IBM PROJECT REPORT

Team ID	NM2023TMID01943
Project Name	GAS PIPELINE MONITORING SYSTEM FOR HOSPITAL

S.NO	**TEAM MEMBERS**	**MAIL ID**
1.	VANITHA LAKSHMI G	vanithagk406@gmail.com
2.	SANMATHI S	sanmathis022003@gmail.com
3.	CHARUMATHI B	balaselvi051@gmail.com
4.	HARSHITHA K S	shrisakthiharshitha@gmail.com
5.	SRIMATHI V	srimathiv1707@gmail.com

INDEX:

1.INTRODUCTION:

1.1.PROJECT OVERVIEW:

The Internet of Things (IoT) shall be able to incorporate transparently and seamlesslya large number of different systems, while providing data for millions of people to useand capitalize. Building a general architecture for the IoT is hence a very complex task,mainly because of the extremely large variety of devices, link layer technologies, andservices that may be involved in such a system.

PURPOSE:

A waste management system is the strategy an organization uses to dispose, reduce, reuse, and prevent waste. Possible waste disposal methods are recycling composting, incineration, landfills, bioremediation, waste to energy, and waste minimization. IoT-help you utilize smart bin sensor technology from thebeginning. One of the best types of smart bin sensors, the Fill Level Sensor, supported by IoT technology, you can: Track the location with real-time data. Viewfullness levels for creating daily optimized routes for collection. A reduction in the number of waste collections needed by up to 80%, resulting in less manpower, emissions, fuel use and traffic congestion. A reduction in the number of waste bins needed. Analytics data to manage collection routes and the placement of bins more effectively.

Team ID:	NM2023TMID01943
College Name:	ADHIPARASAKTHI ENGINEERING COLLEGE MELMARUVATHUR.
Team Leader:	VANITHA LAKSHMI G
Team Member-1:	SANMATHI S
Team Member-2:	CHARUMATHI B
Team Member-3:	SRIMATHI V
Team member-4:	HARSHITHA K S

LITERATURE SURVEY:

1	**Paper title**	An Intelligent Oil and Gas Well MonitoringSystem based on Internet of Things
	Problem definition	The oil and gas industrial sector is nowadays inclined towards utilizing smart field technologie foroptimizing various operations of upstream, midstream anddownstream sectors.
	Methodology/Algorithm	Oil and gasindustrial operations, from extraction to refining, requireefficient and reliable techniquesused.
	Advantages	The recent advances in Internet Of things (IoTs) have promising benefits and advantages over manual wired/wireless systems. Oil and gas wells form an important element of upstream sector.
	Disadvantages	It is difficult to carry out well head maintenance activities and check every well in person by sending employees, smartand intelligent .

2 .	**Paper title**	Pipeline Monitoring Using Highly Sensitive Vibration Sensor Based on Fiber Ring Cavity Laser.
	Problem definition	A vibration fiber sensor based on a fiber ring cavity laser and an interferometer based single mode multimode singlemode (SMS) fiber structure is proposed and experimentally demonstrate.
	Methodology/ Algorithm	The output lasing wavelength sweep is realized by varying the displacement on a fiber knotstructure using a linear translation stage.
	Advantages	• pipeline vibration monitoring • simple tunability of the ring laser wavelength • a wide range of detectable frequenciesfrom 10 Hz to 400 kHz high standards of pipeline safety and integrity monitoring
	Disadvantages	Funding has no external funding , not applicable for institutional review Board statement, informed consent Data Sment

3	**Paper title**	Zigbee and Long-Range Architecture Based Monitoring System for Pipeline Monitoring with the Internet of Things.
	Problem definition	To develop a pipeline monitoring is having a significant role in minimizingthe impact on the environment and humans during pipeline accidents.
	Methodology/ Algorithm	The monitoring end device id utilized for sensing the critical patameters of thr pipeline such as vibration,flow,temperature.humidity, pressure.
	Advantages	• It encourages implementation of IOT as a realtime monitoring System • It proposed cloud-enabled hybrid architecture based on 2.4 GHz based Zigbee and LoRa communicate
	Disadvantages	It is not applicable for institutional Review Board Statement, Informed Consent Statement,Data Availability Statement.

The current gas pipeline monitoring system in our hospital lacks efficientmonitoring, timely detection of gas leaks, and immediate response capabilities.This poses a significant risk to the safety and well-being of patients, staff, andvisitors.Therefore, there is a need for a robust gas pipeline monitoring system that can ensure continuous monitoring, prompt detection of gas leaks, and timelyalerts for quick response and mitigation.

1.1.REFERENCE:

1.S. Savazzi, U. Spagnolini, L. Goratti, D. Molteni, M. Latva-aho and M.Nicoli,"Ultra-wide band sensor networks in oil and gas explorations," in IEEECommunicationsMagazine, vol. 51, no. 4, pp. 150-160,April 2013.

2.Stajanca, P.; Chruscicki, S.; Homann, T.; Seifert, S.; Schmidt, D.;Habib,ADetection of Leak-Induced Pipeline Vibrations Using Optic Distributed Acoustic Sensing. **2018**, 3. Rehman, K.; Nawaz, F. Remote pipeline monitoring using wire networks. In Proceedings of the International Conference on Communication, Computing and Digital Systems (C-CODE), Islamabad, Pakistan, 8–9 March 2017;
4.Cramer, R.; Shaw, D.; Tulalian, R.; Angelo, P.; van Stuijvenberg, M.Detecting and correcting Pipeline leaksbefore they become a big problem. *Mar. Technol. Soc. J.*
5.Jia, Z.; Wang, Z.; Sun, W.; Li, Z. Pipeline leakage localization based on distributed FBG hoop strain measurements and support vector machine *Optik*

1.2. EXISTING SYSTEM:

In hospital the user/patient send query by using IOT application.IOT system for used controlling medical gas pipeline Equipement,IOT plataworm to exchange thesensor data. Then that query is send to IBM Watson.I Watson platform to aid in the recognition of gas leaks and to theAbnormal conditons.Node-red to connect patient data medical records with clinical staff. Then stored in the WEB UI.Then staff to check the level of gas present for use and will be able to take safetymeasures .

1.2.1TECHNICAL ARCHITECTURE:

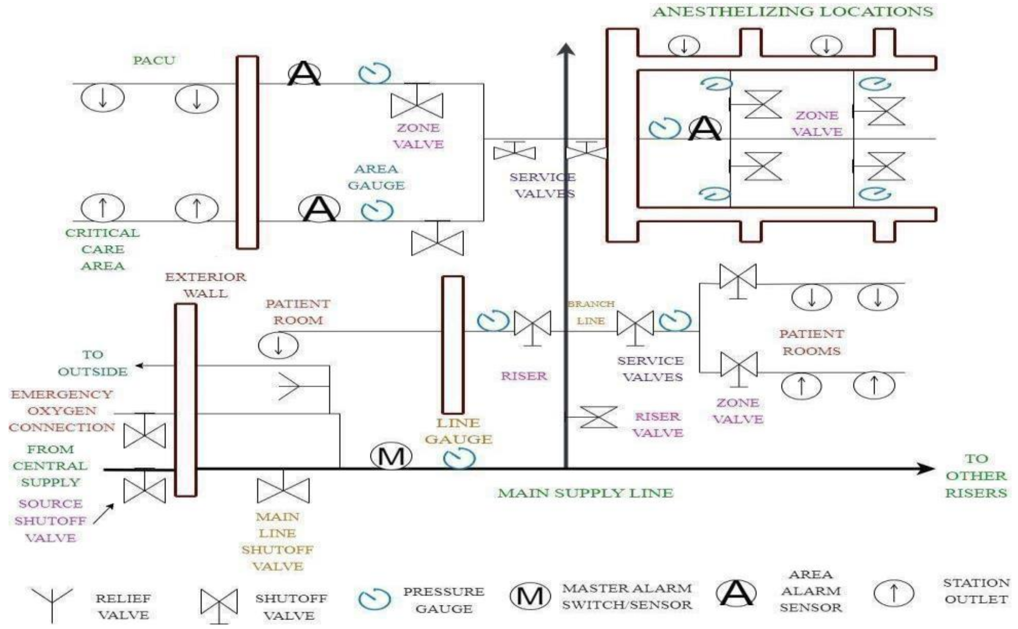
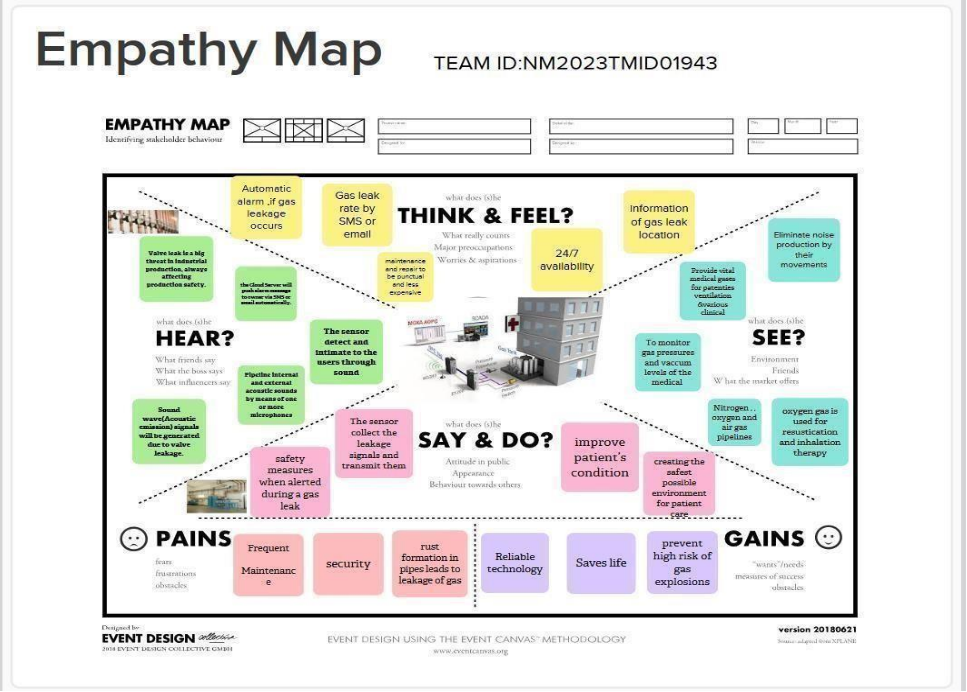


Figure:1.1 Technical Architecture

IDEATION & PROPOSED SOLUTION:

3.1. EMPATHY MAP:



Automatic alarm ,if gas leakage occurs

Gas leak rate by SMS or email

maintenance and repair to be punctual and less expensive

24/7 availability

Information of gas leak location

Valve leak is a big threat in industrial production, always affecting production safety.

the Cloud Server will push alarm message to owner via SMS or email automatically.

