

## **GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES**

<b>TITLE</b>	<b>GAS LEAKAGE MONITORING ALERTING SYSTEM FOR INDUSTRIES</b>
<b>DOMAIN NAME</b>	<b>INTERNET OF THINGS</b>
<b>TEAM ID</b>	<b>PNT2022TMID05333</b>
<b>TEAM MEMBERS</b>	<b>K.SINDHU S.SINDHU N.SIVASELVI K.SOWMIYAH</b>

### **1. Introduction:-**

#### **1.1 Project Overview**

The world is moving at a rapid pace. The pandemic is long behind us, and businesses across domains are gearing up to catch up with the two years they lost due to the Coronavirus outbreak. Now is the time to embrace excellence and reduce unnecessary expenses with scalable IoT solutions - and this also holds true for the oil and gas domain. Various commercial companies such as hotels and takeaway joints utilize flammable gasses - for instance, carbon dioxide, LPG, ammonia, and so on - to deliver the best customer service possible. The use of such gasses cannot be denied. However, they have also brought about a greater risk and threat to human life. With safety a primary concern, businesses dealing with gas must take certain precautions to ensure work is carried out in the most secure manner possible.

#### **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. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere, but also wastage of gases will hurt our economy. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years

### **2. Literature Survey**

#### **2.1 Existing Problem**

In the existing method, gas sensing technology is used. The LPG leakage is detected by the semiconductor sensor. The leakage of gas may happen due to the human error, false chemical reaction, lack of service done in the gas valve. In the existing method, periodic check done by manually and partial sensing methodology is used. When the leakage was happened, it leads to major fire accident Before controlling the fire major accident may happen which leads to heavy loss in industry as well as human life. In addition to that the leak of gas may spread in the atmosphere, it may affect all the living things in an around them. In the existing system MQ5 sensor is used to detect gas leakage. Exhaust fans are

used to suck out the gases when the leakage occurs. In the existing method, it raises only alarm whenever Gas leaked or fire is detected at any place in a factory. Due to this alarm, people could start to run haphazardly. Fire Service truck vehicle only control the fire accident.

## **2.2 References**

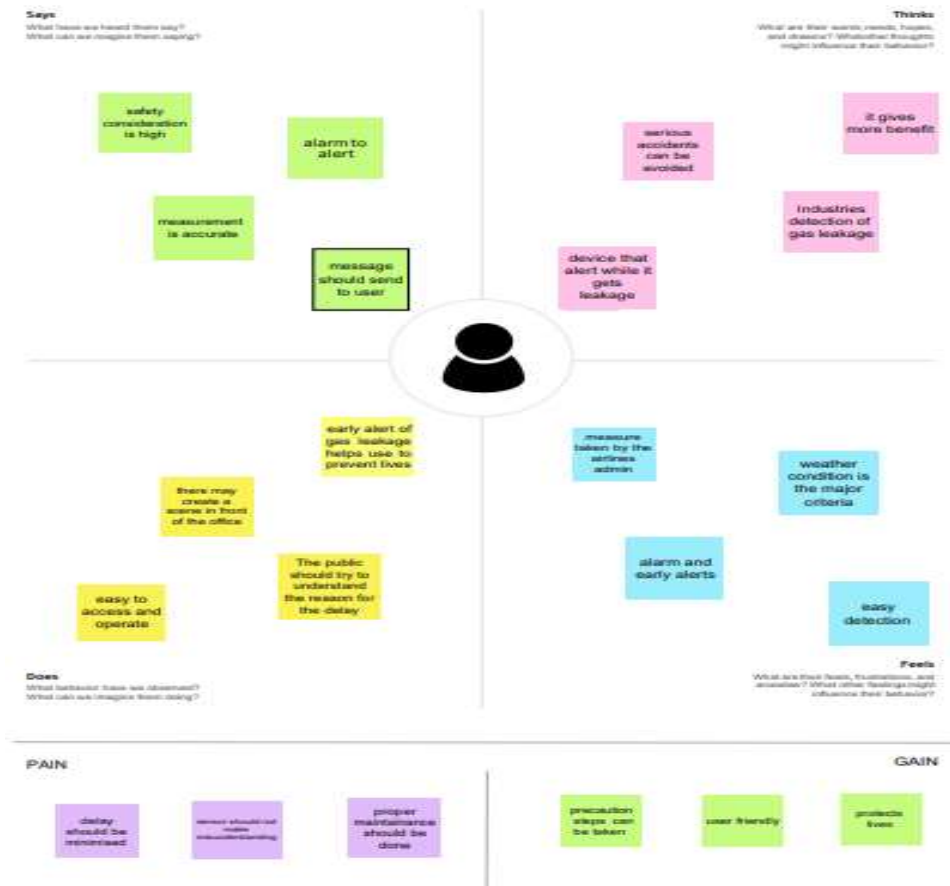
[1] Shital Imade, Priyanka Rajmane, Aishwarya Gavali, V. N. Nayakwadi "Review paper on- LPG Gas leakage detection using IOT": IJIRS –International Journal of Innovative Research & Studies, Volume 8, Issue 2, Feb 2018 IJIRS: ISSN NO: 2319-9725. [2] Gas Leakage Detection Based on Arduino And Alarm Sound, Rhonnel S. Paculanan, Israel Carino, International Journal of Innovative Technology and Exploring Engineering (IJITEE) Vol 8, April 2019. [3] Dr. Chetana Tukkoji, Mr. Sanjeev Kumar, "Review paper on- LPG Gas leakage detection using IOT": IJEAST –International Journal of Engineering Applied Science & Technology, Volume 4, Issue 12, April 2020 IJEAST (online): 603-609. [4] Sanjoy Das, Sahana S, Soujanya K Swathi M C, "Gas leakage detection and prevention using IoT", International Journal of Scientific Research % Engineering Trends. Vol 6, Issue 3, May-June 2020, ISSN (online): 2395-566X. [5] Amatul Munnaza, Rupa Tejaswi, Tarun Kumar Reddy, Saranga Moahan "IoT Based Gas Leakage Monitoring System"

