

**VEL TECH HIGH TECH DR.RANGARAJAN DR.SAKUNTHALA
ENGINEERING COLLEGE**

Gas Leakage Monitoring And Alerting System For Industries

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PROJECT REPORT

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TITLE: Gas Leakage Monitoring And Alerting System For Industries

1.INTRODUCTION :

Now a days the smart safety detection system plays the important role for the security of people. Since all the people from the industry makes impossible to check on the appliances available at work specially gas cylinders, wired circuits, etc. Since last three years there is a tremendous hike in the demands of liquefied petroleum gas (LPG) and natural gas. To meet this access amount of demand for energy and replace oil or coal due to their environmental disadvantage, LPG and natural gas are preferred. These gases are mostly used on large scale in industry, heating, home appliances and motor fuel. So as to track this leakage gas, the system includes MQ6 gas sensor. This sensor senses the amount of gas leak present in the surrounding atmosphere. Through this, explosion or getting affected by the leakage of gas could be avoided.

a. PROJECT OVERVIEW:

The technology includes ultrasonic sensors that determine if the system is being monitoring for industrial purposes or not. If it is discovered that the system is not in use, the device uses an automatic switching off mechanism to cut off the gas supply. The moment gas leakage will probably be recognized, users will be informed via SMS through GSM, and so that user can solve the issue as soon as possible. The system will monitor flame and fire through flame sensor. When a fire is detected, the buzzer begins to sound. Aside from that, the system also has a cloud storage capability. The usage of gas for each user each day may be tracked with the aid of this cloud storage solution. At the end of the day, this procedure will assist in detecting the natural gas usage. The system has been tested and it is able to monitor gas leakage and send a SMS to the user. The resulting performance indicated its effectiveness toward saving a significant portion of the leaked gas in industry.

b. PURPOSE:

The Internet of Things (IoT) is a system of gadgets, vehicles, and home machines that includes hardware, programming, actuators, and networks that allow these things to communicate, collaborate, and share information with each other. Traditional areas such as installed frameworks, remote sensor systems, and computerization of control frameworks (home meters and building mechanization) are all helping drive the Internet of Things. The presence of dangerous gas leaks in homes and workplaces also leads to storage gas tanks with ideal performance characteristics. Gas leaks in industrial areas cause many health problems. In order to prevent such disasters, it is necessary to regularly monitor and control the atmosphere in the workplace and maintain a clean air environment. Leakage of any kind of gas has been a concern in recent years, whether it is in a residential setting and industries. In this paper development of

an IoT based gas leakage monitoring, detecting and alerting system is proposed. This paper elaborates design such an intelligent system that will help save gas and smartly prevent accidents. The device needs to be integrated with the system.

2.LITERATURE SURVEY:

2.1 EXISTING PROBLEM:

Leaks of natural gas and refrigerant gas into the atmosphere are especially harmful due to their global warming potential and ozone depletion potential. Leaks of gases associated with industrial operations and equipment are also generally known as fugitive emissions. While exposure to low levels of natural gas is not harmful, long-term exposure can affect your health. Burning natural gas produces nitrogen oxide, carbon monoxide, and methane. These chemicals can trigger respiratory problems, depression, and decrease the quality of your health.

2.2 REFERENCES:

- Gas Leakage Detection Based on IOT : Kumar A Akshay, Ramya R Shekar, V Suma : 2019
- Gas Leakage Detection System using IoT with integrated notifications using Push bullet : M Athish Subramanian, Naveen Selvam, S. Rajkumar : 2020
- Gas Leakage Detection and Smart Alerting and prediction using IoT : Asmita Varma, Prabhakar S, Kayalvizhi Jayavel : 2017
- Microcontroller based low cost gas leakage detector with SMS alert : Arijit Banik,Bodhayan Aich, Suman Ghosh : 2018
- Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor : Rohan Chandra Pandey , Manish Verma, Lumesh Kumar Sahu : 2017
- Gas Leakage Detection System (GLDS) : Daudi S. Simbeye : 2013

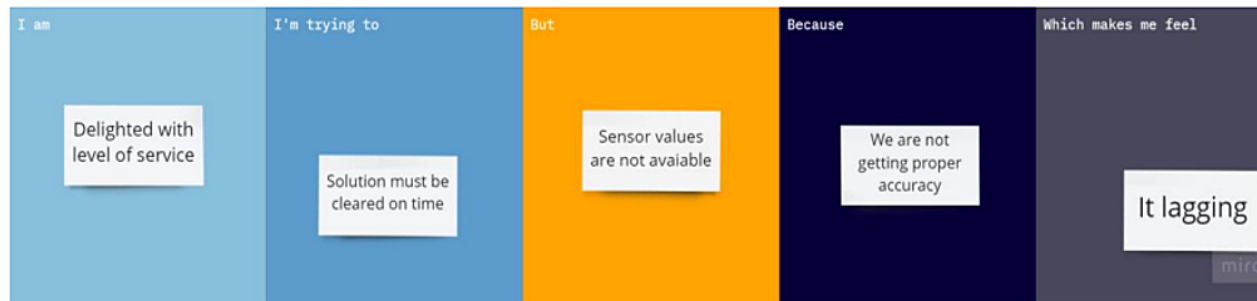
2.3 PROBLEM STATEMENT DEFINITION:

Customer problem Statement:

PS 1:



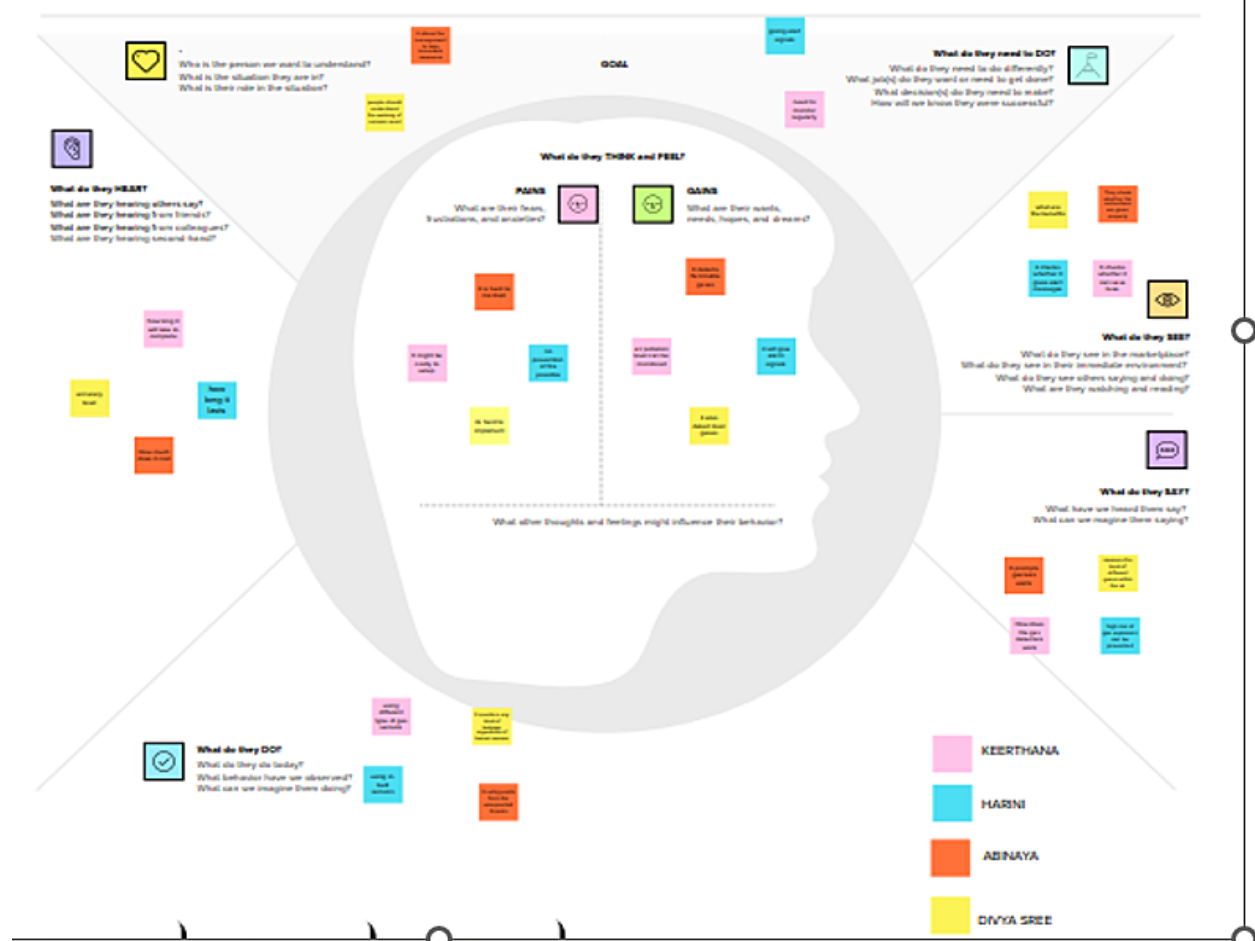
PS2:



Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Detection of gas leakage	Giving some to sensor identifying the leakage	Alarm should identifying	Alarm is not working properly	Dissappointment
PS-2	Delighted with level of service	Solution must be cleared on time	Sensor values are not available	We are not getting proper accuracy	Its lagging


3.1 EMPATHY MAP CANVAS:

Summarize the data you have gathered related to the people that are impacted by your work. It will help you generate ideas, prioritize features, or discuss decisions.