The sensor detect and intimate to the users through sound

Pipeline internal and external acoustic sounds by means of one or more microphones

Sound wave(Acoustic emission) signals will be generated due to valve leakage.

Eliminate noise production by their movements

Provide vital medical gases for patenties ventilation &various clinical

To monitor gas pressures and vaccum levels of the medical

Nitrogen , , oxygen and air gas pipelines

oxygen gas is used for resustication and inhalation therapy

safety measures when alerted during a gas leak

The sensor collect the leakage signals and transmit them

improve patient's condition

creating the safest possible environment for patient care

Frequent Maintenanc e

security

rust formation in pipes leads to leakage of gas

Reliable technology

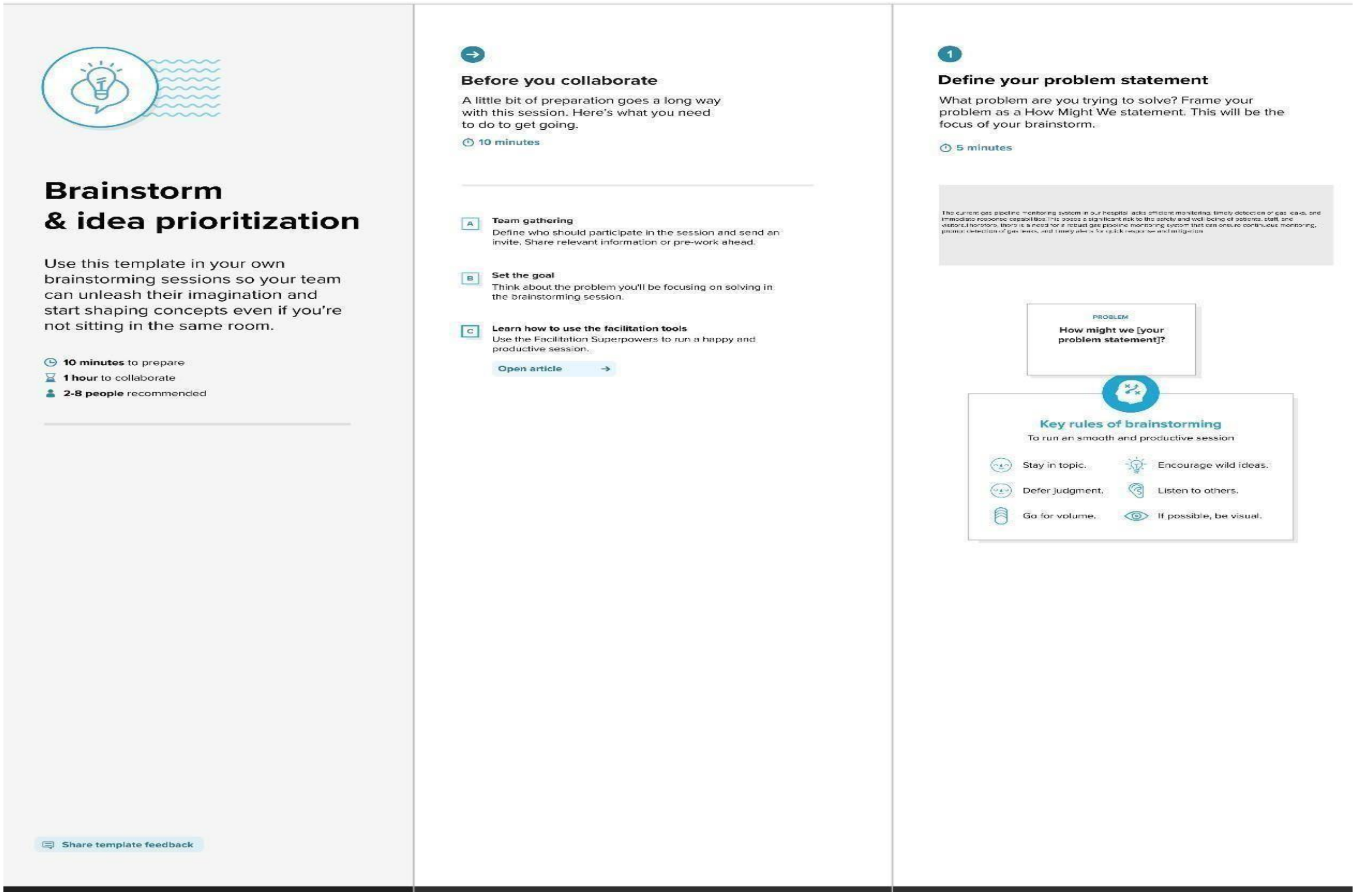
Saves life

prevent high risk of gas explosions

Figure 1.2: Empathy map

3.1. BRAINSTROME:

Step-1: Team Gathering, Collaboration and Select the Problem Statement



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

The current gas pipeline monitoring system in our hospital lacks efficient monitoring, timely detection of gas leaks, and immediate response capabilities.This poses a significant risk to the safety and well-being of patients, staff, and visitors.Therefore, there is a need for a robust gas pipeline monitoring system that can ensure continuous monitoring, prompt detection of gas leaks, and timely alerts for quick response and mitigation.

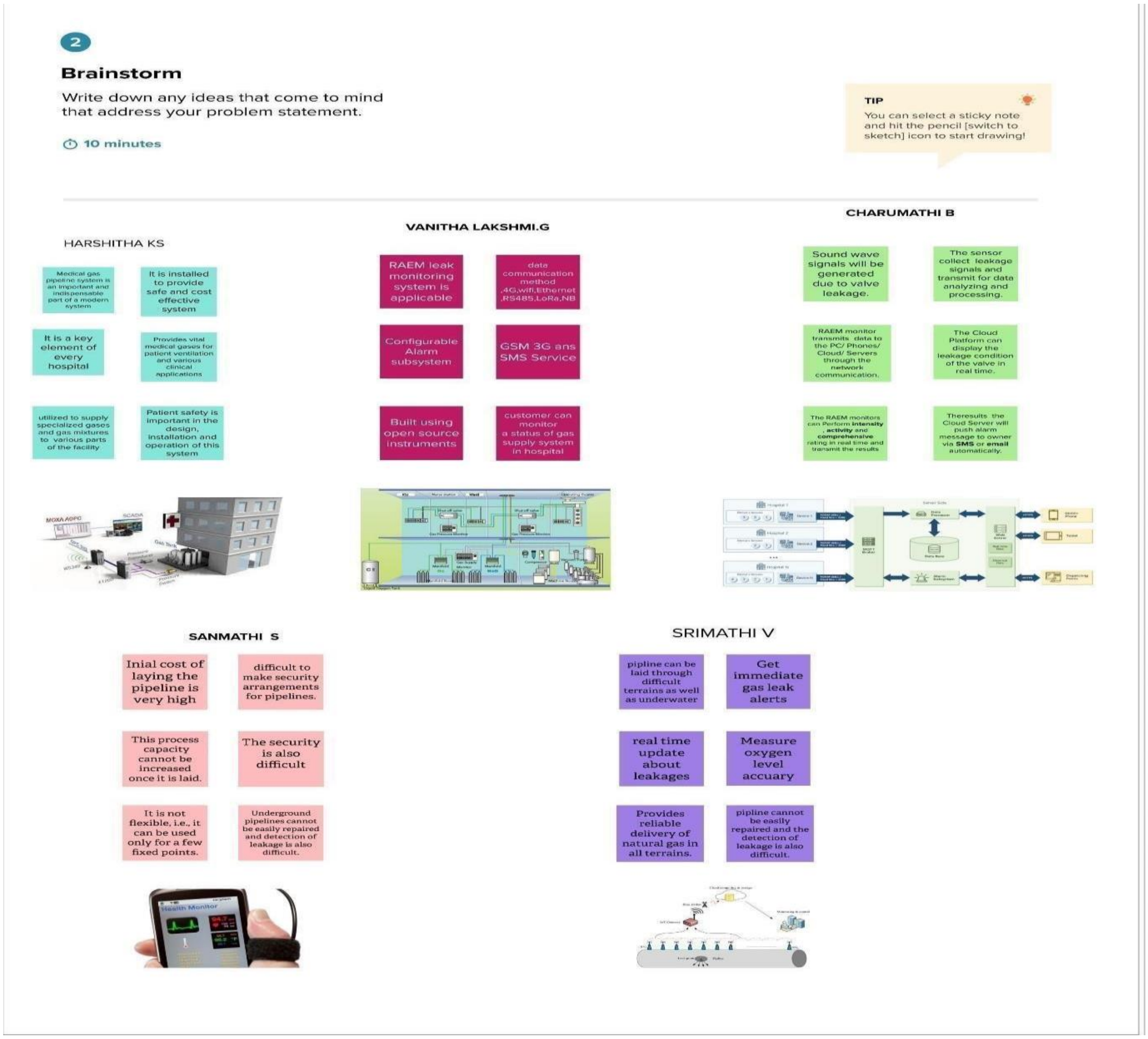
PROBLEM
How might we [your problem statement]?

Key rules of brainstorming
To run an smooth and productive session

Stay in topic.	Encourage wild ideas.
Defer judgment.	Listen to others.
Go for volume.	If possible, be visual.

Figure:3.1.1 Team gathering ,collaboration and problem statement

Step-2: Brainstorm, Idea Listing and Grouping



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 hit the pencil [switch to sketch] icon to start drawing!

HARSHITHA KS

Medical gas pipeline system is an important and indispensable part of a modern system

It is installed to provide safe and cost effective system

It is a key element of every hospital

Provides vital medical gases for patient ventilation and various clinical applications

utilized to supply specialized gases and gas mixtures to various parts of the facility

Patient safety is important in the design, installation and operation of this system

VANITHA LAKSHMI.G

RAEM leak monitoring system is applicable

data communication method ,4G,wifi,Ethernet ,RS485,LoRa,NB

Configurable Alarm subsystem

GSM 3G ans SMS Service

Built using open source instruments

customer can monitor a status of gas supply system in hospital

CHARUMATHI B

Sound wave signals will be generated due to valve leakage.

The sensor collect leakage signals and transmit for data analyzing and processing.

RAEM monitor transmits data to the PC/ Phones/ Cloud/ Servers through the network communication.

The Cloud Platform can display the leakage condition of the valve in real time.

The RAEM monitors can Perform **intensity** , **activity** and **comprehensive** rating in real time and transmit the results

Theresults the Cloud Server will push alarm message to owner via **SMS** or **email** automatically.

