

PROJECT REPORT

IOT BASED GAS LEAKAGE MONITORING ALERTING SYSTEM FOR INDUSTRIES

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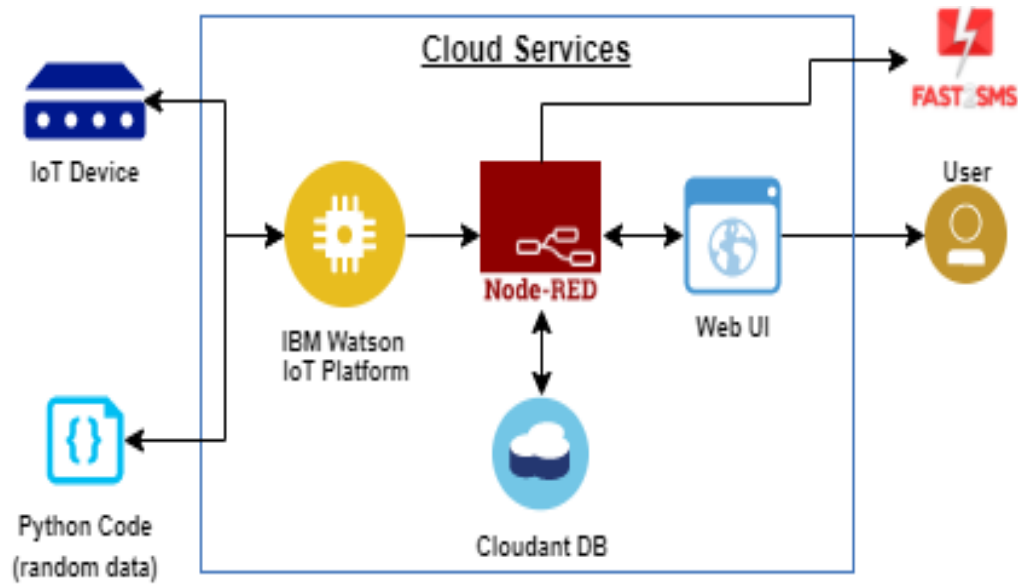
1 INTRODUCTION

1.1 OVERVIEW

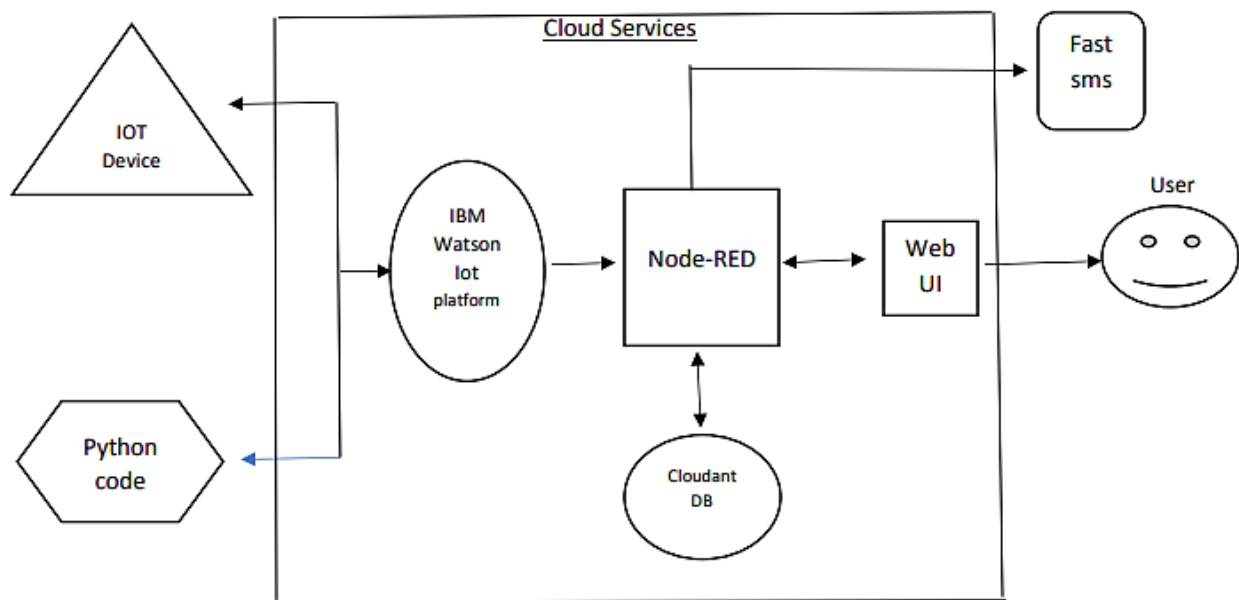
The Internet of Things is a developing theme of specialized, social, and monetary centrality. Customer items, tough goods, cars and trucks, modern and utility segments, sensors, and other regular articles are being joined with Internet availability and amazing information systematic capacities that guarantee to change the manner in which we work, live, and play. The expansive scale usage of IoT gadgets guarantee to change numerous parts of the manner in which we live. For shoppers, new IoT items like Internet-empowered machines, home mechanization parts, and vitality the executive's gadgets are pushing us toward a dream of the "savvy home", offering greater security and vitality effectiveness. The Internet of Things (IoT) is an essential theme in innovation industry, strategy, and designing circles. IoT frameworks like arranged vehicles, savvy traffic frameworks, and sensors implanted in streets and scaffolds draw us nearer to "brilliant urban areas", which help limit clog and vitality utilization. IoT innovation offers the likelihood to change horticulture, industry, and vitality creation and dissemination by expanding the accessibility of International Journal of Scientific Research in Science and Technology data along the esteem chain of generation utilizing arranged sensors.

