GAS LEAKAGE MONITORING AND ALERTING SYSTEM

IBM - NALAIYA THIRAN PROJECT BASED LEARNING

ON
PROFESSIONAL READINESS FOR INNOVATION,
EMPLOYABILITY AND ENTREPRENEURSHIP

A PROJECT REPORT
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ABSTRACT

Home fires have been more common in recent years, posing a greater risk to human life and property. Liquid petroleum gas (LPG) is very flammable and can burn even far from the site of the leak. The majority of fires are caused by a poor-quality rubber tube or because the regulator is not switched off while not in use. As a result, designing a gas leakage alarm system is critical. As a result, this study proposes a gas leakage warning system that detects gas leaks and alerts the individuals onboard.

The number of deaths has risen in recent years as a result of LPG explosions. To avoid this problem, a system to detect LPG leakage is required. The method of detecting potentially harmful gas leaks using multiple sensors is known as gas leak detection. Several LPG detection and alarm system designs have been presented in the literature. We have created a kitchen gas leak detection and automated gas shut-off system. Gas detectors based on wireless and GSM technologies have also been proposed. This paper describes an LPG leak detection and alarm system for preventing fires and ensuring home safety.

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GAS LEAKAGE MONITORING AND ALERTING SYSTEM

1. INTRODUCTION

1.1 PROJECT OVERVIEW:

The world has been moving at a rapid pace to adapt the most advanced technologies and connect anything, which means everything. Various establishments such as hotels, canteens, and industries use flammable gases such as LPG, carbon dioxide, ammonia, and others to provide the best hospitality services to their customers. The use of these gases has undoubtedly made technologies smarter, but it also introduces a risk factor that poses a threat to and damages life. As a result, safety becomes a serious concern. Due to this factor, a gas leaking monitoring and alerting system is required at such accident-prone locations so that continuous monitoring of any type of leakage could be detected regardless of human senses. The designed system continuously monitors the surroundings for any leakage and alerts the user. It alerts the user about environmental conditions such as temperature and gas level using an Ethernet shield module and an Android application. The Internet of Things (IoT) is a futuristic technology that proposes the interconnection of devices and the internet. Because safety is a top priority, the proposed gas detection system employs IoT to detect leaks and alert the user to prevent them. Because the gases are toxic, they must be monitored in such a way that any increase in their level is detected and appropriate precautions are taken.

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 PROBLEMS:

The primary goal of the gas leakage monitoring system is to detect malfunctions in the pressurized gas system to prevent the accumulation of gases and thus the explosion. Our gas detection system not only continuously monitors the surroundings but also prevents further gas leakage in the environment, reducing the risk of fire. The gas detection system not only continuously monitors the surroundings but also prevents further gas leakage in the environment, reducing the risk of fire. This integrated system will take IoT to the next level and will undoubtedly assist people in meeting their business requirements. In today's world, safety is critical, and certain solutions must be implemented in places of work and residence. Working or living in hazardous conditions, whether with electricity or oil and gas, necessitates certain safety protocols. The gas leakage detection system can be optimized for toxic gas detection while also being upgraded with smoke and fire
detectors to detect the presence of smoke and fire. It is critical to ensure worker safety, but it is even more critical to use the appropriate technology.

2.2 REFERENCES:

1. ***Irfanullah, Razaullah, Saleem Aslam, Fazal Muqeem***, "Internet of Things Platform for Real Time Automated Safety System Based on Multi Sensor Network and Bluetooth Module", 2022 5th Conference on Cloud and Internet of Things (CIoT),

2. ***G. Ramesh, J. Jolin Dorrothi, R. Nithya Shree, S. Sailanjali Ajitha***, "Smart in Sync Cylinder Reserving and LPG Gas Tracking System", 2021 3rd International Conference on Advances in Computing, Communication Control and Networking (ICAC3N), pp.554-557, 2021.

3. ***Sourav Debnath, Samin Ahmed, Suprio Das, Abdullah-Al Nahid, Anupam Kumar Bairagi***, "IoT based Low-Cost Gas Leakage, Fire, and Temperature Detection System with Call Facilities", 2020 2nd International Conference on Advanced Information and Communication Technology (ICAICT), pp.11-16, 2020.

4 ***Flores-Cortez, O., Cortez, R., & González, B.*** (2021, June). Design and Implementation of an IoT Based LPG and CO Gases Monitoring System. In CS & IT Conference Proceedings (Vol. 11, No. 8). CS & IT Conference Proceedings.

5 ***Khan, M. M. (2020)***. Sensor-Based Gas Leakage Detector System. In Engineering Proceedings (Vol. 2, No. 1, p. 28). Multidisciplinary Digital Publishing Institute.
6. Islam, M. N., Mondal, S. K., Hossain, M. A., & Al Zubaer, A. Multi-functional Gas Detector can be in the Air Gas Concentration Signal into the Electrical Signal Display and Remote Transmission.

7. ***Wei, J. C., & Wei, J. T.*** (2021). U.S. Patent No. 10,969,357. Washington, DC: U.S. Patent and Trademark Office.

8 ***Singh, H., Abdulla, R., & Selvaperumal, S. K***. (2021). Carbon monoxide detection using IoT. Journal of Applied Technology and Innovation (e-ISSN: 2600-7304), 5(3), 7.

9 ***Mariselvam, V., & Dharshini, M. S.*** (2021). IoT-based level detection of gas for booking management using the integrated sensor. Materials Today: Proceedings, 37, 789-792

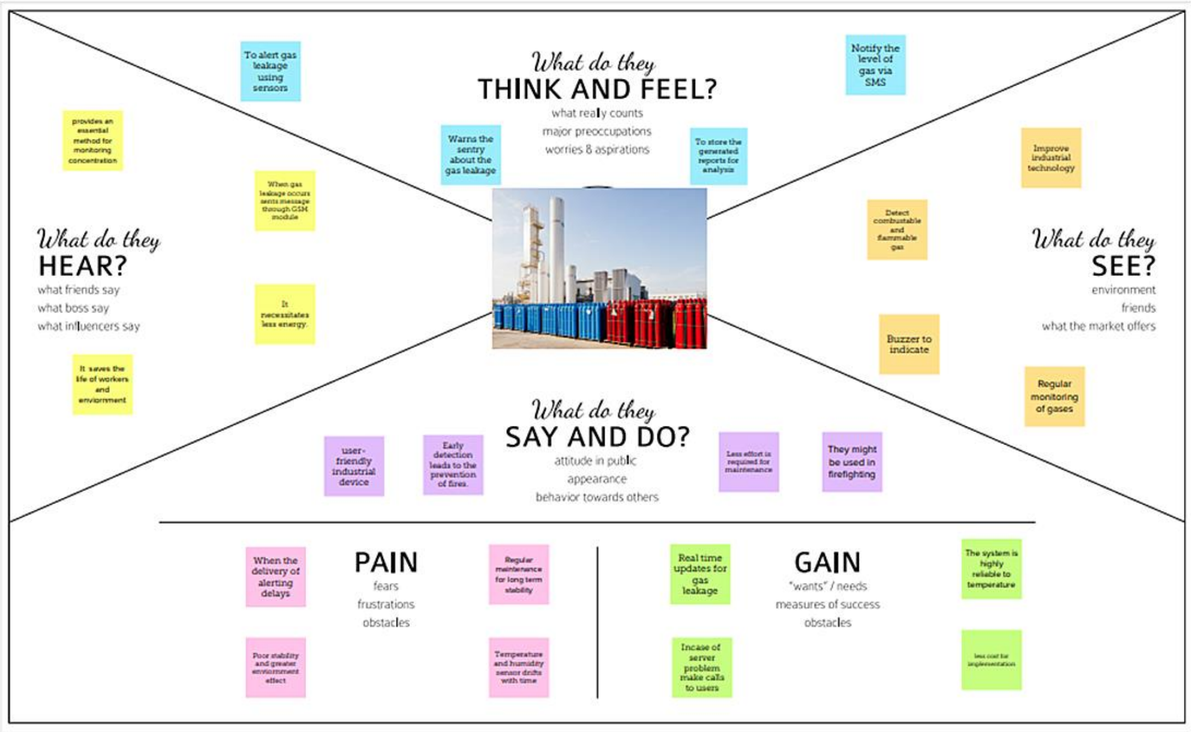
10 ***Alqourabah, H., Muneer, A., & Fati, S. M***. (2021). A smart fire detection system using IoT technology with an automatic water sprinkler. International Journal of Electrical & Computer Engineering (2088-8708), 11(4)