SANMATHI S

Inial cost of laying the pipeline is very high

difficult to make security arrangements for pipelines.

This process capacity cannot be increased once it is laid.

The security is also difficult

It is not flexible, i.e., it can be used only for a few fixed points.

Underground pipelines cannot be easily repaired and detection of leakage is also difficult.

SRIMATHI V

pipline can be laid through difficult terrains as well as underwater

Get immediate gas leak alerts

real time update about leakages

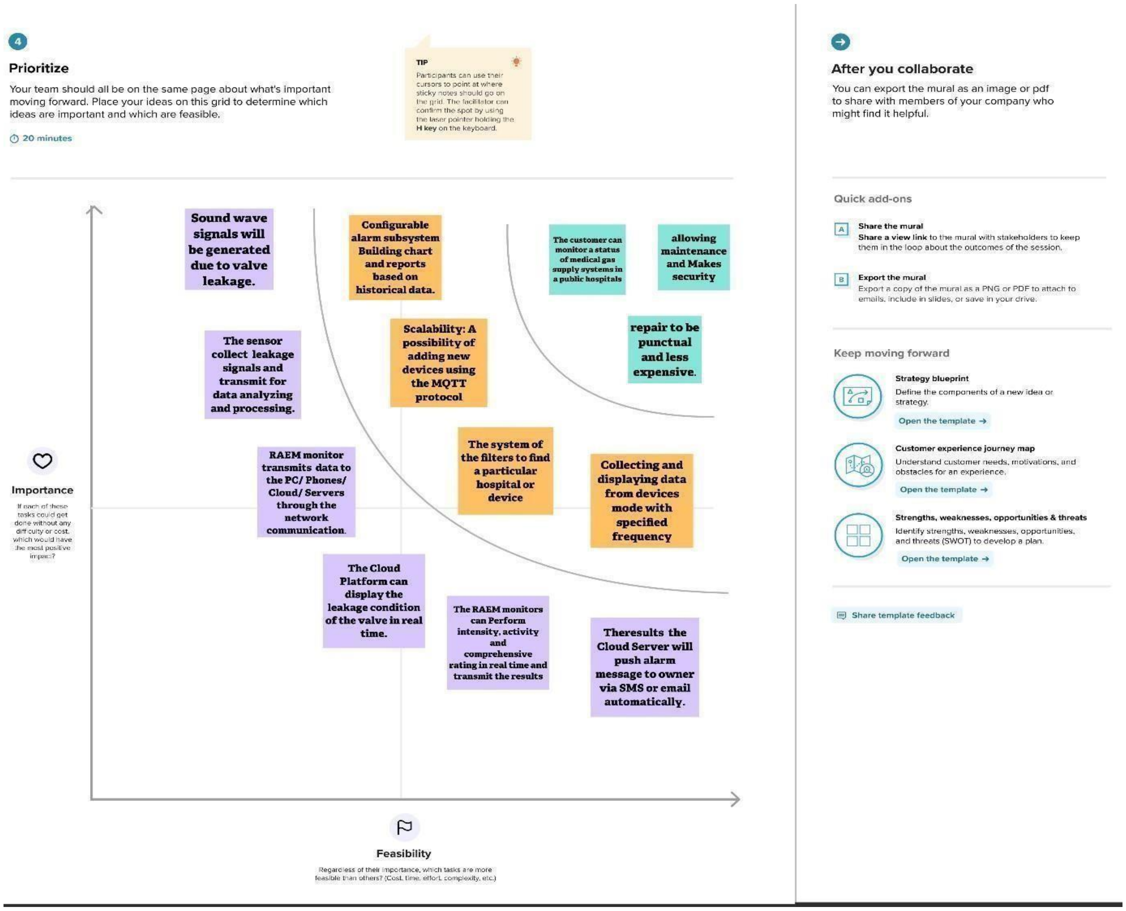
Measure oxygen level accuary

Provides reliable delivery of natural gas in all terrains.

pipline cannot be easily repaired and the detection of leakage is also difficult.

Figure: 3.1.2 Brain storm ,idea listening and Grouping

Step-3: Idea Prioritization



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 cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the **H key** on the keyboard.

Sound wave signals will be generated due to valve leakage.

Configurable alarm subsystem Building chart and reports based on historical data.

The customer can monitor a status of medical gas supply systems in a public hospitals

allowing maintenance and Makes security

repair to be punctual and less expensive.

The sensor collect leakage signals and transmit for data analyzing and processing.

Scalability: A possibility of adding new devices using the MQTT protocol

The system of the filters to find a particular hospital or device

RAEM monitor transmits data to the PC/ Phones/ Cloud/ Servers through the network communication.

Collecting and displaying data from devices mode with specified frequency

The Cloud Platform can display the leakage condition of the valve in real time.

The RAEM monitors can Perform intensity, activity and comprehensive rating in real time and transmit the results

Theresults the Cloud Server will push alarm message to owner via SMS or email automatically.

Importance

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

Feasibility

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

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

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

B 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

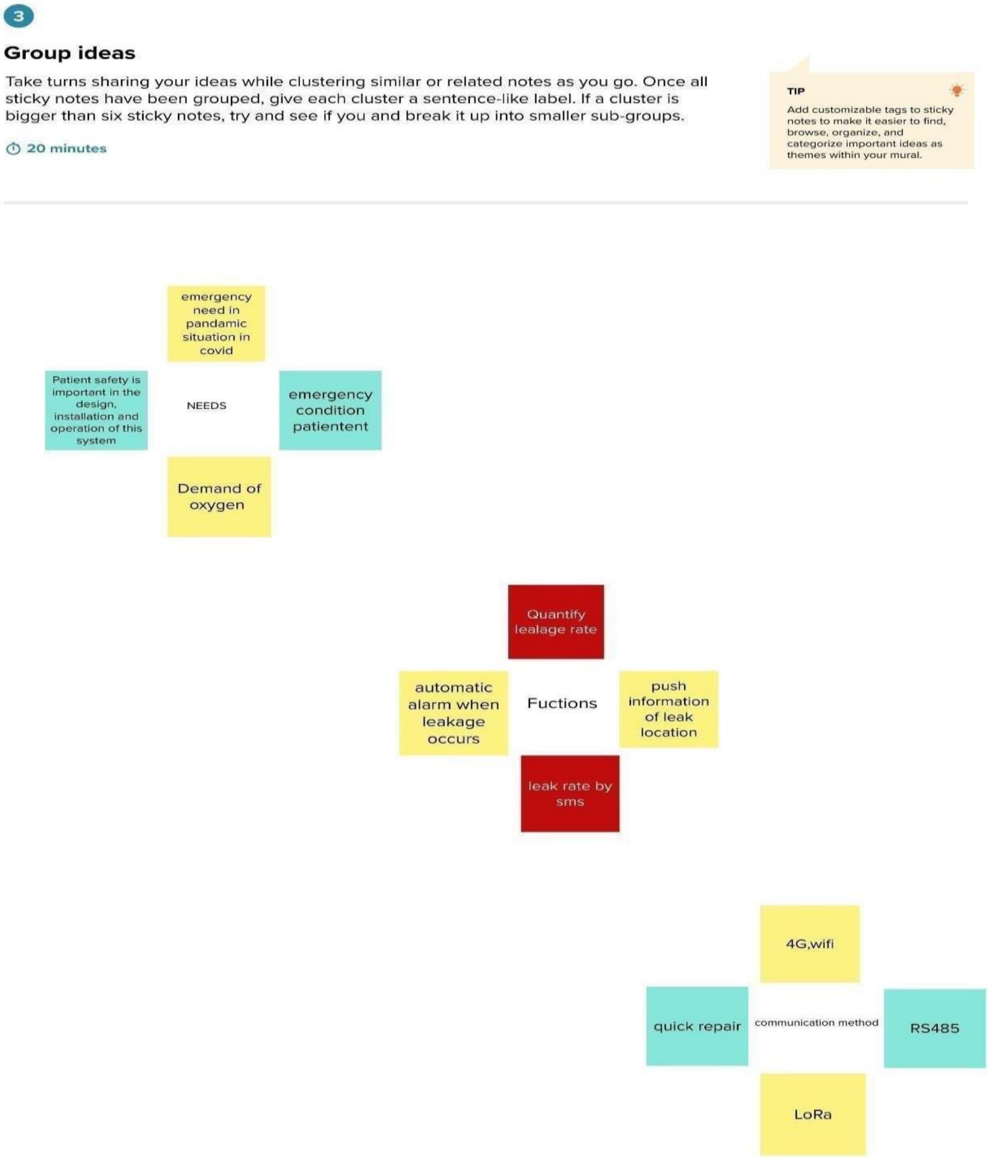
Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

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

Figure:3.1.3 Idea Prioritization



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 and break it up into smaller sub-groups.

20 minutes

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

emergency need in pandamic situation in covid
Patient safety is important in the design, installation and operation of this system
NEEDS
emergency condition patientent
Demand of oxygen
Quantify lealage rate
automatic alarm when leakage occurs
Fuctions
push information of leak location
leak rate by sms
4G,wifi
quick repair
communication method
RS485
LoRa

4.REQUIRMENT ANALYSIS:

4.1. FUNCTIONAL REQUIREMENTS:

Following are the functional requirements of the proposed solution.

FR no:	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR -1	Gas Leak Detection:	Detect gas leaks accurately and promptly. Detection mechanism should be sensitive enough to identify even small gas leaks.
FR 2	Real time bin monitoring.	Display the status of each pipeline, including pressure levels and gas flow rates.
FR -3	Remote Monitoring and Control	Authorized personnel should be able to access the monitoring system. Remote control functionality should allow for shutting off gas supply to affected areas in case of emergencies.
FR -4	Data Logging and Reporting	System should provide historical data analysis and reporting functionalities for maintenance and auditing purposes. Record and store gas pipeline data, including gas pressure, flow rates, and alarm events.
FR -5	Integration with Building Management System (BMS)	It should communicate and exchange data with fire alarm systems, HVAC systems, and security systems, to ensure coordinated responses in emergency situations.
FR -6	System Redundancy and Failover:	Redundant sensors, data acquisition units, and communication modules should be employed to minimize system downtime.

4.1. NON FUNCTIONAL REQUIREMENTS:

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

FR No.	Non-Functional Requiremenet	Description
NFR-1	**Usability**	To maintain patient safety and streamline healthcare operations.
NFR-2	**Security**	Robust security measures to protect againstunauthorized access or tampering. Accessto the system should be restricted to authorized personnel only.
NFR-3	**Reliability**	low probability of false alarms or missed detections. backup power source to maintain operation during power outages.
NFR-4	**Performance**	System should have a fast response time to detect gas leaks and generate alerts promptly.capable of handling a high volume of real-time data from multiple sensors simultaneously.
NFR-5	**Availability**	System's availability by analyzing, historical data, including downtime occurrences, maintenance records, and system logs.
NFR-6	**Scalability**	It should support the addition of newsensors and monitoring points as theinfrastructure grows.