Block diagram:

Technical Architecture:



Structural Architecture:



Literature Survey:

Title/Author name	Year	Technique	Findings
Gas leakage monitoring and alerting system E. Jebamalar Leavline ¹ , D. Asir Antony Gnana Singh ² , B. Abinaya ³ H. Deepika ⁴	2017	Gas sensor	The sensor used to monitor indoor natural gas on the basis and will sound the alarm if the gas exceeds the limit
Gas leakage monitoring and alerting system Rohan Chandra Pandey ¹ , Manish Verma ² , Lumesk Kumar Sahu ³	2017	Air pollution monitoring gas sensor and raspberry pi	It's necessary to detect the components of the air. It is used in smoke detector
Gas leakage monitoring and alerting system Pranay Meshram ¹ , Stuti Mendhekar ² , Renuka Gadge ³ , Nancy Shukla ⁴ , Shivani Kanaskar ⁵	2019	Android app, Gas leakage, IoT, LPG, Sensors	If gas is detected, the red light will light up the buzzer will activate then the system sends a notification message

Gas leakage detection and alerting system R. Sudha, S. Arun Prasad.	2022	Node MCU, smartphone, gas sensor	It's an open-source platform based on ESP8266 it can connect object and let data transfer using Wi-Fi protocols
Gas leakage monitoring and alerting system using Arduino Ayesha Siddika, Imam Hossain	2018	Gas sensor, GSM module, microcontroller	It's a device that uses GSM mobile telephone technology to provide a wireless data link to network
Gas pipe leakage detection and alerting system using IoT Pala Mahesh Kumar, Suman Mishra	2019	Raspberry pi, LPG Sensor	MQ sensors are used to detect the concentration of gas and it's also used in gas detecting equipment
Gas leakage monitoring system using MQ 5 sensor Muhammad Ahmad Baballe, Usman Yusuf, Magashi, Munzali Surajo	2018	MQ 5 sensor, Arduino, detection system	Arduino is a microcontroller board based on the Atmega328p

Reference:

- 2013.Arun Raj, Athira Viswanathan, Athul T S, "LPG Gas MonitoringSystem", International Journal of Innovative Technology andResearch, Volume 3, Issue 2, February 2015, Pg – 1957 to 1960.
- S Shyamaladevi, V. G. Rajaramya, P. Rajasekar, P. SebastinAshok, "ARM7 based automated high-performance systemfor LPGrefill booking & leakage detection", Journal of VLSI Design andSignal Processing", Volume 3, Issue 2, 2014.
- S. Sharma, V. N. Mishra, R. Dwivedi, R. Das, "Classificationof gases/odours using Dynamic Response of Thick FilmGas SensorArray", IEEE Conference on Sensors Journal, 2013.
- Ankit Sood, Babalu Sonkar, Atul Ranjan, Mr. Ameer Faisal, "Microcontroller Based LPG Gas Leakage Detector Using GSMModule", International Journal of Electrical and Electronics Research, Volume 3, Issue2, AprilJune 2015.
- Rajeev B. Ahuja, Jayant K. Dash, Prabhat Shrivastava, "A comparativeanalysis of liquefied petroleum gas (LPG) and kerosene relatedburns", Burns, Volume 37, Issue 8, December 2011.
- Shivalingesh B. M, Ramesh C, Mahesh S. R, Pooja R, Preethi K. Mane, Kumuda S, "LPG Detection, Measurement and Booking System", IJRSI, Volume 1, Issue 4, November 2014.

Problem Statement:

Gas Leaks from equipment can become dangerous. Conducting routine leak detection inspections to a facility can help prevent unexpected incidents. By Installing gas leakage detection system to prevent these unexpected incidents.

