

## PROJECT REPORT

PROJECT NAME	GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES
TEAM ID	PNT2022TMID00378
TEAM MEMBERS	SWEETY.R RAMYA.K SOMASHREE.U SHAMNI GAYATHRI.D
BRANCH	ELECTRONICS AND COMMUNICATION ENGINEERING

## **CONTENTS**

### **1. INTRODUCTION**

- 1.1 Overview
- 1.2 Purpose

### **2. LITERATURE SURVEY**

- 2.1 Existing problem
- 2.2 Problem statement

### **3.IDEATION AND PROPOSED SOLUTION**

- 3.1 Empathy Map Canvas
- 3.2 Ideation and Brain Storming
- 3.3 Proposed Solution
- 3. 4.Problem Solution Fit

### **4. THEORITICAL ANALYSIS**

- 4.1 Block Diagram
- 4.2 Functional requirement
- 4.3 Non Functional requirement

### **5. PROJECT DESIGN**

- 5.1 Data Flow Diagrams
- 5.2 Solution and Technical Architecture

### **6. PROJECT PLANNING AND SCHEDULING**

- 6.1 Sprint Planning & Estimation
- 6.2 Sprint Delivery Schedule

### **7. CODING & SOLUTIONING (Explain the features added in the project along with code)**

- 7.1 Feature 1

7.2 Feature 2

7.3 Database Schema (if Applicable)

## **8. TESTING**

8.1 Test Cases

8.2 User Acceptance Testing

## **9. RESULTS**

9.1 Performance Metrics

## **10. ADVANTAGES/DISADVANTAGES**

## **11. APPLICATIONS**

## **12. CONCLUSION**

## **13. FUTURE SCOPE**

## **14. GITHUB and DEMO LINK**

## **1.INTRODUCTION**

### **1.1 Project Overview:**

The internet of Things is a developing topic of technical, social, and economic significance. The usage of the gas brings great problems in the domestic as well as working places. The inflammable gas, which is excessively used in the work places (Industries). The leakage of the gas causes destructible impact to the lives and as well as to the heritage of the people. Most of the societies have fire safety mechanism. But it can use after the fire exists. As a result, a system for detecting and monitoring gas leaks is required. Through a flame sensor, the system will sense fire and flame. The buzzer begins to ring when a fire is detected. Tests have shown that the system can keep track of the wastage of gas and leaks and notify the user. The performance that was produced showed that it was successful in reducing the amount of gas that was wasted.

### **1.2 Purpose:**

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed. This is an affordable, less power using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. To monitor this gas leak, the system includes an MQ6 gas detector. This sensor detects the amount of leaking gas present in the surrounding atmosphere. In this way, the consequences of an explosion or gas leak can be avoided.

## **2.LITERATURE SURVEY :**

### **2.1 Existing Problem:**

Gas leakage is nothing but the leak of any gaseous molecule from a pipeline, or cylinder etc in the industries. Gas Leakages in open or closed areas can prove to be dangerous .This can occur either purposefully or even unintendedly. As we are aware that these kinds of leaks are dangerous to our health, and when it becomes explosive it could cause great danger to the people, industry and the environment. Therefore, we have used IoT technology to make a Gas Leakage Detector for society which has Smart Alerting techniques involving sending a text message to the concerned authority and the ability to perform data analytics on sensor readings. Our main aim is to propose a gas leakage system for a society where each flat has gas leakage detector hardware. This will detect the harmful gases in the environment and alerting to society members through the alarm and sending notifications.

### **2.2 References:**

1. Shital Imade, Priyanka Rajmanes, Aishwarya Gavali , Prof. V. N. Nayakwadi “GAS

## LEAKAGE DETECTION AND SMART ALERTING SYSTEM USING IOT

<https://www.pramanaresearch.org/gallery/22.%20feb%20ijirs%20-%20d539.pdf>

2. Kumar Keshamoni and Sabbani Hemanth. "Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT " International Advance Computing Conference IEEE, 2017.
3. Petros Spachos , Liang Song and Dimitrios Hatzinakos. "Gas Leak Detection and Localization System Through Wireless Sensor Networks" The 11th Annual IEEE Consumer Communications and Networking Conference - Demos. IEEE, 2014.
4. "Design and Implementation of an Economic Gas Leakage Detector" National Institute of Health (2004). What you need to know about natural gas detectors.  
Available:[http://www.nidcd.nih.gov/health/smelltaste/gas\\_dtctr.asp](http://www.nidcd.nih.gov/health/smelltaste/gas_dtctr.asp).
5. Prof.M.Amsaveni, A.Anurupa, R.S.Anu Preetha, C.Malarvizhi,M.Gunasekaran "Gsm based LPG leakage detection and controlling system" the International Journal of Engineering and Science (IJES) ISSN (e): 2319 – 1813 ISSN (p):2319 – 1805 Pages 112116 March- 2015.
6. Srinivasan,Leela,Jeyabharathi,Kirthika,Rajasree"GAS LEAKAGE DETECTION AND CONTROL" Scientific Journal of Impact Factor(SJIF): 3.134.
7. Pal-Stefan Murvaya, IoanSileaa "A survey on gas leak detection and localization techniques".
8. Ch. Manohar Raju, N. Sushma Rani, "An android based automatic gas detection and indication robot. In International Journal of Computer Engineering and Applications. 2014;8(1).
9. Falohun A.S., Oke A.O., Abolaji B.M. "Dangerous Gas Detection using an Integrated Circuit and MQ-9" in International Journal of Computer Applications (0975 –8887) Volume 135 – No.7, February 2016.
10. Ashish Shrivastava,Ratnesh Prabhaker, Rajeev Kumar and Rahul Verma "GSM BASED GAS LEAKAGE DETECTION SYSTEM" in International Journal of Technical Research and Applications e-ISSN: 2320- 8163,www.ijtra.com Volume 1, Issue 2 (mayJune 2013).

