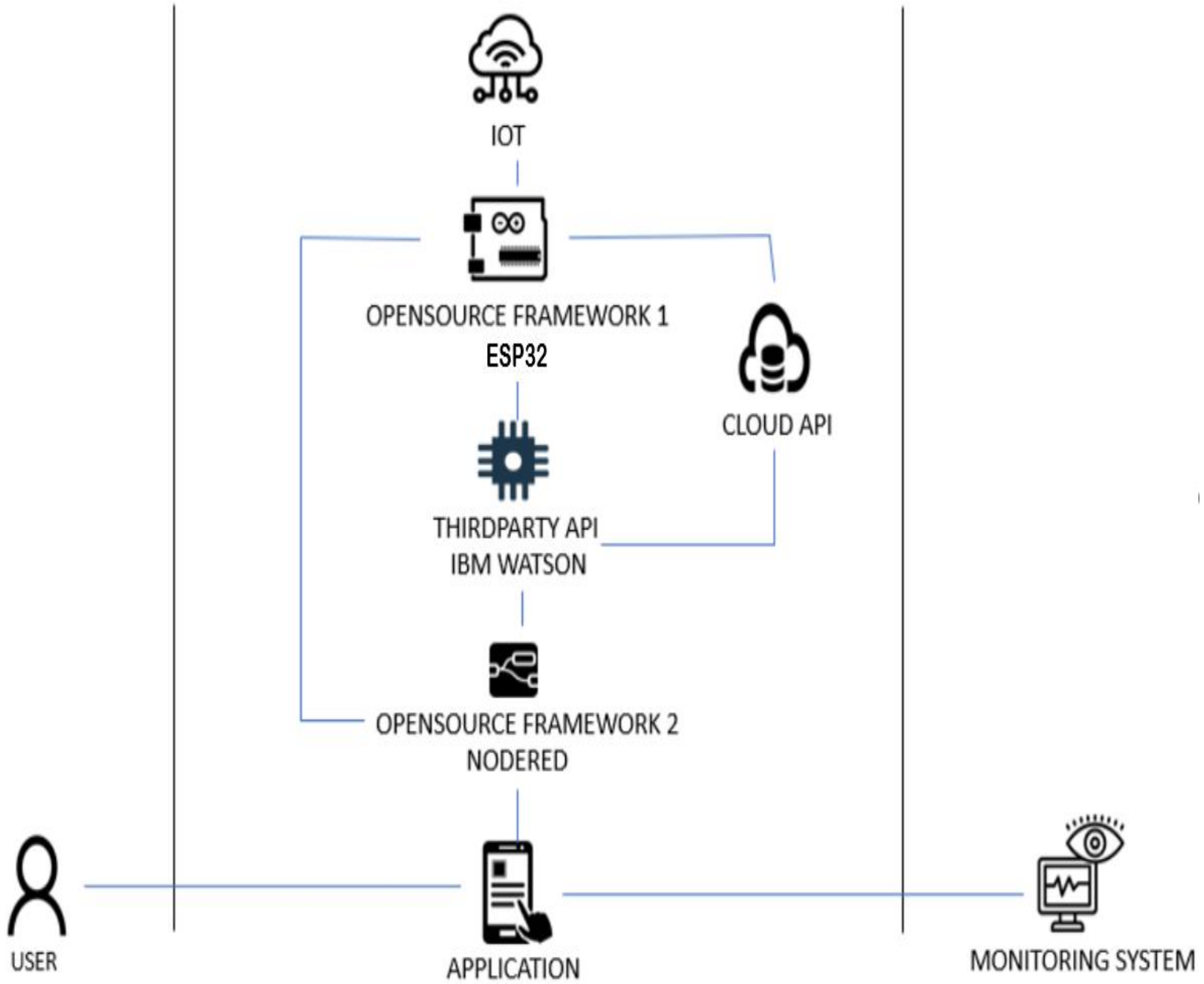


Figure: 4.2

Solution planning of the system.

4.2.1 APPLICATION CHARACTERISTICS:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Wokwi,Tinkercad,Node-red
2.	Security Implementations	General access control the built-in security features of IBM Cloud are present.	IBM Watson Assistant,IBM Cloud DB
3.	Scalable Architecture	The architecture consists of three tiers, the client side, the web server, and the cloud server. Each of these can be scaled as per requirements.	Client Side:IOT Web Server IBMWatsonAssistant Cloud Server: IBM Cloud.
4.	Availability	Remote Monitoring System that usessensors monitor temperature levels and Send information to a mobile application.	Cloud services, Data loggers.
5.	Performance	Alert the user when the temperature level is increased.	IBM Cloud

4.3 USER STORIES:

User Story No.	User	User Story/Task
USN:01	Pipeline operator	I want to install temperature sensors throughout the pipeline
USN:02	Maintenance Technician	I want to be able to access real time temperature data using a mobile app.
USN:03	Pipeline engineer	I want to able to analyze temperatue data over time
USN:04	Customer	I want to be able to access information about pipeline temperature and safety records

4.3.1 PRODUCT BACKLOG AND ESTIMATION:

User	Functional Requirements	User Story No.	User Story ,Task	Acceptance criteria	Prior -ty	Team member
Pipeline operator	Data loggers	USN:01	I want to install temperature sensors throughout the pipeline	I can Remotely monitor the pipeline temperature from anywhere	High	Vanmathi.S
Maintenance Technician	MIT-app inventor	US:02	I want to be able to acces real-time temperature using a mobile application	I want to identify the issue and avoid safety hazards	High	Jayashree.K
Pipeline engineer	Web application	USN:03	I want to be able to analyze temperature data over - time	I can ensure that the pipeline is operating within the safe operating limits	High	Madhumitha . G
Customer	Web application	USN:04	I want to be able to access information about pipeline temperature and safety records	I trust the company to deliver gas reliability and safety	Medi -um	Sakthiuma.S

4.3.2 COMPONENTS AND TECHNOLOGIES:

S.NO	Component	Description	Technology
1.	Application Logic -1	The system can also be designed to store the data for historical analysis and reporting	Wokwi,Tinkercad
2.	Application Logic -2	The system can also be designed to store the data for historical analysis and reporting	IBM Cloud
3.	Cloud Database	It enables real-time monitoring of pipelines from any location, not just from control rooms particular location.	IBM Cloud DB
4.	MIT app inventor	Allows users to remotely operate the entire system through a developed app on their phone.	App Development
5.	Node red	It enables remote gas pipeline monitoring by providing a visual interface and an extensive library of nodes that can be used to connect data from different types of hardware and sensors used in the monitoring process	Web app development

4.3.3 APPLICATION CHARACTERISTICS:

S.NO.	Characteristics	Description	Technology
1.	Open-Source frameworks	List the open-source frameworks used.	ESP32, Node-red
2.	Security Implementations	General access control and the built-in security features of IBM Cloud are present.	General access control and the built-in security features of IBM Cloud are present.
3.	Scalable Architecture	The architecture consists of three tiers, client side, the web server, and the cloud server. Each of these can be scaled as per requirements.	Client Side: IOT Web Server: IBM Watson Assistant Cloud Server: IBM Cloud
4.	Availability	Remote Monitoring System that uses sensors to monitor temperature levels and Send information to a mobile application.	Cloud services, Data loggers.
5.	Performance	Alert the user when the temperature level is increased.	IBM Cloud