## **2.3 Problem Statement Definitions**

This device does not get damaged very quickly, and if it does get damaged, water is the main reason for it. This device is easily damaged by water. Therefore, this device should be installed in a place where water does not go. This installation will not damage the device, if the device does, an example is water. This tool is considered to be one and very safe for the users. My members are trusted. My members' invention is considered very safe for this country and its people and their families. Absence of this tool makes women in our country nervous by the spread of gas in their kitchen and is considered to be a sign of some accident. It is also proud to think of this project for people's lives only to eliminate this fear

## **3. Ideation & Proposed Solution**

### **3.1 Empathy Map Canvas**



### 3.2 Ideation & Brainstorming



## Brainstorm & ideaprioritization

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
- 2-6 people recommended

Share template feedback



### Before you collaborate

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

10 minutes

#### 1. Invite gathering

Define who should participate in the session and send all invite. 30 mins relevant information or pre-work ahead.

#### 2. Set the goal

Think about the problem you'll be focusing on getting to the brainstorming session.

#### 3. Create time to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

Open article



### 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



### Key rules of brainstorming

These are essential and production oriented

- Stay in topic
- Encourage wild ideas
- Defer judgment
- Listen to others
- Go for volume
- Be possible, be useful

2

## Brainstorm

Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

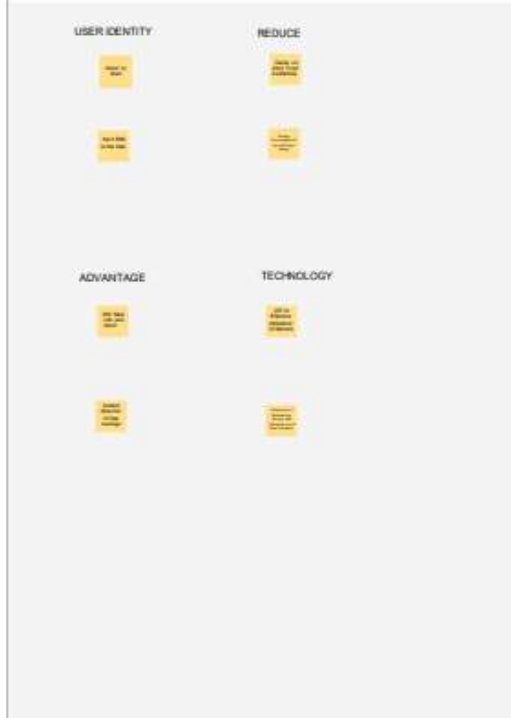


3

## 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 can break it up into smaller sub-groups.

🕒 20 minutes

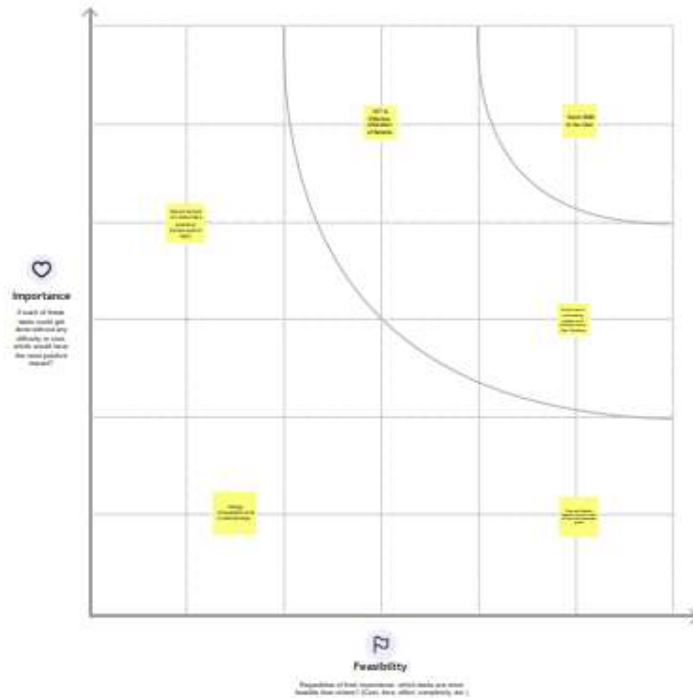




### Prioritize

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.

22 Minutes



### After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

#### Quick add-ons



##### Share the mural

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



##### Export the mural

Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save to your drive.

#### Keep moving forward



##### Strategy Blueprint

Define the components of a new idea or strategy.

[Open the template](#)



##### Customer experience journey map

Understand customer needs, motivations, and obstacles for an experience.

[Open the template](#)



##### Strengths, weaknesses, opportunities & threats

Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.

[Open the template](#)



##### Share template feedback

## 3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Liquid Petroleum Gas (LPG) is a highly flammable chemical that consists of mixture of propane and butane. LPG is used for cooking at home, restaurant, and certain use for industry. They have certain weaknesses that make the gas leakage occur. 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 that has a low sense of smell. Furthermore, gas leakage can cause fire that will lead to serious injury or death and it also can destroy human properties.
2.	Idea / Solution description	<ul style="list-style-type: none"> <li>• When the gas leakage is detected it will alert the user by alarm/buzzer</li> <li>• It can send the sms to the user also</li> <li>• We can also make the exhaust fan on while during the gas leakage</li> <li>• Detection of the gas leakage is important and halting leakage is important equally.</li> </ul>
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> <li>• instant detection of gas leakage</li> <li>• send sms to the concerned user</li> <li>• easy to access and operate</li> </ul>
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> <li>• Cost efficient</li> <li>• Easy to access and operate</li> <li>• Easy installation and detect the gas leakage fastly</li> <li>• Prevent fires and explosions</li> </ul>
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> <li>• This project is mainly for Industries so we can visit to the industries and explain them about the benefits of our</li> </ul>

