PROJECT BASED EXPERIMENTIAL LEARNING PROGRAM (NALAIYA THIRAN)

Gas leakage Monitoring & Alerting System for Industries

PROJECT REPORT

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Project Report

1. INTRODUCTION

1.1 Project Overview

Gas Detectors have been in the market for a very long time and have been vastly used. They have wide range of applications and can be found in industrial plants, refineries, pharmaceutical manufacturing, paper pulp mills, aircraft and ship-building facilities, wastewater treatment facilities, vehicles, indoor air quality testing and homes. There are a lot of ways in which the Gas Detectors could be characterized. They are categorized on the basis of what type of gas they detect, what is the technology behind the making of the sensor and sometimes even the components which are used that affect their operation mechanism (semiconductors, oxidation, catalytic, photo ionization, infrared, etc.). Gas Detectors are also widely characterized as fixed or portable detectors. They are characterized on the basis of which category of risk they fall in, ExOx-Tox, the three categories of risk - Ex – Risk of explosion by flammable gases .

Ox – Oxygen Risk of asphyxiation by oxygen displacement Risk of increase of flammability by oxygen enrichment - Tox – Risk of poisoning by toxic gases, the list of categorization goes on. As a result we cannot have a single system or a group of systems which we can call the best but instead there is a plethora of devices available for matching the varying user requirements.

1.2 Purpose

The gas detectors can be used for the detection of combustible, flammable and poisonous gases and for loss of oxygen, and also to detected a gas leak or other pollutants. It makes the area where the leak occurs an warning sound and instructs operators to leave the area.

2.LITERATURE REVIEW

2.1 Existing Problem

In industries,the existing Problem in gas monitoring is that there is no efficient system for monitoring the gas leakage, the good system are of high cost and also the installation process is too complicated.Then the affordable of the system is high and the systems are sometimes making disasters and the number of sensors is unpredictable and the positioning of equipment is improper

2.2 References

1.**TITLE :** Automated unified system for LPG using micro-controller and GSM module
AUTHOR: B. B. Did pay, Prof. S. K. Nanda
SUBJECT: Their paper Proposed an advance and innovative approach for LPG leakage detection,prevention and automatic Booking for refill. In advance, the system provides the automatic controlling of LPG regulator also if leakage is detected the system will automatically turn off the main switch of power supply. Hence it helps to avoid the explosion and blast.

2. **TITLE :** leakage detection and analysis of leakage point in the gas pipeline system

AUTHOR: Zhao Yang, Mingliang Liu, Min Shah, and Yingjie Ji, 2011
SUBJECT: In this paper they gave various model which used SCADA I/F Model: The SCADA system has the function of transferring the acquired data from a pipeline system to Transient Simulation Model every 30seconds. This module communicates with SCADA. Dynamic parameters are collected every 30 seconds, such as pressure, flow and temperature. Transient Simulation Model: Transient flow is simulated utilizing perfect numerical methods based on actual data. Pressure and temperature served as independent variables are provided in order to get average pressure and average temperature. Then all the parameters of the gas in the pipeline system can be acquired. Leakage Detection: The leakage detection is carried out by comparing the data acquired through the SCADA system with that by the Transient Simulation Model. This model could provide leakage point judgment and prompt warning based on transient simulation and volume balance

3. **TITLE :** Gas detection using an integrated circuit and MQ-9
AUTHOR: Falohun A.S., Oke A.O., and Abolaji B.M. 2016
SUBJECT: In this basically, they used an embedded design which includes typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light level etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer, and may lack human interaction device. The amount and type of detectors and the type of fire alarm system that one chooses for property protection will depend on the owner's property protection goals, the value of the property and the requirements of the owner's insurance company.