4. PROJECT DESIGN:

4.1 DATA FLOW DIAGRAM:LEVEL 0:

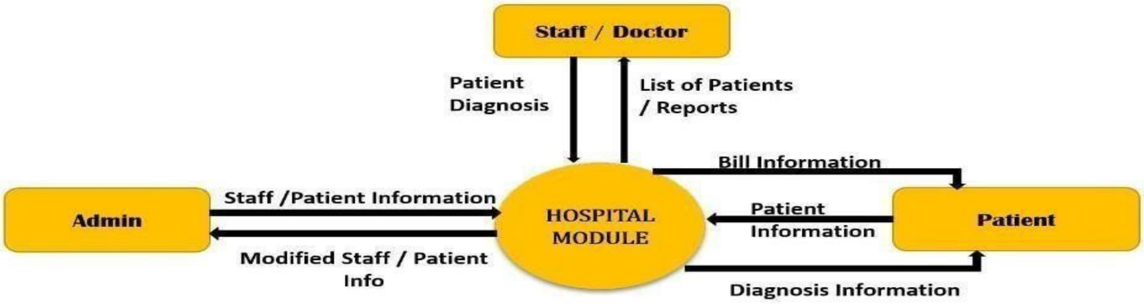


Figure: Data flow level-0

LEVEL 1:

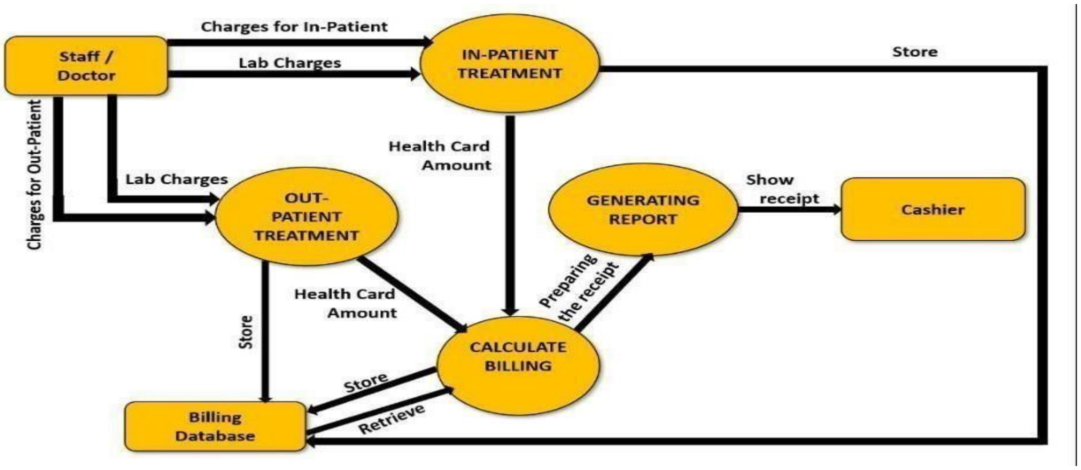


Figure: Data flow level-1

LEVEL 2:

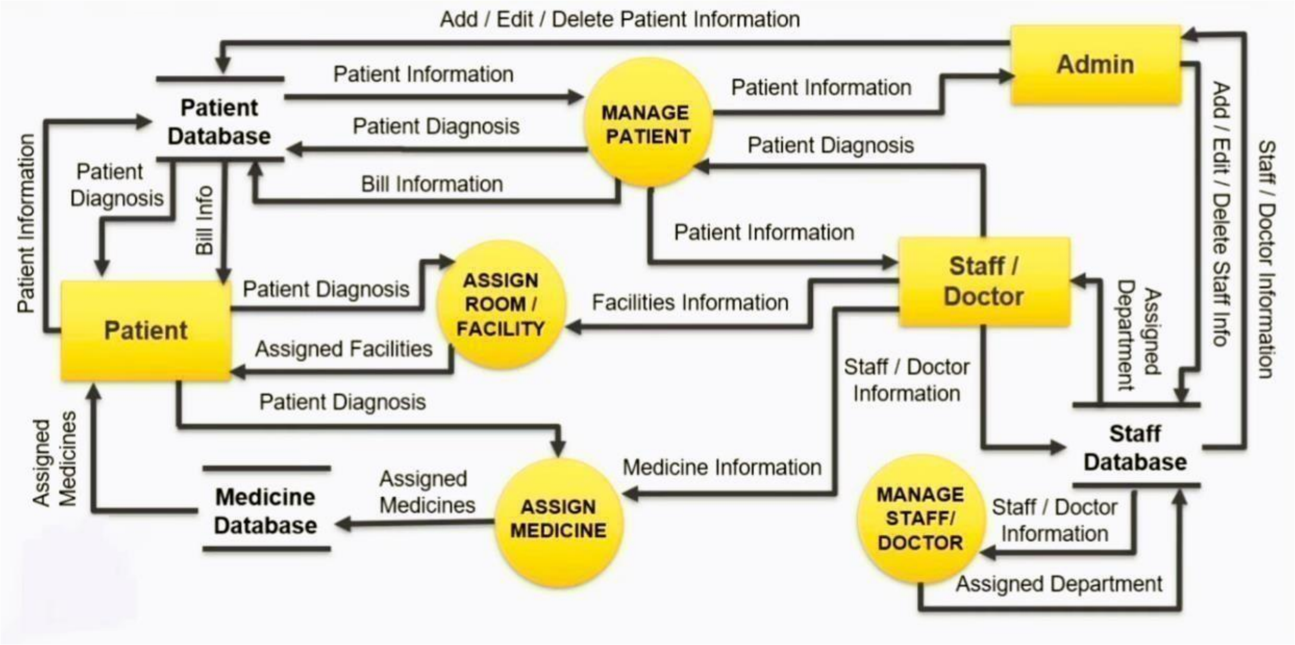


Figure: Data flow level-2

5.1 SOLUTION AND TECHNICAL ARCHITECTURE

5.1.1 TECHNICAL ARCHITECTURE:

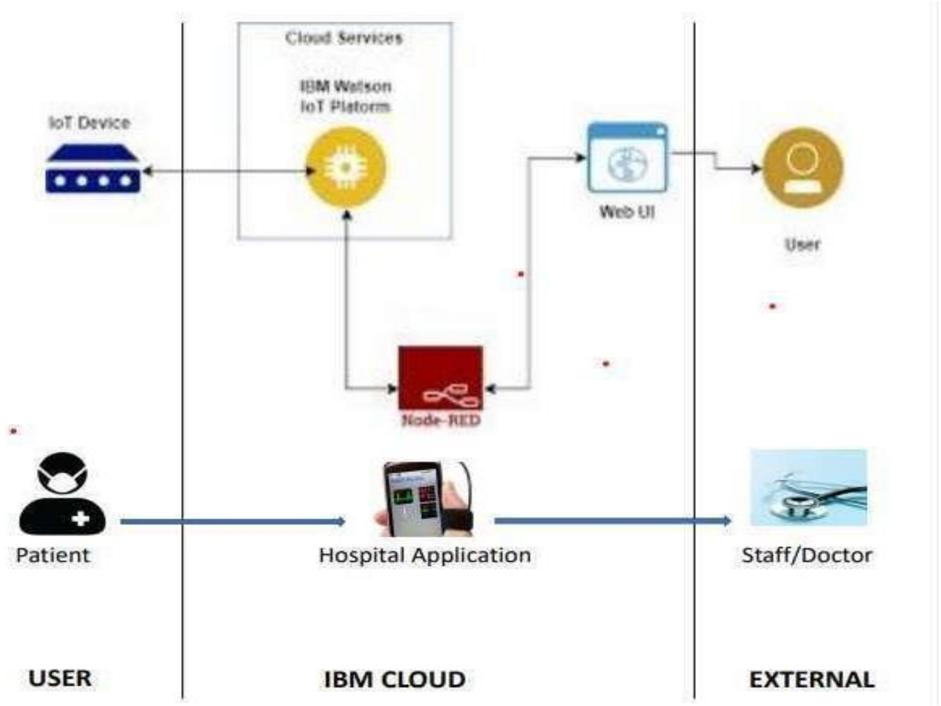


Figure5.1:Technical Architecture

5.1 USER

USER TYPE	**USER TYPE**	**USER TYPE**	**User Story / Task**
Mobile user	Gas leak Detection	USN-1	As a user, can detect gas leaks accurate and promptly
		USN-2	The detection mechanism should be sensitive, as a user can detect small gas leaks
		USN-3	As a user, I can display the status of each pipeline.
	Real-time monitoring	USN-4	As a user, I can have authorized personnel To access the monitoring system.
		USN-5	As a user, I can shut off gas supply to affected areas in case of emergency using remote control functionality
	Data logging and reporting	USN-6	System should provide historical data analysis, So as a user, I can audit and maintain.
		USN-7	System should record and store gas pipeline data, flowrates, so as user I canmaintain efficiently
		USN-8	System should communicate and exchange data with fire alarm system andsecurity system, so as a user I can ensure coordinated response in emergency situations.

	Integration with emergency response system	USN-9	Redundant sensors, data acquisition units, and communication modules should be employed to minimize system downtime.
		USN-10	The system should efficient collaborate between the monitoring system, technicians,and maintenance team to prove averting a Potentially hazardous
		USN-11	As a user, I can able to identify the location of the gas leak within the hospital premises for efficient response.
	Maintenance and support	USN-12	As a user, I can ensure the smooth functioning of critical medical equipment, the hospital relied on a remote gas pipeline monitoring system
		USN-13	As a user, the monitoring team, composed,diligently investigated the issue and quickly identified the location of the crack
		USN-14	As a user, I can ensure the uninterrupted flow of gas to power critical medical equipment, guaranteeing the safety of patients.
Administrator		USN-15	As a user , The system should have fail-safe mechanisms in place to ensure uninterrupted monitoring,

		USN-16	As a user, I can ensure the system's reliability and functionality.