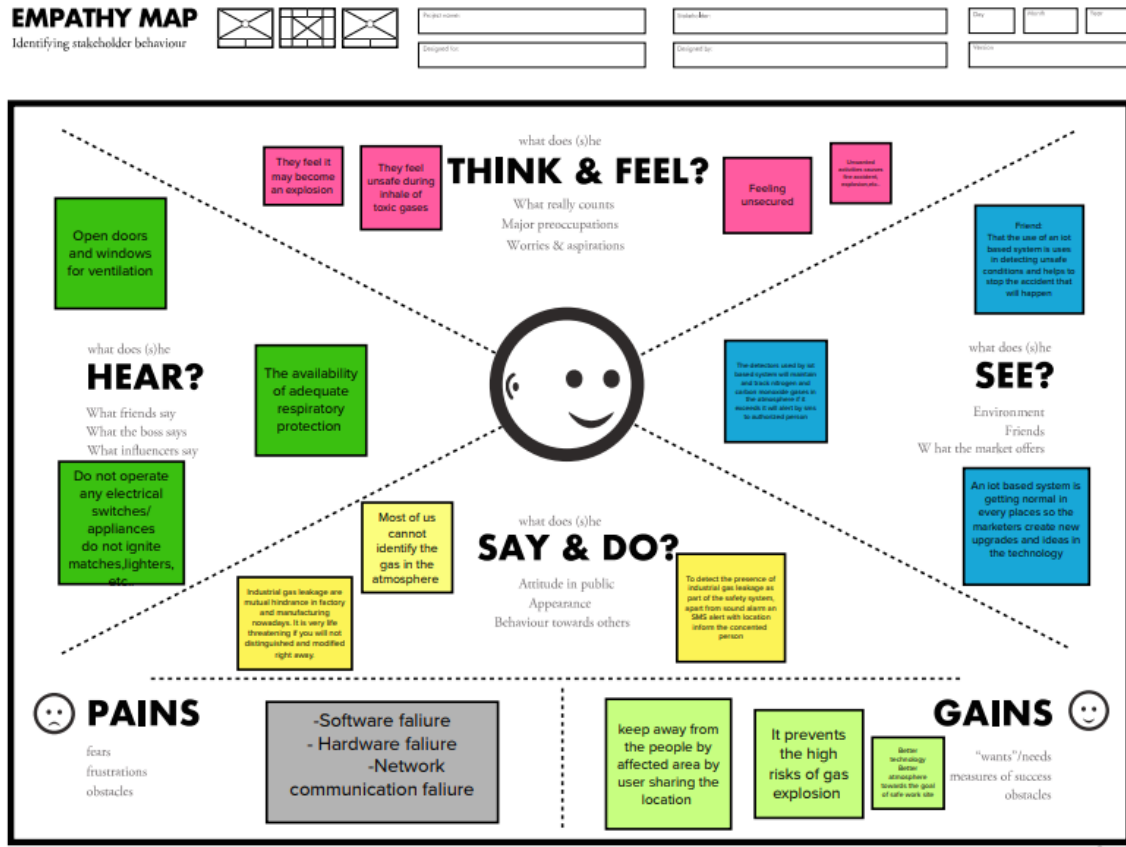
I am	I am worker who was working in an industries.
I am trying to	I want to device which will detect gas leakage in industries.
But	There is no device to detect gas leakage and alerting system in industries.
Because	There is no installation of gas leakage detecting device to identify gas leakage.
Which makes me feel	Which will makes me to feel confusion.

Example:

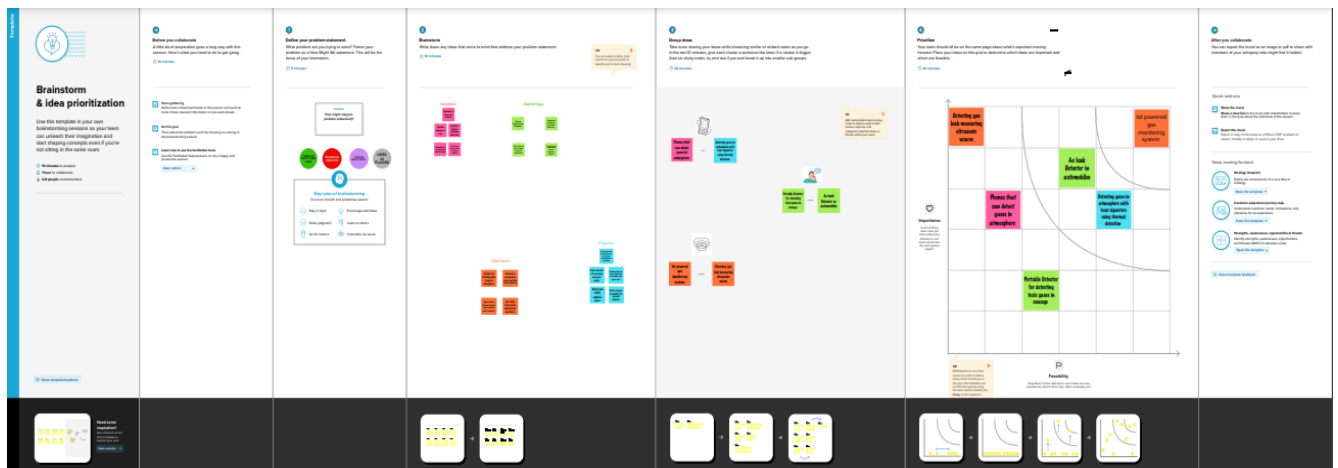


Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	worker	detect leakage in gas	it is difficult to identify leakage in gas	there is no device for identifying gas leakage.	confusion
PS-2	Chemical Engineer	to detect gas leakage with detail of temperature	it is difficult to identify leakage in	there is no device for identifying gas leakage.	frustration

Empathy map canvas:



Ideation and Brainstorming:



Proposed Solution:

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	People usingLPG in theirlife, so this is to ensure the safe usage of LPG usage in homes.
2.	Idea / Solution description	*Detection of gas leakage *Automatic shut Off Valve *Alerting thecustomer through text Notification
3.	Novelty / Uniqueness	The use of DC motor helps to close the nob immediately if gas leakage is sensed notification will automatically alert the customer through GSM module notification.Hence, we can avoid explosion in industries/house.
4.	Social Impact / Customer Satisfaction	Customers can be live freely withoutthe worry of gas leakage.
5.	Business Model (Revenue Model)	*Low Budget *Easy to fix *Quick actionof an incident *No worries of anyleakage explosion
6.	Scalability of the Solution	After Sending Notification Automatic Alarms to be fixedin the House/Industries if any gas leakage occurs.