4. **TITLE :** gas leakage and LPG levels where gas leakage occurs automatically
AUTHOR: Ms.Shinde Sayali P , Ms. Chavan Sakshi S, Ms. Dhas Snehal S (June 2021)
SUBJECT: The authors suggests that gas leakage is performed by various gas sensors. Whose author has worked on gas leaks and mentions that we can take care if a found using a sensor and gas booking can be done automatically when a small amount of gas is taken closed. RFID tag

micro controller, pressure sensors and buzzers are used to monitor gas. Through this paper important parameters are used to find the level of gas in the container.. Arduino was originally created as a tool for fast sampling and activities for Students with no knowledge for electronics. This paper uses a micro controller, buzzer and a gas sensor to detect gas leakage system. When a gas leak is detected by a gas sensor ,the micro controller turn on the buzzer in critical condition. The proposed system detects LPG leaks and alerts customers. The alarm starts when the system notice and increases in LPG leakage concentration by sending an alarm and sending a message to specific mobile phone. The device assures safety and prevents explosions.A micro controller based system based on gas sensor(MQ6) has been developed in proposed system to detect LPG leakage . The unit is also integrated with an alarm unit to detect signal a leak.

5. **TITLE :** Leakage detection and analysis of leakage point in the gas pipeline system
AUTHOR: The Manichandana Simrah et.al (2019)
SUBJECT: In this paper they gave various model which used SCADA I/F Model: The SCADA system has the function of transferring the acquired data from a pipeline system to Transient Simulation Model every 30 seconds. This module communicates with SCADA.Dynamic parameters are collected every 30 seconds, such as pressure, flow and temperature. Transient Simulation Model: Transient flow is simulated utilizing perfect numerical methods based on actual data. Pressure and temperature served as independent variables are provided in order to get average pressure and average temperature.

6. **TITLE :** ARM7 primarily based machine-driven high performance system
is used for LPG refill booking and outpouring detection
AUTHOR: Rahul Nalawade et.al, (2018)
SUBJECT: That decreases the outpouring resistance.Microcontroller sends a message “EMERGENCY ALERT: LPG gas outpouring found in your home to needed cell numbers via GSM module and therefore the same are going to be displayed on digital display. This technique detects the outpouring of the LPG associated alerts the patron regarding the leak by

SMS and as an emergency live the system can shut down the ability offer, whereas activating the alarm

2.3 Problem Statement Definition

For monitoring gas leakage in the industry and Control the gas leakage ,we create a system for monitoring gas leakage and makes the installation propose simple.

How does the Problem affect?

The main consequences are the emission of flammable substances into the environment,fire, explosion, and distribution of toxic substances Serious risks of carbon monoxide poisoning in people and animals.

What is the issue?

Improper use of gas furnace, stove, or appliance.Fault in the gas pipeline

What is the impact of the issue?

Create potential hazards for the workers in the industry Create Pollution to the environment Diseases prone

What would happen if this problem is not solved?

Emission of toxic gases which is harmful to the environmentLeads to explosion or other types of fire hazard Rusted and poor pipelines create hazards.

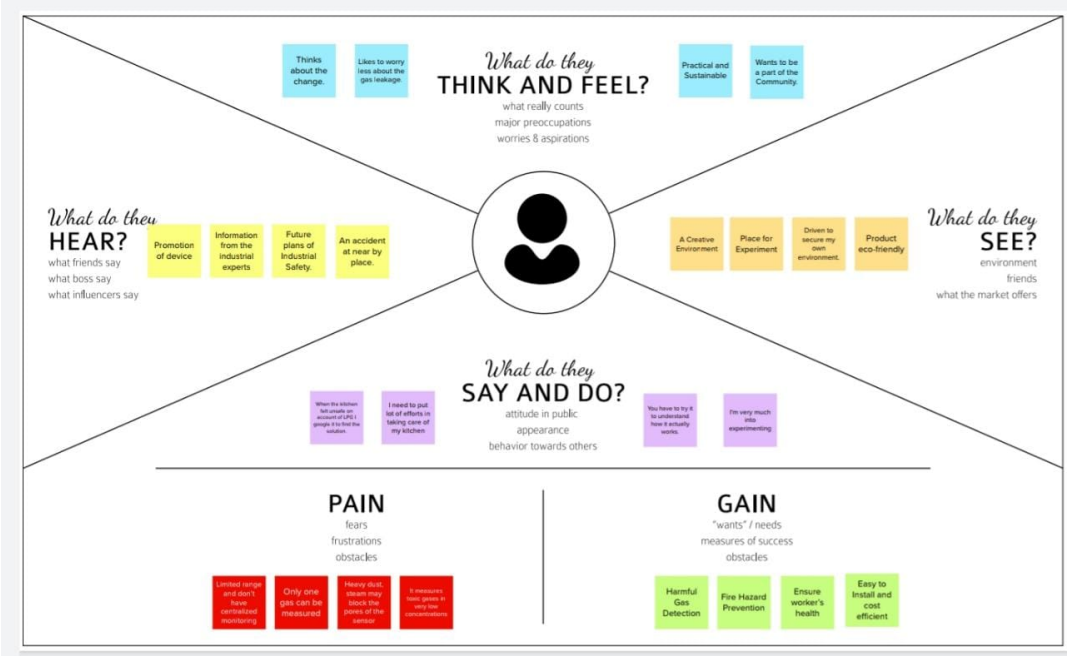
What would happen if this problem is fixed?By identifying and solving the issue parameters like pollution and the spreading of poisonous gas, we can fix the problem.