2.3. PROBLEM STATEMENT DEFINITION

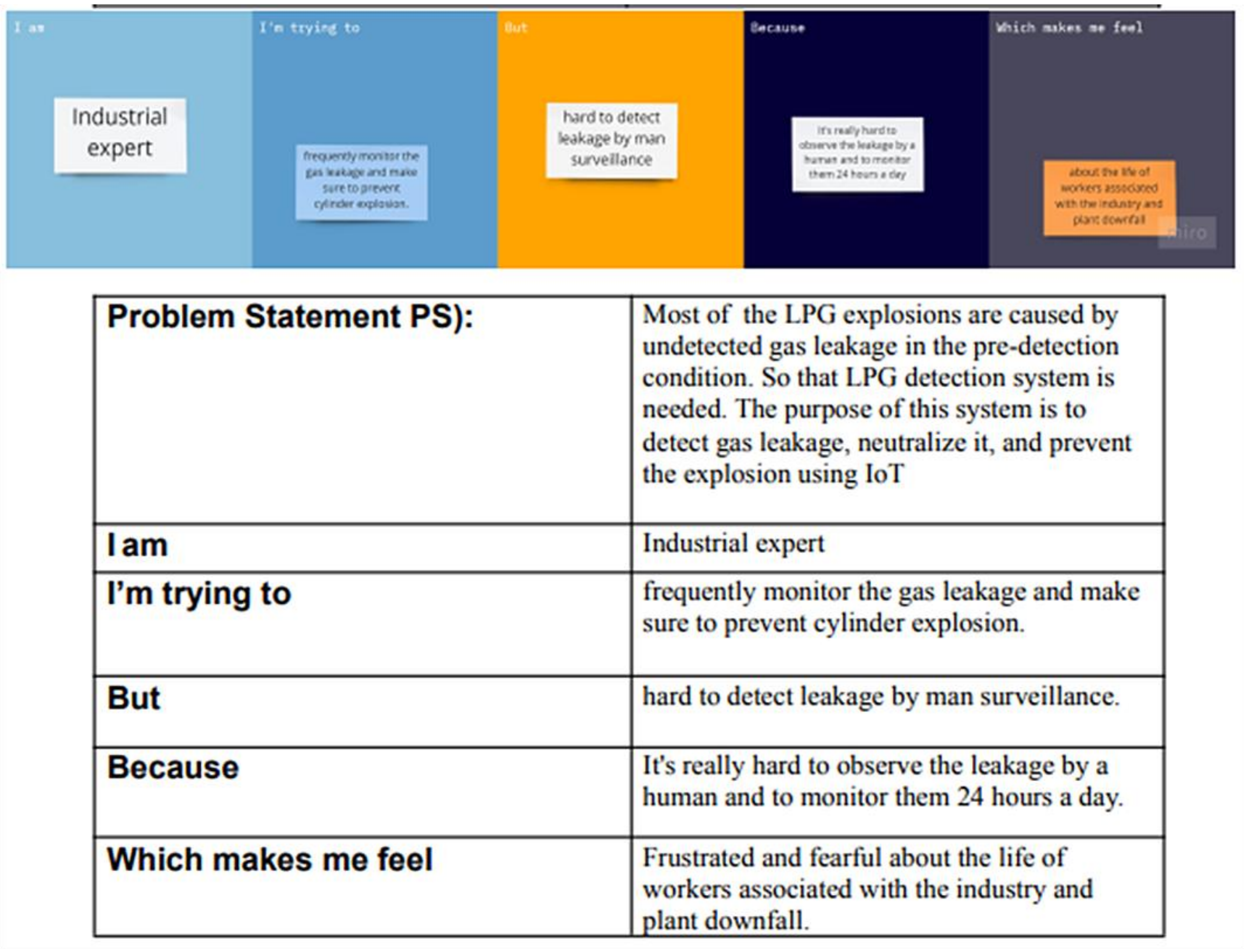
In most industries, one of the key parts of any safety plan for reducing risks to personnel and plant is the use of early-warning devices such as gas detectors. These can help to provide more time in which to take remedial or protective action. They can also be used as part of a total, integrated monitoring 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.

3.IDEATION AND PROPOSED SOLUTION

3.1. EMPATHY MAP CANVAS:

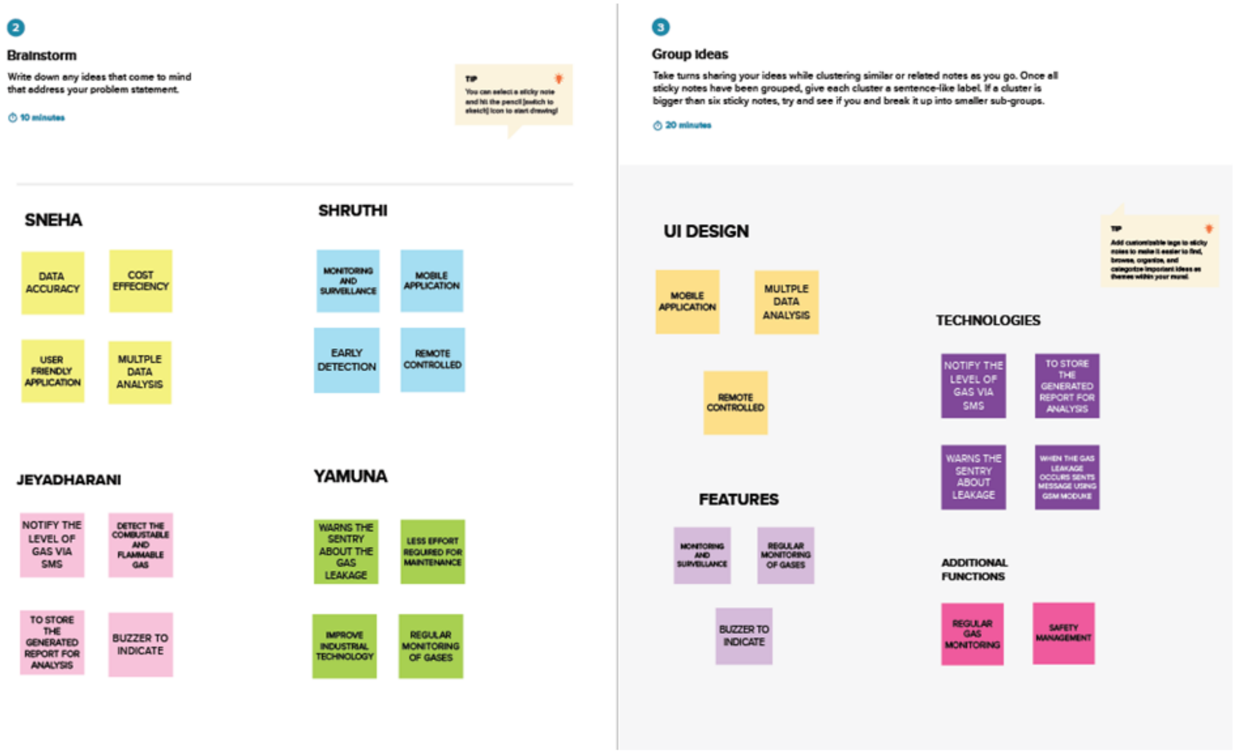

To alert gas leakage using sensors
What do they
THINK AND FEEL?
what realy counts
major preoccupations
worries 8 aspirations
Notify the level of gas via SMS
Warns the sentry about the gas leakage
To store the generated reports for analysis
provides an essential method for monitoring concentration
When gas leakage occurs sents message through GSM module
Improve industrial technology
Detect combustable and flammable gas
What do they
HEAR?
what friends say
what boss say
what influencers say
What do they
SEE?
environment
friends
what the market offers
It necessitates less energy.
Buzzer to indicate
It saves the life of workers and enviornment
Regular monitoring of gases
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
user-friendly industrial device
Early detection leads to the prevention of fires.
Less effort is required for maintenance
They might be used in firefighting
When the delivery of alerting delays
PAIN
fears
frustrations
obstacles
Regular maintenance for long term stability
Real time updates for gas leakage
GAIN
"wants" / needs
measures of success
obstacles
The system is highly reliable to temperature
Poor stability and greater environment effect
Temperature and humidity sensor drifts with time
Incase of server problem make calls to users
less cost for implementation

3.2.1IDEATION :


I am
Industrial expert
I'm trying to
frequently monitor the gas leakage and make sure to prevent cylinder explosion.
But
hard to detect leakage by man surveillance
Because
It's really hard to observe the leakage by a human and to monitor them 24 hours a day
Which makes me feel
about the life of workers associated with the industry and plant downfall
miro

Problem Statement PS):	Most of the LPG explosions are caused by undetected gas leakage in the pre-detection condition. So that LPG detection system is needed. The purpose of this system is to detect gas leakage, neutralize it, and prevent the explosion using IoT
I am	Industrial expert
I'm trying to	frequently monitor the gas leakage and make sure to prevent cylinder explosion.
But	hard to detect leakage by man surveillance.
Because	It's really hard to observe the leakage by a human and to monitor them 24 hours a day.
Which makes me feel	Frustrated and fearful about the life of workers associated with the industry and plant downfall.

3.2.2. BRAINSTORMING:



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!