### 3.4 Problem Solution Fit

Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> <small>Who is your customer? Are working parents with 3 y.o. kids</small> <p>The industrialists who use gases for their manufacturing.</p>	<b>6. CUSTOMER CONSTRAINTS</b> <small>What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, no bank connection, available facilities</small> <p>High budget in installing other products make them to move far from modern technologies.</p>	<b>5. AVAILABLE SOLUTIONS</b> <small>Which solutions are available to the customers when they face the problem? Or what is not the job done? What have they tried in the past? What price &amp; costs do these solutions have? i.e. get and paper to an alternative to digital solution</small> <p>Then sensor-enabled solution helps 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.</p>	Explore AS, differentiate
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> <small>Which jobs to be done for customers do you address for your customers? There could be more than one, explore different jobs.</small> <p>most of gas explosions are caused by undetected gas leakage in the pre-detection condition, so that, gas leakage monitoring and alerting system is needed. the purpose of this system is to detect gas leakage, neutralize it, and prevent the explosion.</p>	<b>9. PROBLEM ROOT CAUSE</b> <small>What is the real reason that this problem exists? What is the basic story behind the need to do this job? i.e. customers have used it because of the change in regulations</small> <p>when the workers failed to monitor properly, the gas can cause high risk to their health or the properties of the industry.</p>	<b>7. BEHAVIOUR</b> <small>What does your customer do to address the problem and get the job done? Or, the story behind: find this right order panel, replace, installation usage and handling (industry associated) customers spend time on understanding work &amp; a (overseas)</small> <p>using manpower as the source of monitoring the leakage causes high hazards. if the gas leaked is heavily toxic, there is a chance of causing hereditary health issues too.</p>	
Focus on J&P, dig into BC, understand RC	<b>3. TRIGGERS</b> <small>What triggers customers to act? i.e. seeing their neighbour smoking, smoke alarm, hearing about a close friend's accident in the news</small> <p>most of gas explosions are caused by undetected gas leakage in the pre-detection condition, so that, gas leakage monitoring and alerting system is needed.</p>	<b>10. YOUR SOLUTION</b> <small>If you are working on an existing business, write down your current solution that fit in the service, and check how much it fits really. If you are working on a new business proposition, then keep it blank until you fit in the service and come up with a solution that the better customer immediately, during a problem and maintain customer behaviour</small> <p>Develop an efficient system &amp; an application and alter the workers.</p>	<b>8. CHANNELS of BEHAVIOUR</b> <b>8.1 ONLINE</b> <small>What kind of solution do customers take online? What online channels does it fit</small> <b>8.2 OFFLINE</b> <small>What kind of solution do customers take offline? What offline channels does it fit and use them for customer development</small> <p>ONLINE: Promoting through social media with the help of social media entrepreneurs/influencer. OFFLINE: Newspaper advertisements.</p>	Focus on J&P, dig into BC, understand RC
	<b>4. EMOTIONS: BEFORE / AFTER</b> <small>How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure + confident, in control + yes it is your communication strategy &amp; design</small> <p>Before: the heavy losses due to the leakage made them feel of guilt due to reduced reputation of their products. After: increased the level of confidence and feel.</p>	<b>Identify strong TR &amp; EM</b>		

## 4. Requirement Analysis

### 4.1 Functional Requirement

FR No.	Functional Requirement (EPIC)	Sub Requirement (Story / Sub-Task)
FR-1	Create cloud account	Registration through Form Registration through G mail Registration through Link
FR-2	User Confirmation	Confirmation via Email Confirmation via OT
FR-3	User Login	User Login Via Mail id And Password
FR-4	Cloud registration	Connect the hardware device
FR-5	Connect to mobile	Connect the cloud with the mobile phone
FR-6	Connect Hardware	Connect hardware to the gas cylinders or in the wall