5.PROJECT PLANNING AND SCHEDULING

5.1 FEATURE-1

WOKWI CODE :

```
#include <WiFi.h>
#include <PubSubClient.h>
#include <DHTesp.h>
#include <Stepper.h>
#include <ESP32Servo.h>
/* NOTE:
 As Gas Sensor is not available in Wokwi platform.
 Slide Potentiometer is used instead of Gas Sensor, to variably set level of gas leakage.*/
#define DHTPIN 15
#define GAS_LEVEL 34  // Slide Potentiometer
#define buzzer 13
#define LED 5
const int servoPin = 12;
Servo valve;
DHTesp dhtsensor;
Stepper stepper(1000, 19,21,22,23);

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);

#define ORG "h9eaiu"
#define DEVICE_TYPE "abcde"
#define DEVICE_ID "12345"
#define TOKEN "12345678"
```

```
String data3;
float h, t, g;
int pos=0;
boolean valve_open=true;
//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/Data/fmt/json";
char subscribetopic[] = "iot-2/cmd/test/fmt/String";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;
//-----------------------------------------
WiFiClient wifiClient;
PubSubClient client(server, 1883, callback ,wifiClient);
void setup()
{
  Serial.begin(115200);
  dhtsensor.setup(DHTPIN,DHTesp::DHT22);
  stepper.setSpeed(100);
  valve.attach(servoPin);
  pinMode(GAS_LEVEL, INPUT);
  pinMode(buzzer,OUTPUT);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
  valve.write(90);
```

```
}
void loop()
{
  try
  {
  int duration = random(100, 1000); // Generate a random duration between 100 and 1000 milliseconds
  int frequency = random(100, 10000); // Generate a random frequency between 100 and 10000 Hz
  TempAndHumidity data=dhtsensor.getTempAndHumidity();
  t=data.temperature;
  h=data.humidity;
  g=map(int(analogRead(GAS_LEVEL)), 0, 4095, 200, 2000);
  Serial.print("temperature:");
  Serial.println(t);
  Serial.print("Humidity:");
  Serial.println(h);
  Serial.print("Gas Level:");
  Serial.println(g);

  if(g>500 || t>49)
  {
    tone(buzzer, 1000);
    stepper.step(1000);
    valve.write(180);
  }
  else
  {
```

```
    valve.write(90);
    noTone(buzzer);
  }
  PublishData(t, h, g);
  delay(1000);
  if (!client.loop())
  {
    mqttconnect();
  }
}
catch(const std::exception& e)
  {
  Serial.println("Exception occurred:");
  Serial.println(e.what());
  //handling the exception here
  }
}
/*....................................retrieving to Cloud...............................*/
void PublishData(float temp, float humid, float gas_level)
{
  mqttconnect();
  String payload = "{\"temperature\":";
  payload += temp;
  payload += "," "\"humidity\":";
  payload += humid;
  payload += "," "\"gas_level\":";
  payload += gas_level;
```

```
  payload += "}";
  Serial.print("Sending payload: ");
  Serial.println(payload);
  if (client.publish(publishTopic, (char*) payload.c_str()))
  {
    Serial.println("Publish ok");
  } 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()
```

```
{
  Serial.println();
  Serial.print("Connecting to ");
  WiFi.begin("Wokwi-GUEST", "", 6);
  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++)
  {
    data3 += (char)payload[i];
  }

  Serial.println("data: "+ data3);

  data3="";
}
```