6.PROJECT PLANNING AND SCHEDULING:

Product Backlog, Sprint Schedule, and Estimation :

Use the below template to create product ack log and sprint schedule

User type	User type	User Story / Task	Points	Team Members
Web server login	USN -1	Administrator, I need to give user id and pass code for every worker’s over there in hospital	10	Vanitha
Login	USN -2	As a Co-Admin, I will take security measures prevent unauthorized access and ensure data integrity	10	Sanmathi
User	USN -3	As a user, I’ll follow Co-Admins Instruction to check the status of the gas pipelines from anywhere within the hospital premises	20	Charumathi

worker	USN -4	As a worker,I can shut off the gas supply to affected areas in case of s major gas leak and issues audible alarm to quickly notify the staff incase of a gas leak.	10	Srimathi
worker	USN -5	Detailed logs and reports gas pipeline activites and maintenance activities system performance of a gas leak	20	Harshita

CODING AND SOLUTION:

```
#include <WiFi.h>//library for wifi

#include <PubSubClient.h>//library for MQttfloat pressure;
float leakage;

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

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

#define ORG "iw0cp7"//IBM ORGANITION ID

#define DEVICE_TYPE "gas"//Device type mentioned in ibm watson IOT Platform#define DEVICE_ID
"1234"
```

```
//Device ID mentioned in ibm watson IOT Platform#define TOKEN "123456789"       //Token
String data3;
//float h, t;

//-------- Customise the above values --------

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name char publishTopic[] =
"iot-2/evt/Data/fmt/json";// topic name and type of event perform andformat 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);

delay(10);  Serial.println();

wificonnect();  mqttconnect();

}

                void loop()// Recursive Function

{

                pressure=analogRead(34);  leakage=analogRead(32);Serial.print("Pressure: ");
Serial.println(pressure);
                Serial.print("Leakage: ");

Serial.println(leakage);  delay(1000);PublishData(pressure,leakage);
delay(1000);  if (!client.loop())

{    mqttconnect();

}


}

/*....................................retrieving to Cloud .........................................*/

Void      PublishData(float pressure,float leakage) { mqttconnect();//function call for connecting to ibm
/*
```

```
creating the String in in form JSon to update the data to ibm cloud

*/

String payload = "{\"pressure\":"; payload

  += pressure;      payload += ","“\"leakage\":";
payload += leakage;  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 publishok 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 ");

}


}

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 connectionwhile
(WiFi.status() != WL_CONNECTED)
  {
  delay(500);

Serial.print(".");
}

wificonnect(); mqttconnect();
}

void loop()// Recursive Function

{

pressure=analogRead(34);leakage=analogRead(32); Serial.print("Pressure: "); Serial.println(pressure);
Serial.print("Leakage: ");
Serial.println(leakage);
delay(1000);
PublishData(pressure,leakage);
delay(1000);
                    if (!client.loop())

{    mqttconnect();

}

}

/*....................................retrieving to Cloud .................................................. */



void PublishData(float pressure,float leakage) {
```

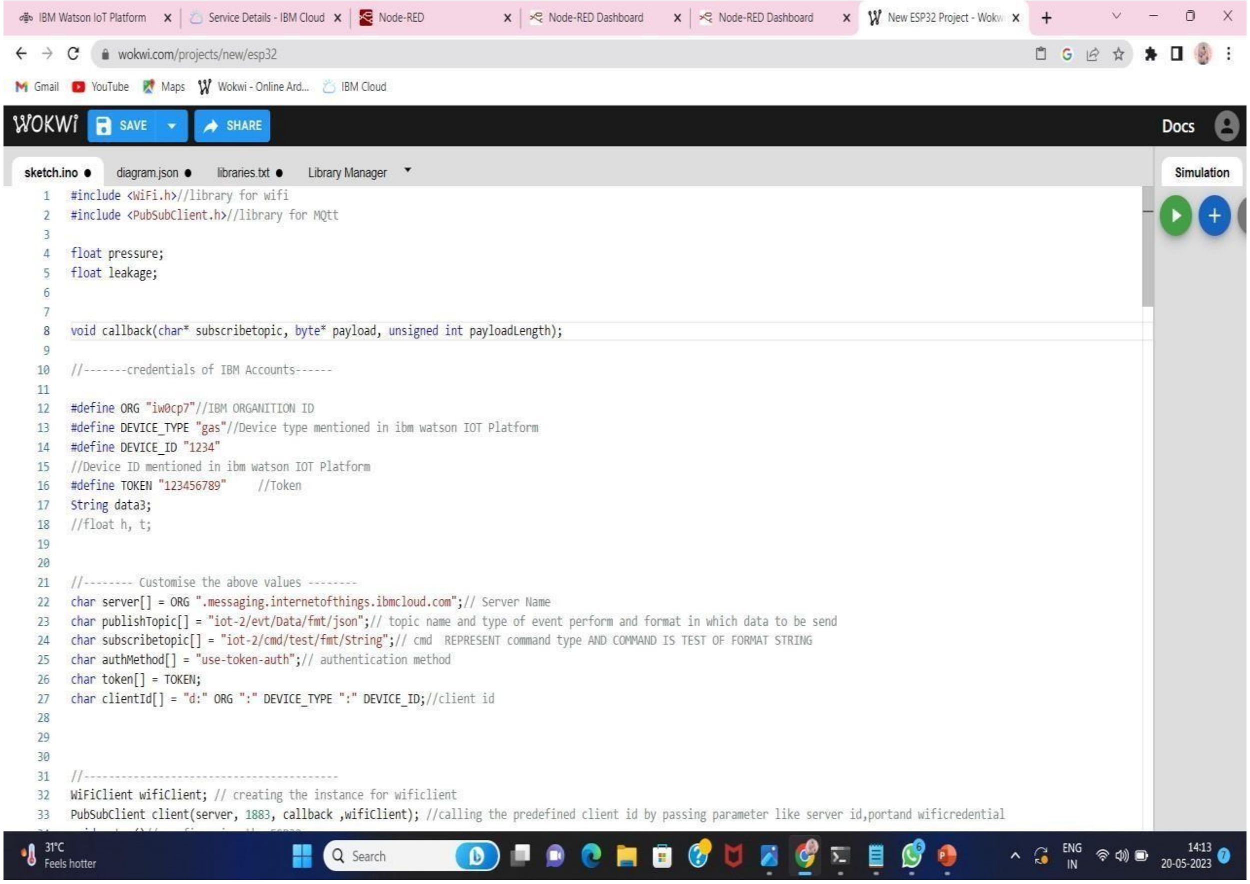
```
mqttconnect();//function call for connecting to ibm

/*

creating the String in in form JSon to update the data to ibm cloud*/


String payload = "{\"pressure\":"; payload += pressure; payload += ",""\"leakage\":"; payload +=
leakage;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 itwill 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
```

```
connectionwhile  {

            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.print((char)payload[i]);
        data3+= (char)payload[i];

}

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

data3="";

}


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);
```

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

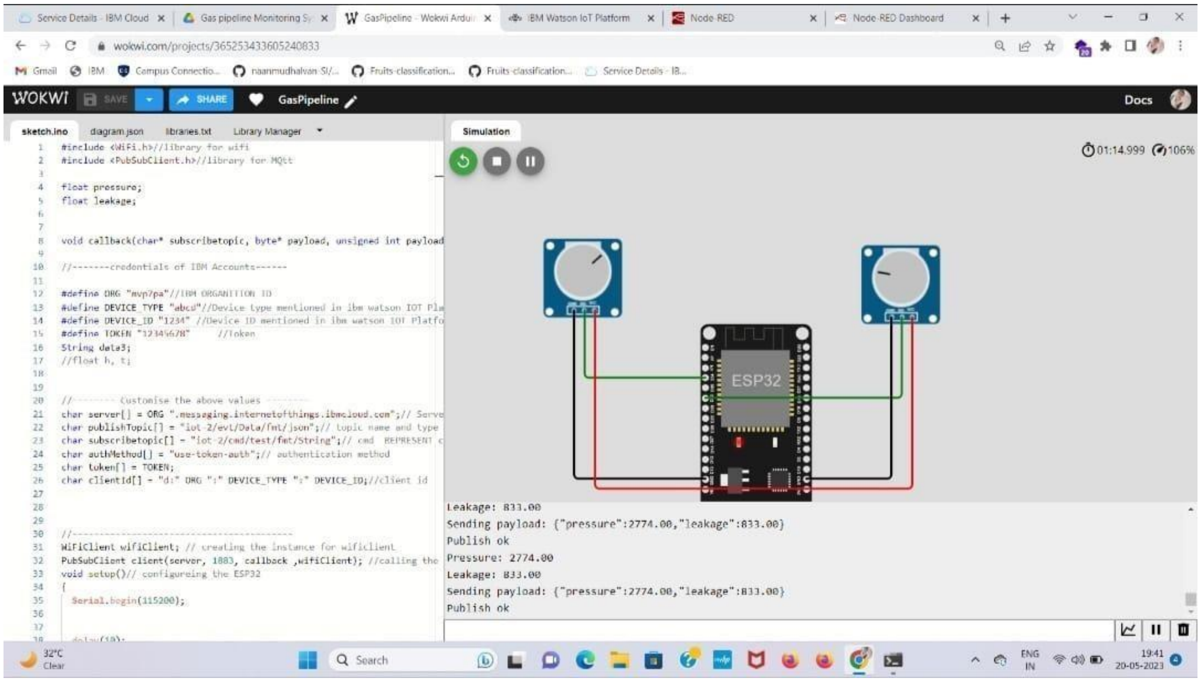
OUTPUT:

WOWKI TO IBM CLOUD :