3.2 IDEATION & BRAINSTORMING:

Template



Brainstorm & idea prioritization

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

⌚ 10 minutes to prepare
🕒 1 hour to collaborate
👥 2-8 people recommended

Before you collaborate

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

⌚ 10 minutes

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

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

C Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) →

1 Define your problem statement

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

⌚ 5 minutes

PROBLEM

How might we tell them that gas was leaking?

PROBLEM

How might we maintain the whole setup?

Key rules of brainstorming

To run a smooth and productive session

🗣️ Stay in topic.

⏸️ Defer judgment.

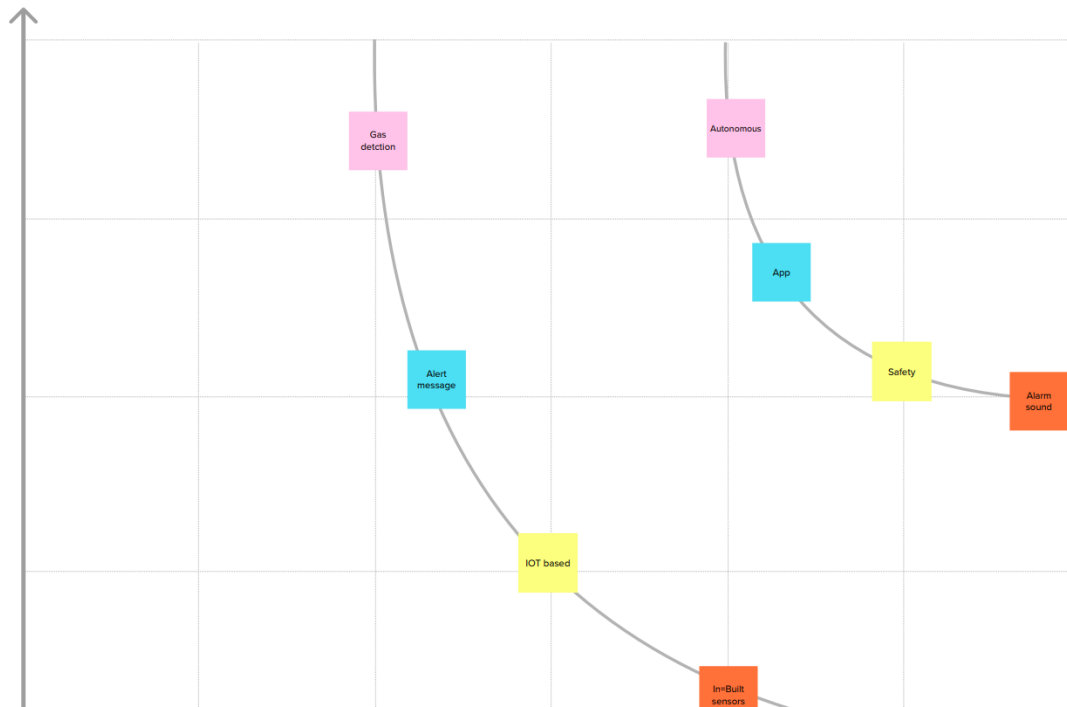
🗣️ Go for volume.

💡 Encourage wild ideas.

👂 Listen to others.

👁️ If possible, be visual.





3.3 PROPOSED SOLUTION

Proposed Solution Template:

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To detect the gas leak and send the necessary alarm signal to the user.
2.	Idea / Solution description	System can notify the user if excess amount of harmful gases are released in the environment.
3.	Novelty / Uniqueness	Alarm as a warning condition when the concentration exceeds the safe concentration.
4.	Social Impact / Customer Satisfaction	The responses are very timely. Gas sensor system performs in an extended service on attending the fault in any - Satisfied and Safe
5.	Business Model (Revenue Model)	As the performance level of sensors increases the budget of the project will also increases.
6.	Scalability of the Solution	The sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises. High gas exposure will change the calibration curve of the sensors causing false or inaccurate readings