## 2.3 Problem Statement Definition:

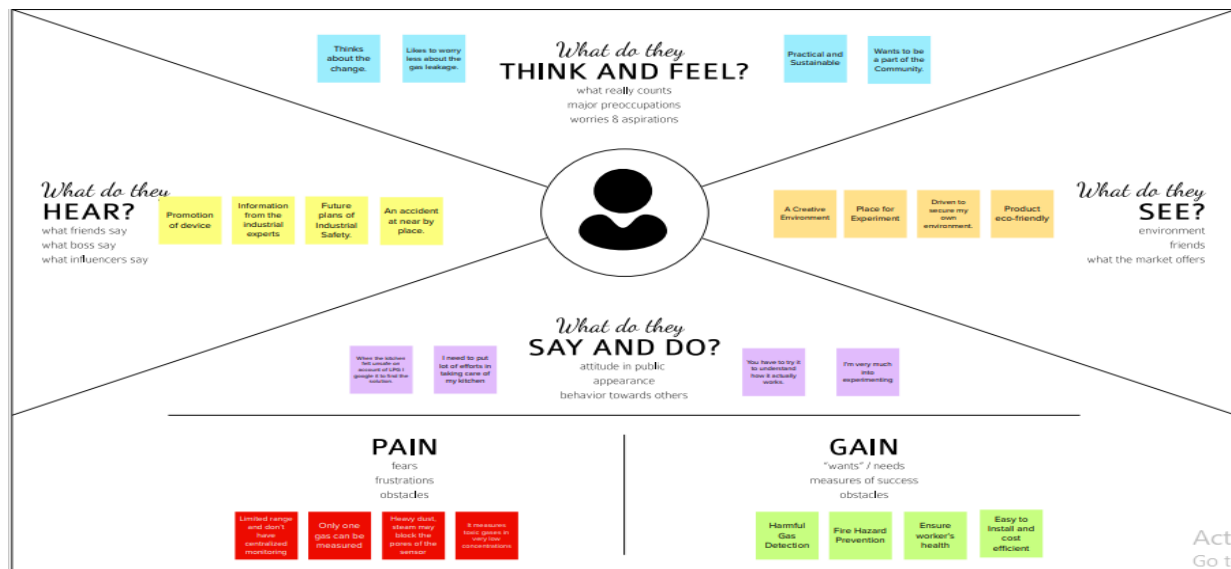
In most industries, one of the key parts of any safety plan for reducing risks to personnel and plant is the use of early-warning devices such as gas detectors. These can help to provide more time in which to take remedial or protective action. They can also be used as part of a total, integrated monitoring and safety system for an industrial plant. Rapid expansion of oil and gas industry leads to gas leakage incidents which are very serious and dangerous. Solutions need to be found out at least to minimize the effects of these incidents since gas leaks also produce a significant financial loss. The challenges are not only to design a prototype of the device that can only detect but also automatically respond to it whenever the leakage occurs.

Customer Problem Statement:



## 3. IDEATION & PROPOSED SOLUTION:

### 3.1 Empathy Map Canvas:



### 3.2 Ideation & Brainstorming:

[illegible]

The screenshot shows the 'Project Explorer' interface with the 'Gas leakage monitoring' project selected. The project details are as follows:

- Project Name:** Gas leakage monitoring
- Project Description:** Use the template in your own monitoring system as your own or adjust the template and add things or remove stuff if you're not using it in the same way.
- Project Status:** 1. Development, 2. Deployment, 3. Deployment
- Project Settings:** 1. Add new, 2. Add new, 3. Add new
- Project Data:** 1. Add new, 2. Add new, 3. Add new
- Project Actions:** 1. Add new, 2. Add new, 3. Add new
- Project Summary:** 1. Add new, 2. Add new, 3. Add new
- Project Details:** 1. Add new, 2. Add new, 3. Add new
- Project Notes:** 1. Add new, 2. Add new, 3. Add new
- Project Tags:** 1. Add new, 2. Add new, 3. Add new
- Project Filters:** 1. Add new, 2. Add new, 3. Add new
- Project Sort:** 1. Add new, 2. Add new, 3. Add new
- Project Search:** 1. Add new, 2. Add new, 3. Add new
- Project Pagination:** 1. Add new, 2. Add new, 3. Add new
- Project Loading:** 1. Add new, 2. Add new, 3. Add new
- Project Error:** 1. Add new, 2. Add new, 3. Add new
- Project Success:** 1. Add new, 2. Add new, 3. Add new
- Project Warning:** 1. Add new, 2. Add new, 3. Add new
- Project Info:** 1. Add new, 2. Add new, 3. Add new
- Project Help:** 1. Add new, 2. Add new, 3. Add new
- Project About:** 1. Add new, 2. Add new, 3. Add new
- Project Contact:** 1. Add new, 2. Add new, 3. Add new
- Project Privacy:** 1. Add new, 2. Add new, 3. Add new
- Project Terms:** 1. Add new, 2. Add new, 3. Add new
- Project Policy:** 1. Add new, 2. Add new, 3. Add new
- Project License:** 1. Add new, 2. Add new, 3. Add new
- Project Source:** 1. Add new, 2. Add new, 3. Add new
- Project Docs:** 1. Add new, 2. Add new, 3. Add new
- Project Wiki:** 1. Add new, 2. Add new, 3. Add new
- Project Forum:** 1. Add new, 2. Add new, 3. Add new
- Project Blog:** 1. Add new, 2. Add new, 3. Add new
- Project News:** 1. Add new, 2. Add new, 3. Add new
- Project Events:** 1. Add new, 2. Add new, 3. Add new
- Project Jobs:** 1. Add new, 2. Add new, 3. Add new
- Project Partners:** 1. Add new, 2. Add new, 3. Add new
- Project Suppliers:** 1. Add new, 2. Add new, 3. Add new
- Project Customers:** 1. Add new, 2. Add new, 3. Add new
- Project Vendors:** 1. Add new, 2. Add new, 3. Add new
- Project Agents:** 1. Add new, 2. Add new, 3. Add new
- Project Brokers:** 1. Add new, 2. Add new, 3. Add new
- Project Intermediaries:** 1. Add new, 2. Add new, 3. Add new
- Project Facilitators:** 1. Add new, 2. Add new, 3. Add new
- Project Coordinators:** 1. Add new, 2. Add new, 3. Add new
- Project Managers:** 1. Add new, 2. Add new, 3. Add new
- Project Supervisors:** 1. Add new, 2. Add new, 3. Add new
- Project Inspectors:** 1. Add new, 2. Add new, 3. Add new
- Project Auditors:** 1. Add new, 2. Add new, 3. Add new
- Project Evaluators:** 1. Add new, 2. Add new, 3. Add new
- Project Reviewers:** 1. Add new, 2. Add new, 3. Add new
- Project Validators:** 1. Add new, 2. Add new, 3. Add new
- Project Testers:** 1. Add new, 2. Add new, 3. Add new
- Project Debuggers:** 1. Add new, 2. Add new, 3. Add new
- Project Developers:** 1. Add new, 2. Add new, 3. Add new
- Project Engineers:** 1. Add new, 2. Add new, 3. Add new
- Project Scientists:** 1. Add new, 2. Add new, 3. Add new
- Project Researchers:** 1. Add new, 2. Add new, 3. Add new
- Project Analysts:** 1. Add new, 2. Add new, 3. Add new
- Project Designers:** 1. Add new, 2. Add new, 3. Add new
- Project Architects:** 1. Add new, 2. Add new, 3. Add new
- Project Planners:** 1. Add new, 2. Add new, 3. Add new
- Project Strategists:** 1. Add new, 2. Add new, 3. Add new
- Project Consultants:** 1. Add new, 2. Add new, 3. Add new
- Project Advisors:** 1. Add new, 2. Add new, 3. Add new
- Project Mentors:** 1. Add new, 2. Add new, 3. Add new
- Project Coaches:** 1. Add new, 2. Add new, 3. Add new
- Project Trainers:** 1. Add new, 2. Add new, 3. Add new
- Project Teachers:** 1. Add new, 2. Add new, 3. Add new
- Project Professors:** 1. Add new, 2. Add new, 3. Add new
- Project Researchers:** 1. Add new, 2. Add new, 3. Add new
- Project Scientists:** 1. Add new, 2. Add new, 3. Add new
- Project Analysts:** 1. Add new, 2. Add new, 3. Add new
- Project Designers:** 1. Add new, 2. Add new, 3. Add new
- Project Architects:** 1. Add new, 2. Add new, 3. Add new
- Project Planners:** 1. Add new, 2. Add new, 3. Add new
- Project Strategists:** 1. Add new, 2. Add new, 3. Add new
- Project Consultants:** 1. Add new, 2. Add new, 3. Add new
- Project Advisors:** 1. Add new, 2. Add new, 3. Add new
- Project Mentors:** 1. Add new, 2. Add new, 3. Add new
- Project Coaches:** 1. Add new, 2. Add new, 3. Add new
- Project Trainers:** 1. Add new, 2. Add new, 3. Add new
- Project Teachers:** 1. Add new, 2. Add new, 3. Add new
- Project Professors:** 1. Add new, 2. Add new, 3. Add new
- Project Researchers:** 1. Add new, 2. Add new, 3. Add new
- Project Scientists:** 1. Add new, 2. Add new, 3. Add new
- Project Analysts:** 1. Add new, 2. Add new, 3. Add new
- Project Designers:** 1. Add new, 2. Add new, 3. Add new
- Project Architects:** 1. Add new, 2. Add new, 3. Add new
- Project Planners:** 1. Add new, 2. Add new, 3. Add new
- Project Strategists:** 1. Add new, 2. Add new, 3. Add new
- Project Consultants:** 1. Add new, 2. Add new, 3. Add new
- Project Advisors:** 1. Add new, 2. Add new, 3. Add new
- Project Mentors:** 1. Add new, 2. Add new, 3. Add new
- Project Coaches:** 1. Add new, 2. Add new, 3. Add new
- Project Trainers:** 1. Add new, 2. Add new, 3. Add new
- Project Teachers:** 1. Add new, 2. Add new, 3. Add new
- Project Professors:** 1. Add new, 2. Add new, 3. Add new
- Project Researchers:** 1. Add new, 2. Add new, 3. Add new
- Project Scientists:** 1. Add new, 2. Add new, 3. Add new
- Project Analysts:** 1. Add new, 2. Add new, 3. Add new
- Project Designers:** 1. Add new, 2. Add new, 3. Add new
- Project Architects:** 1. Add new, 2. Add new, 3. Add new
- Project Planners:** 1. Add new, 2. Add new, 3. Add new
- Project Strategists:** 1. Add new, 2. Add new, 3. Add new
- Project Consultants:** 1. Add new, 2. Add new, 3. Add new
- Project Advisors:** 1. Add new, 2. Add new, 3. Add new
- Project Mentors:** 1. Add new, 2. Add new, 3. Add new
- Project Coaches:** 1. Add new, 2. Add new, 3. Add new
- Project Trainers:** 1. Add new, 2. Add new, 3. Add new
- Project Teachers:** 1. Add new, 2. Add new, 3. Add new
- Project Professors:** 1. Add new, 2. Add new, 3. Add new
- Project Researchers:** 1. Add new, 2. Add new, 3. Add new
- Project Scientists:** 1. Add new, 2. Add new, 3. Add new
- Project Analysts:** 1. Add new, 2. Add new, 3. Add new
- Project Designers:** 1. Add new, 2. Add new, 3. Add new
- Project Architects:** 1. Add new, 2. Add new, 3. Add new
- Project Planners:** 1. Add new, 2. Add new, 3. Add new
- Project Strategists:** 1. Add new, 2. Add new, 3. Add new
- Project Consultants:** 1. Add new, 2. Add new, 3. Add new
- Project Advisors:** 1. Add new, 2. Add new, 3. Add new
- Project Mentors:** 1. Add new, 2. Add new, 3. Add new
- Project Coaches:** 1. Add new, 2. Add new, 3. Add new
- Project Trainers:** 1. Add new, 2. Add new, 3. Add new
- Project Teachers:** 1. Add new, 2. Add new, 3. Add new
- Project Professors:** 1. Add new, 2. Add new, 3. Add new
- Project Researchers:** 1. Add new, 2. Add new, 3. Add new
- Project Scientists:** 1. Add new, 2. Add new, 3. Add new
- Project Analysts:** 1. Add new, 2. Add new, 3. Add new
- Project Designers:** 1. Add new, 2. Add new, 3. Add new
- Project Architects:** 1. Add new, 2. Add new, 3. Add new
- Project Planners:** 1. Add new, 2. Add new, 3. Add new
- Project Strategists:** 1. Add new, 2. Add new, 3. Add new
- Project Consultants:** 1. Add new, 2. Add new, 3. Add new
- Project Advisors:** 1. Add new, 2. Add new, 3. Add