Why it is important to fix the problem?

Emission of harmful gases leads to varying of environmental weather and affects the earth layer which is protected by the UV radiation.

3.IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP



3.2 Ideation And Brainstorming:

Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for enhancing the existing safety standards. Safety has always been an important criterion while designing home, buildings, industries as well as cities. The increased concentration of certain gases in the atmosphere can prove to be extremely dangerous. These gases might be flammable at certain temperature and humidity conditions, toxic after exceeding the specific concentrations limits or even a contributing factor in the air pollution of an area leading to problems such as smog and reduced visibility which can in turn cause severe accidents and also have adverse effect on the health of people. Most of the societies have fire safety mechanism. But it can use after the fire exists. In order to have a control over such conditions we proposed system that uses sensors which is capable of detecting the gases such as LPG, CO2, CO and CH4. This system will not only able to detect the leakage of gas but also alerting through audible alarms. Presence of excess amounts of harmful gases in environment then this system can notify the user. System can notify to society admin about the condition before mishap takes place through a message.

3.3 Proposed Solution:

S.No.	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	➢ Leaks are considered very dangerous since they can build into an explosive concentration So the proposed solution is used for the development for an efficient system & an application that can monitor and alert the workers
2.	**Idea / Solution description**	➢ In several areas, the gas sensors will be integrated to monitor the gas leakage ➢ The proposed system takes an automatic control action after the detection of 0.001% of LPG leakage. ➢ This automatic control action provides a mechanical handle driven by stepper motor for closing the valve ➢ We are increasing the security for human by using the combination of a relay and the stepper motor which will shutdown the electric power of the house .Also by using a GSM module, we are sending an alert message by SMS (Short messaging services) to warn the

		users about the LPG leakage and a buzzer is provided for alerting the neighbors in case of the absence of the users about the LPG leakage ➢ The main advantage of this system over the manual method is that, it does all the process automatically and has a quick response time.
3.	**Novelty / Uniqueness**	➢ User friendly ➢ Pioneering study of natural gas detection with CCD in visible range
4.	**Social Impact / Customer Satisfaction**	➢ Cost efficient ➢ Easy installation and provide efficient results.
5.	**Business Model (Revenue Model)**	➢ With widespread deployment of the urban natural gas industry, the energy security is now becoming one of the priorities in practice. ➢ The gas leakage model was applied to analyse the pressure, temperature and flow rate of gas leakage over time under both the steady-state and dynamic conditions. ➢ As the product usage can be understood by everyone, it is easy for them to use it properly for their safest organization.
6.	**Scalability of the Solution**	➢ Establishing fast communication equipment with the nearest fire station and other relief station to have the fastest response in case of an accident. ➢ Even when the gas leakage is more, the product sense the accurate values and alerts the workers effectively

3.4 Proposed Solution Fit:

Project Design Phase-I - Solution Fit

Project Title: Gas Leakage monitoring & Alerting system for Industries

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) — CS

Who is your customer?

Most of Industry workers who are engaged with gas related productions.