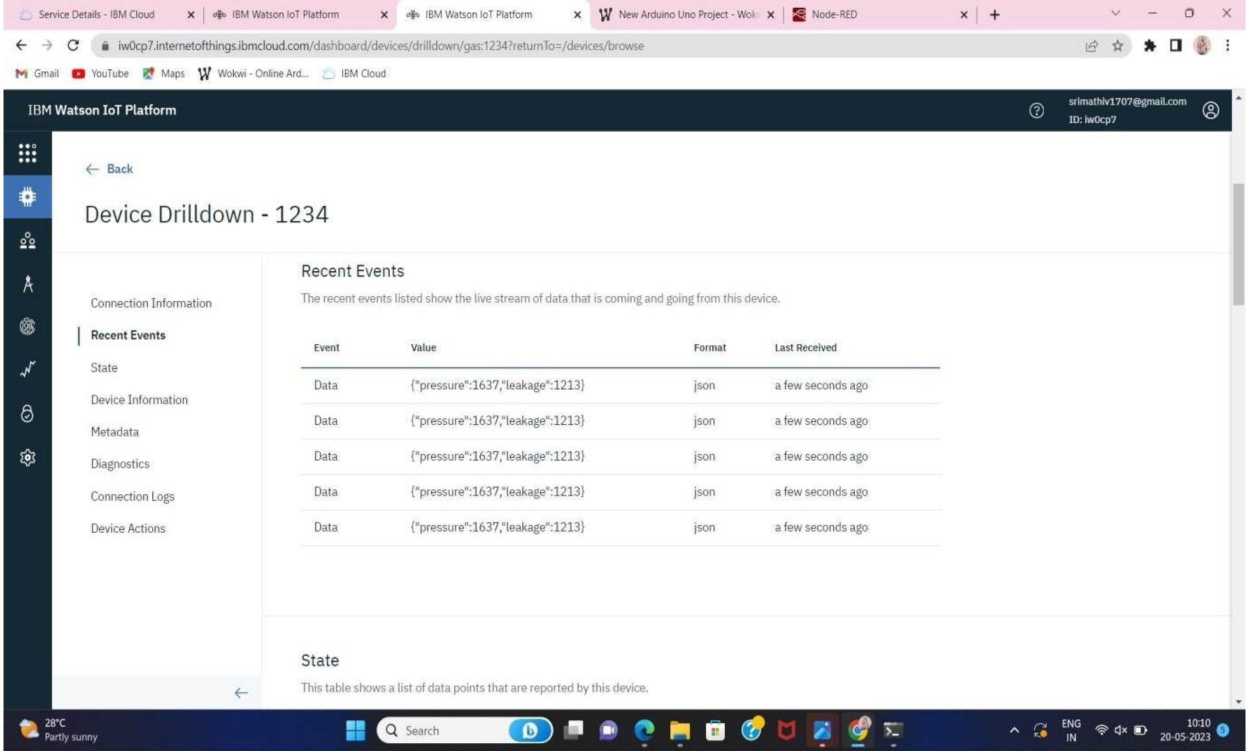
```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt

float pressure;
float leakage;


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

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

#define ORG "iw0cp7"//IBM ORGANITION ID
#define DEVICE_TYPE "gas"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "1234"
//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "123456789"     //Token
String data3;
//float h, t;


//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform and format in which data to be send
char subscribetopic[] = "iot-2/cmd/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
```

WOKWI TO IBM CLOUD:



```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt

float pressure;
float leakage;


void callback(char* subscribetopic, byte* payload, unsigned int payload

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

#define ORG "mvp7pa"//IBM ORGANITION ID
#define DEVICE_TYPE "abcd"//Device type mentioned in ibm watson IOT Pla
#define DEVICE_ID "1234" //Device ID mentioned in ibm watson IOT Platfo
#define TOKEN "12345678"     //Token
String data3;
//float h, t;


//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Serve
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type
char subscribetopic[] = "iot-2/cmd/test/fmt/String";// cmd  REPRESENT c
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
void setup()// configureing the ESP32
{
  Serial.begin(115200);


  delay(10);
```

```
Leakage: 833.00
Sending payload: {"pressure":2774.00,"leakage":833.00}
Publish ok
Pressure: 2774.00
Leakage: 833.00
Sending payload: {"pressure":2774.00,"leakage":833.00}
Publish ok
```


iw0cp7.internetofthings.ibmcloud.com/dashboard/devices/drilldown/gas:1234?returnTo=/devices/browse
IBM Watson IoT Platform
srimathiv1707@gmail.com
ID: iw0cp7
Back

Device Drilldown - 1234

Connection Information
Recent Events
State
Device Information
Metadata
Diagnostics
Connection Logs
Device Actions

Recent Events

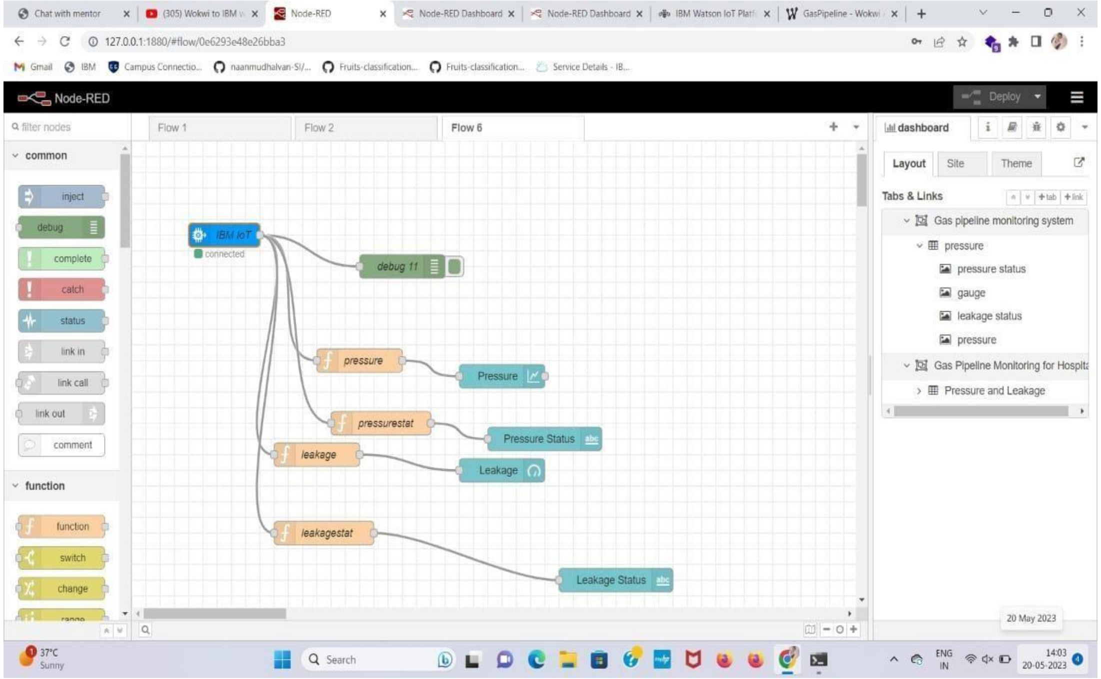
The recent events listed show the live stream of data that is coming and going from this device.

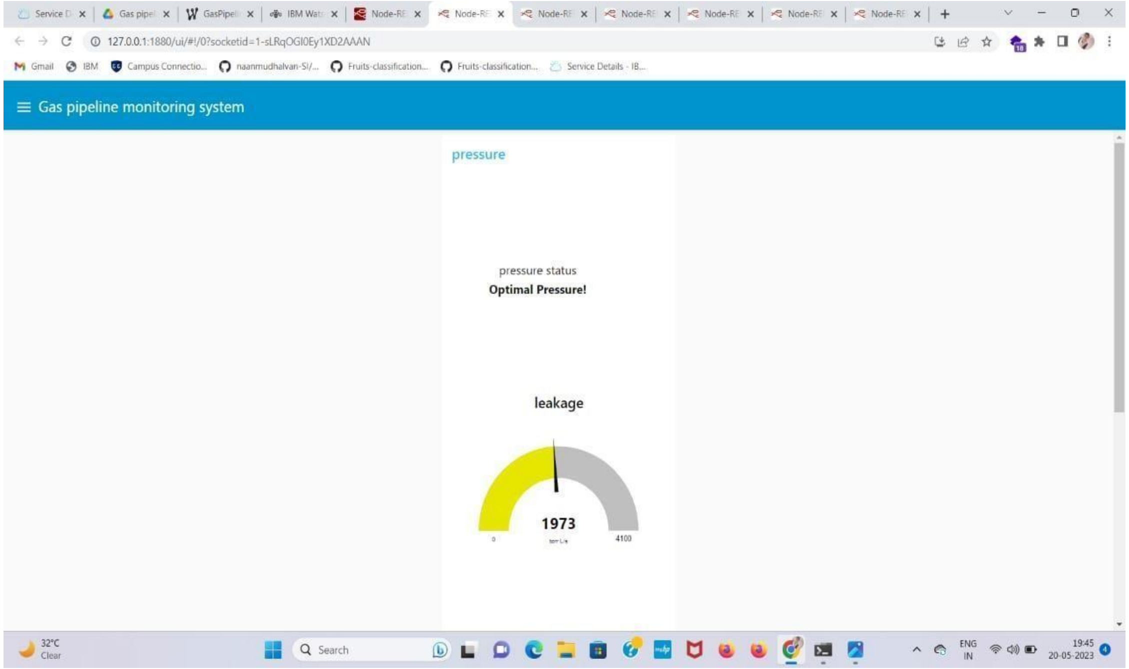
Event	Value	Format	Last Received
Data	{"pressure":1637,"leakage":1213}	json	a few seconds ago
Data	{"pressure":1637,"leakage":1213}	json	a few seconds ago
Data	{"pressure":1637,"leakage":1213}	json	a few seconds ago
Data	{"pressure":1637,"leakage":1213}	json	a few seconds ago
Data	{"pressure":1637,"leakage":1213}	json	a few seconds ago

State

This table shows a list of data points that are reported by this device.

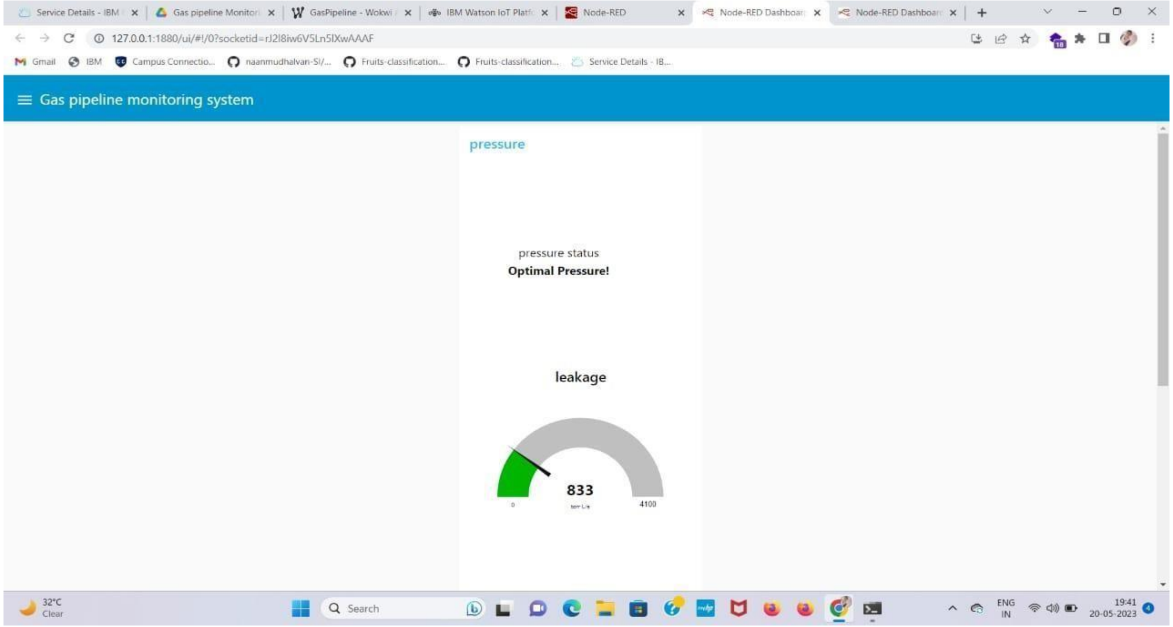
WOKWI TO NODE-RED:





pressure status
Optimal Pressure!