### 3.3 Proposed Solution:

#### PROPOSED SOLUTION TEMPLATE:

S.NO	PARAMETER	DESCRIPTION
1.	PROBLEM STATEMENT (Problem to be solved)	Gas leakage is one of the major issues in industries. The leakage of a gas leads to major fire accidents which lead to heavy damage inside the industry and also to the workers in the industry as well as the loss of human beings .It is feasible to detect the gas leakage before any disaster happened. So industries need a very efficient gas leakage monitoring and detection system. The aim of this paper is to propose an industrial safety system for workers working in these types of polymer industries by automatically detect, alert and control gas leakage ,fire and smoke using IOT based system.
2.	IDEA /SOLUTION DESCRIPTION	In order to overcome the leakage problem ,the proposed solution consist of an gas sensor integrated to monitor .If gas leakage is detected in any area the admins will be notified along with the location, and the admins can view the sensor parameters through the web application.
3.	NOVELTY	Even though there are many solutions for this problem they failed to satisfy the needs of the customers or workers .Some of the solutions detect and alert only to the main department related to the industry and other solutions are with defects. Our proposed solution not only notifies the industry person but also notify the fire fighters so that can take control over the situation and our solution will also alert the workers even there is a small leakage of gas.
4.	SOCIAL IMPACT/CUSTOMER SATISFACTION	The benefit of a gas detection and alerting system is that it will provide the customer or worker with 24/7 monitoring, and it can watch all areas. Even if you have a section left unmanned the majority of the time, it still can monitor to warn your personnel of a hazardous environment before entering. Through this proposed solution the workers lives can be saved.



5.	BUSINESS MODEL(Revenue model)	The aim target of our solution is industries so we have planned to visit industries and explain them about the benefits of our products .so that they can aware of the importance of this solution and use it.
6.	SCALABILITY OF THE SOLUTION	Our solution can be integrated for further future use because the solution we have provided with be lay on the basic or initial stage of any upgraded version