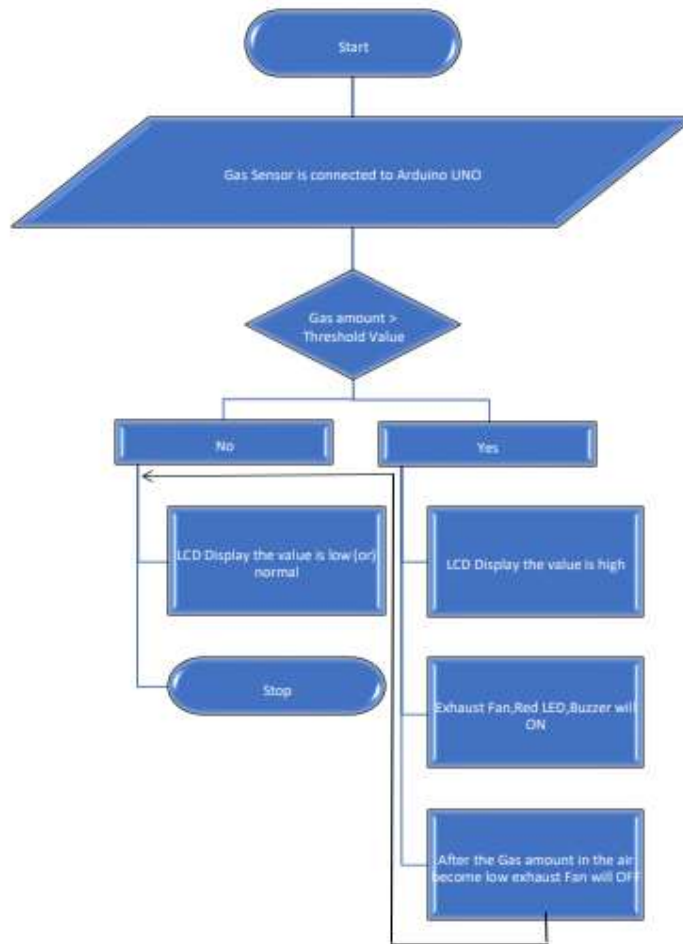
### 4.2 Non- Functional Requirements



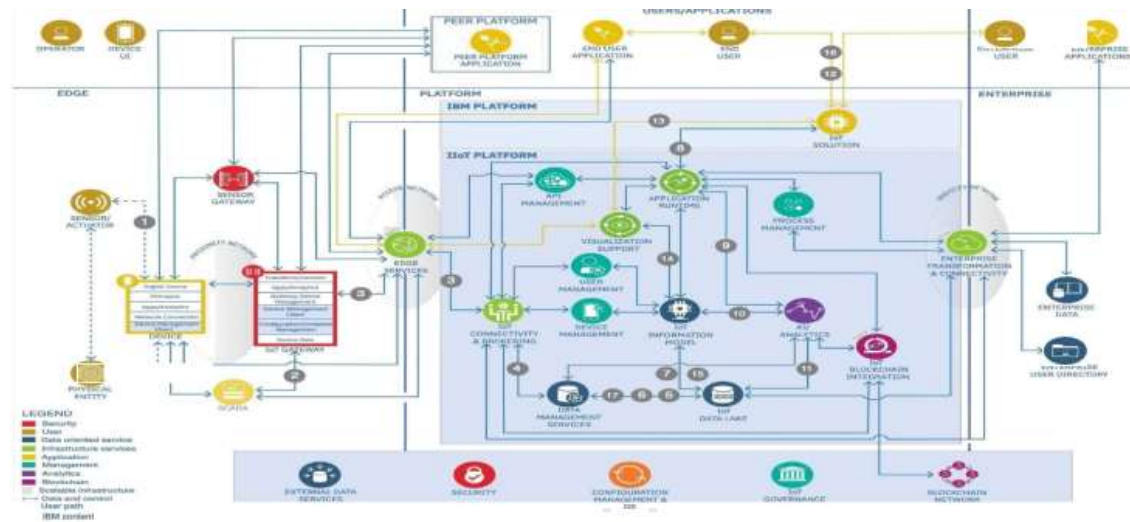
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	<ul style="list-style-type: none"> <li>● It is user friendly</li> <li>● Easy to handle</li> <li>● Process is simple</li> </ul>
NFR-2	Security	<ul style="list-style-type: none"> <li>● The device is highly secure.</li> <li>● Privacy is maintained</li> </ul>
NFR-3	Reliability	<ul style="list-style-type: none"> <li>● The device is more reliable</li> <li>● The device is more trustable in tough conditions</li> </ul>
NFR-4	Performance	<ul style="list-style-type: none"> <li>● The performance is more accurate.</li> <li>● It is a real time application</li> </ul>
NFR-5	Availability	<ul style="list-style-type: none"> <li>● It can be available easily.</li> <li>● It requires very few hardware components.</li> </ul>
NFR-6	Scalability	<ul style="list-style-type: none"> <li>● Less maintenance.</li> <li>● Low cost.</li> <li>● Compact.</li> </ul>

## 5. Project Design

### 5.1 Data Flow Diagrams



## 5.2 Solution & Technical Architecture



### 5.3 User Stories

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User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	High	Sprint-2
	Login	USN-4	As a user, I can register for the application through Gmail	I can access by message	Medium	Sprint-1