3

Group Ideas

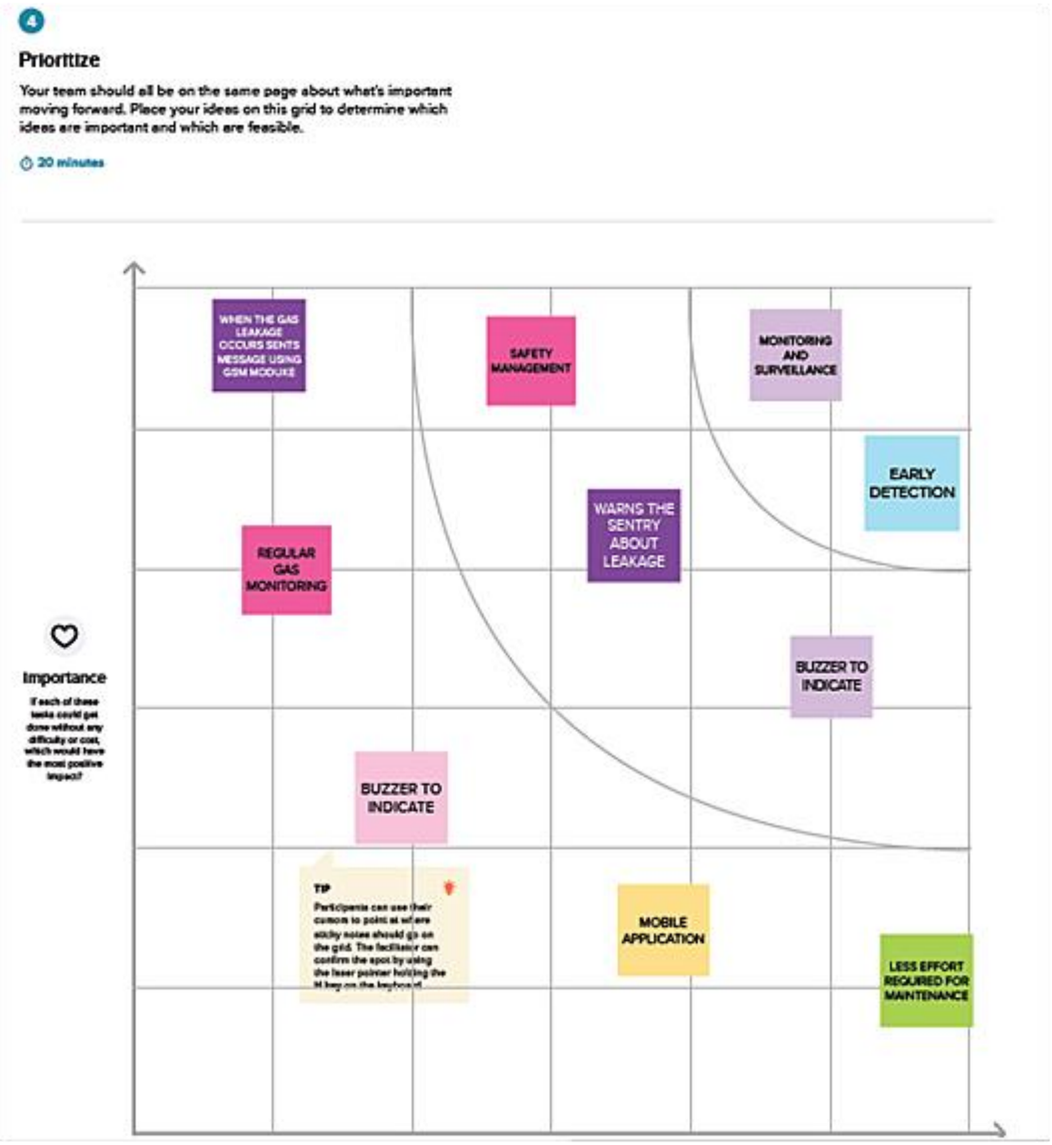
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

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.

SNEHA
DATA ACCURACY
COST EFFECIENCY
USER FRIENDLY APPLICATION
MULTPLE DATA ANALYSIS
SHRUTHI
MONITORING AND SURVEILLANCE
MOBILE APPLICATION
EARLY DETECTION
REMOTE CONTROLLED
JEYADHARANI
NOTIFY THE LEVEL OF GAS VIA SMS
DETECT THE COMBUSTABLE AND FLAMMABLE GAS
TO STORE THE GENERATED REPORT FOR ANALYSIS
BUZZER TO INDICATE
YAMUNA
WARNS THE SENTRY ABOUT THE GAS LEAKAGE
LESS EFFORT REQUIRED FOR MAINTENANCE
IMPROVE INDUSTRIAL TECHNOLOGY
REGULAR MONITORING OF GASES
UI DESIGN
MOBILE APPLICATION
MULTPLE DATA ANALYSIS
REMOTE CONTROLLED
FEATURES
MONITORING AND SURVEILLANCE
REGULAR MONITORING OF GASES
BUZZER TO INDICATE
TECHNOLOGIES
NOTIFY THE LEVEL OF GAS VIA SMS
TO STORE THE GENERATED REPORT FOR ANALYSIS
WARNS THE SENTRY ABOUT LEAKAGE
WHEN THE GAS LEAKAGE OCCURS SENTS MESSAGE USING GSM MODUKE
ADDITIONAL FUNCTIONS
REGULAR GAS MONITORING
SAFETY MANAGEMENT



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

Importance

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

TIP

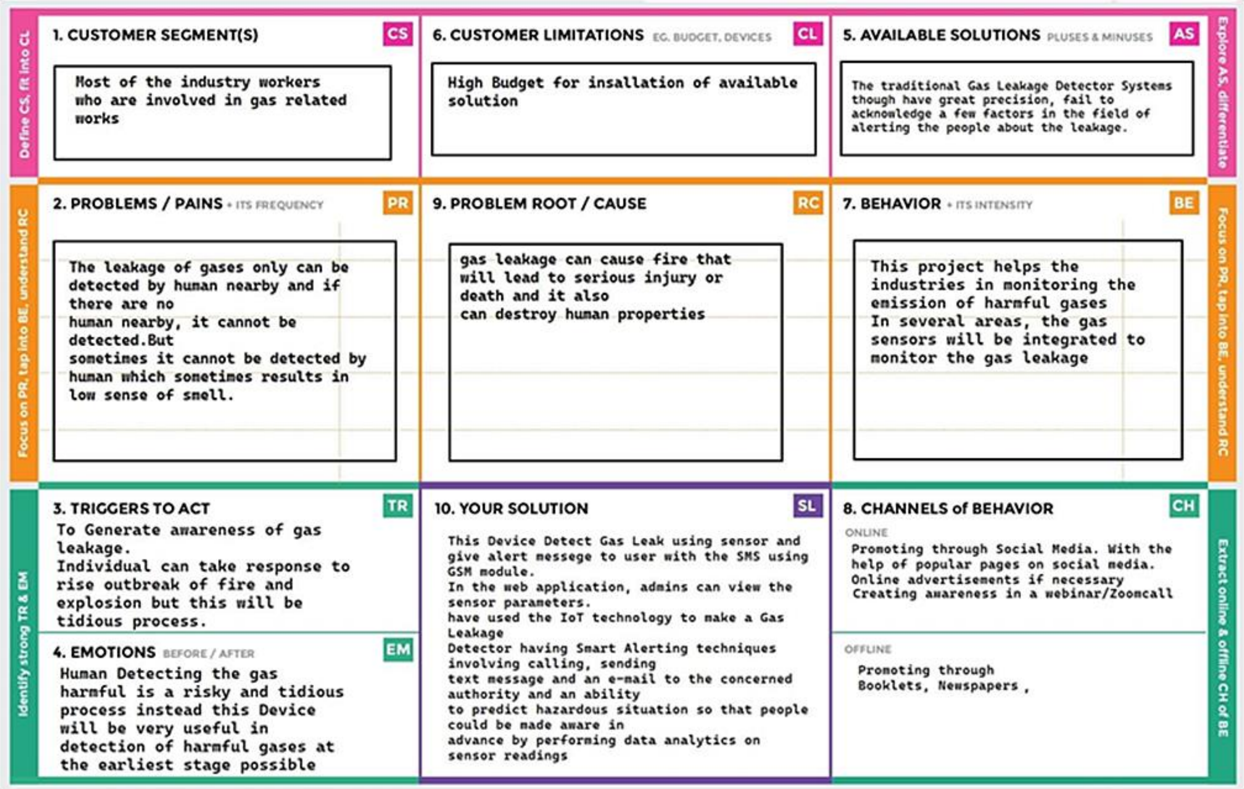
Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the H key on the keyboard.

WHEN THE GAS LEAKAGE OCCURS SENTS MESSAGE USING GSM MODUKE
SAFETY MANAGEMENT
MONITORING AND SURVEILLANCE
EARLY DETECTION
WARNS THE SENTRY ABOUT LEAKAGE
REGULAR GAS MONITORING
BUZZER TO INDICATE
BUZZER TO INDICATE
MOBILE APPLICATION
LESS EFFORT REQUIRED FOR MAINTENANCE

3.3. PROPOSED SOLUTION:

S.No.	Parameter	Description
1.	ProblemStatement(Problem to be solved)	Develop an ***ADVANTAGES:*** ADVANTAGES: 1.'Intrinsically Safe' conformity is simple to achieve. 2.Low operating expenses and maintenance requirements. 3.Trustworthy technology. 4.Long-term exposure to a gas does not cause the instrument to become "poisoned" or degrade it
2.	Idea/Solution description	● This product helps the industries in monitoring the mission of harmful gases ● In several areas, the gas sensors will be integrated to monitor the gas leakage ● If in any area gas leakage is detected the admins will benotified along with the location
3.	Novelty/Uniqueness	● Fastest alerts to the workersUser friendly.
4.	SocialImpact/CustomerSatisfaction	● Cost efficient. ● Easy installation and provide efficient resultsCan work with irrespective of fear.
5.	BusinessModel(RevenueModel)	● The product is advertised all over the platforms. Since itis economical, even helps small scale industries from disasters. ● As the product usage can be understood by everyone, it iseasy for them to use it properly for their safest organization.
6.	Scalability of the Solution	● Since the product is cost efficient, it can be placed in many places in the industries. ● Even when the gas leakage is more, the product sense the accurate values and alerts the workers effectively.