5.1.2 CIRCUIT DIAGRAM:

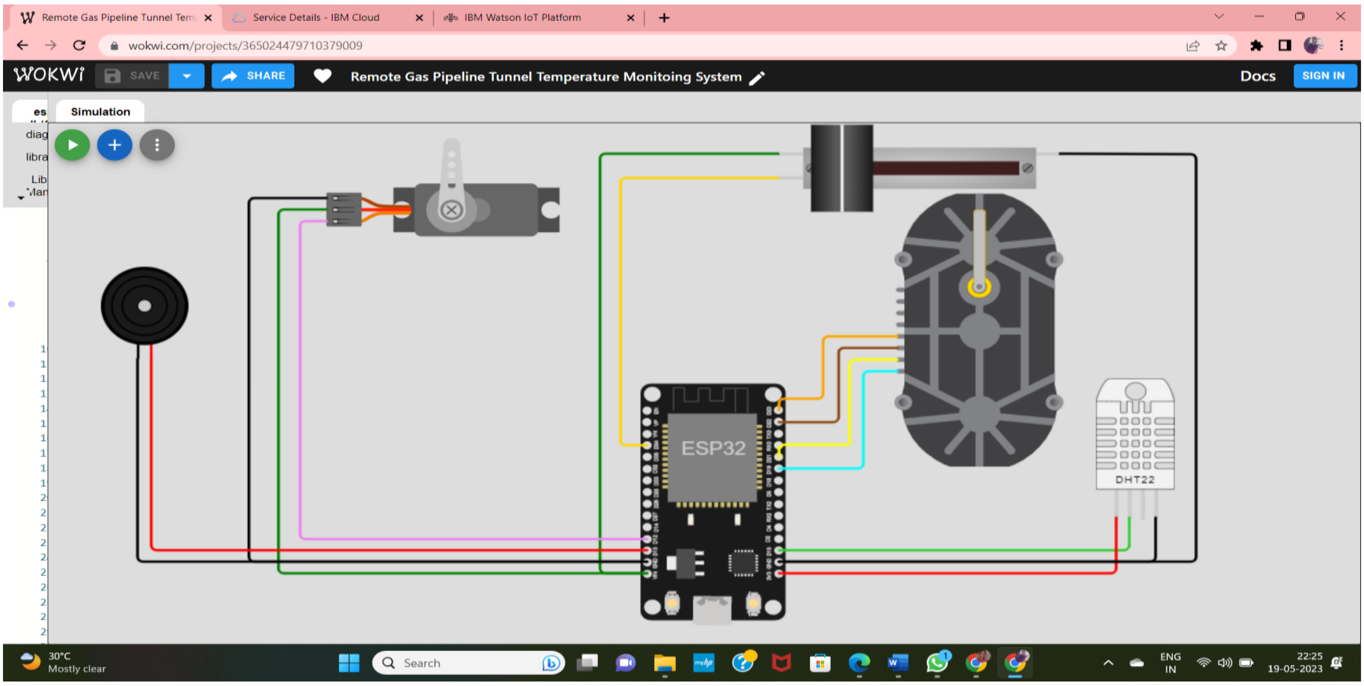


Figure: 5.1.2

Circuit diagram of wokwi

5.1.3 OUTPUT :

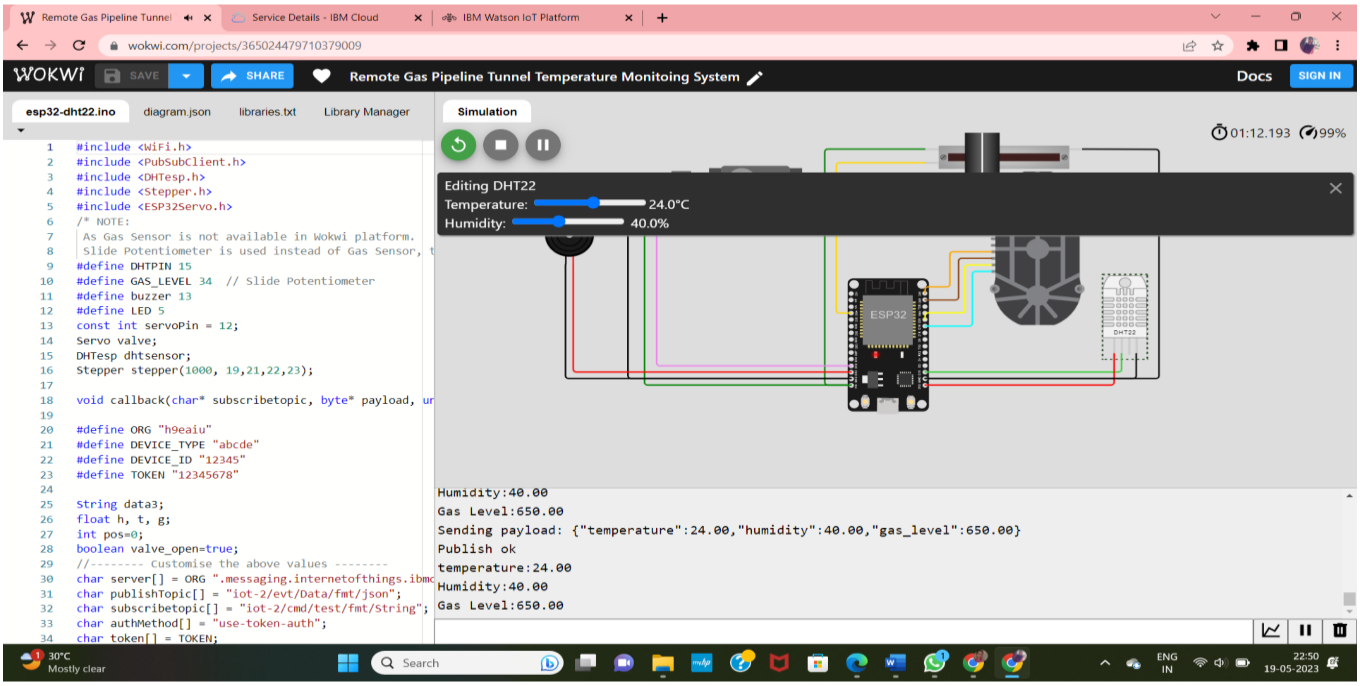


Figure: 5.1.2

Output of Wokwi

5.1.4 CONNECTING WOKWI TO CLOUD

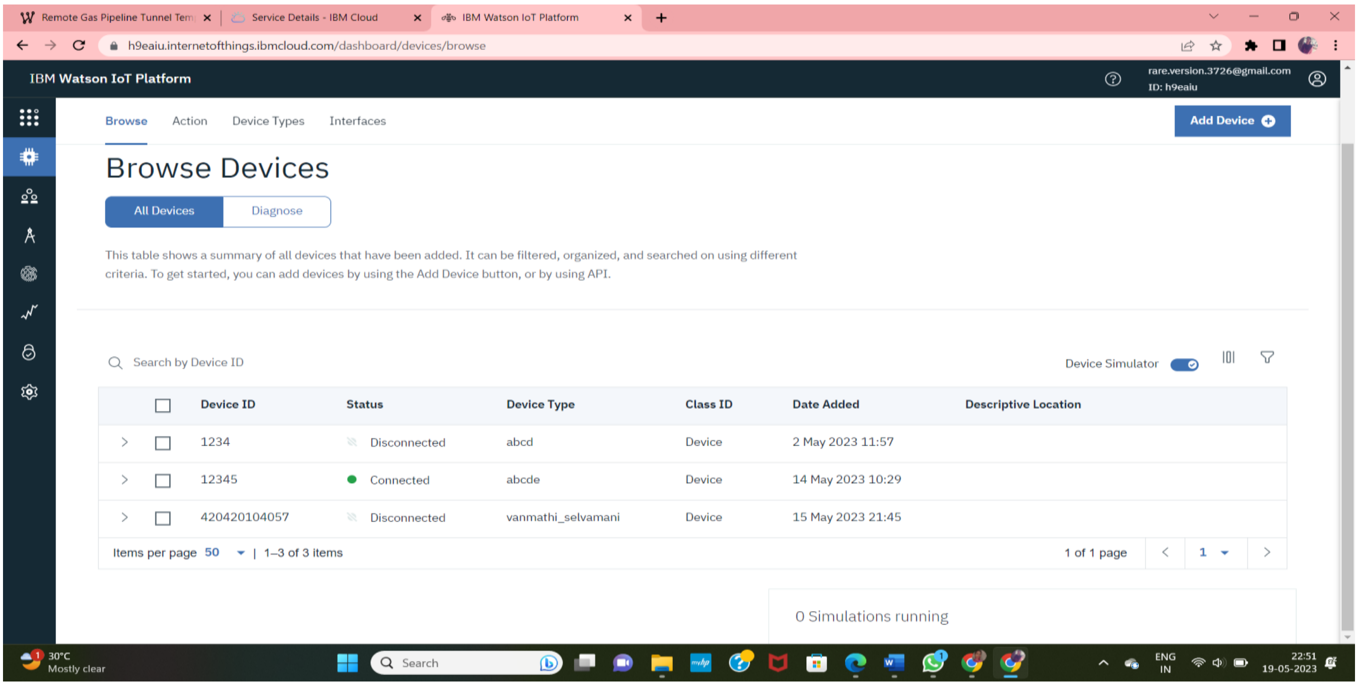


Figure: 5.1.4

Establishing Connection from IOT devices to Cloud