6. CUSTOMER — CC

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

- ✓ It measures toxic gases in very low concentrations.
- ✓ It has ability to detect wide range of gases.
- ✓ It is difficult to know failure

5. AVAILABLE SOLUTIONS — AS

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 dothese solutions have? i.e. pen and paper is an alternative to digital notetaking

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.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS — J&P

Which jobs-to-be-done (or problems) do you address for your customers?There could be more than one; explore different sides.

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.

9. PROBLEM ROOT CAUSE — RC

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 chanee in reeulations.

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.

7. BEHAVIOUR — BE

What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

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.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS — TR

What triggers customers to act? i.e. seeing their neighbour installingsolar panels, reading about a more efficient solution in the news.

Constitution should bring gas leakage indicating system as a mandatory precaution in every factory and industries like fire extinguisher.

4. EMOTIONS: BEFORE / AFTER — EM

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.

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.

10. YOUR SOLUTION — SL

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 inthe canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

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

8. CHANNELS of BEHAVIOUR — CH

ONLINE

What kind of actions do customers take online? Extract online channels from #7

- ✓ In online, user can monitor the each sensor and its rates, sensor like temperature, gas, humidity, oxygen level.
- ✓ Also have the statistical report.
- ✓ Precautions can be altered and users take care of the

OFFLINE

What kind of actions do customers take offline? Extract offline channels from #7and use them for customer development.

- ✓ The have to manually check the leakage of gases when the statistics changes.
- ✓ Handling the critical situation should be taken care of the safety officers.

Extract online & offline CH of BE

4.Requirement Analysis

4.1 Functional Analysis:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Hardware Requirement	Optical Soil Ultra-Sonic Flow Meter
FR-4	Software Requirement	Flow change Pressure point Statistic
FR-5	User Welfare	Calibration No Poisoning of the Sensor Reliable in All Environmental Conditions Easy to Use

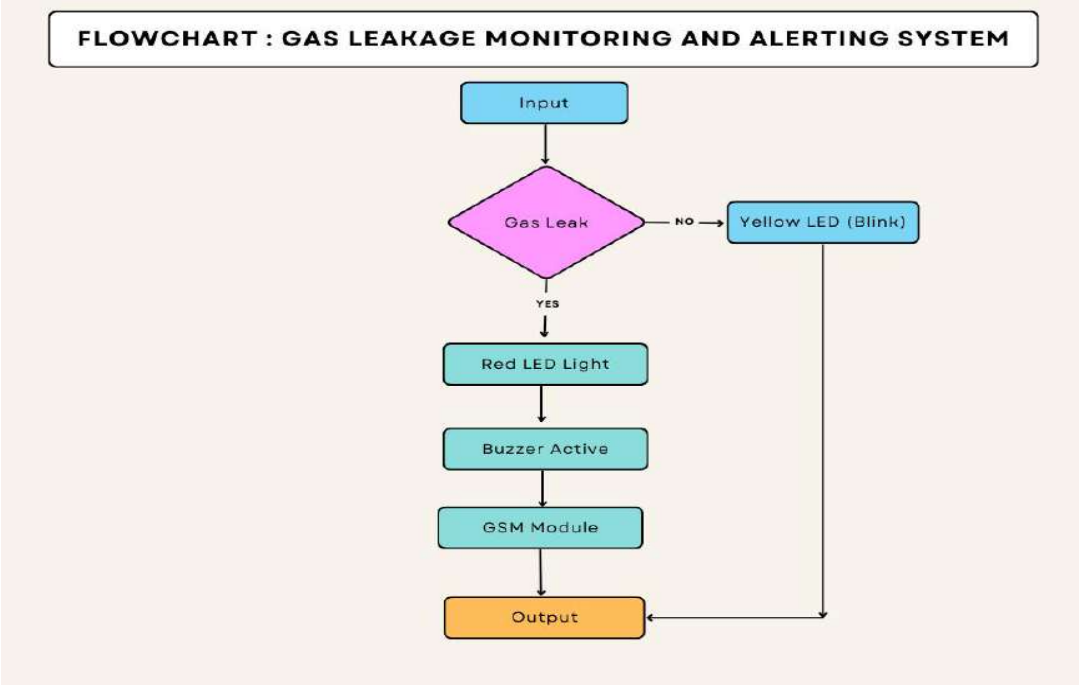
4.2 Non Functional Analysis:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises
NFR-2	**Security**	The device is intended for use in household safety where appliances and heaters that use natural gas and liquid petroleum gas (LPG) may be a source of risk.
NFR-3	**Reliability**	Gas Leakage Detection System (GLDS) can detect leakage at homes, commercial premises or factories. GLDS detects the leakage soon after it happened and sends users an immediate alarm on the incident.