3.4. PROBLEM SOLUTION FIT:


Define CS, fit into CL
Explore AS, differentiate
Focus on PR, tap into BE, understand RC
Focus on PR, tap into BE, understand RC
Identify strong TR & EM
Extract online & offline CH of BE

1. CUSTOMER SEGMENT(S) CS

Most of the industry workers who are involved in gas related works

6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES CL

High Budget for insallation of available solution

5. AVAILABLE SOLUTIONS PLUSES & MINUSES AS

The traditional Gas Leakage Detector Systems though have great precision, fail to acknowledge a few factors in the field of alerting the people about the leakage.

2. PROBLEMS / PAINS + ITS FREQUENCY PR

The leakage of gases only can be detected by human nearby and if there are no
human nearby, it cannot be detected.But
sometimes it cannot be detected by human which sometimes results in low sense of smell.

9. PROBLEM ROOT / CAUSE RC

gas leakage can cause fire that will lead to serious injury or death and it also
can destroy human properties

7. BEHAVIOR + ITS INTENSITY BE

This project helps the industries in monitoring the emission of harmful gases
In several areas, the gas sensors will be integrated to monitor the gas leakage

3. TRIGGERS TO ACT TR

To Generate awareness of gas leakage.
Individual can take response to rise outbreak of fire and explosion but this will be tidious process.

4. EMOTIONS BEFORE / AFTER EM

Human Detecting the gas harmful is a risky and tidious process instead this Device will be very useful in detection of harmful gases at the earliest stage possible

10. YOUR SOLUTION SL

This Device Detect Gas Leak using sensor and give alert messege to user with the SMS using GSM module.
In the web application, admins can view the sensor parameters.
have used the IoT technology to make a Gas Leakage
Detector having Smart Alerting techniques involving calling, sending
text message and an e-mail to the concerned authority and an ability
to predict hazardous situation so that people could be made aware in
advance by performing data analytics on sensor readings

8. CHANNELS of BEHAVIOR CH

ONLINE

Promoting through Social Media. With the help of popular pages on social media.
Online advertisements if necessary
Creating awareness in a webinar/Zoomcall

OFFLINE

Promoting through Booklets, Newspapers ,

4.REQUIREMENT 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	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	Predefined set of GPS locations of nodes is obtained.
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**:

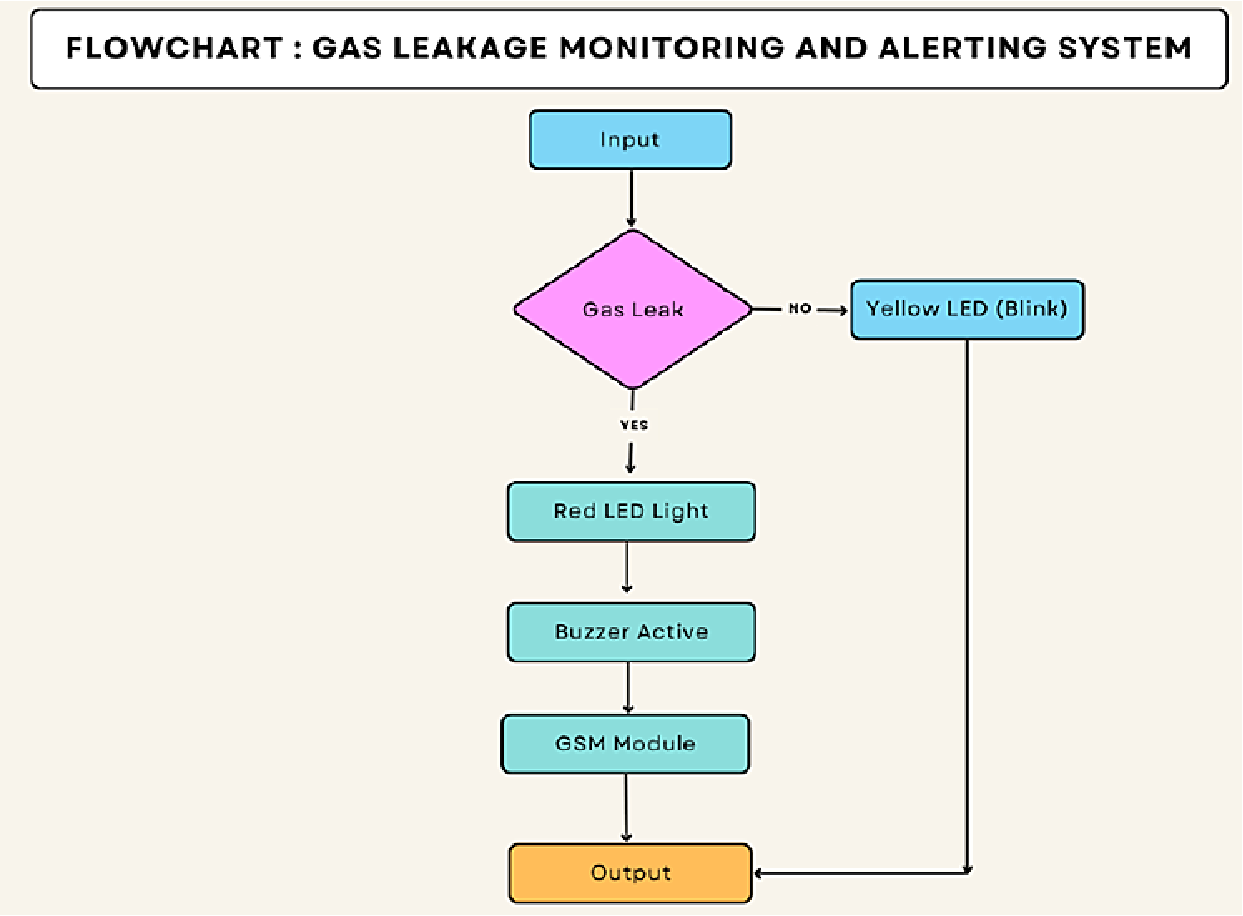
Following are the non-functional requirements of the proposed solution.

FR No	**Non-FunctionalRequirement**	**Description**
NFR-1	Usability	Easy user interface with alerting notifications and location of the defect gas cylinder.
NFR-2	Security	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 accidents and protect workplace safely.
NFR-3	Reliability	1. Gas exposure will measured with ± 25% of the true concentration of the target analyze with 95% certainty. 2.Robust device that can withstand harsh industrial conditions and provide real-time gas leakage detection
NFR 4	Performance	1. Accurate data monitoring system enables periodic analysis of the air quality.
NFR 5	Availability	1. Through Suppliers. 2. With online shopping platforms