5.1.5 SENDING DATA FROM WOKWI TO CLOUD

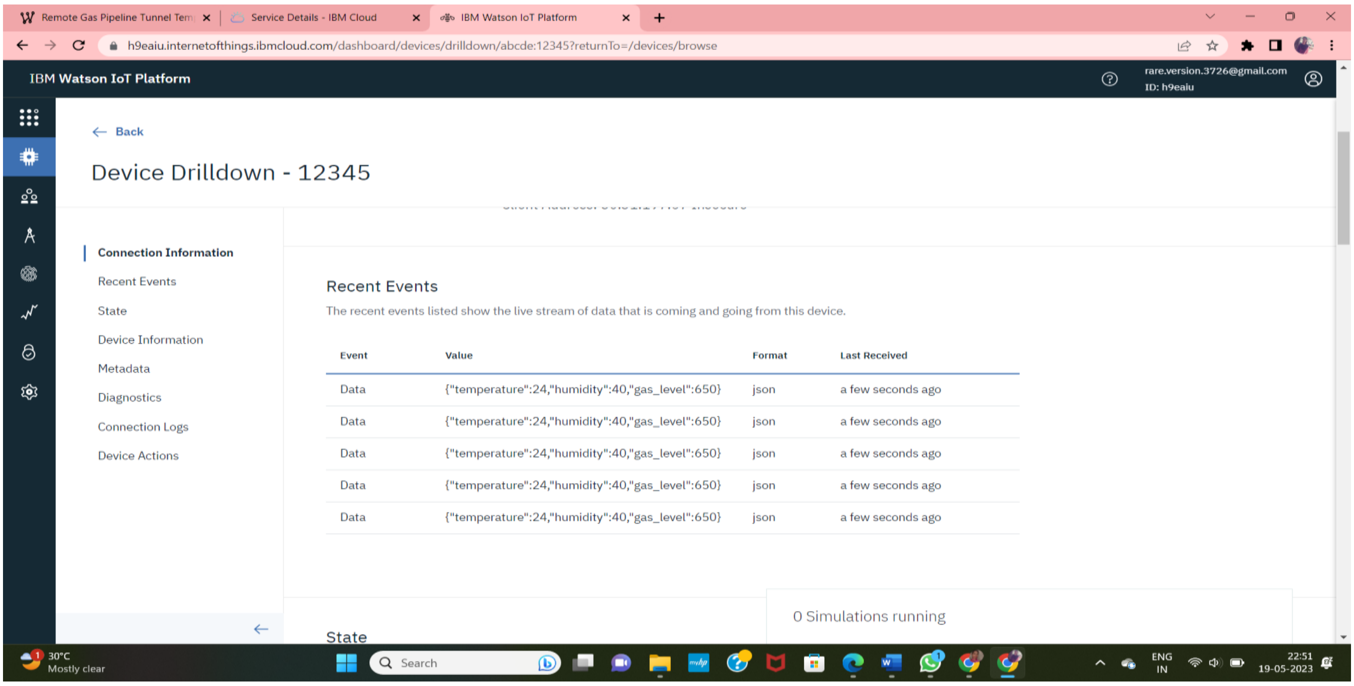


Figure: 5.1.5

Publishing the collected data from Wokwi and storing in cloud

5.2 FEATURE-2

5.2.1 WEB APPLICATION CREATION:

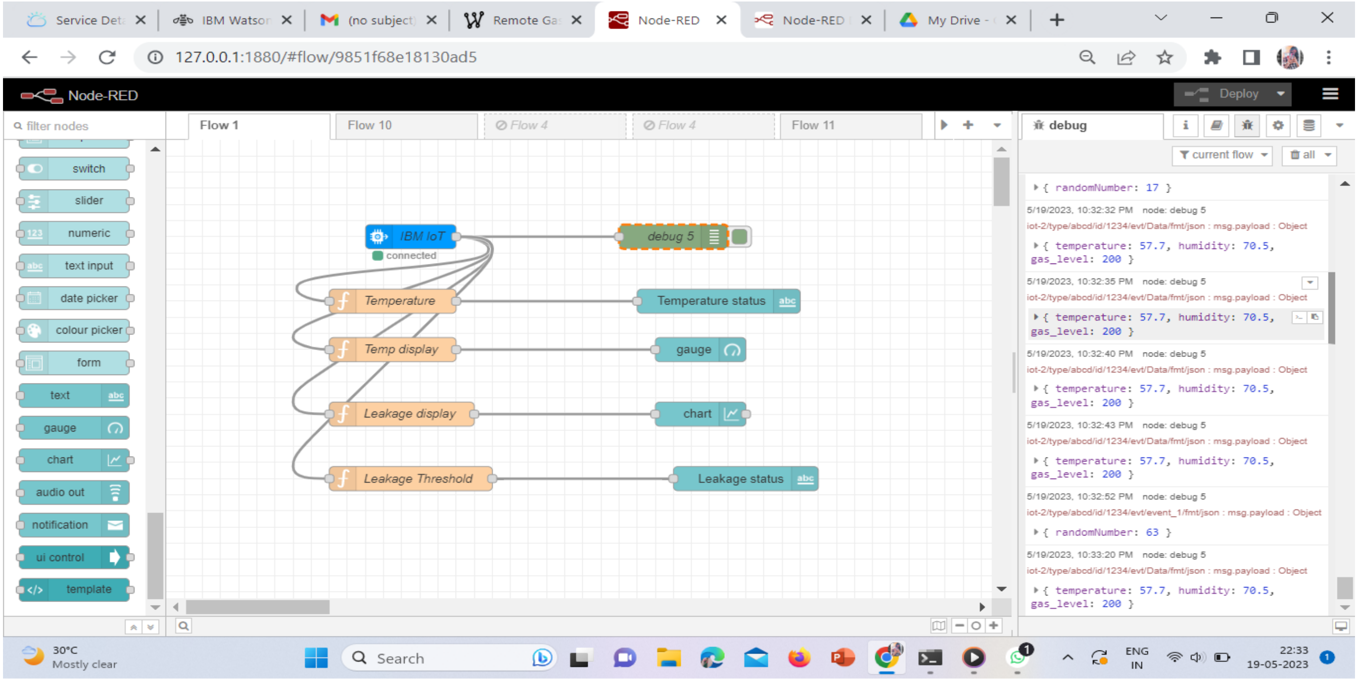


Figure: 5.2.1

Connecting the nodes & buttons with respect IOT devices.