Problem Solution fit:



Requirement Analysis:

Functional Requirements:

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 OTP Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Dashboard	Can access the dashboard

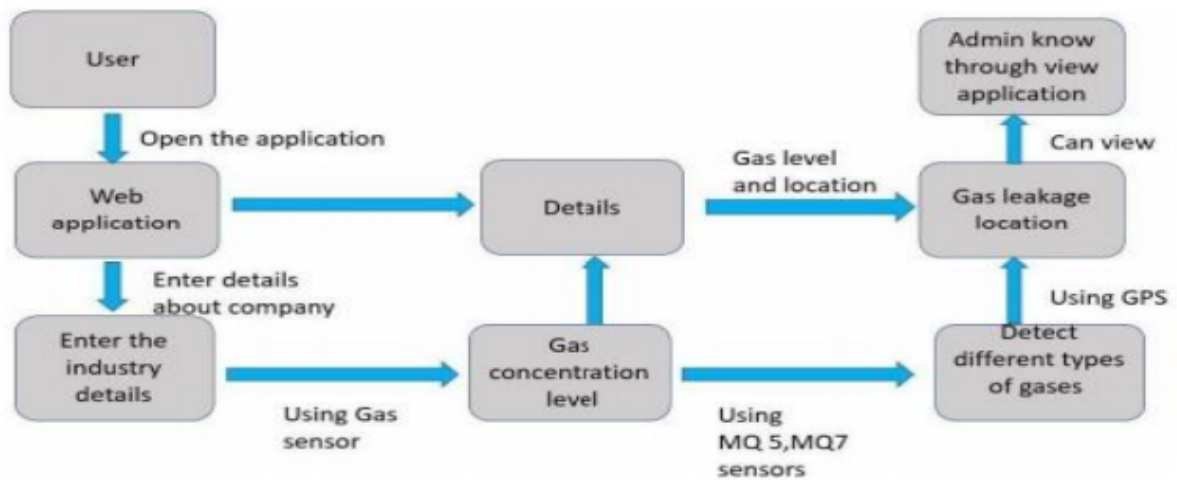
Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	To determine the type of Gas leak in the industries
NFR-2	Security	Manage the safety and security of the customer
NFR-3	Reliability	The system is more reliable because of its Quick response and system security.
NFR-4	Performance	Because of the system efficiency the System Performance are high
NFR-5	Availability	Low availability sometimes because of the Slow network connection.
NFR-6	Scalability	Only the User can be accessing the data.

Project Design:

Data Flow Diagram:



Technical Architecture:

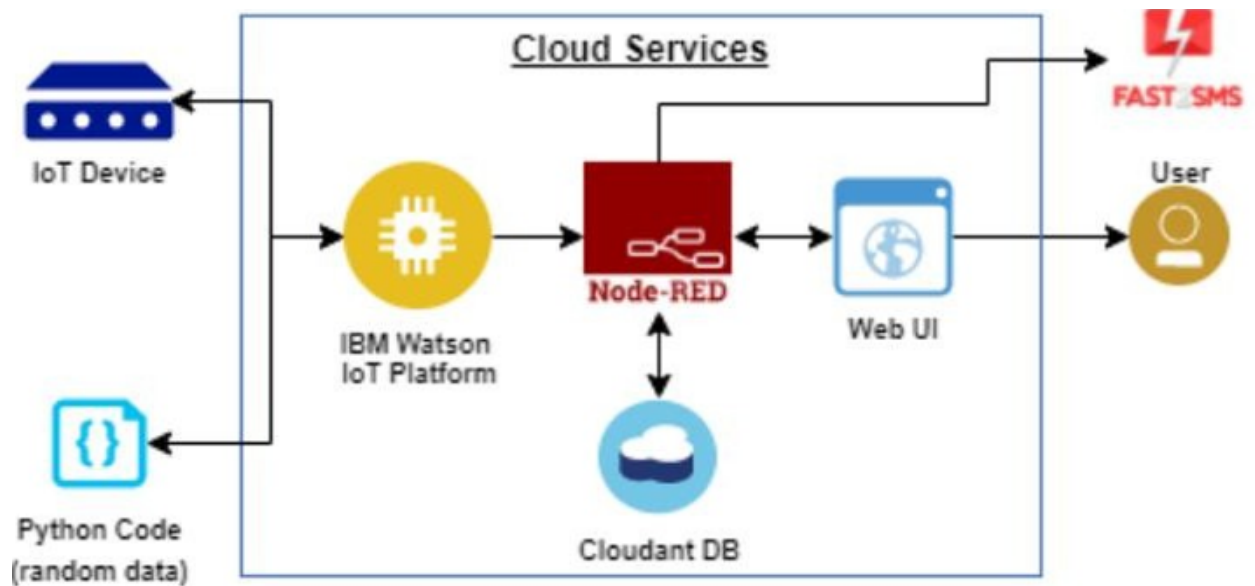


Table-1: Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Mobile App	IOT Platform
2.	Application Logic-1	Mobile App to identify the Gas leak	
3.	Application Logic-2	Gets the location of the leakage data from database	Python
4.	Application Logic-3	Converts the Data into a text Notification and alert	IBM Watson IoT API Call data
5.	Database	Incident location and kind of leakage	IBM Watson Assistant
6.	Cloud Database	Call the data IBM Cloud is used and user login credentials	MySQL
7.	File Storage	App code and IoT credentials are stored and API keys	IBM DB2, IBM Cloudant
8.	External API-1	To get the status of location of gas leak	IBM Block Storage
9.	External API-2	To get the login credentials in IBM DB2	IBM box status API
10.	Machine Learning Model	To convert the Gas leak location and to alert for averting Incident	Username and Password API
11.	Infrastructure (Server/ Cloud)	To host the server and application	Notification alert
			Cloud Foundry, Node Red

Table-2: Application Characteristics:

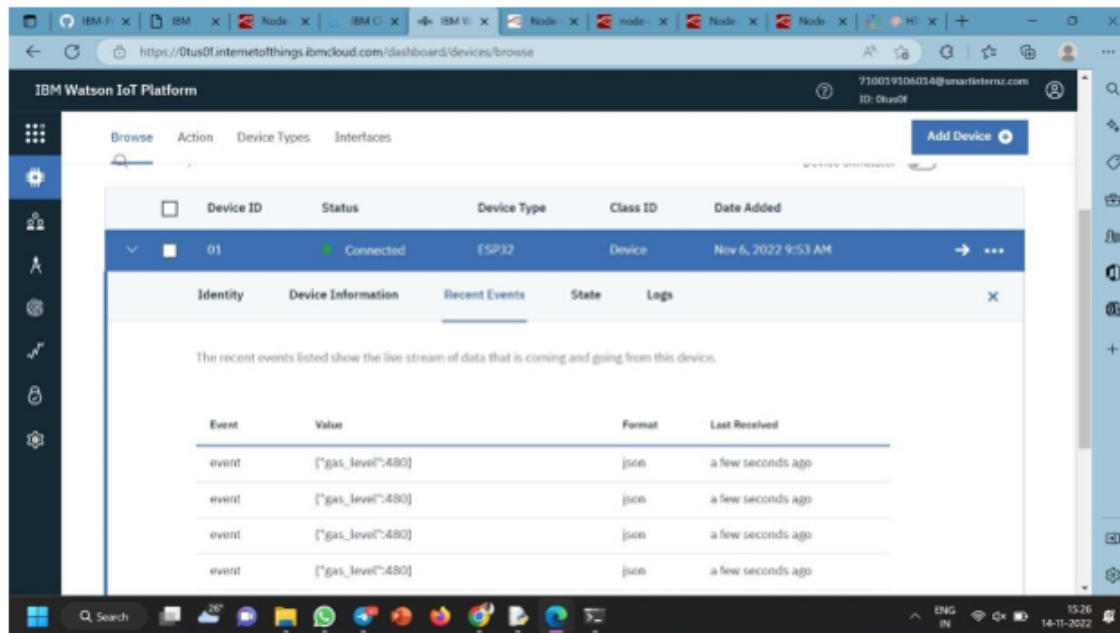
S.N	Characteristics	Description	Technology
1.	Open-Source Frameworks	To develop the application interface, we use IOT Device	IOT Device
2.	Security Implementations	To secure the users login credentials and personal information	IBM Watson IOT platform
3.	Scalable Architecture	To scale the application database	IBM Auto scaling
4.	Availability	To make use the application and data are available 24/7	IBM Cloud load balancer
5.	Performance	To increase the performance the application is hosted in the high-performance instance	IBM instance

User Stories:

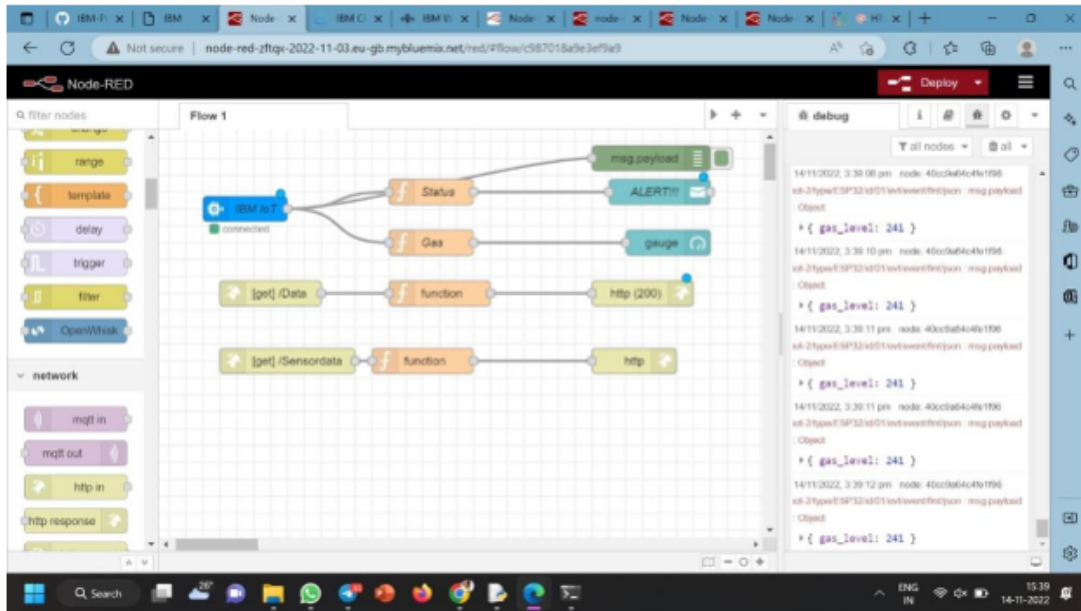
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through OTP	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering Login Id & password		High	Sprint-1
	Dashboard					