### 3.4 Problem Solution fit:

**Project Design Phase-I - Solution Fit**

**Project Title:** Gas Leakage monitoring & Alerting system for Industries

Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> <span style="float: right;">CS</span> Who is your customer? <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           Most of Industry workers who are engaged with gas related productions.         </div>	<b>6. CUSTOMER</b> <span style="float: right;">CC</span> What constraints prevent your customers from taking action on their choice of solution? i.e. spending power, budget, no cash, network connection, available devices. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;"> <ul style="list-style-type: none"> <li>✓ It measures toxic gases in very low concentrations.</li> <li>✓ It has ability to detect wide range of gases.</li> <li>✓ It is difficult to know failure</li> </ul> </div>	<b>5. AVAILABLE SOLUTIONS</b> <span style="float: right;">AS</span> 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? i.e. pen and paper is an alternative to digital everything. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           Testbenches, Quick connectors (They enable a fast and tight "Connection" also on non-round and cast surfaces), Leak tester are some of the available solutions.         </div>	Explore AS, differentiate
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> <span style="float: right;">J&amp;P</span> Which jobs-to-be-done (or problems) do you address for your customers? There could be many than one; explore different sides. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           Flammable gas leakage may lead to secondary accidents such as fire and explosion, while toxic gas dispersion mainly leads to poisoning casualties lead to death.         </div>	<b>9. PROBLEM ROOT CAUSE</b> <span style="float: right;">RC</span> What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           Behind this gas leakage problem there could be many reasons like atomic reactions between gas molecules, material's quality...etc. Even though customers have to do this job then only we can get our end products or needful chemical solutions.         </div>	<b>7. BEHAVIOUR</b> <span style="float: right;">BE</span> What does your customer do to address the problem and act the job done? i.e. directly related, find the right solar panel installer, calculate usage and benefits, indirectly associated, customers spend less time on volunteer work (i.e. Greenpeace) <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           Have a check of where it has the sense of Harmful gases such as H2S, Methane, and CO.             Will also check for temperature sensor that helps to detect the concentration of the gases present in the atmosphere to avoid hazardous consequences like fire breakouts.         </div>	
Identify strong TR & EM	<b>3. TRIGGERS</b> <span style="float: right;">TR</span> What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           Constitution should bring gas leakage indicating system as a mandatory precaution in every factory and industries like fire extinguisher.         </div>	<b>10. YOUR SOLUTION</b> <span style="float: right;">SL</span> 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 rather canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           We are planning to fit a sensor nearby the gas plants which will detect if there is any leak of gas. If there is a gas leak then we will send a message to admin department and also alarm will be set on so that the workers can know about the leak and run into a safe place         </div>	<b>8. CHANNELS of BEHAVIOUR</b> <span style="float: right;">CH</span> ONLINE What kind of actions do customers take online? Extract online channels from #7 <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;"> <ul style="list-style-type: none"> <li>✓ In online, user can monitor the each sensor and its rates, sensor like temperature, gas, humidity, oxygen level.</li> <li>✓ Also have the statistical report.</li> <li>✓ Precautions can be altered and users take care of the</li> </ul> </div> OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;"> <ul style="list-style-type: none"> <li>✓ The have to manually check the leakage of gases when the statistics changes.</li> <li>✓ Handling the critical situation should be taken care of the safety officers.</li> </ul> </div>	Extract online & offline CH of BE
	<b>4. EMOTIONS: BEFORE / AFTER</b> <span style="float: right;">EM</span> How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure -> confident, in control - use it in your communication strategy & design. <div style="border: 1px dashed black; padding: 10px; margin-top: 10px;">           While facing the problem people may get fatigue, dizziness, severe headache, loss of concentration, loss of consciousness. Afterwards people feel insecurity because of the health issues it's hard for them to lead a normal life.         </div>			

Activate  
 Go to getting



#### 4. REQUIREMENT ANALYSIS:

##### 4.1 Functional requirement:

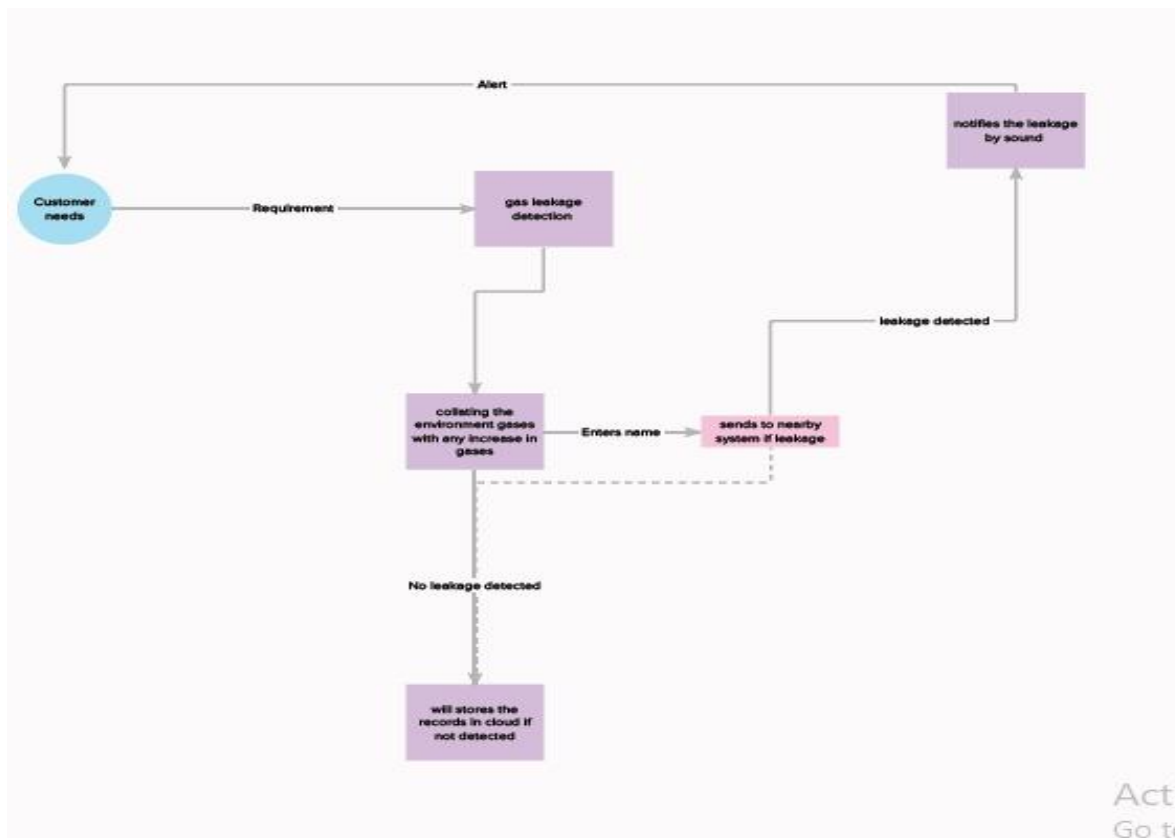
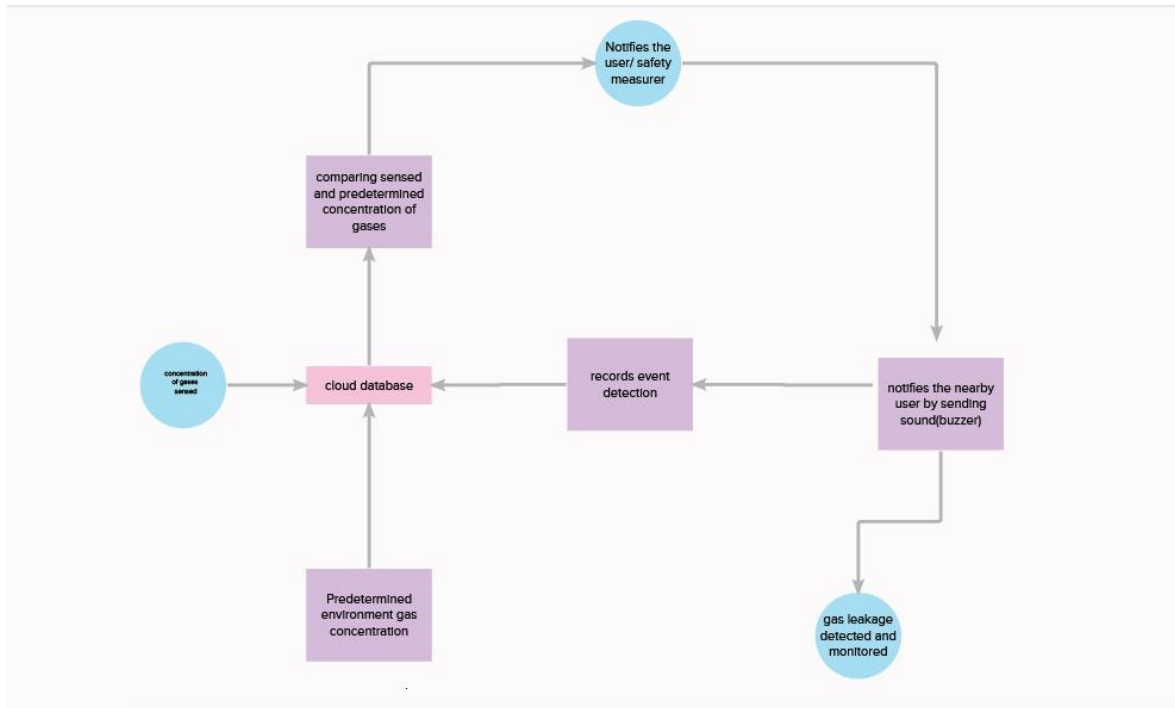
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Leakage	Installation of Gas sensors at specified intervals.
FR-2	Notification	When rule condition is met, notification triggered using MQTT.
FR-3	Geo coordinates of nodes	1. Predefined set of GPS locations of nodes is obtained. 2. When notification is triggered, Geo coordinates of the node is also sent along
FR-4	IoT Platform	IBM Watson IoT Platform
FR-5	Cloud Services	IBM Cloud Database
FR-6	Programming tool	NODE-RED Services