3.4 PROBLEM SOLUTION FIT:

Project Title: Gas leakage monitoring and alerting system

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMD22125

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) Who is your customer? 👤 working parents of 0-5 yrs kids Industrial and home	6. CUSTOMER CONSTRAINTS What constraints prevent your customers from taking action or limit their choices of solutions? <u>eg</u> spending power, budget, no cash, network connection, available devices. Budget, <u>inaccuracy</u> , <u>network</u> problem	5. AVAILABLE SOLUTIONS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? <u>eg</u> pen and paper is an alternative to digital notetaking. Ensure that the safety measures are done in the instrument. Emergency alarm was used when gas leak	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. Detection of gas leak and sending the alert	9. PROBLEM ROOT CAUSE What is the real reason that this problem exists? What is the back story behind the need to do this job? <u>eg</u> customers have to do it because of the change in regulations. Over a period of time, gas pipes can warp, bend, or <u>break</u> <u>lack</u> of proper appliance	7. BEHAVIOUR What does your customer do to address the problem and get the job done? <u>eg</u> directly related: find the right solar panel installer, calculate usage and benefits; Find the right gas leak detector and <u>sensor</u> , measure the gas leak	
Focus on J&P, fit into BE	3. TRIGGERS What triggers customers to act? <u>eg</u> seeing their <u>babies</u> installing solar panels, reading about a more efficient solution in the news. By seeing or reading the gas leak accidents and their impact on surrounding	10. YOUR SOLUTION If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer <u>babies</u> . Gas detector is used to identify the gas leak and notify the user by giving a <u>red</u> alert signal	8. CHANNELS OF BEHAVIOUR 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 Customers will look for the specifications of the gas leak detector and their components 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. Customers will look at the showcase product and its working performances	
	4. EMOTIONS: BEFORE / AFTER How do customers feel when they face a problem or a job and afterwards? <u>eg</u> lost, insecure > confident, in control - use it in your communication strategy & design. Before - fear and loss of consciousness After - confident and feel secure			

4. REQUIREMENT ANALYSIS:

4.1 FUNCTIONAL REQUIREMENT:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	<ul style="list-style-type: none"> Registration through Form Offline Registration
FR-2	User Confirmation	<ul style="list-style-type: none"> Confirmation via Email Confirmation via OTP
FR-3	User Authentication	<ul style="list-style-type: none"> User verification through valid User ID and password.
FR-4	User Access	<ul style="list-style-type: none"> Realtime Monitoring of Gas Leakage System, through web portal for Authorized Users.
FR-5	User Alert	<ul style="list-style-type: none"> User receives an alert through SMS. Turn on Alerting System in Industry.
FR-6	Review and Feedback	<ul style="list-style-type: none"> Receive Feedback from Users.

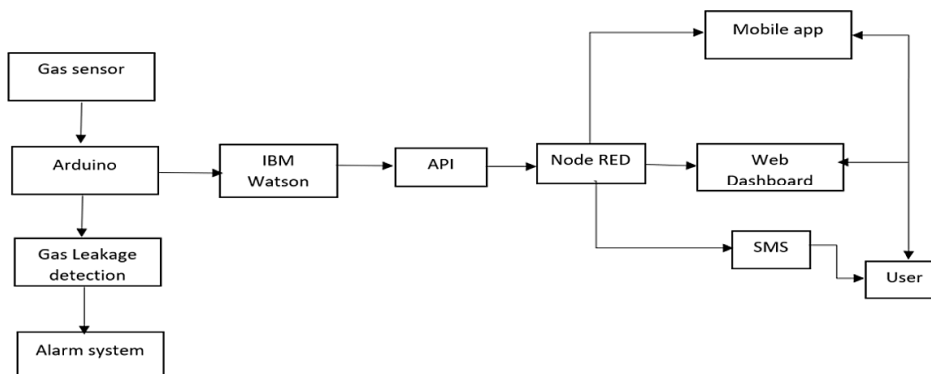
4.2 NON-FUNCTIONAL REQUIREMENT:

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	○ Easier Installation process, and Realtime Monitoring Service.
NFR-2	Security	○ Data transmission and handling through secured protocols. ○ Data encryption & Cloud security.
NFR-3	Reliability	○ Only authorised personnel have access to the system. ○ Assured Data Security and Information conciseness. ○ Longer Lifetime of Product/Service.

NFR-4	Performance	○ High Accuracy of gas leakage detection in localized area. ○ Faster Response to Gas Leakage Detection (SMS alert, valve closing).
NFR-5	Availability	○ The user can access the System 24/7. ○ Realtime monitoring system.
NFR-6	Scalability	○ The system is scalable even in case of many gas sensors. Or in case of many supervisors.