Project planning and Scheduling:

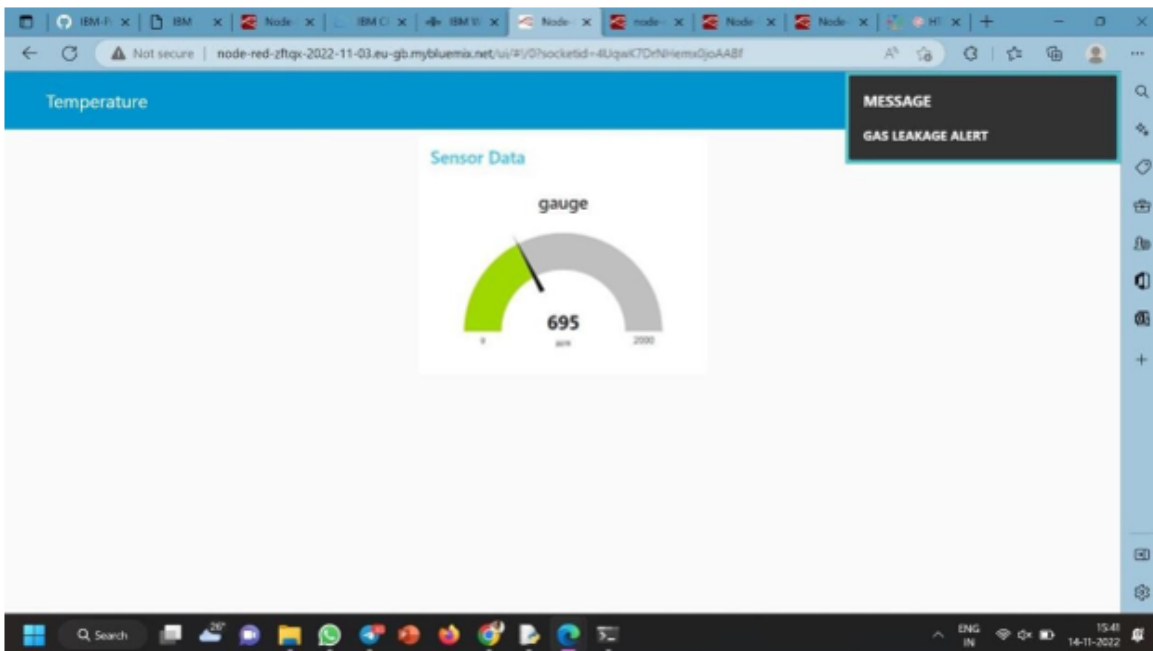
Step 1: Creating IBM Watson and Node red.