SCREENSHOT-01

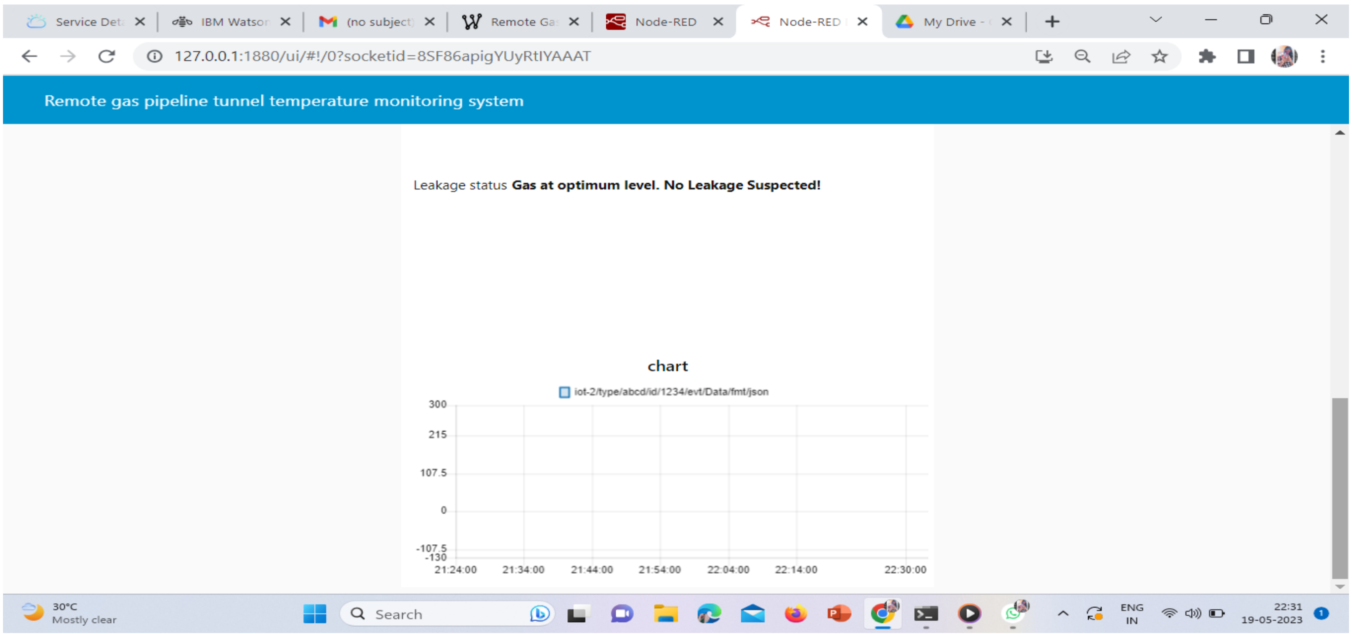


Figure: 5.2.2

Graphical result-1 on the dashboard.

SCREENSHOT-02

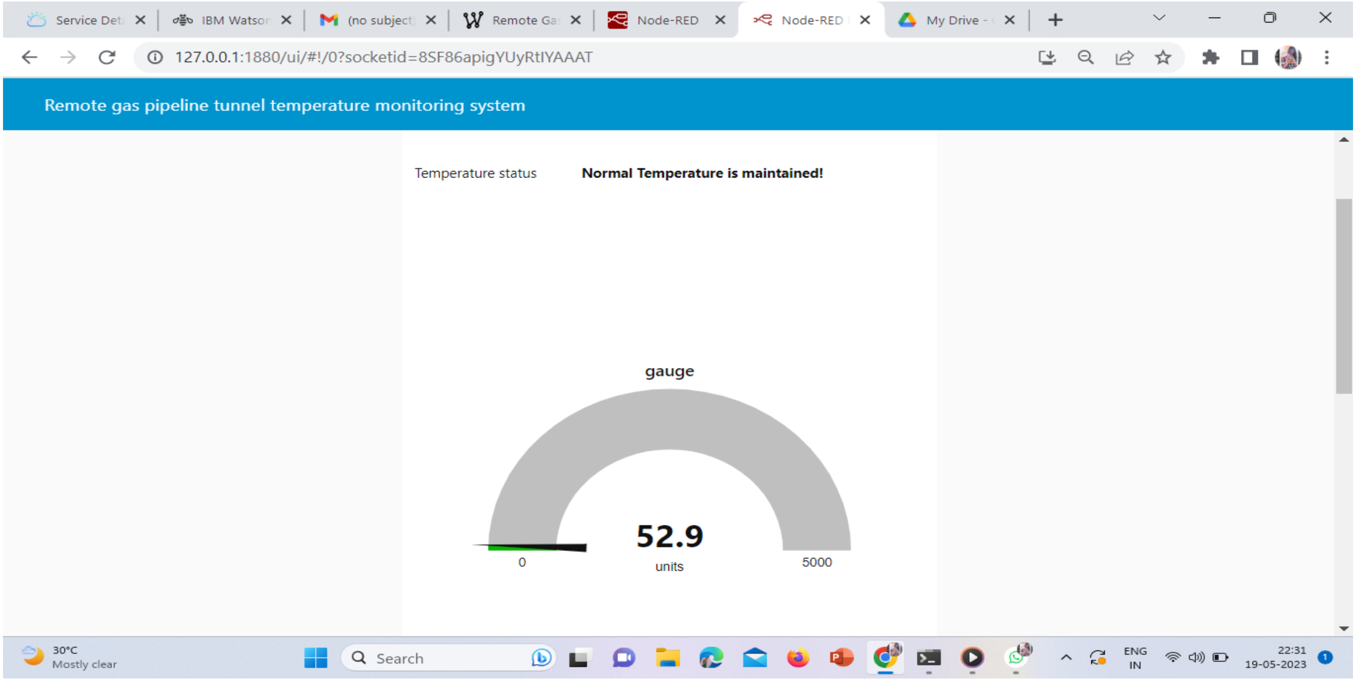


Figure: 5.2.3

Graphical result-2 on the dashboard.

SCREENSHOT-03

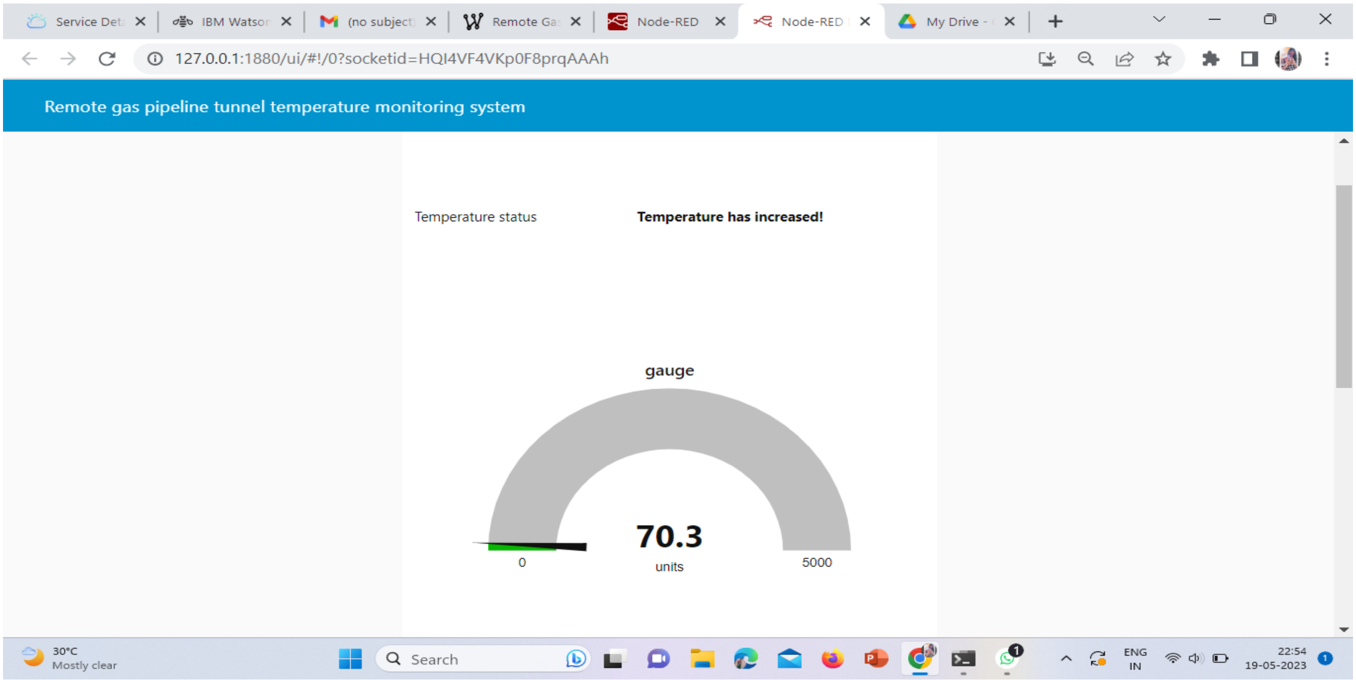


Figure: 5.2.3.1

Graphical view on dashboard with varying results.