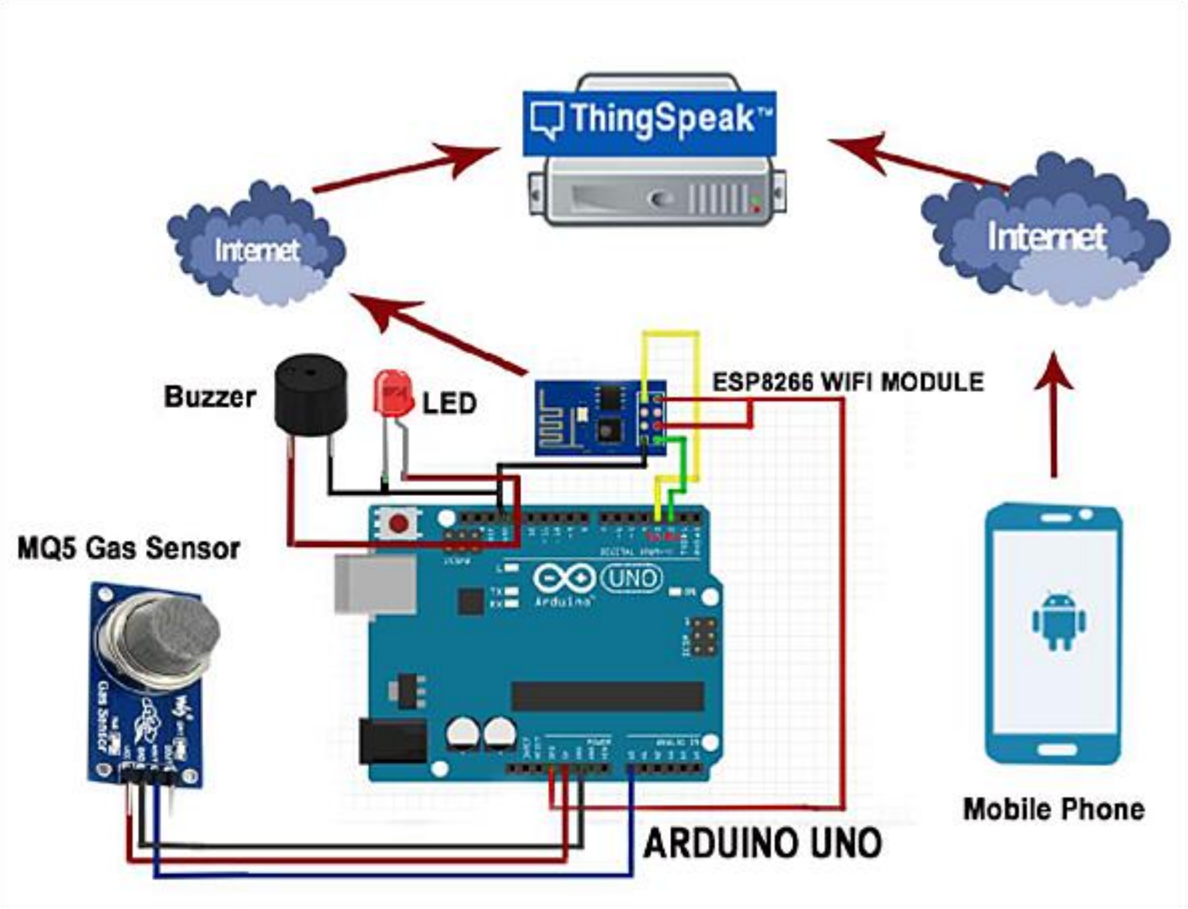
5.PROJECT DESIGN

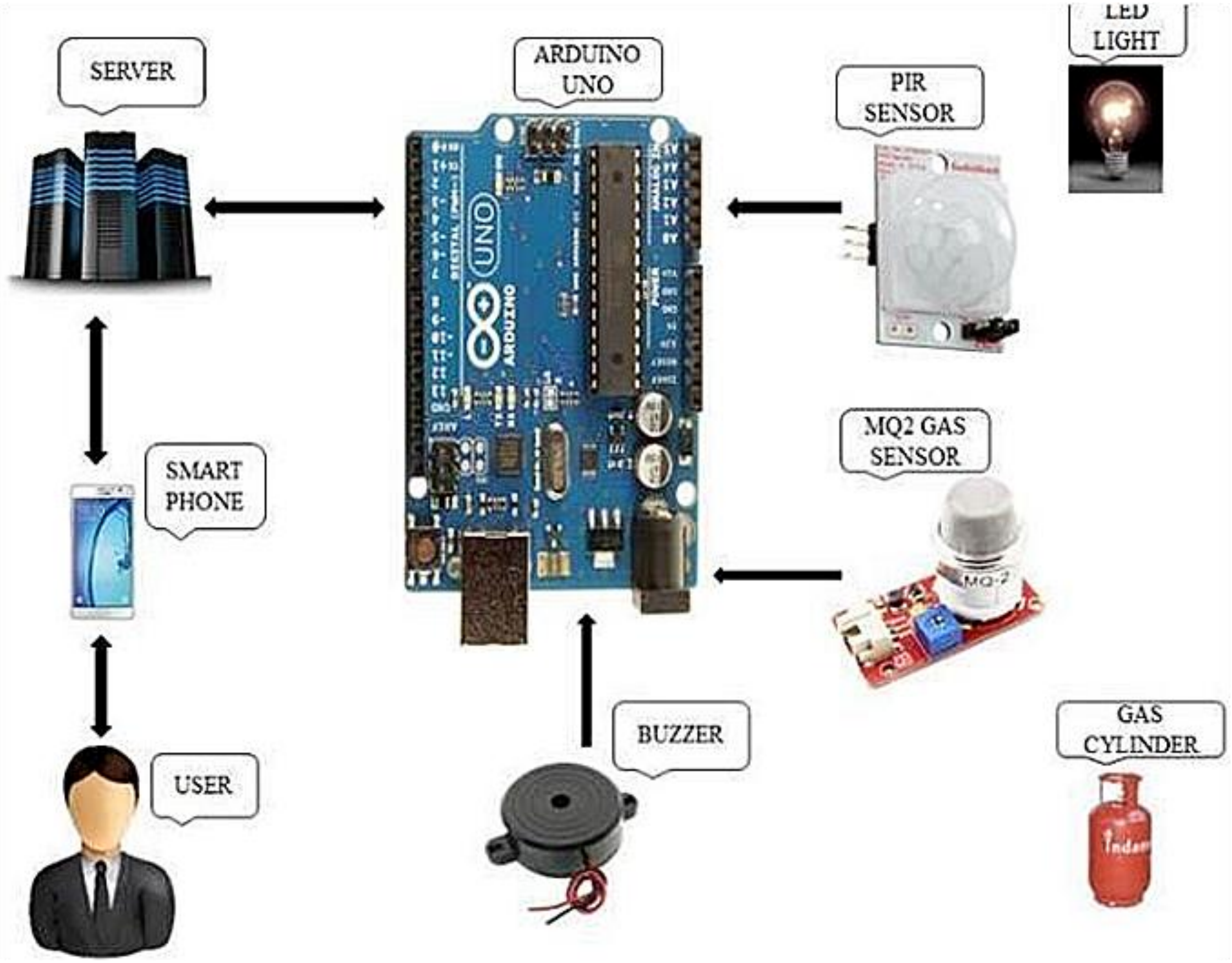
5.1 Data Flow Diagrams:

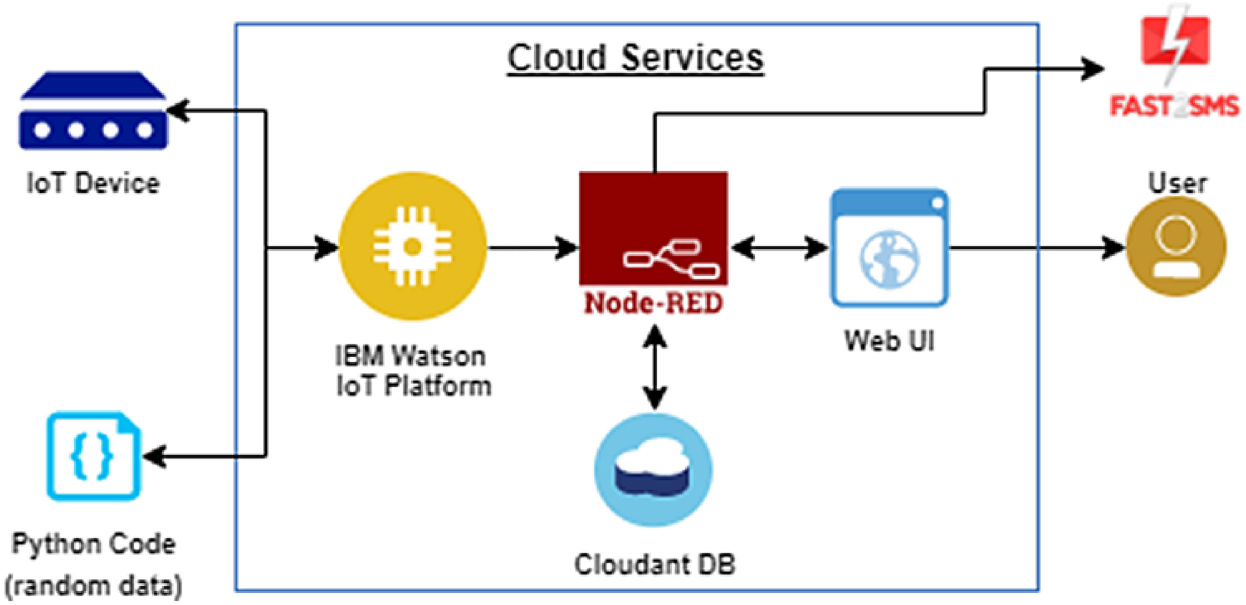
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2. SOLUTION AND TECHNICAL ARCHITECTURE:




SERVER
ARDUINO UNO
PIR SENSOR
LED LIGHT
SMART PHONE
MQ2 GAS SENSOR
MQ-2
BUZZER
GAS CYLINDER
Indane
USER



5.3 USER STORIES:

User type	Functional requirements	User story Number	User story/task	Acceptance criteria	Priority	Release	Team members
Customer	Gas detection and level monitoring	USN-1	As a user I can get the gas leakage alert when gas leaking	I can notice gas leakage	HIGH	SPRINT-1	Saranya Santhosh Sripriya Soundarya Ranjithkumar
		USN-2	As a user I can get the different gas level	I can observe the level of gas leakage	MEDIUM	SPRINT-1	Saranya Santhosh Sripriya Soundarya Ranjithkumar
		USN-3	As a user I can turn on exhausting fan	I can operate the exhausting fan anytime.	MEDIUM	SPRINT-2	Saranya Santhosh Sripriya Soundarya Ranjithkumar
		USN-4	As a user I can turn on exhaust fan	I can turn on fan when there is a	HIGH	SPRINT-2	Saranya Santhosh Sripriya

			when gas leaking	leakage of gas.			Soundarya Ranjithkuma-r
	Node-Red Creation	USN-5	As a user I can receive gas leakage levels to alert message	I can receive a;erting message when there is a gas leak.	HIGH	SPRINT-3	Saranya Santhosh Sripriya Soundarya Ranjithkuma-r
		USN-6	As a user,i can receive gas leaking levels with alerting messages.	I can receive messages instantly when there is a gas leak.	MEDIUM	SPRINT-3	Saranya Santhosh Sripriya Soundarya Ranjithkuma-r
	Documentation	USN-7	As a user I can get gas level and documentation	Documentation with gas level and amount of gas level	HIGH	SPRINT-4	Saranya Santhosh Sripriya Soundarya Ranjithkuma-r

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning and Estimation:

S.NO	MILESTONES	ACTIVITIES	DATE
1.	PhasePreparation	Pre-requisites	24Aug2022
		Prior Knowledge	25Aug2022
		Project Structure	23Aug2022