5. PROJECT DESIGN:

5.1 DATA FLOW DIAGRAMS:



5.2 SOLUTION & TECHNICAL ARCHITECTURE:

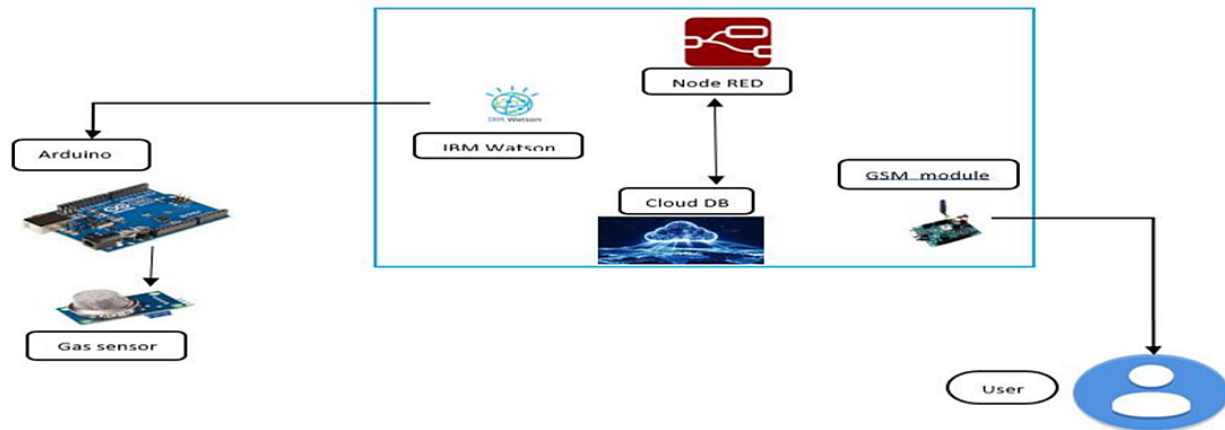


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	User has to register and we can able to view the other device. ex: using web UI, mobile app etc.	HTML, CSS, JavaScript / React Js etc.
2.	IOT Application Logic-1	Industry Owner's device should be connected to the system	Java / Python
3.	Application Logic-2	User 'sdevice should be in on condition	IBM Watson STT service
4.	Application Logic-3	Sensor will give buzzer sound	IBM Watson Assistant
5.	Database	Database will be depended on owner	MySQL , etc.
6.	Cloud Database	It will have all the database will be storage in cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	Its require full storage devices	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of using catalytic diffusion sensors	IBM Weather API, etc.
9.	External API-2	Purpose of detection of noxious and harmful gases	Aadhar API, etc.
10.	Machine Learning Model	Its to collect the data from database	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Cloud, Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

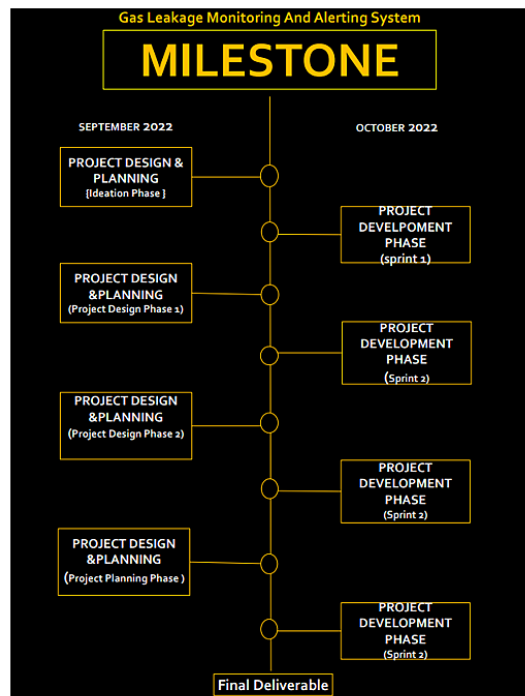
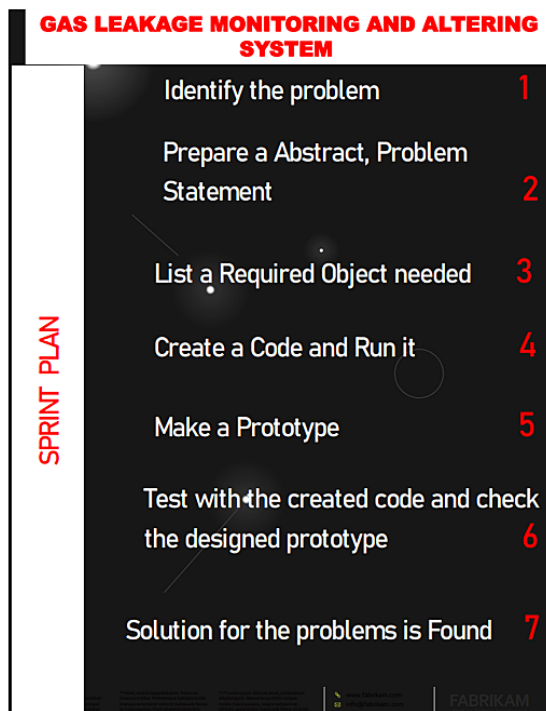
S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Device that removes much of the manual work needed to write and configure code. It provides rapid development ,is easy to setup and has a strong support base	IOT Zeta for nonstop streaming of detecting gas leakage level
2.	Security Implementations	Alert notification Enabled with GPS module received	e.g. SHA-256, Encryptions, IAM
		in owner mobile.	Controls, OWASP etc.
3.	Scalable Architecture	If a problem arises owner can see the problems and check gas level	Multiple Data store Technologies , Reliable, Micro services
4.	Availability	*sensor to detect the leakage and LCD Displa	GSM module, raspberry pi
5.	Performance	Then the performance will better	Used in future technogy