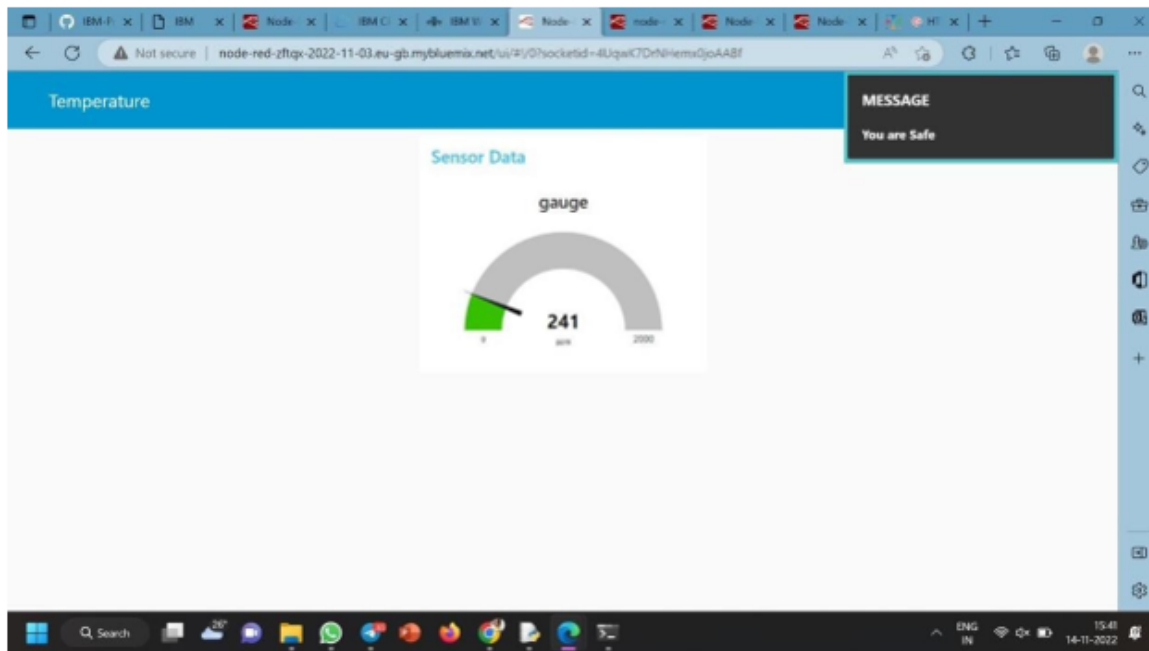


Step 2: Connecting the flow with IBM modules with node red package.



Step 3: By using Python we have connecting with Ibm authentication keys.





Testing:

Test case 1:

Amazing Craft-Habbi

Simulator time: 00:00:49

Code Stop Simulation Send To

1 (Arduino Uno R3)

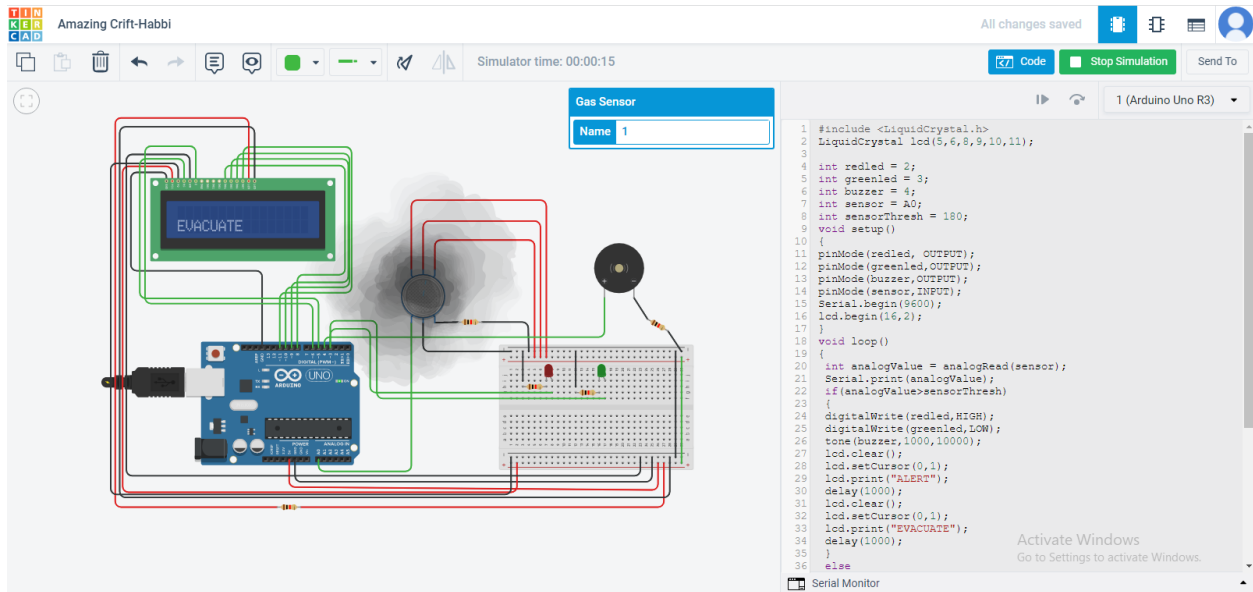
```
1 #include <LiquidCrystal.h>
2 LiquidCrystal lcd(5,6,9,9,10,11);
3
4 int redled = 2;
5 int greenled = 3;
6 int buzzer = 4;
7 int sensor = A0;
8 int sensorThresh = 180;
9 void setup()
10 {
11   pinMode(redled, OUTPUT);
12   pinMode(greenled, OUTPUT);
13   pinMode(buzzer, OUTPUT);
14   pinMode(sensor, INPUT);
15   Serial.begin(9600);
16   lcd.begin(16,2);
17 }
18 void loop()
19 {
20   int analogValue = analogRead(sensor);
21   Serial.print(analogValue);
22   if (analogValue > sensorThresh)
23   {
24     digitalWrite(redled, HIGH);
25     digitalWrite(greenled, LOW);
26     tone(buzzer, 1000, 10000);
27     lcd.setCursor(0,1);
28     lcd.print("ALERT");
29     delay(1000);
30     lcd.setCursor(0,1);
31     lcd.print("EVACUATE");
32     delay(1000);
33   }
34   else
35   {
36     digitalWrite(redled, LOW);
37     digitalWrite(greenled, HIGH);
38     lcd.setCursor(0,1);
39     lcd.print("ALL CLEAR");
40     delay(1000);
41   }
42 }
```

Activate Windows
Go to Settings to activate Windows.

Serial Monitor

Industries at normal temperature, it is not alerted.