		USN-5	As a user, I can log into the application by entering email & password	No need to login mail id	High	Sprint-1
Customer (Web user)	Dashboard					
Customer Care Executive	Registration	USN-1	User want to use sim card and gsm module	Message receiver for arduino connected sim	High	Sprint-1
		USN-1	Sensor and module	All component is connected to	High	Sprint-1

### 6. Project Planning & Scheduling

#### 6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Preparation & Data Visualization	USN-1	As a user, I provide Safety to the customers	5	High	Sindhu k
Sprint-1		USN-2	As an Analyst, I collect the data & Provide meaningful insights through IBM Cloud	3	High	Sindhu k
Sprint-2	Dashboard	USN-3	As a user, I want to make sure the safe environment.	3	High	Sindhu S
Sprint-2		USN-4	As an Analyst, I will upload the data in IBM Cloud to createa interactive dashboard	3	Medium	Sowmiyah K
Sprint-3	Report	USN-5	As a user, I want to secure the lives and data of each	3	Medium	SivaSelvi N

			employee that report a particular event			
Sprint-3		USN-6	As an Analyst, I will use IBM Cloud to generate a report	3	Medium	Sindhu S
Sprint-4	Story	USN-7	As a user, I can only understand the Analysis in animated presentation of dataset	5	Medium	SivaSelvi N
Sprint-4		USN-8	As an Analyst, I use IBM to create an animated presentation (Story) of the dataset	3	High	Sowmiyah K