5.3 USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Industry owner)	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
Customer (Industry owner)	Confirmation	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
Customer (Industry owner)	Authorize	USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard Login	Low	Sprint-2
Customer (Supervisor)	Monitor	USN-4	As a user, I can register for the application through Gmail	I can get access to dashboard	Medium	Sprint-1
Customer (Supervisor)	Login	USN-5	As a user, I can log into the application by entering email & password	I can view the status of gas leakage system	Medium	Sprint-2
Customer (Line Workers)	Notification	USN-6	As a user, I can get alarm alert about gas leakage	I can get alert about gas leak.	Medium	Sprint-4
Customer (Supervisor)	Notification	USN-7	As a user, I can get SMS notification	I can get alert about gas leakage	Medium	Sprint-1
Customer (Industry owner)	Notification	USN-8	As a user, I can get mobile app notification about gas leakage	I can get alert about gas leakage	Medium	Sprint-3
Customer (Industry owner)	Notification	USN-9	As a user, I can sign-up using any social media login.	I can sign-up with the application using social media	High	Sprint-1
Customer (Supervisor)	Sign-Up	USN-10	As a user, I can sign-up using mobile login	I can sign-up with the mobile application	High	Sprint-2
Administrator	Service Request	USN-11	As a user, I can request for service in case of any issue with gas leakage monitoring system	I can get service from the provider.	High	Sprint-1
Administrator	Increased service	USN-12	As a user, I can request for scaling up the gas leakage monitoring system.	I can get service from the provide	High	Sprint-1

6.PROJECT PLANNING & SCHEDULING:

6.1 SPRINT PLANNING & ESTIMATION:

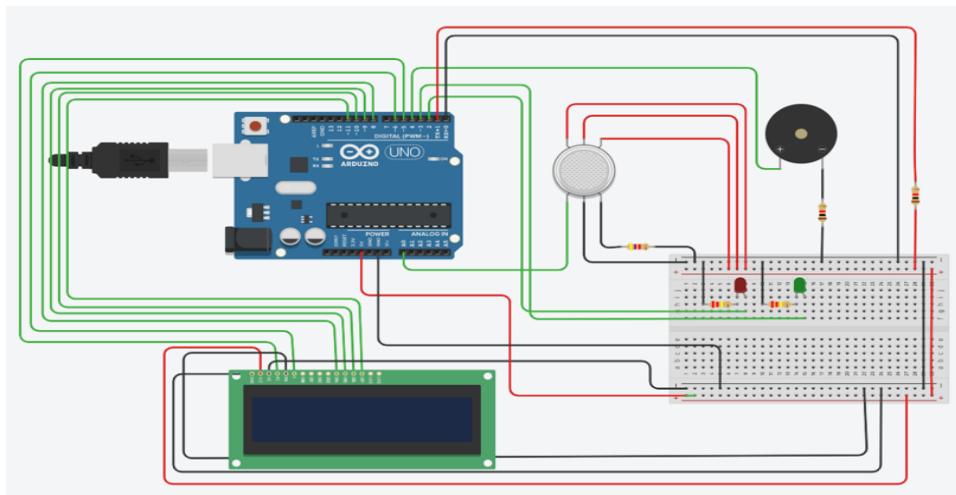


6.2 SPRINT DELIVERY SCHEDULE:

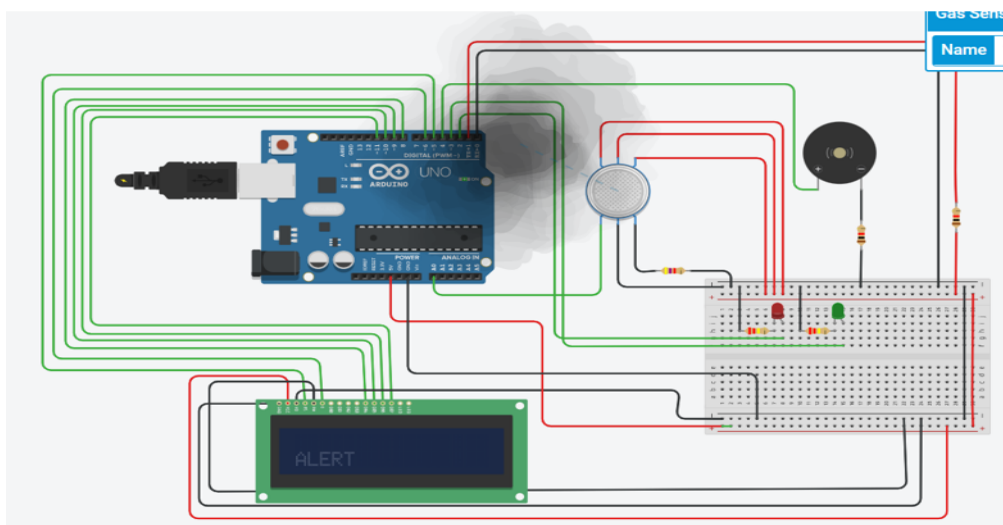
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	16	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	19	04 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	11 Nov 2022	19	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	16 Nov 2022	16	19 Nov 2022