5.2.2 Task:

Data is brought to NODE-RED and displayed in dashboard.

steps:

1. Here we use IBM iot node to gather sensor data in which API key is attached to establish a connection with IBM Watson IOT platform.

2. Function such as Temperature,Temp display,Leakage display and leakage threshold are used to obtain the data which is displayed in the dashboard.

3. using guage and chart node the temperature and leakage information are displayed.

4 finally by clicking "deploy" the output is displayed in the NODE-RED site.

Source code:

<u>Temperature:</u>

```
 msg.payload = msg.payload.temperature
if (msg.payload > 0) {
   msg.payload = "Temperature has increased!";
}
else {
   msg.payload = "Normal Temperature is maintained!";
}
return msg;
```

<u>Temp display</u>:

```
msg.payload = msg.payload.temperature
return msg;
```

<u>Leakage display:</u>

```
msg.payload = msg.payload.LeakageThreshold
return msg;
```

Leakage threshold:

```
msg.payload = msg.payload.LeakageThreshold
if (msg.payload > 2000) {
   msg.payload = "Leakage Suspected!";
}
else {
   msg.payload = "Gas at optimum level. No Leakage Suspected!";
}
return msg;
```

5.3 MOBILE APPLICATION CREATION:

SCREENSHOT-1

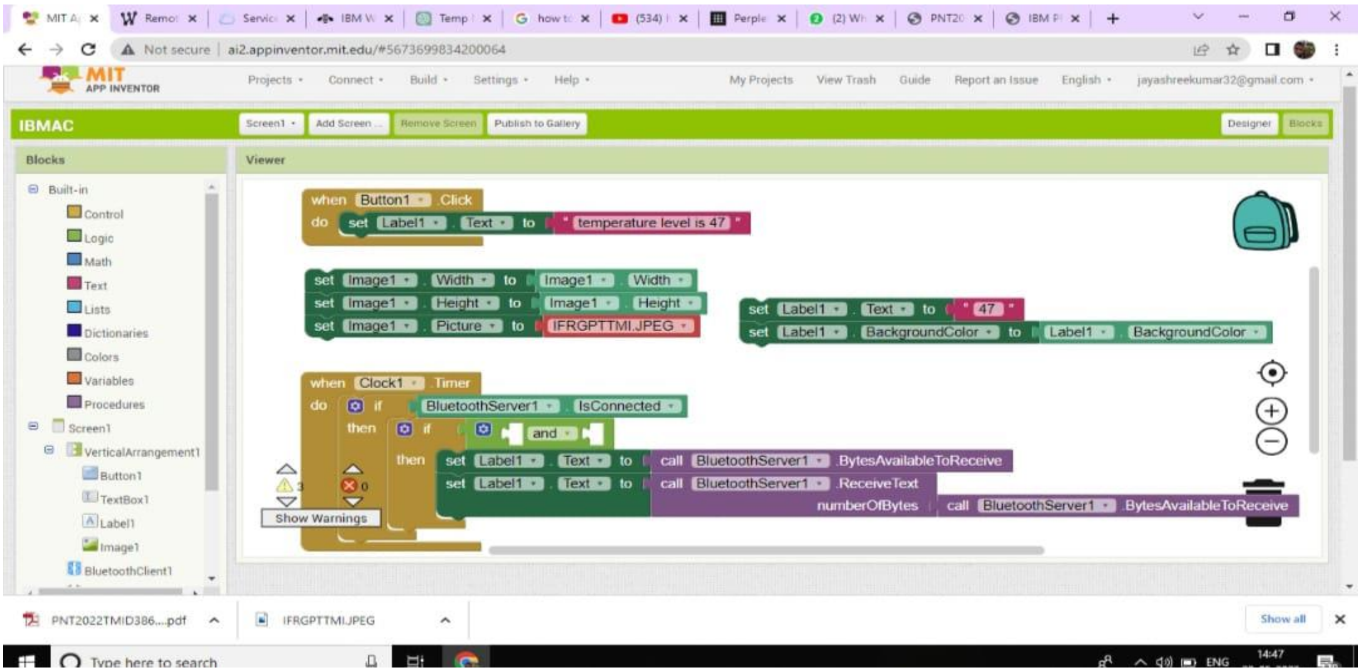


Figure: 5.3

Buliding a blocks based on the requirements.

SCREENSHOT-2

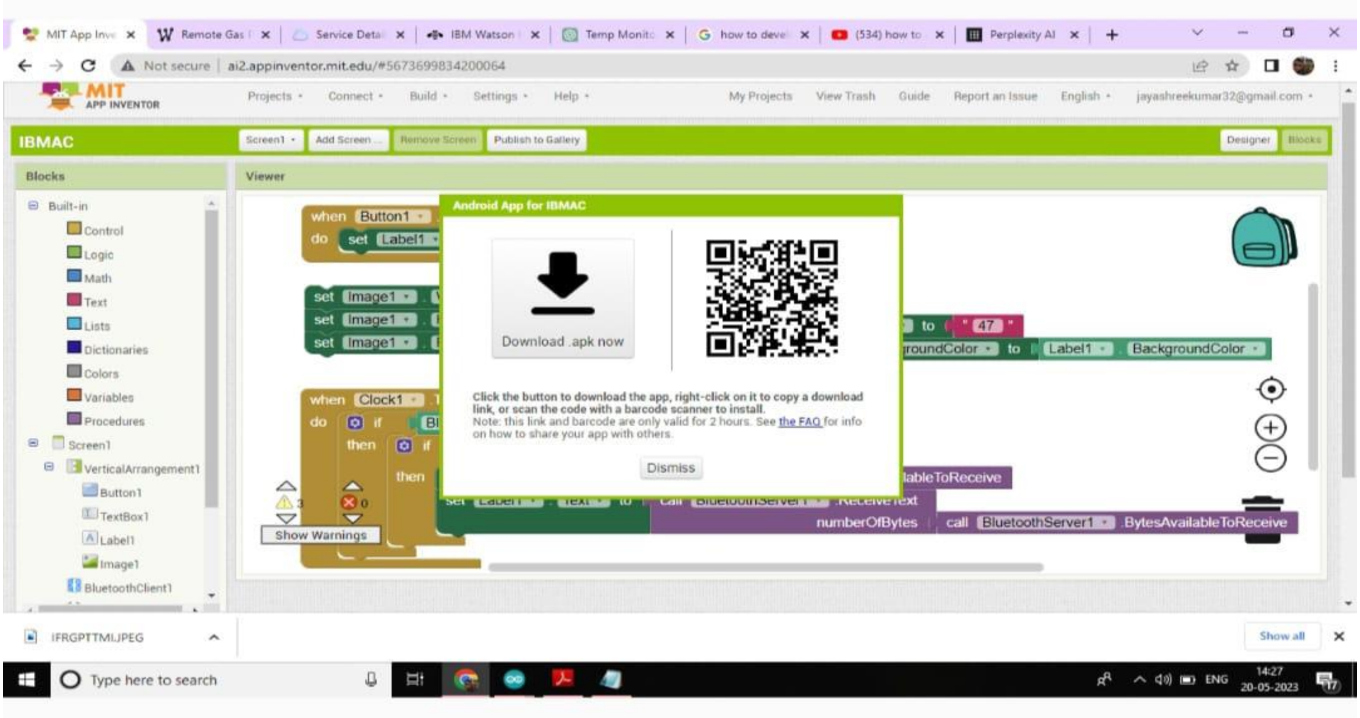


Figure: 5.3.1

Generating QR-code for compilation.