OPTIMAL PRESSURE :



Gas pipeline monitoring system

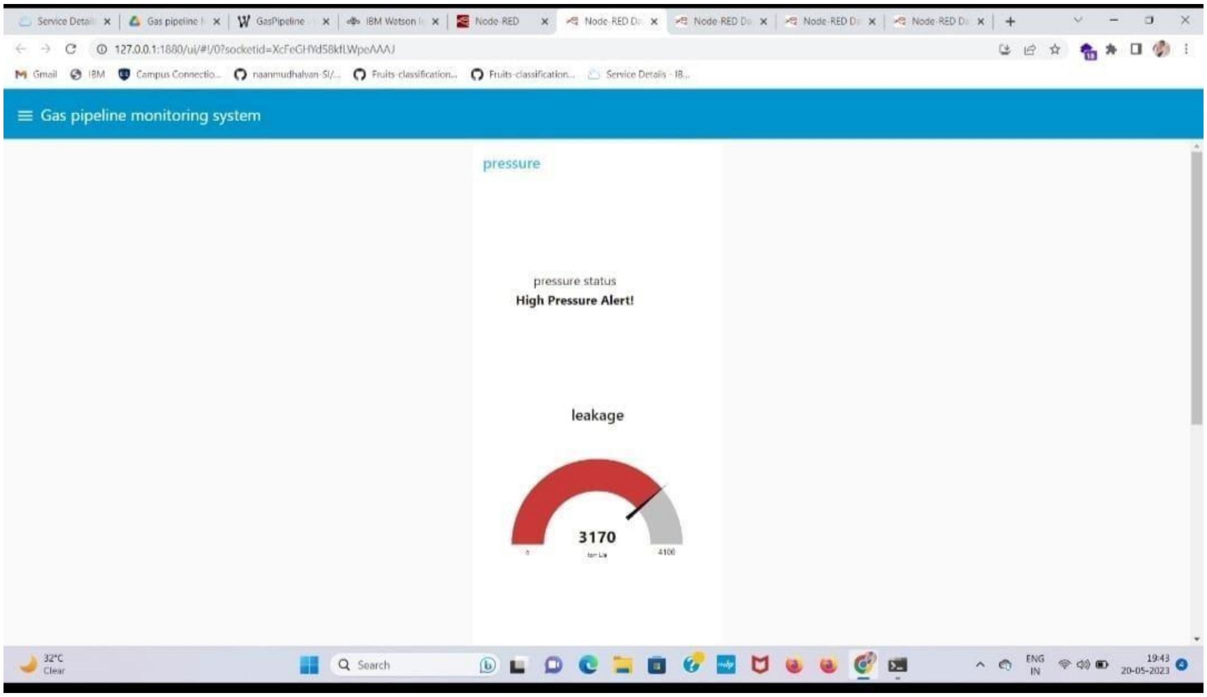
pressure

pressure status
Optimal Pressure!

leakage

833

0 4100



Gas pipeline monitoring system

pressure

pressure status
High Pressure Alert!

leakage

3170

0 4100

8.TESTING:

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies,assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testingrequirement.

TYPES OF TESTS

Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce validoutputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done afterthe completion of an individual unit before integration. This is a testing, that relies on knowledge of its construction and is invasive. Unittests perform basic tests at component level and test a specific businessprocess, application, and/or system configuration. Unit tests ensure thateach unique path of a business process performs accurately to the
documented specifications and contains clearly defined inputs and expectedresults.

Integration testing

Integration tests are designed to test integrated software components to determine if they run as one program. Testing is event driven and is moreconcerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction,as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing isspecifically aimed at exposingthe problems that arise from the combination ofcomponents

Functional test

Functional tests provide systematic demonstrations that functions testedare available as specified by the business and technical requirements, system documentation, and user manuals**.**

Functional testing is centered on the following items

Valid Input : identifiedclasses of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must beexercised.

Output : identified classes of application outputs must be exercised. Systems/Procedures: interfacing systems or procedures must be invoked.Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration-oriented systemintegration test. System testing is based on process descriptions and flows,emphasizing pre-driven process links and integration points.

White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the

inner workings, structure and language of the software, orat least its purpose. It is purpose. It is used to test areas that cannot bereached from a black box level.

Black Box Testing

Black Box Testing is testing the software without any knowledge of the innerworkings, structure or language of the module being tested. Black box tests,as most other kinds of tests, must be written from a definitive source document, such as specification requirements document, such as specification or requirements document. It is a testing in which the softwareunder test is treated, as a black box.you cannot "see" into it.

Unit Testing

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding andunit testing to be conducted as two distinct phase test phase of the software lifecycle.

Test strategy and approach

Field testing will be performed manually, and functional tests will be writtenin detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link. · The entry screen,messages and responses must not be delayed.

Features to be tested

· Verify that the entries are of the correct format

· No duplicate entries should be allowed

· All links should take the user to the correct page.

Integration Testing

Software integration testing is the incremental integration testing of two ormore integrated software components on a single platform to produce failures caused by interface defects.

The task of the integration test is to check that components or softwareapplications,

e.g. components in a software system or – one step up – softwareapplications at the company level – interact without error.

Test Results: All the test cases mentioned above passed successfully.

Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the systemmeets the functional requirements.

8. RESULT:

MOBILE APPLICATION USING MIT

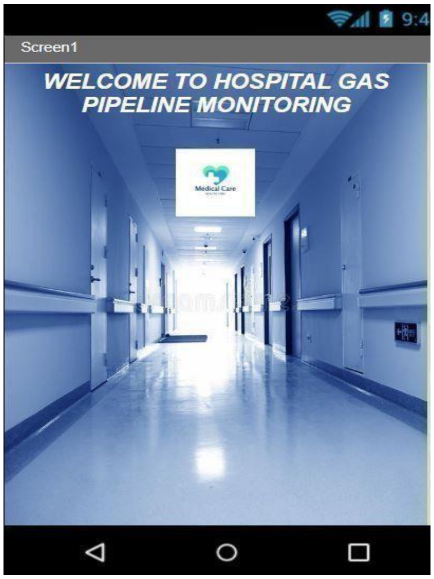
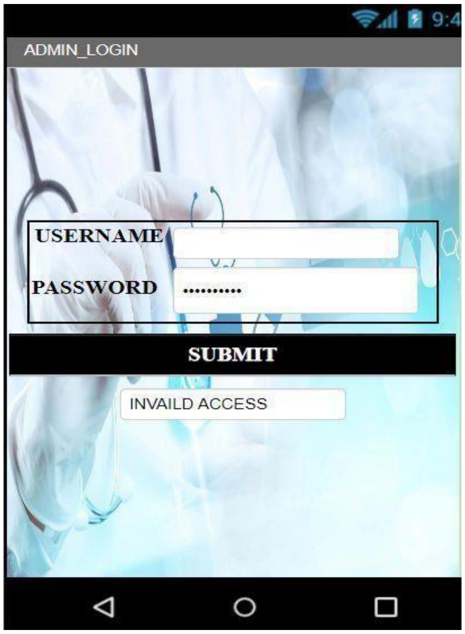


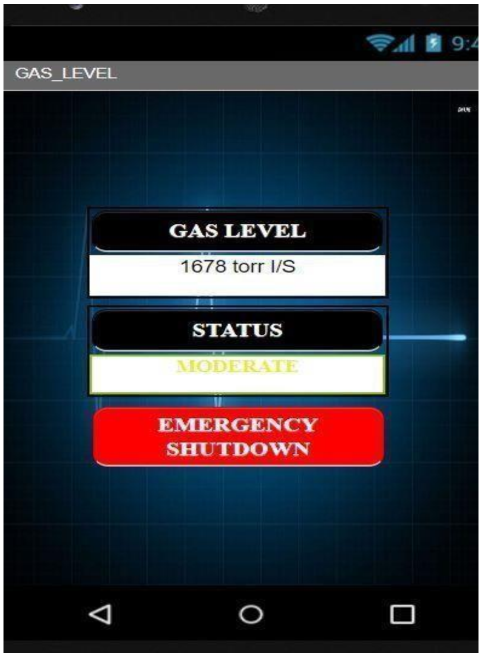
Figure 8.1: Home page of the app



PASSWORD ....

INVAILD ACCESS

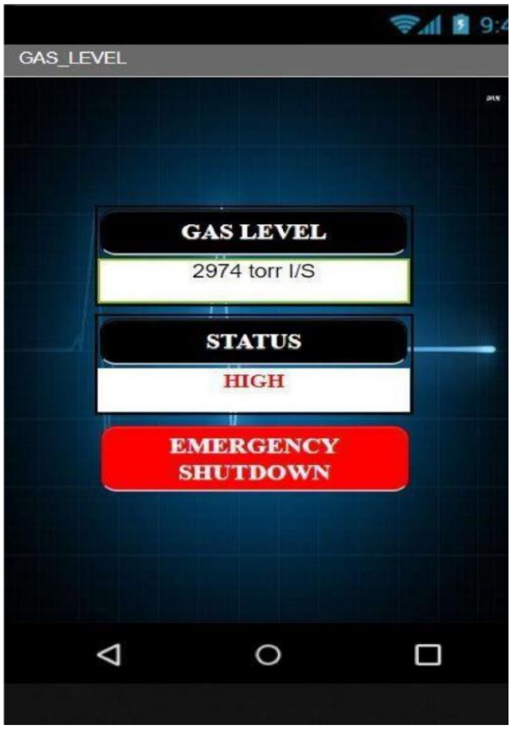
Figure 8.2: Enter user name and password



GAS LEVEL: 1678 torr l/S

STATUS: MODERATE

Figure 8.3: Gas_level(Moderate)