7.CODING & SOLUTIONING:

7.1 FEATURE 1:

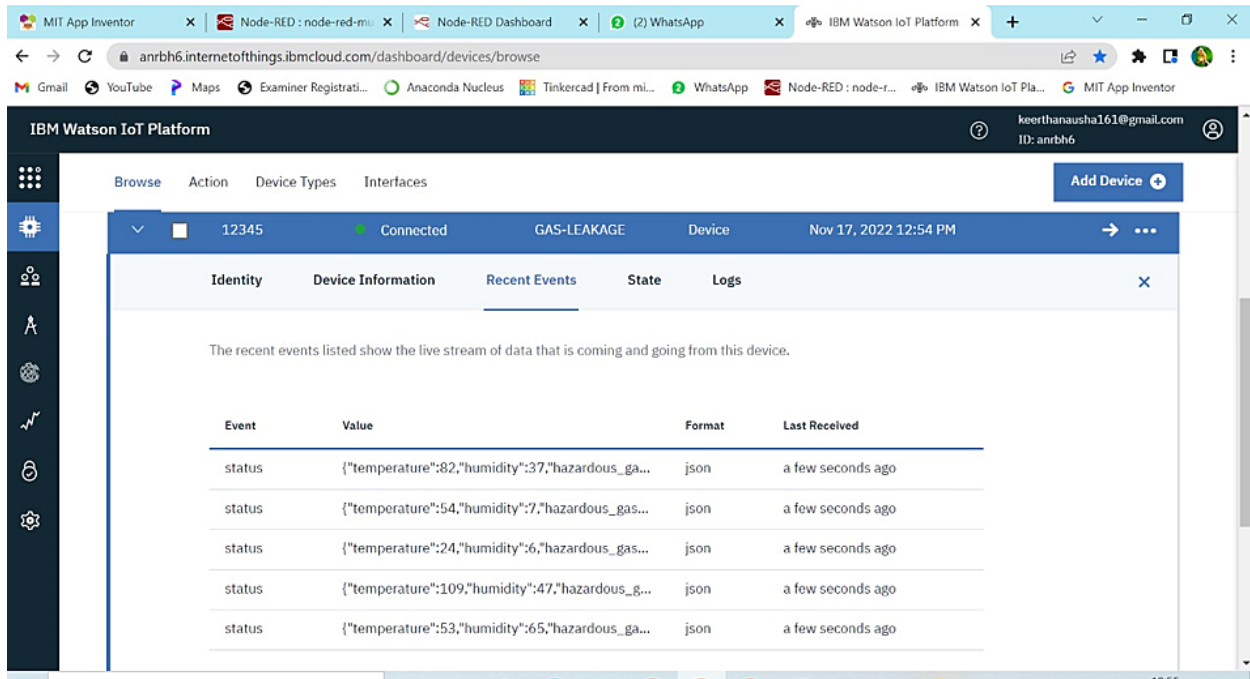


7.2 FEATURE 2:



8. TESTING:

8.1 TEST CASES:



The screenshot shows the IBM Watson IoT Platform dashboard. The top navigation bar includes 'Browse', 'Action', 'Device Types', and 'Interfaces'. A sidebar on the left contains icons for various IoT functions. The main content area displays details for a device with ID '12345', which is 'Connected' and named 'GAS-LEAKAGE'. The 'Recent Events' tab is selected, showing a table of live data events.

Event	Value	Format	Last Received
status	{"temperature":82,"humidity":37,"hazardous_ga...	json	a few seconds ago
status	{"temperature":54,"humidity":7,"hazardous_gas...	json	a few seconds ago
status	{"temperature":24,"humidity":6,"hazardous_gas...	json	a few seconds ago
status	{"temperature":109,"humidity":47,"hazardous_g...	json	a few seconds ago
status	{"temperature":53,"humidity":65,"hazardous_ga...	json	a few seconds ago

8.2 USER ACCEPTANCE TESTING:



The screenshot shows a mobile application interface titled 'Gas leakage application'. It displays real-time sensor data: Temperature 27.99, Humidity 65, and Hazardous gas 74. Below the data, there are two buttons: 'alarm ON' and 'alarm OFF'.