		Project Flow	23Aug2022
		Project Objectives	22Aug2022
		Registrations	26Aug2022
		Environment Set-up	27Aug2022
2.	Ideation Phase	Literature Survey	29Aug2022–03Sept2022
		Empathy Map	5Sept 2022-7Sept 2022
		ProblemStatement	8Sept 2022-10Sept 2022
		Ideation	12Sept 2022–16Sept
3.	Project Design Phase - 1	Proposed Solution	19 Sept 2022 – 23 Sept 2022
		Problem Solution Fit	24 Sept 2022 – 26 Sept 2022
		Solution Architecture	27 Sept 2022 – 30 Sept 2022
4.	Project Design Phase - 2	Customer Journey Map	03 Oct 2022 – 08 Oct 2022
		Requirement Analysis	09 Oct 2022 – 11 Oct 2022
		Data Flow Diagrams	11 Oct 2022 – 14 Oct 2022
		Technology Architecture	15 Oct 2022 - 16 Oct 2022

5.	Project Planning Phase	Milestones & Tasks	17 Oct 2022 – 18 Oct 2022
		Sprint Schedules	19 Oct 2022 – 22 Oct 2022
6.	Project Development Phase	Sprint - 1	26 Oct 2022 – 31 Oct 2022
		Sprint – 2	01 Nov 2022 – 07 Nov 2022
		Sprint – 3	08 Nov 2022 – 13 Nov 2022
		Sprint – 4	15 Nov 2022 – 20 Nov 2022

1.Sprint Delivery Schedule

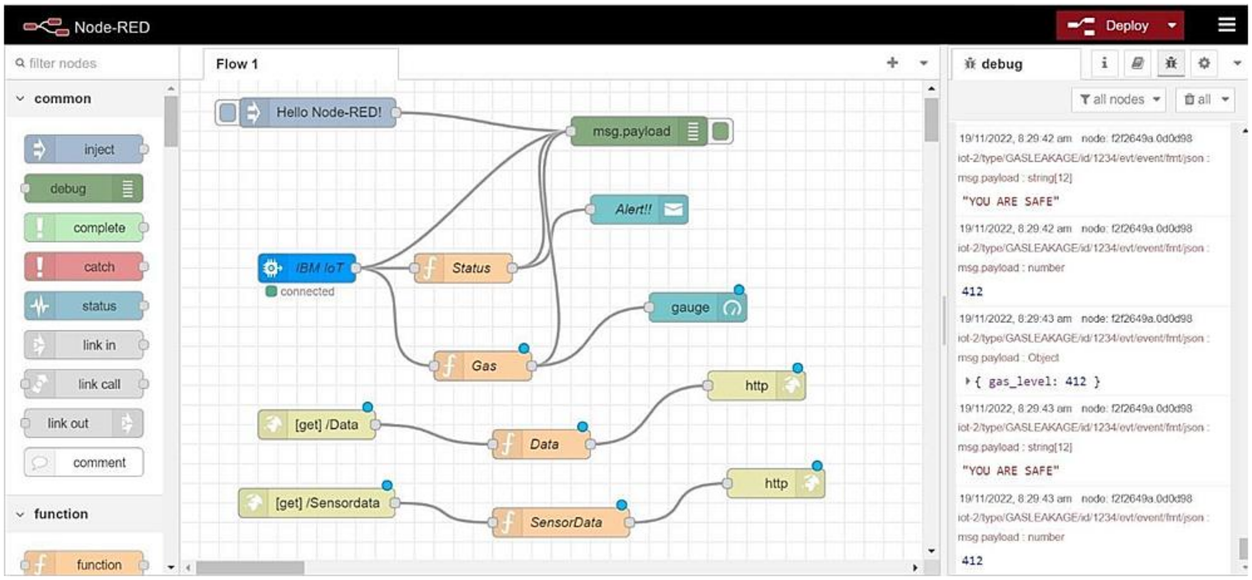
Sprint	Functional Requirement (Epic)	User Story	User Story / Task	Story Point	Priority
Sprint-1	Create	US-1	Create the IBM Cloud services which are being used in this project.	5	High
Sprint-1	Configure	US-2	Configure the IBM Cloud	1	Medium

			services which are being used in completing this project.		
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	1	Medium

			Node- RED service for accessing the IBM IoT Platform		
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 NodeRED 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



```
19/11/2022, 8:29:42 am   node: f2f2649a.0d0d98
iot-2/type/GASLEAKAGE/id/1234/evt/event/fmt/json :
msg.payload : string[12]
"YOU ARE SAFE"
19/11/2022, 8:29:42 am   node: f2f2649a.0d0d98
iot-2/type/GASLEAKAGE/id/1234/evt/event/fmt/json :
msg.payload : number
412
19/11/2022, 8:29:43 am   node: f2f2649a.0d0d98
iot-2/type/GASLEAKAGE/id/1234/evt/event/fmt/json :
msg.payload : Object
▸{ gas_level: 412 }
19/11/2022, 8:29:43 am   node: f2f2649a.0d0d98
iot-2/type/GASLEAKAGE/id/1234/evt/event/fmt/json :
msg.payload : string[12]
"YOU ARE SAFE"
19/11/2022, 8:29:43 am   node: f2f2649a.0d0d98
iot-2/type/GASLEAKAGE/id/1234/evt/event/fmt/json :
msg.payload : number
412
```

6.3. Reports from JIRA:

PROJECT TRACKER:

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	20	24 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	07 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

7.CODING AND SOLUTIONING

CODE

This is the code that was run in python idle version 3.7(64-bit), this code is used to simulate the gas values, and acts as the input for the project.
In this python code we simulate the levels of five gases Propane, carbon monoxide. LPG ,methane, Hydrogen, the units used is ppm. These values are integers and they are published as a d object to the website.

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

#Provide your IBM Watson Device Credentials
organization = &quot;s0uwr0&quot;
deviceType = &quot;weather_device&quot;
deviceId = &quot;vpsr_weather&quot;
authMethod = &quot;token&quot;
authToken = &quot;9mMbsPkwZ-NtBMUAPc&quot;

# Initialize GPIO
def myCommandCallback(cmd):
print(&quot;Command received: %s&quot; % cmd.data[&#39;command&#39;])
print(cmd)

try:

deviceOptions = {&quot;org&quot;: organization, &quot;type&quot;: deviceType, &quot;id&quot;:
deviceId, &quot;auth-
method&quot;: authMethod, &quot;auth-token&quot;: authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)
#..............................................

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

# Connect and send a datapoint &quot;hello&quot; with value &quot;world&quot; into the cloud as an
event of
type &quot;greeting&quot; 10 times
```

```
deviceCli.connect()

while True:
#Get Sensor Data from DHT11
Propane = random.randint(0, 2000);
Carbon_Monoxide = random.randint(0, 100);
LPG= random.randint(0, 2000);
Methane = random.randint(0, 1000);
Hydrogen= random.randint(0, 5000);
data = {&quot;d&quot;:{
&quot;Propane&quot;: Propane,
&quot;Carbon_Monoxide&quot;:
Carbon_Monoxide, &quot;LPG&quot;: LPG,
&quot;Methane&quot;: Methane,
&quot;Hydrogen&quot;:Hydrogen
}
}

#print data
def myOnPublishCallback():
print (&quot;Published Propane = %s ppm&quot; % Propane, &quot;LPG = %s ppm&quot; % LPG,
&quot;to
IBM Watson&quot;)

success = deviceCli.publishEvent(&quot;IoTSensor&quot;, &quot;json&quot;, data, qos=0,
on_publish=myOnPublishCallback)
if not success:
print(&quot;Not connected to IoTF&quot;)
time.sleep(1)
deviceCli.commandCallback = myCommandCallback

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

This code connects to the device in the IBM IoT platform, which is in turn connected to Node red. The gas levels can also be viewed at Node red.

7.1 FEATURE 1

- Here the Gas level is continuously monitored in real time using an app with negligible delay.

- High sensitivity to the five gases s Propane, carbon monoxide. LPG ,methane, Hydrogen
- Long life of the system, easy to monitor and maintain
- Detection threshold for the gases in ppm