SCREENSHOT-3

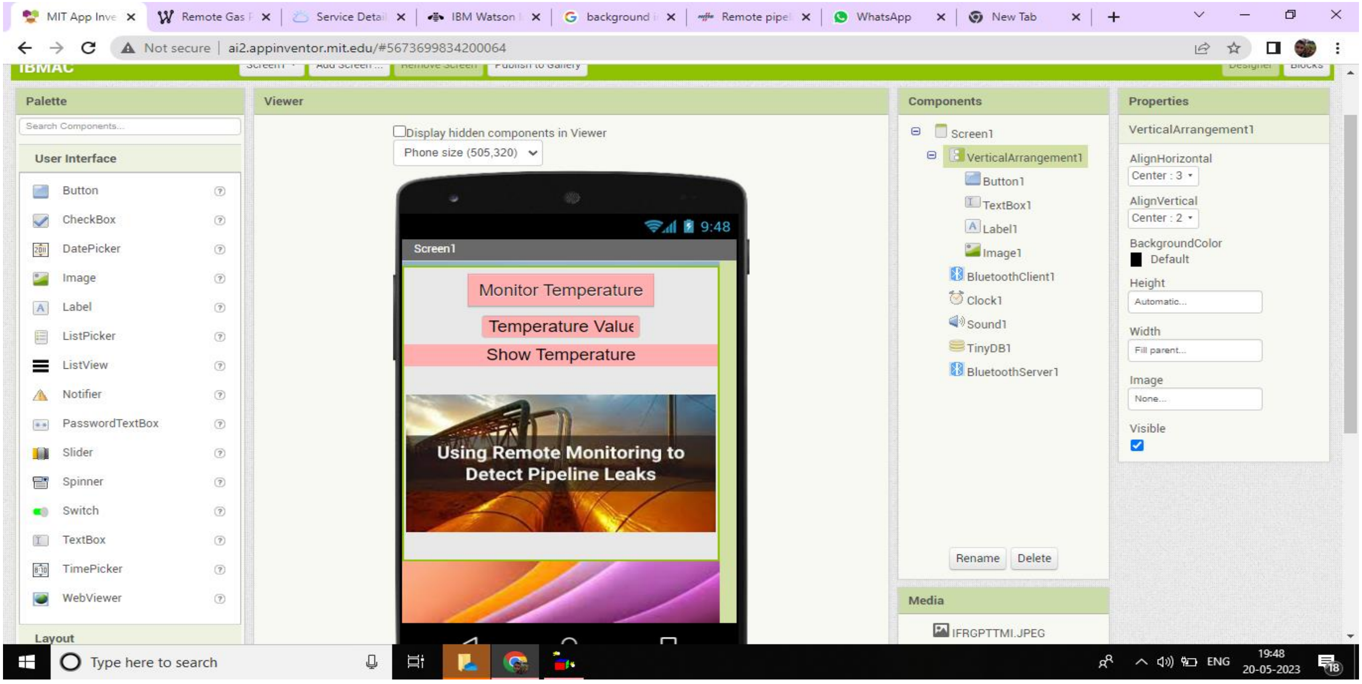


Figure: 5.3.2

Final view on the MIT-App inventor.