## 4.2 Non-Functional requirements:

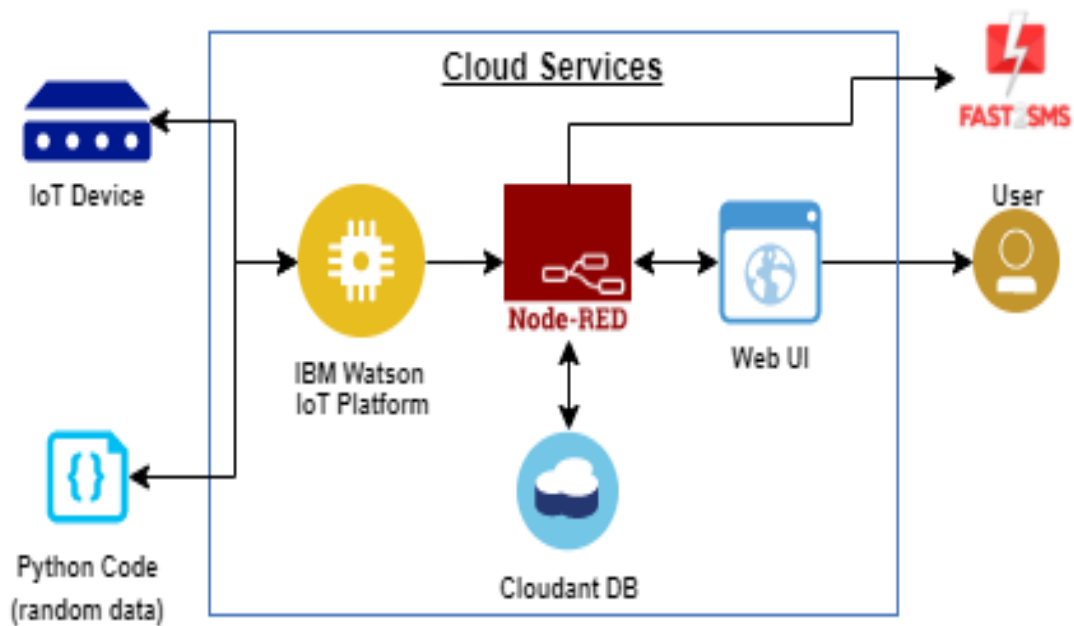
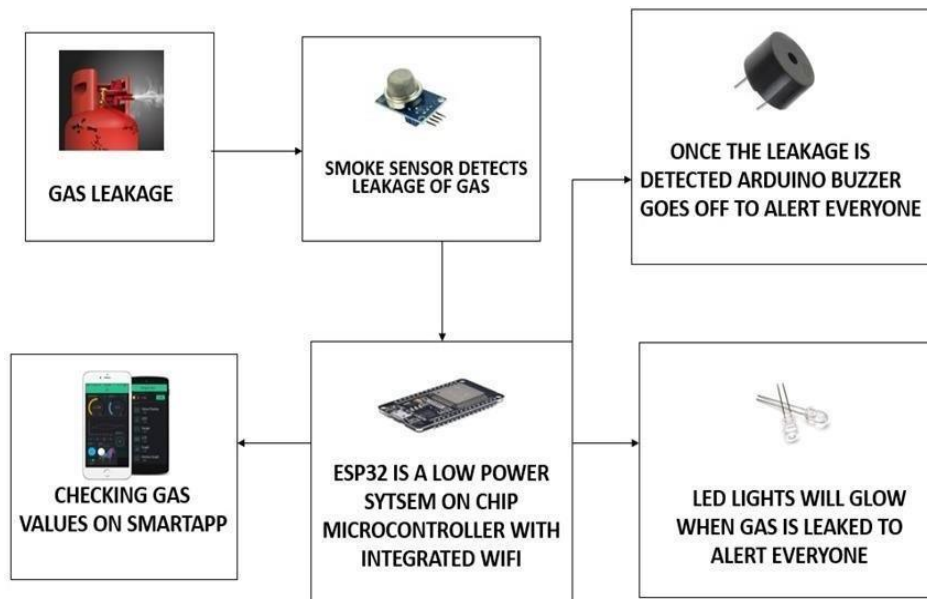
FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	Easy user interface with alerting notifications and location of the defect gas cylinder.
NFR-2	<b>Security</b>	1. Secure Cloud database is used. 2. Notify only the registered and verified users. 3. Multiple deployments across the potential sources can help industries to avoid any industrial accident and protect workplacesafely.
NFR-3	<b>Reliability</b>	1. Gas exposure will measured with $\pm 25\%$ of the true concentrationof the target analyte with 95% certainty. 2. Robust device that can withstand harsh industrial conditions andprovide real-time gas leakage detection.
NFR-4	<b>Performance</b>	1. Accurate data monitoring system enables periodic analysis of the air quality.
		2. Provides data on a real-time basis which enables safety managers to take timely corrective actions
NFR-5	<b>Availability</b>	1. Through Suppliers. 2. With online shopping platforms.
NFR-6	<b>Scalability</b>	1. Can be extended further from industrial application to domestic gas applications. 2. Deployment in petrol banks and vehicle fuel plants for gas leakage detection application.