1. Propane 1,000 ppm.
2. Carbon Monoxide 50 ppm.

3. LPG Harmful level 2,000 ppm
4. Methane 1,000 ppm
5. Hydrogen 4,100ppm

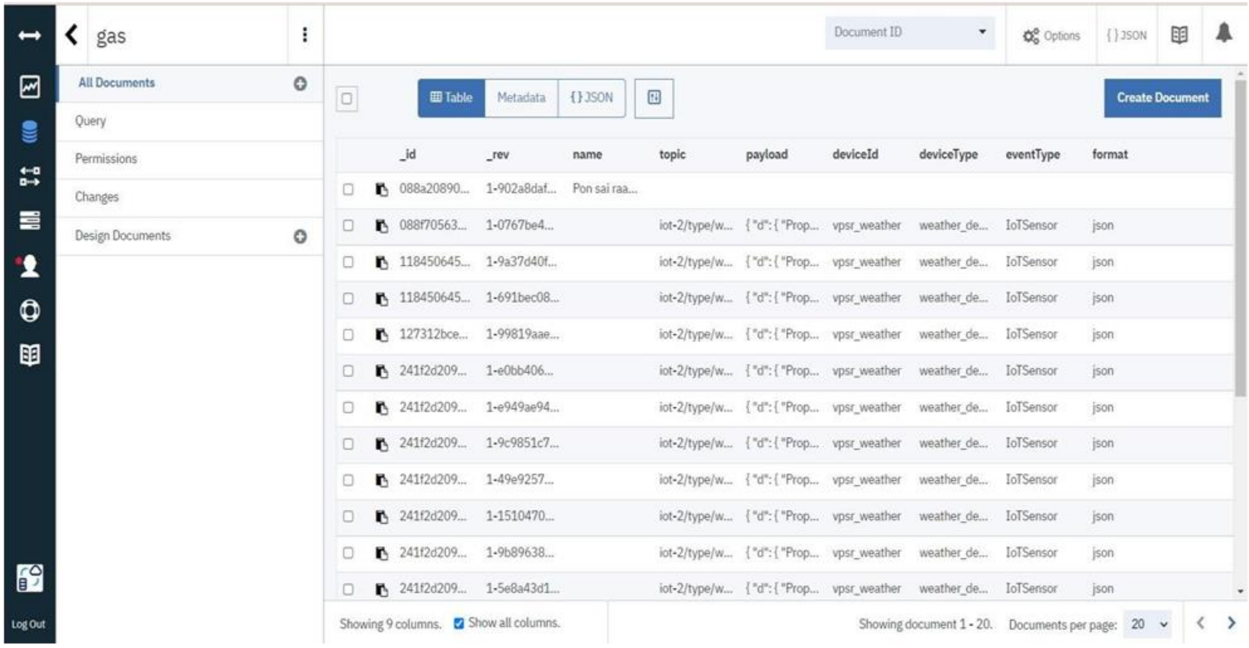
- If the detection threshold is breached,then the user is alerted.

7.2 FEATURE 2

- This project helps the industries in monitoring the emission of harmful gases from any location (i.e any part of the world).
- The inspectors don’t necessarily have to be in the factory/ plant, so they don’t have to get exposed to these harmful gases.
- In several industries, the leakage of gases can cause , economic loss to the company , which can be minimized using this system.
- In the web application, admins can view the sensor parameters and the gas levels.

7.3 DATABASE SCHEMA

The table in the database named gas:-



	_id	_rev	name	topic	payload	deviceId	deviceType	eventType	format
□	088a20890...	1-902a8daf...	Pon sai raa...						
□	088f70563...	1-0767be4...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	118450645...	1-9a37d40f...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	118450645...	1-691bec08...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	127312bce...	1-99819aae...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	241f2d209...	1-e0bb406...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	241f2d209...	1-e949ae94...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	241f2d209...	1-9c9851c7...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	241f2d209...	1-49e9257...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	241f2d209...	1-1510470...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	241f2d209...	1-9b89638...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json
□	241f2d209...	1-5e8a43d1...		iot-2/type/w...	{ "d": { "Prop...	vpsr_weather	weather_de...	IoTSensor	json

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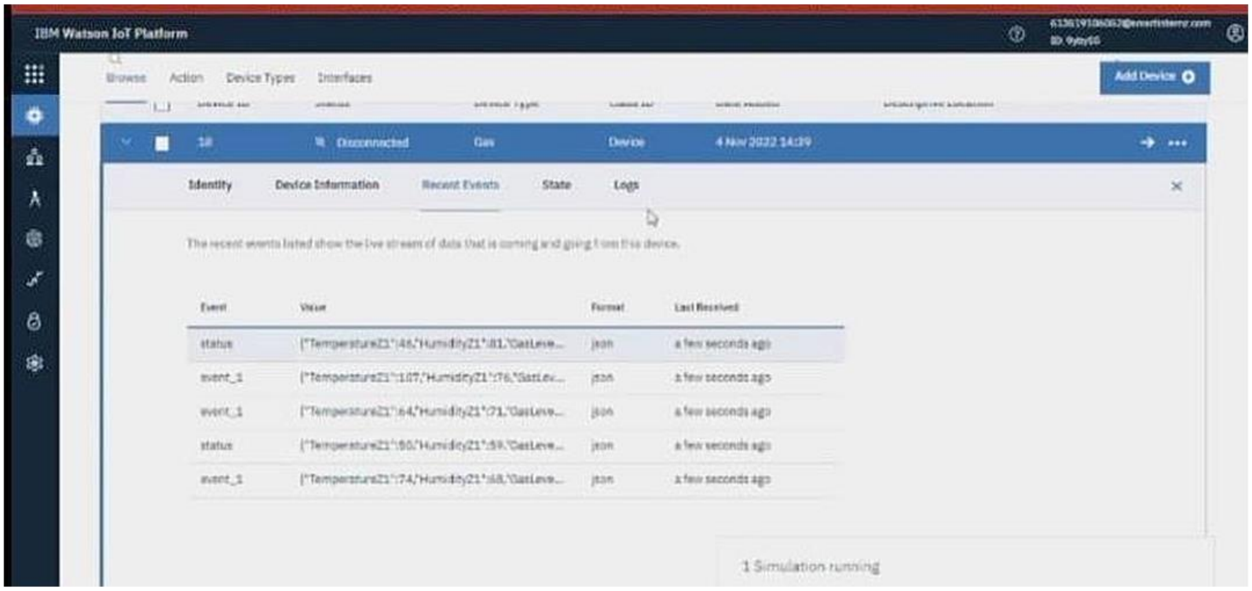
8. TESTING:

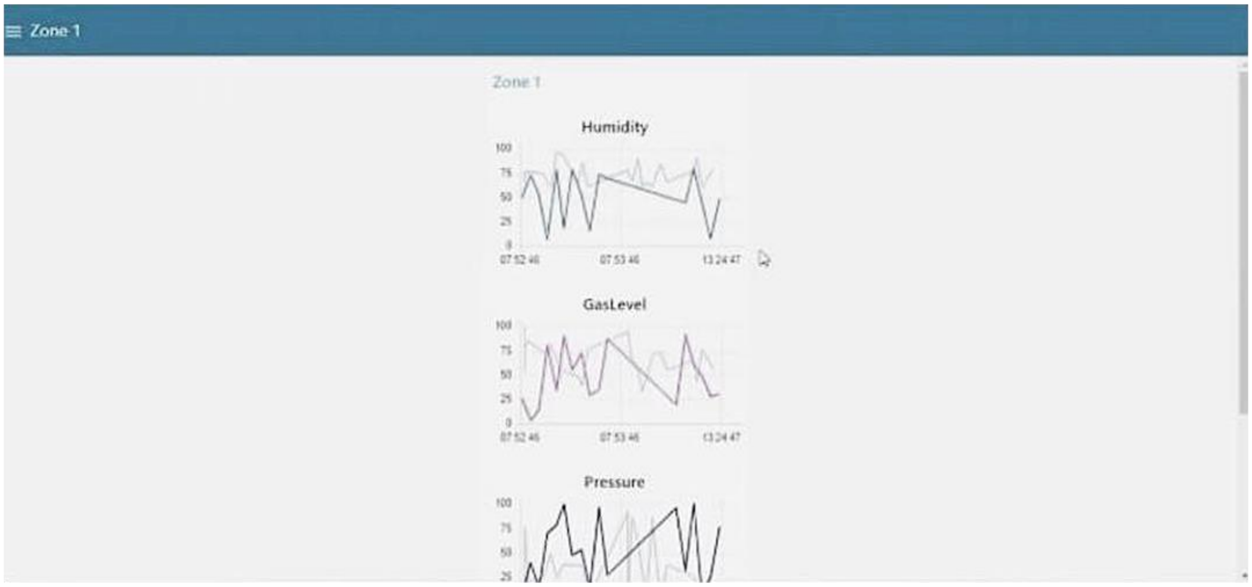
8.1 TEST CASE

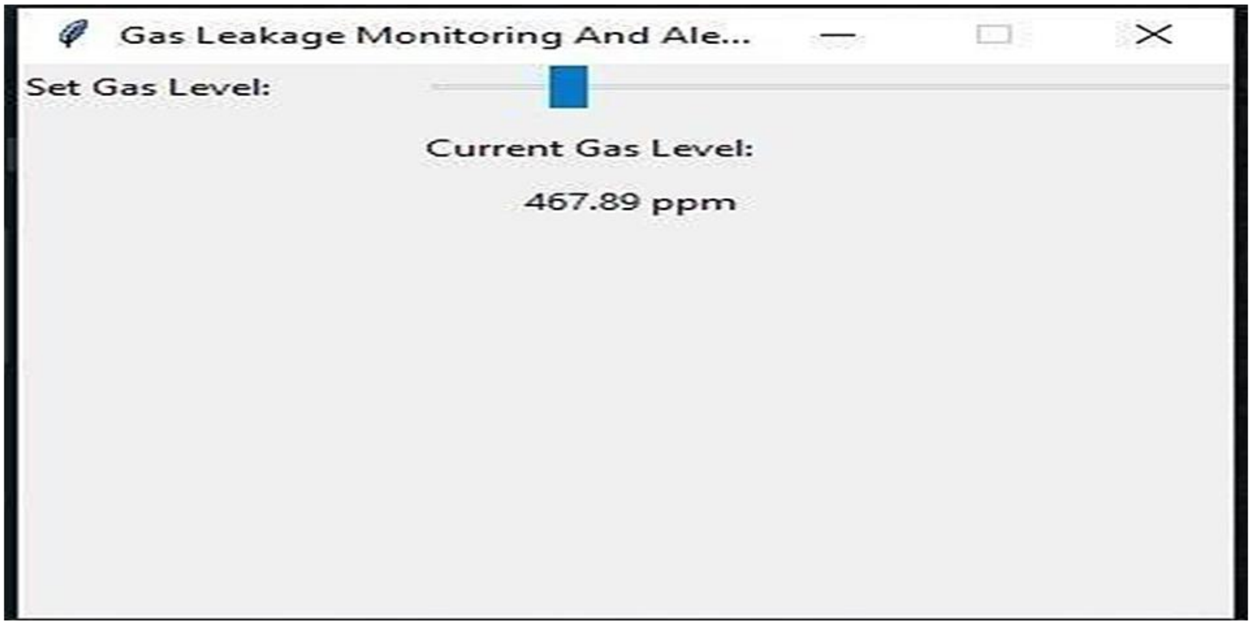


18	Disconnected	Gas	Device	4 Nov 2022 14:39

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":80,"HumidityZ1":59,"GasLeve...	json	a few seconds ago
event_1	{"TemperatureZ1":74,"HumidityZ1":68,"GasLeve...	json	a few seconds ago