SCREENSHOT-4

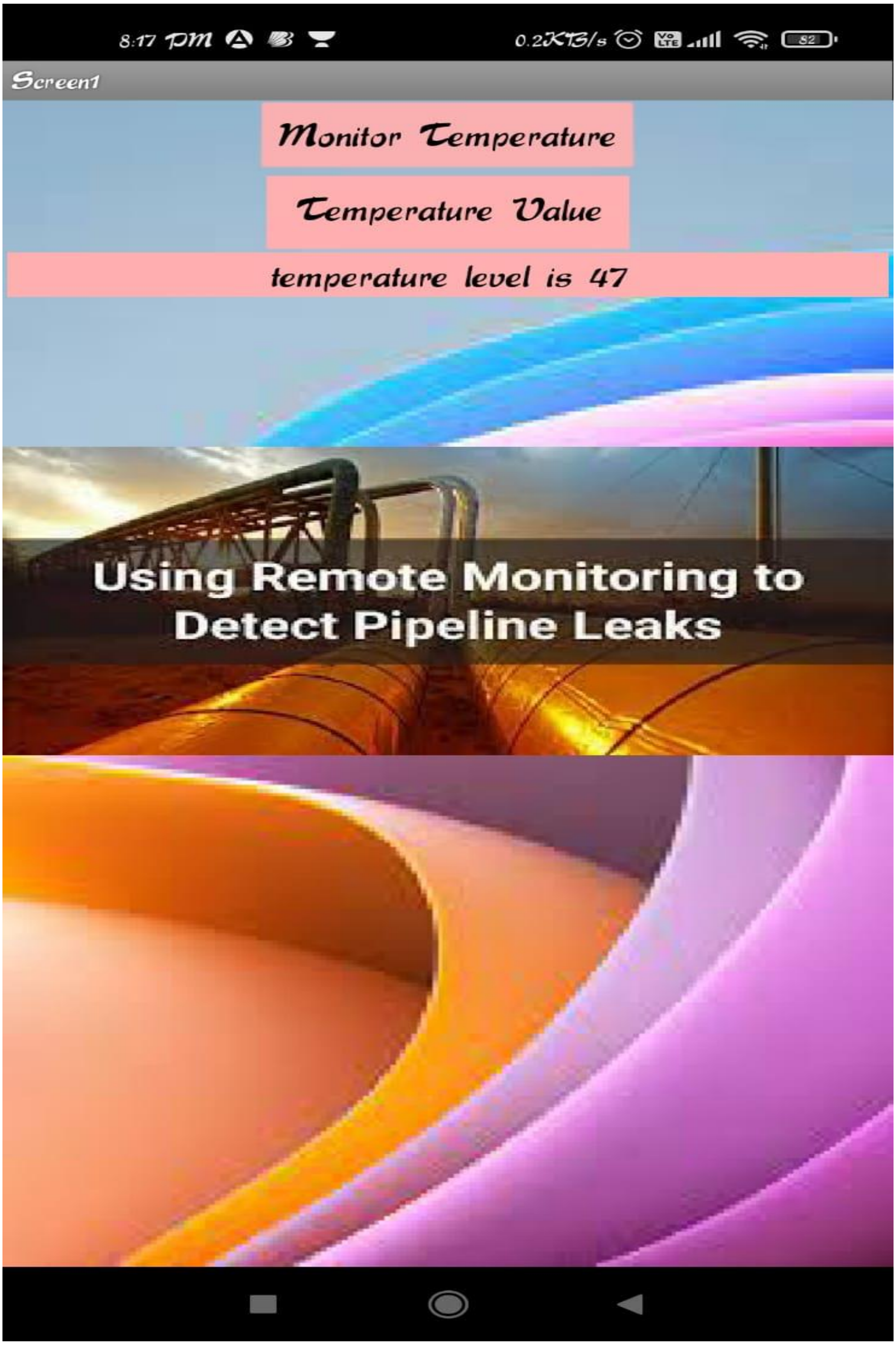


Figure: 5.3.3

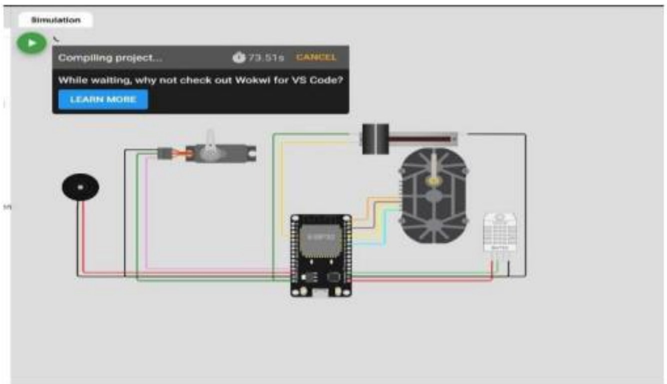
Viewing the results in mobile

6. RESULTS

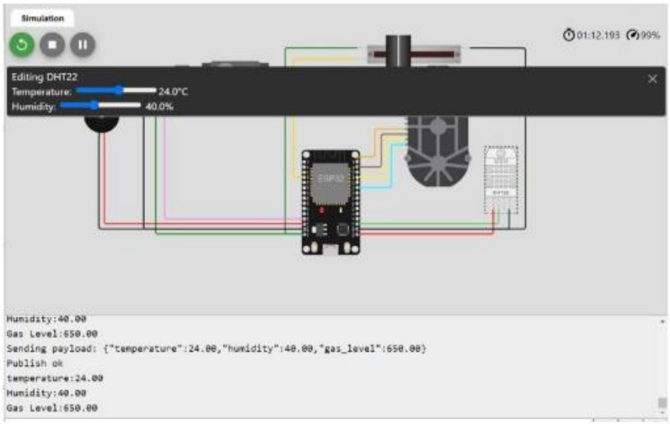
6.1PERFORMANCE METRICS:

<table>
<tr><th>Parameter</th><th>Values</th><th>Screenshot</th></tr>
<tr><td>Metrics</td><td>WOWKI execution time =73.51s</td><td>

SCREENSHOT OF EXECUTION TIME:



SCREENSHOT OF OUTPUT:



</td></tr>
</table>

Figure:6.1

Metrics that are considered for the performance.

6.1.2 TEST CASES:

DATE:20 MAY 2023

TEAM ID : NM2023TMID01942

NFT RISK ASSESSMENT

SNO	Project Name	Scope/Featur	Functional Cha	Hardware Changes	Software Changes	Impact of downtime	Load/Volume Changes	Risk Score	Justification
1	Remote gas pipeline tunnel temperature monitorin	New	Low	Moderate	Moderate	Low	>20 to 30%	Green	No Changes Seen

NFT DETAILED TEST PLAN

S.NO	Project overview	NFT Test Approach	Assumptions/Dependencies/Risk	Approval/SignOff
1	Gas leakage monitoring	Stress	App Crash/Site down	Approved
2	Gas leakage monitor	Load	Server crash/Server down	Approved

S.no	Project overview	NFT Test Approacl	NFR MET	Test outcome	GO/NO-GO Decision	Recommendations	Identified Defects (Detected/Closed/Opened)	Approval/SignOff
1	Gas pipeline tunnel temperature monitoring system	Stress	Performance	CPU-01	GO	High Performance	closed	Approved
2	Gas pipeline tunnel temperature monitoring system	Load	Stability	Database storage-01	NO-GO	Nodered	closed	Approved

Figure: 6.2

Revealing errors and defects in the system.

7. ADVANTAGES AND DISADVANTAGES

7.1 ADVANTAGES:

- It reduces overall maintenance costs.
- It helps to prevent accidents.
- Remote monitoring systems can collect data on pipeline temperatures over time, allowing for better analysis and decision-making.
- Response with quick reaction.

7.2 DISADVANTAGES:

- This system may be vulnerable to cyber attacks such as hacking.
- Transmitting data over long distances, which can be challenging in areas with poor connectivity.
- Temperature sensors and data acquisition devices require regular maintenance to ensure accurate readings**.**
- High power and internet consumption.

8. CONCLUSION

Implementing remote temperature monitoring systems is essential to safeguard gas pipeline infrastructure and maintain a reliable supply of gas. Thus, the focus of our system is to prevent accidents in industries and it also avoids the wastage of gas which leads to a rise in the economy, because when gas leaks, it not only contaminates the atmosphere but also the wastage of gases will hurt our economy.

9. FUTURE SCOPE

Further, feature such as alerting by sending messages directly to the safety department and also making installation further easier. The present gas spillage recognition framework can be additionally improved. For modern purposes, versatile robots can be produced for recognizing numerous gas fixations. Expansion of the load cell can likewise be utilized as a weight sensor that identifies the measure of gas in the chamber and recognizes high-weight gas in barrel pipe, showing the alarm messages using SMS and LCD Displays.

10. APPENDIX

WOKWI LINK:

https://wokwi.com/projects/365024479710379009

PROJECT DEMO LINK:

https://youtu.be/bGZ5oZog-Rw

11.REFERENCE:

1. Z. Sun et al.MISE-PIPE: Magnetic induction-based wireless sensor networks for underground pipeline monitoring Ad Hoc Netw. (2011)

2.G. Oren and N. Stroh, "Antileaks: A device for detection and discontinuation of leakages in domestic water supply systems," European Journal for Young Scientist and Engineers, vol. 1, pp. 10-13, 2012.

3. Charlotte Van Leeuwen, Arjan Hensen, Harro A. J. Meijer. “Leak Detection of CO2 pipelines with simple Atmospheric CO2 sensors for Carbon Capture and Storage. International Journal of Greenhouse Gas Control. Vol 19, pp 420 – 431, 2013.

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5. Li, Z.; Cheng, H.; Gu, T. Research on the dynamic relationship between natural gas consumption and economic growth in China. Struct Chang Econ Dyn 2019, 49, 334−9

6. Yuan, F.; Zeng, Y.; Khoo, B. C. A new real-gas model to characterize and predict gas leakage for high-pressure gas pipeline. J. Loss Prev Process Ind. 2022, 74, 104650.

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