Screen1

Gas leakage application

Temperature 27.99

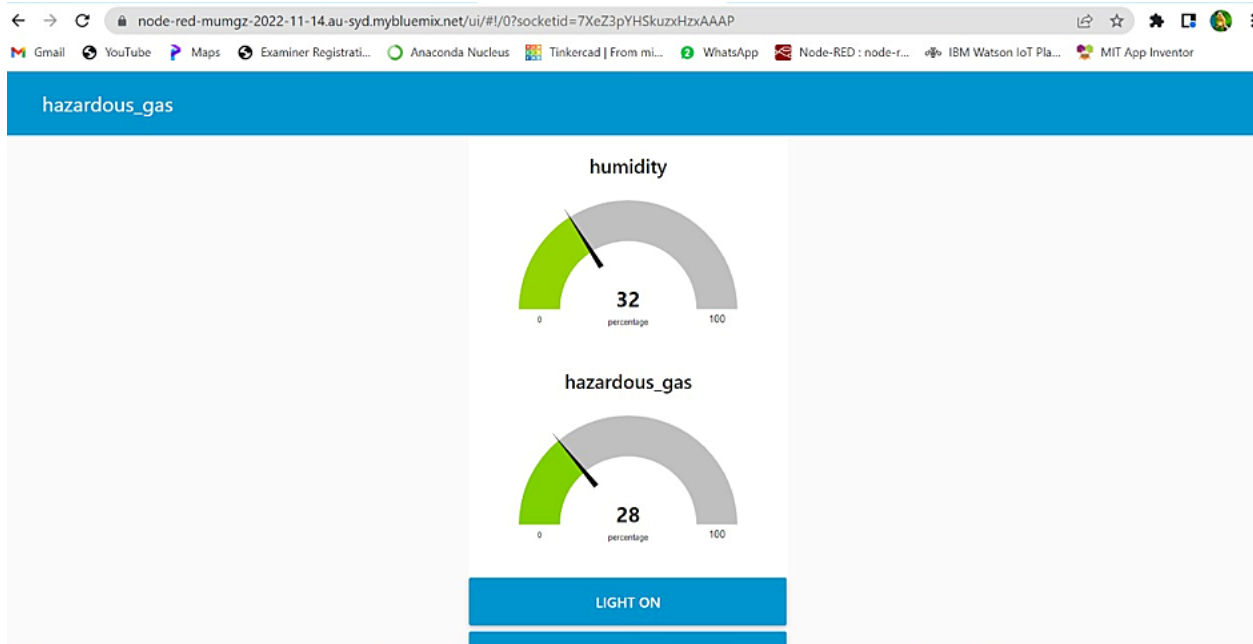
Humidity 65

Hazardous gas 74

alarm ON alarm OFF

9. RESULTS:

9.1 PERFORMANCE METRICS:



10. ADVANTAGES & DISADVANTAGES:

ADVANTAGES:

- The sensor-enabled solution helps to prevent the high risk of gas explosions and affecting any casualties within and outside the premises.
- The gas sensors help detect the concentration of the gases present in the atmosphere to avoid hazardous consequences like fire breakouts.

- It helps benefit the factories and refineries by keeping them safe against any unexpected threats like explosions.
- It can also be used commercially in in-house buildings to detect the presence of carbon dioxide and other combustible gases.

DISADVANTAGES:

- Poor stability and greater environmental impact.
- The selectivity of each sensor is not * and the output parameters cannot be determined.
- it should not be used in places where accurate measurement is required.
- When heavy dust, steam or fog, the system will not be able to take measurements.

11.CONCLUSION:

In this paper, we focus on designing IoT based gas leak monitoring system. The proposed system is cost-effective and it is real-time. It monitors gas leakage on continuous basis and displayed the weight and gas level on mobile. The customer will get the information about the leakage. IoT based system will send an alert message to users on their phones so that they will be more aware about the gas level & leakage.

12. FUTURE SCOPE:

Major cities of India are pushing Smart Home application, gas monitoring system is a part of Smart Home application. Enhancing Industrial Safety using IoT. IoT turns drone into gas detection sensor. Another major future scope could be including a Automatic Shut-off device which will turn off the gas supply whenever it will detect any gas leakage. This system can be implemented in Industries, Hotels and wherever the LPG cylinders are used. This system can be used in industries involving applications such as Furnace, Boilers, Gas welding, Gas cutting, Steel Plants, Metallurgical industries, Food processing Industries, Glass Industries, Plastic industries, Pharmaceuticals, Aerosol manufacturing. As hospitals require to provide maximum possible safety to patients, this system can be used to keep track of all the cylinders used in it. Some of the cylinders used are Oxygen cylinder, Carbon dioxide cylinder, Nitrous oxide cylinder. As many students are naïve the risk of causing accidents is high. Hence, our system can also be used in schools, colleges. Many colleges have well established labs including chemistry lab and pharmaceutical labs where gas burners are used. Plenty of medical equipment requires gas cylinders.

13. APPENDIX

Source Code

Python code: [Click Here](#)

Tindercad code: [Click Here](#)

GitHub Link: [Click Here](#)

Project Demo Link: [Click Here](#)