Test case 2:



Due to gas leakage in industries, this circuit model is alerting through Alarm. It will be monitor and rectify by workers in industries

```
#include <LiquidCrystal.h>
```

```
LiquidCrystal lcd(5,6,8,9,10,11);
```

```
int redled = 2;
int greenled = 3;
int buzzer = 4;
int sensor = A0;
int sensorThresh = 180;
void setup()
{
  pinMode(redled, OUTPUT);
  pinMode(greenled, OUTPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(sensor, INPUT);
  Serial.begin(9600);
```

```
lcd.begin(16,2);
}
void loop()
{
  int analogValue = analogRead(sensor);
  Serial.print(analogValue);
  if(analogValue>sensorThresh)
  {
    digitalWrite(redled,HIGH);
    digitalWrite(greenled,LOW);
    tone(buzzer,1000,10000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("Alert");
    delay(1000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("Evacuvate");
    delay(1000);
  }
  else
  {
    digitalWrite(greenled,HIGH);
    digitalWrite(redled,LOW);
    noTone(buzzer);
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("SAFE");
    delay(100);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("All Clear");
    delay(1000);
  }
}
```

List of components:

Name	Quantity	Component
GAS1	1	Gas Sensor
PIEZO1	1	Piezo
M1	1	DC Motor
S2	1	Pushbutton
D1	1	Red LED
Rpot2	1	250 k Ω Potentiometer
R1,R3	2	1 k Ω Resistor
R2	1	330 Ω Resistor
U2	1	LCD 16 x 2
U3	1	Arduino Uno R3

Arduino UNO R3:

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The term Uno means "one" in the language of "Italian" and was selected for marking the release of Arduino's IDE 1.0 software. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the reference versions of Arduino and currently progressed to new releases.

Breadboard:

A breadboard is a widely used tool to design and test circuit. You do not need to solder wires and components to make a circuit while using a bread board. It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle.

LED:

LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electro-luminescence. Electro-luminescence is the property of the material to convert electrical energy into light energy and later it radiates this light energy. In the same way, the semiconductor in LED emits light under the influence of electric field.

Resistor:

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

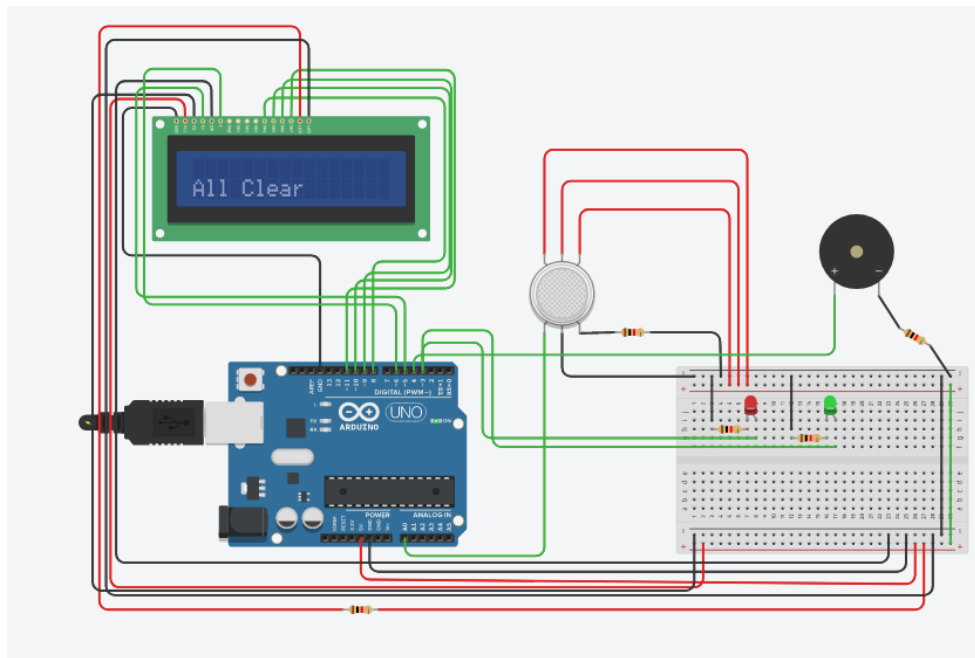
Gas Sensor:

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas, the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value, the type and concentration of the gas can be estimated.

LCD 16*2: 16×2:

LCD is one kind of electronic device used to display the message and data. The term LCD full form is Liquid Crystal Display. The display is named 16×2 LCD because it has 16 Columns and 2 Rows. It can display $(16 \times 2 = 32)$ 32 characters in total and each character will be made of 5×8 Pixel Dots.

Circuit Diagram:



Advantage and Disadvantage:

Advantage:

- ☆ This project helpful for detecting gas leakage in Industries
- ☆ Component and Equipment are more efficient
- ☆ Lower power consumption and reliable.
- ☆ It is also used in house for LPG gas leakage

Disadvantage:

- ☆ Location cannot be identify where gas leaking because there are several areas contain gas cylinder.
- ☆ Its sensitivity depends on Humidity and Temperature.
- ☆ Without Internet, This will not run and work
- ☆ Installation is difficult.

Conclusion:

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by

the GSM module. A sensor node senses gas like CO₂, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.