## 5. PROJECT DESIGN:

### 5.1 Data Flow Diagrams:



## 5.2 Solution & Technical Architecture:



### 5.3 User Stories:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Monitor the gas leakage	USN-1	The Industrialist have own industries so the industry owner must take of <u>workers</u> .The workers have family so the industries give security assurance of workers.	2	High	Shanmugam S Vigneashwaran B Vishnu V Thirumurugan M
Sprint-2	Avoid From Disaster	USN-2	The gas leakage occur at the time fire service will take care to protect the people from the disaster.	1	High	Shanmugam S Vigneashwaran B Vishnu V Thirumurugan M
Sprint-3	Detect the gas	USN-3	We have <u>monitor</u> the gas by 24/7 hrs. To avoid <u>leakage</u> ,the industry have quality pipes to transfer the gas and proper <u>maintenance</u> service once in a month. The industry must take care of what are the necessary process to avoid the gas leakage.	2	Low	Shanmugam S Vigneashwaran B Vishnu V Thirumurugan M
Sprint-4	The model is trained and tested by sample dataset.	USN-4	The programmer <u>design</u> the model to detect the gas leakage.	2	Medium	Shanmugam S Vigneashwaran B Vishnu V Thirumurugan M
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-5	Warning message	USN-5	<u>In</u> case any gas leakage occur, the device <u>give</u> the alarm and alert message to concerned user within a minute.	1	High	Shanmugam S Vigneashwaran B Vishnu V

## 6. PROJECT PLANNING & SCHEDULING:

### 6.1 Sprint Planning & Estimation:

- SPRINT PLAN
- ANALYZE THE PROBLEM
- PREPARE an ABSTRACT, PROBLEM STATEMENT
- LIST A REQUIRED OBJECT NEEDED
- CREATE A PROGRAM CODE AND RUN IT
- MAKE A PROTOTYPE TO IMPLEMENT
- TEST WITH THE CREATED CODE AND CHECK THE DESIGNED PROTOTYPE

## 6.2 Sprint Delivery Schedule:

Sprint	Functional Requirement (Epic)	User Story	User Story / Task	Story Point	Priority
Sprint-1	Create	US-1	Create the IBM Cloud services which are being used in this project.	5	High
Sprint-1	Configure	US-2	Configure the IBM Cloud services which are being used in completing this project.	1	Medium
Sprint-1	Create	US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	1	Medium



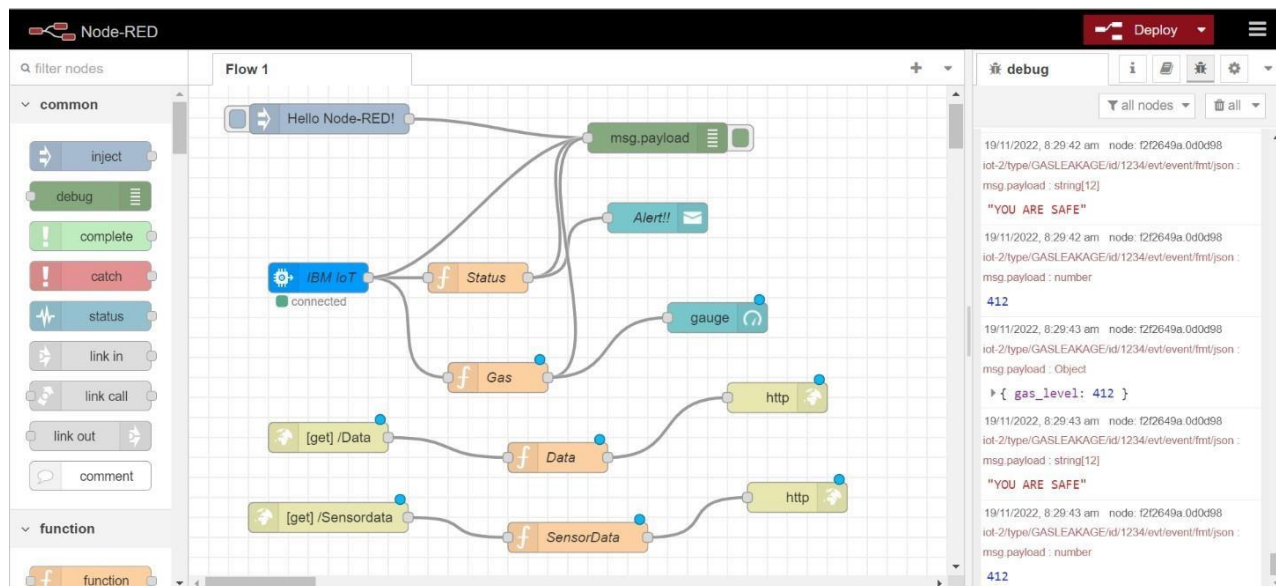
Sprint-1	Configure	US-4	Configure the IBM Watson IoT which are being used to display the output.	13	High
Sprint-2	Create	US-1	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	13	High

Sprint-2	Configure	US-2	Configure a device in the IBM Watson IoT platform and get the device credentials.	3	Medium
Sprint-2	Create	US-3	Create a Node-RED service.	3	High
Sprint-2	Configure	US-4	Configure the connection security and create API keys that are used in the Node- RED service for accessing the IBM IoT Platform.	1	Medium

Sprint-3	Develop	US-1	Develop a python script to publish random sensor data such as temperature, Flame level and Gas level to the IBM IoTplatform	1 3	High
Sprint-3	Configure	US-2	After developing python code and commands just run the code	1	Medium
Sprint-3	Print	US-3	Print the statements which represent the control of the devices.	1	Low
Sprint-3	Publish	US-4	Publish Data to The IBM Cloud	5	High
Sprint-4	Create	US-1	Create Web UI in Node- Red	5	High

Sprint-4	Configure	US-2	Configure the Node-RED flow to receive data from the IBMIoT platform	5	High
Sprint-4	Configure	US-3	Use cloudant DB nodes to store the received sensor data in the cloudant DB	5	High
Sprint-4	Publish	US-4	Publish the received data in webapplication	5	High

## NODE RED WORKING



## 7. CODING & SOLUTIONING:

```

# Importing Required modules
import time
import sys
import wiotp.sdk.device # IBM IoT Watson Platform Module
import ibmiotf.device
import tkinter as tk # Python GUI
Package from tkinter import ttk # Python GUI
import time
from threading import Thread

organization = "9s9m43" # Organization ID
deviceType = "NodeMCU" # Device type
deviceId = "gasleakage" # Device ID
authMethod = "token" # Authentication
Method authToken = "1234589123" # Replace the auth token

# Tkinter root window
root = tk.Tk()
root.geometry('350x300') # Set size of root window
root.resizable(False, False) # root window non-resizable
root.title('Gas Leakage Monitoring And Alerting System for Industries (PNT2022TMID00378)')

# Layout Configurations
root.columnconfigure(0, weight=1)
root.columnconfigure(1, weight=3)

current_gas = tk.DoubleVar()

def get_current_gas(): # function returns current gas level value
    return '{: .2f}'.format(current_gas.get())

def slider_changed(event): # Event Handler for changes in sliders
    print('-----')
    print('Gas Level: {: .2f}'.format(current_gas.get()))
    print('-----')
    gas_label.configure(text=str(get_current_gas()) + " ppm") # Displays current gas level as label content

# Tkinter Labels