## 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	5	6 Days	1 NOV 22	2 NOV 22	5	3 NOV 22
Sprint-2	5	6 Days	1- NOV 22	2 NOV 22	5	3 NOV 22
Sprint-3	5	6 Days	1- NOV 22	2 NOV 22	5	3 NOV 22
Sprint-4	5	6 Days	1- NOV 22	2 NOV 22	5	3 NOV 22

```
int fan = 5;
```

```

void setup(){
pinMode(ledPin, OUTPUT);
pinMode(buttonPin, INPUT);
pinMode(gasPin,INPUT);
pinMode(fan,OUTPUT);
Serial.begin(9600);
lcd.begin(16, 2);
lcd.setCursor(0,0);
lcd.print(" Welcome");
lcd.setCursor(0,2);
lcd.print("GAS LEAKAGE SYSTEM");
delay(500);
lcd.clear();
} void loop(){
// Read the value from gas sensor and button
gasLevel = analogRead(gasPin); buttonState = digitalRead(buttonPin);
// call the function for gas detection and button work
gasDetected(gasLevel);
buzzer(gasLevel);
exhaustFanOn(buttonState); }
// Gas Leakage Detection & Automatic Alarm and Fan ON
void gasDetected(float gasLevel){
if(gasLevel >= 300){
digitalWrite(buzzPin,HIGH);
digitalWrite(ledPin,HIGH);
digitalWrite(fan,HIGH);
lcd.setCursor(0,0);
lcd.print("GAS:");
lcd.print(gasLevel);
lcd.setCursor(0,2);
lcd.print("FAN ON");
delay(1000);

```

```

    lcd.clear();
}
else{
    digitalWrite(ledPin,LOW);
    digitalWrite(buzzPin,LOW);
    digitalWrite(fan,LOW);
    lcd.setCursor(0,0);
    lcd.print("GAS:");
    lcd.print(gasLevel);
    lcd.setCursor(0,2);
    lcd.print("FAN OFF");
    delay(1000); lcd.clear(); } }

//BUZZER void buzzer(float gasLevel){
    if(gasLevel>=300) {
        for(int i=0; i<=30; i=i+10) {
            tone(4,i); delay(400); noTone(4); delay(400); } } }

// Manually Exhaust FAN ON
void exhaustFanOn(int buttonState){
    if(buttonState == HIGH){
        digitalWrite(fan,HIGH);
        lcd.setCursor(0,0);
        lcd.print("Button State:");
        lcd.print(buttonState);
        lcd.setCursor(0,2);
        lcd.print("FAN ON");
        delay(10000);
        lcd.clear(); } }

```

## **8. Results**

<https://www.tinkercad.com/things/dC3hC5maEF0-ibm-final-project/editel>

<https://drive.google.com/file/d/1Cdk1fOfQ1dNHgwJ1g33uHdaJzRxx0DDF/view?usp=sharing>

## **9. Advantages and Disadvantages**



The gas sensors **help detect the concentration of the gases present in the atmosphere to avoid hazardous consequences like fire breakouts**. Also, it is an imperative solution to keep the plant workers and equipment safe from fire hazards.

**Disadvantages:** **Poor stability and greater environmental impact**; in particular, the selectivity of each sensor is not and the output parameters cannot be determined. Therefore, it should not be used in places where accurate measurement is required.

## 10. Conclusion

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we can save the life by using this system. A sensor node senses gas like CO<sub>2</sub>, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.

## 11. Future Scope

Major cities of India are pushing Smart Home application, gas monitoring system is a part of SmartHome application. Enhancing Industrial Safety using IoT. This system can be implemented in Industries, Hotels and wherever the gas 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 naive 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. Several medical equipment requires gas cylinders.

## 12. Appendix

GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-8780-1658929526>

PROJECT DEMO LINK:

<https://drive.google.com/file/d/1Cdk1f0fQ1dNHqwJ1g33uHdaJzRxx0DDF/view?usp=sharing>