GAS_LEVEL

GAS LEVEL

2974 torr l/S

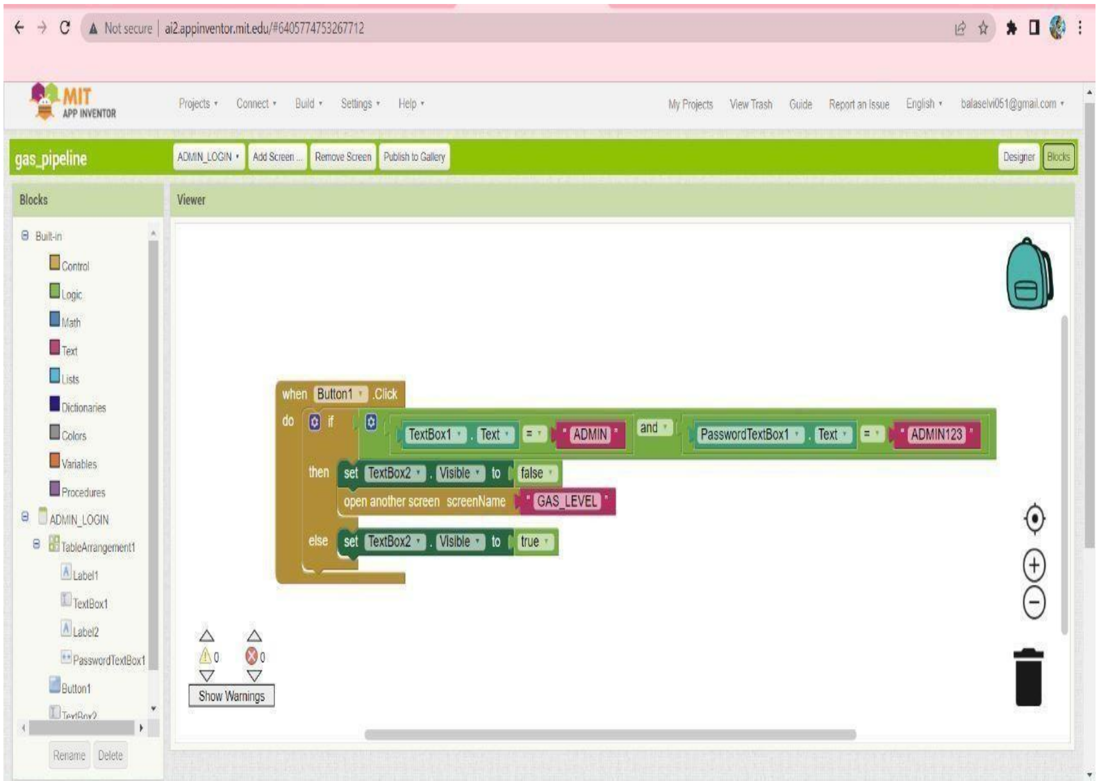
STATUS

HIGH

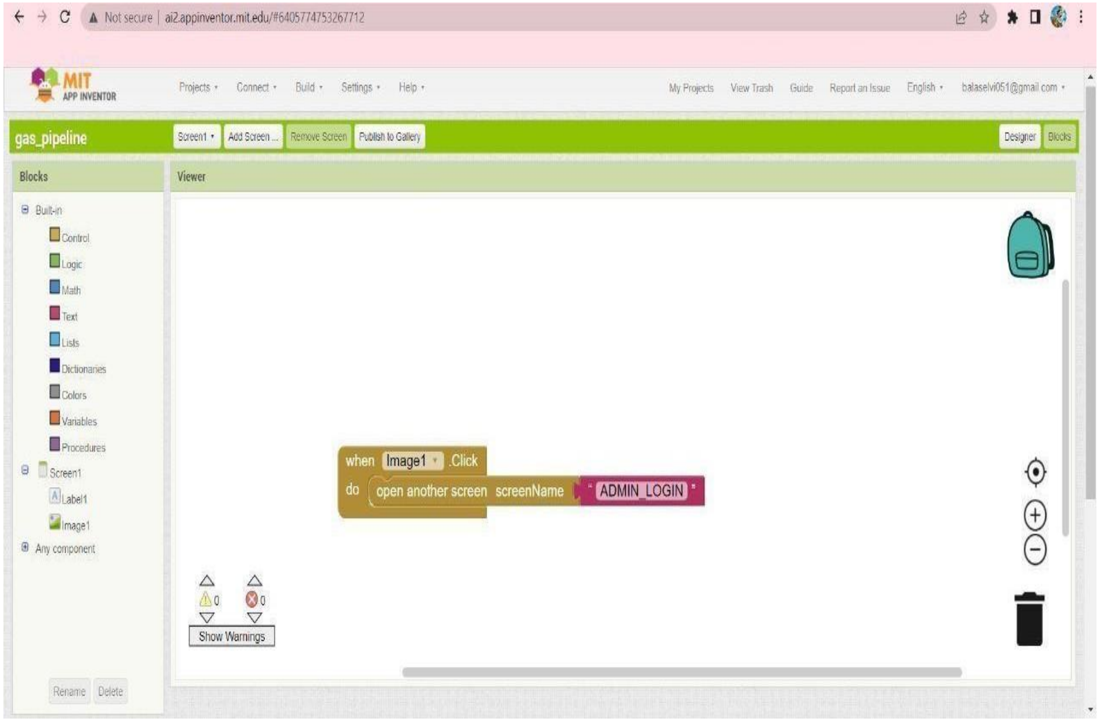
EMERGENCY SHUTDOWN

Figure 8.4: Gas_level(High)

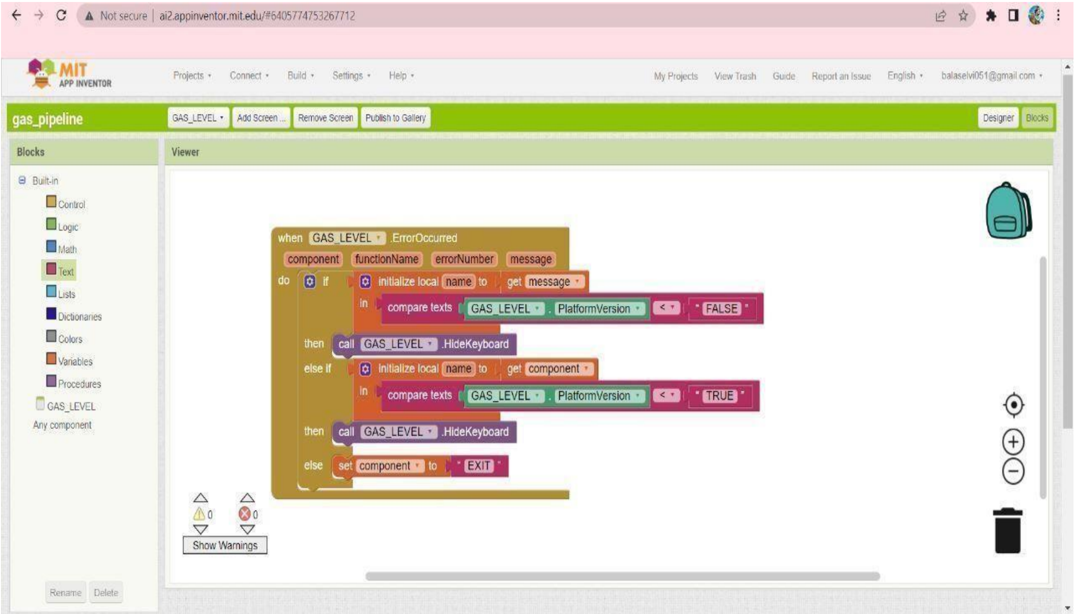
BLOCKS



```
when Button1 .Click
do  if    TextBox1 . Text = " ADMIN "  and  PasswordTextBox1 . Text = " ADMIN123 "
    then  set TextBox2 . Visible to false
          open another screen screenName " GAS_LEVEL "
    else  set TextBox2 . Visible to true
```



```
when Image1 .Click
do  open another screen  screenName  " ADMIN_LOGIN "
```



```
when GAS_LEVEL .ErrorOccurred
 component  functionName  errorNumber  message
do  if      initialize local name to  get message
            in  compare texts  GAS_LEVEL . PlatformVersion  <  " FALSE "
    then    call GAS_LEVEL .HideKeyboard
    else if initialize local name to  get component
            in  compare texts  GAS_LEVEL . PlatformVersion  <  " TRUE "
    then    call GAS_LEVEL .HideKeyboard
    else    set component to  " EXIT "
```

9.ADVANTAGES:

- **Safety:** Gas pipeline monitoring system is ensuring the safety of patients, staff, and thefacility itself. It continuously monitors the gas supply lines for leaks, pressure in fluctuations, or other abnormalities. By detecting and alerting the relevant personnelabout any potential gas leaks or issues, it helps prevent accidents, fire hazards, and gasrelated incidents.
- **Early detection and response:** A gas pipeline monitoring system provides early detection capabilities, allowing staff to respond quickly to any gas-related issues.
- **Remote monitoring and alerts:** Allows authorized personnel to monitor the gas supplylines from a centralized location, such as a control room or a designated monitoring station.
- **Data logging and analytics:** They can capture and store historical data related to gaspressure, flow rates, temperature, and other relevant parameters.
- **Compliance and regulatory requirements:** Hospitals are subject to various safety regulations and standards, including those related to gas supply systems. Implementinga gas pipeline monitoring system helps ensure compliance with these requirements.
- **Cost savings:** By minimizing the potential risks and associated expenses, gas pipelinemonitoring system can lead to cost savings in terms of repairs, insurance claims, and operational disruptions.

11.CONCLUSION:

The gas pipeline monitoring system for hospitals utilizing a servo motor throughIoT offers a comprehensive and efficient solution for ensuring the safety and reliability of gas supply within medical facilities. By integrating IoT technologies,such as sensors and connectivity, with a servo motor, the system can effectivelymonitor gas pipelines, detect anomalies, and take appropriate actions in realtime.

It increases safety, reliability, and efficiency to hospitals. It not only provides a proactive approach to prevent gas-related accidents but also enables remote monitoring and control, ensuring quick response and efficient management. Byimplementing this system, hospitals can enhance patient safety, streamline operations, and improve the overall quality of healthcare services.

9.FUTURE SCOPE:

- Improve the sensitivity and accuracy of gas sensors used in the monitoring system. This could involve using advanced gas detection technologies such as laser-based sensors, electrochemical sensors, or optical sensors to detect gas leaks or abnormalities more effectively.
- Develop advanced algorithms and data analytics techniques to process andanalyze the data collected from the gas monitoring system in real-time.
- Implement predictive maintenance techniques to anticipate and preventpotential gas pipeline issues before they occur.

12.APPENDIX:

GITHUB LINK:

https://github.com/naanmudhalvan-SI/PBL-NT-GP--2781-1680624421

DEMO VIDIO LINK:

https://youtu.be/WthIEulkYe8