```

```

# label for the gas level slider slider_gas_label =
tk.Label(root,text='Set Gas Level:')
slider_gas_label.grid(column=0,row=0,sticky='w')

# Gas Level slider slider_gas
=
tk.Scale(root,from_=0,to=3000,orient='horizontal', command=slider_changed,variable=current_
gas)
slider_gas.grid(column=1,row=0,sticky='we')

# current gas level label
current_gas_label = tk.Label(root,text='Current Gas Level:')
current_gas_label.grid(row=1,columnspan=2,sticky='n',ipadx=10,ipady=10)

# Gas level label (value gets displayed here)
gas_label = tk.Label(root,text=str(get_current_gas()) + " ppm")
gas_label.grid(row=2,columnspan=2,sticky='n')

def publisher_thread():    thread =
Thread(target=publish_data)
    thread.start()

def publish_data():    # Exception Handling    try:        deviceOptions = {"org":
organization, "type": deviceType, "id": deviceId, "auth-method": authMethod,
        "auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)
    # .....

    except Exception as e:        print("Caught exception
connecting device: %s" % str(e))        sys.exit()

deviceCli.connect() # Connect to IBM Watson IoT Platform

while True:        gas_level =
int(current_gas.get())

    data = {'gas_level': gas_level}

```

```

def myOnPublishCallback():          print("Published Gas Level = %s
ppm" % gas_level, "to IBM Watson")

    success = deviceCli.publishEvent("event", "json", data, qos=0,
on_publish=myOnPublishCallback)
if not success:          print("Not
connected to IoTTF")
    time.sleep(1)

publisher_thread()

root.mainloop() # startup Tkinter GUI

# Disconnect the device and application from the cloud deviceCli.disconnect()

```

## CODE:



```

final code.py - C:/Python/Python310/final code.py (3.10.7)
File Edit Format Run Options Window Help

# Importing Required modules import time
import sys
import wiotp.sdk.device # IBM IoT Watson Platform Module import ibmiotf.device
import tkinter as tk # Python GUI Package from tkinter import ttk # Python GUI

import time
from threading import Thread

organization = "nd8val" # Organization ID deviceType = "GASLEAKAGE" # Device type deviceId = "10042002" # Device ID
authMethod = "token" # Authentication Method authToken = "10042002" #Replace the authtoken

# Tkinter root window root = tk.Tk()
root.geometry('350x300') # Set size of root window root.resizable(False, False) # root window non-resizable root.title('Gas Leakage Monitor')

# Layout Configurations root.columnconfigure(0, weight=1) root.columnconfigure(1, weight=3)

current_gas = tk.DoubleVar()

def get_current_gas(): # function returns current gas level value return '{: .2f}'.format(current_gas.get())

def slider_changed(event): # Event Handler for changes in sliders print('Slider Value: {}'.format(slider_gas_label.get()))
print('Gas Level: {:.2f}'.format(current_gas.get())) print(' ')
gas_label.configure(text=str(get_current_gas()) + " ppm") # Displays current gas level as label content

# Tkinter Labels

# label for the gas level slider
slider_gas_label = ttk.Label(root, text='Set Gas Level:') slider_gas_label.grid(column=0, row=0, sticky='w')

# Gas Level slider

```

Activate Windows  
Go to Settings to activate Windows.

Ln: 18 Col: 2



IBM Watson IoT Platform

613619706002@mybluemix.net  
ID: 94y60

Browse Action Device Types Interfaces

18 100% Disconnected Gas Device 4 Nov 2022 14:39

Identity Device Information Recent Events State Logs

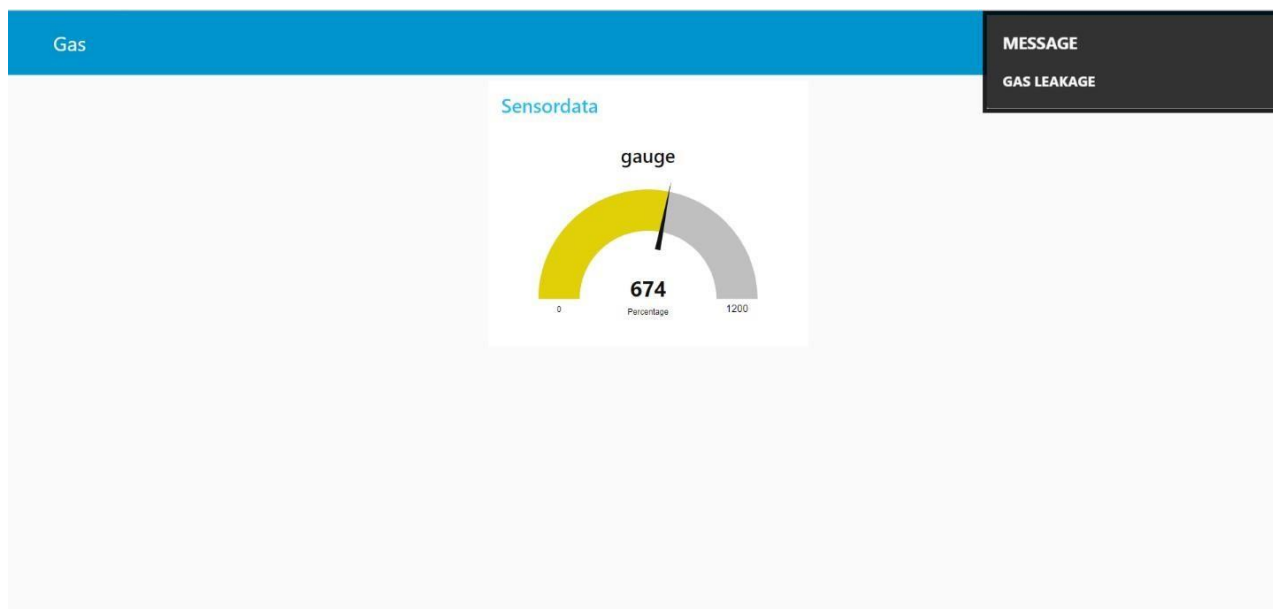
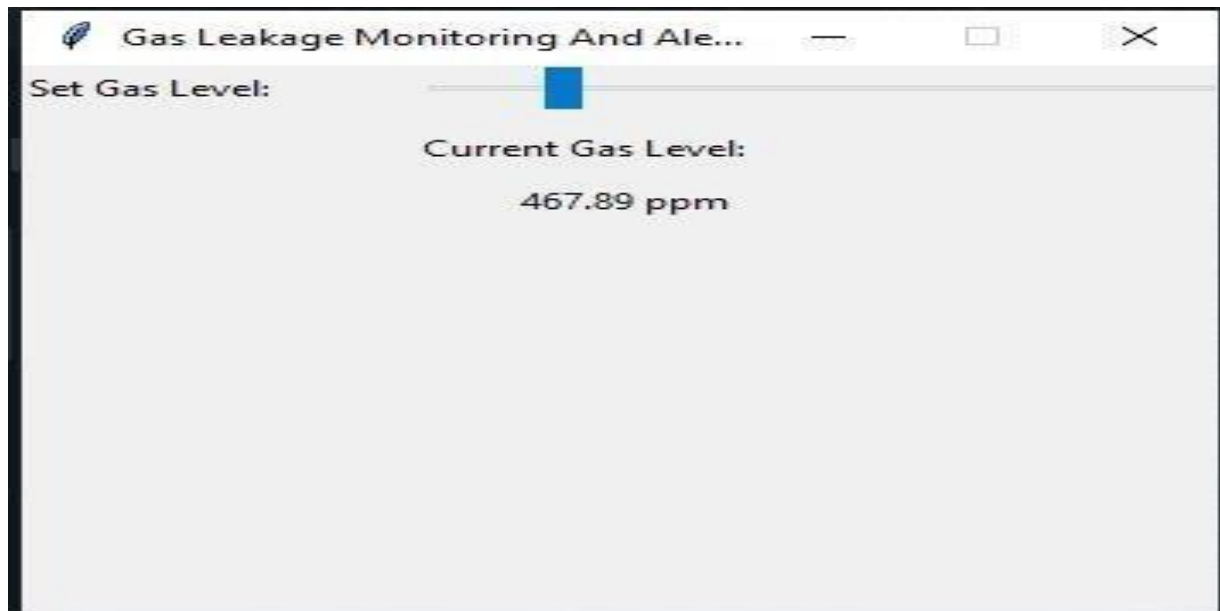
The recent events listed show the live stream of data that is coming and going from this device.