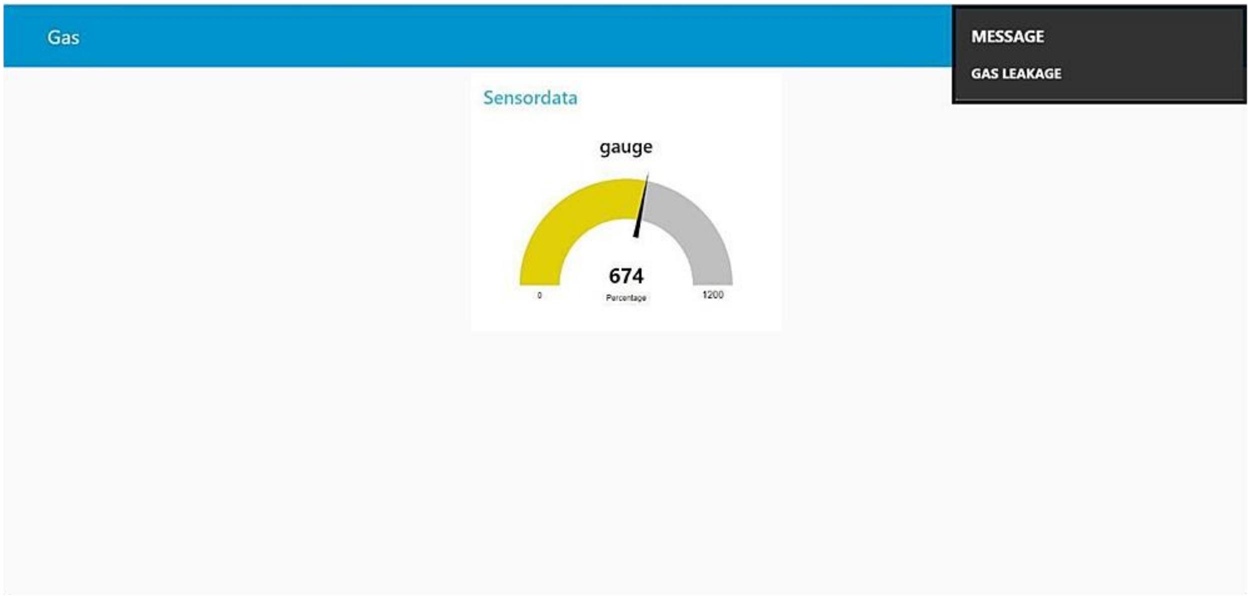


Gas Leakage Monitoring And Ale...

Set Gas Level:

Current Gas Level:

467.89 ppm



Gas

MESSAGE

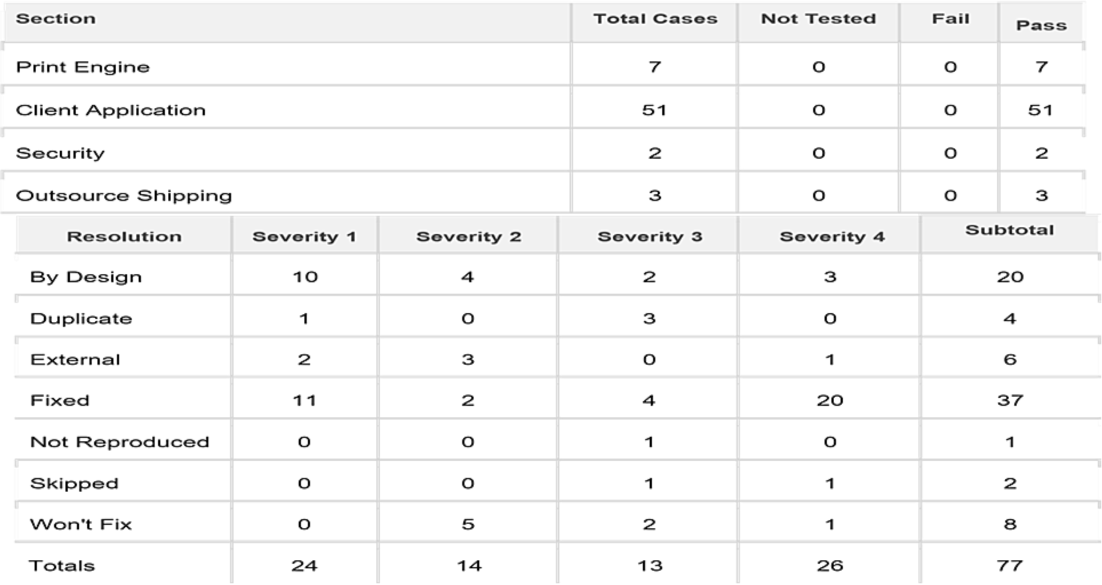
GAS LEAKAGE

Sensordata

gauge

674

8.2 USER ACCEPTANCE 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

9 RESULTS:

The system can be taken as a small attempt to connect 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 is 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 sulfide 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 use data as a primary indicator of leakage inside a plant.

9.1 PERFORMANCE METRICS

S.no	Name of the Phase	Tasks Performed	Performance Metrics
1	Development of Problem statement	The underlying problem was analyzed and a rough idea of the solution was planned	The problem statement was developed
2	Ideation Phase	Extracting use and test case	Empathy map, Ideation and literature survey were formulated.
3	Project design phase-1	Proposed solution Problem solution fit Solution architecture	The same was written and uploaded in git hub.
4	Project design phase2	Customer journey Functional requirements Data flow diagrams Technology architecture.	Customer journey Functional requirements Data flow diagrams Technology architecture were made
5	Project planning phase	Prepare milestone and activity list Sprint delivery plan	Prepare milestone and activity list Sprint delivery plan wereprepared

6	Project developmentphase	Project development delivery of sprint-1 Project development delivery of sprint-2 Project development delivery of sprint-3 Project development delivery of sprint-4	The four sprints were successfully completed

10.ADVANTAGES AND DISADVANTAGES

10.1 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.

10.2 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 featurefor 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 theSMS Gateway, it needs to be enhanced with features such as notifying the user whenever the remainingcredit 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 is not working properly or not connected to the micro-controller for some cases, therefore, it is recommended to add this feature 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 micro controller 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 micro controller as soon as it encounters a gas leakage. The micro controller processes this signal and a message is displayed on the LCD to alert the user.

13. APPENDIX:

```
import time

import sys

import cv2

import numpy as np

import smtplib

import threading Fire_Reported = 0

video = cv2.VideoCapture("Rocket Launch - 228.mp4") # If you want to use a webcam use

Index like 0,1. while True:

(grabbed, frame) = video.read() if not grabbed:

break

frame = cv2.resize(frame, (850, 540))
```

```
blur = cv2.GaussianBlur(frame, (21, 21), 0)

hsv = cv2.cvtColor(blur, cv2.COLOR_BGR2HSV)

lower = [110, 50, 50] # threshold value for fire colour

upper = [130, 255, 255]

lower = np.array(lower, dtype="uint8")

upper = np.array(upper, dtype="uint8")

mask = cv2.inRange(hsv, lower, upper)

output = cv2.bitwise_and(frame, hsv, mask=mask)

no_red = cv2.countNonZero(mask)

if int(no_red) > 15000:

Fire_Reported = Fire_Reported + 1

cv2.imshow("output",output)

cv2.imshow("video",frame)

if cv2.waitKey(1) & 0xFF == ord('q'): #For killing the program break

cv2.destroyAllWindows()

video.release()
```

13.1 SOURCE CODE:

```
#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 = 400;


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(“EVACUATE”);
delay(1000);

}
Else
{
digitalWrite(greenled,HIGH);
 digitalWrite(redled,LOW);
noTone(buzzer);
lcd.clear();
lcd.setCursor(0,0);
lcd.print(“SAFE”); delay(1000);
 lcd.clear();
lcd.setCursor(0,1);
lcd.print(“ALL CLEAR”);
delay(1000);
}
```

13.2.1 GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-45937-1660733528

13.2.2 PROJECT DEMO LINK:

https://drive.google.com/drive/folders/1QKRua1VG9a3GhgXW0Zdz4rXAe_uZdPcD