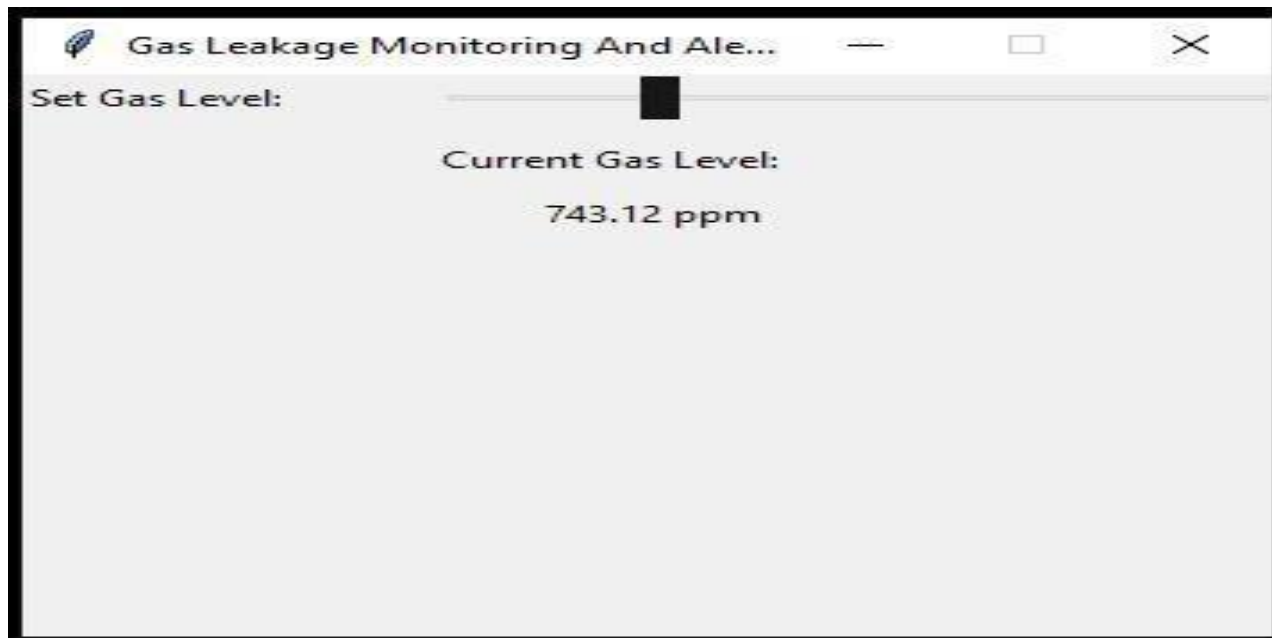
Event	Value	Format	Last Received
status	["TemperatureZ1":46,"HumidityZ1":81,"GasLeve...	json	a few seconds ago
event_1	["TemperatureZ1":107,"HumidityZ1":76,"GasLev...	json	a few seconds ago
event_1	["TemperatureZ1":64,"HumidityZ1":71,"GasLeve...	json	a few seconds ago
status	["TemperatureZ1":90,"HumidityZ1":59,"GasLeve...	json	a few seconds ago
event_1	["TemperatureZ1":74,"HumidityZ1":68,"GasLeve...	json	a few seconds ago

1 Simulation running









## UAT TESTING

Section				Total Cases	Not Tested	Fail	Pass
Print Engine				7	0	0	7
Client Application				51	0	0	51
Security				2	0	0	2
Outsource Shipping				3	0	0	3
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal		
By Design	10	4	2	3	20		
Duplicate	1	0	3	0	4		
External	2	3	0	1	6		
Fixed	11	2	4	20	37		
Not Reproduced	0	0	1	0	1		
Skipped	0	0	1	1	2		
Won't Fix	0	5	2	1	8		
Totals	24	14	13	26	77		

## Test Case Analysis

Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

## 8. Result:

The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of 1m radius of the rover and the sensor output data are continuously transferred to the local server. The accuracy of sensors is not up to the mark thus stray gases are also detected which creates an amount of error in the outputs of the sensors, especially in case of methane. Further the availability and storage of toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware. As the system operates outside the pipeline, the complication of system maintenance and material selection of the system in case of corrosive gases is reduced. Thus, the system at this stage can only be use data primary indicator of leakage inside a plant.

## 9. Advantages/Disadvantages:

### 9.1 Advantages:

1. Get real-time alerts about the gaseous presence in the atmosphere.
2. Prevent fire hazards and explosions.
3. Supervise gas concentration levels.
4. Ensure worker's health.
5. Real-time updates about leakages.
6. Cost-effective installation.
7. Data analytics for improved decisions.

8. Measure oxygen level accuracy.
9. Get immediate gas leak alerts.

## **9.2 Disadvantages:**

1. It requires air or oxygen to work.
2. It gets reacted due to heating of wire.
3. It can be poisoned by lead, chlorine and silicon

## **11. CONCLUSION:**

This gas leak detector system contains two features, this includes the SMS Gateway feature for only sending warning information regarding the gas leak to user, and the alarm for the warning alert. There is some improvement which can be applied for the future work, such as regarding the SMS Gateway, it need to enhance with feature such as notifying the user whenever the remaining credit balance is insufficient. Another thing which can be enhanced is regarding the sensor, the sensors in this module do not include somewhat notification for notifying the user whenever the sensor not working properly or not connected to the micro-controller for some cases, therefore, it is recommended to add this kind of features in the future work for better refinement.

## **12. FUTURE SCOPE:**

We propose to build the system using an MQ6 gas detection sensor and interface it with an Aurdino Uno microcontroller along with an LCD Display. This system uses the gas sensor to detect any gas leakages. The gas sensor sends out a signal to the microcontroller as soon as it encounters a gas leakage. The microcontroller processes this signal and a message is displayed on the LCD to alert the user.

### **12.1 GITHUB:**

**Link :** <https://github.com/IBM-EPBL/IBM-Project-12061-1659368763>

**Demo Link :**

[https://drive.google.com/file/d/146OH\\_vr6TOPn0yBm1Y7U9WMwIVYs8ie-/view?usp=drivesdk](https://drive.google.com/file/d/146OH_vr6TOPn0yBm1Y7U9WMwIVYs8ie-/view?usp=drivesdk)