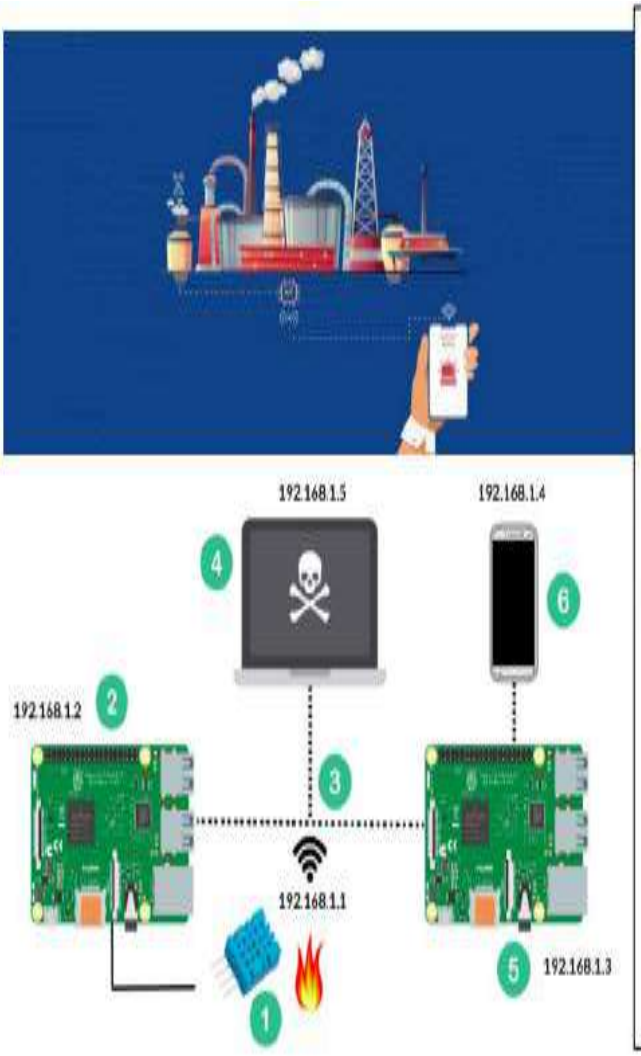
NFR-4	**Performance**	The Gas Leakage Detector is a wall mounted device fitted close to the floor level with an alarm setting at 20% of lower explosive limit. Whenever there is a leak, the in-built sensor detects and alerts the user in less than 5 minutes, much before it can cause any accidents
NFR-5	**Availability**	The circuit for an LPG leakage detector is readily available in the market, but it is extremely expensive). Presented here is a low-cost circuit for a Gas Leakage Detection that you can build easily.
NFR-6	**Scalability**	The system proves the need for gas detection alarm systems to be 100% reliable. A backup power supply can be included in the system design to augment for power failure condition. Also, calibration of the gas sensor can be done in other for a specific gas to be sensed instead of the LPG numerous gases it sense

5.Project Design:

5.1 Data flow Diagram:



5.2 Technical Architecture:



Guidelines:

1. Include sensor to detect gas leakage.

2. Provide light and sound alerting gas leakage.

3. Using Internet of Things, alerting gas leakage in mobile phone.

4. By using Internet of Things, wifi will used for alerting worker through their mobile devices.

5.3 User Stories:

	STAGE-1	STAGE-2	STAGE-3	STAGE-4	STAGE-5
OBJECTIVES	Make a goal or activity list.	Gas leak detection systems protect both people and the environment from potentially dangerous gas exposure.	The system is made up of sensors for detecting gas leaks that are linked to a microcontroller, which will notify the user whenever there is a gas leak and display warning information using liquid.	System for Detecting Gas Leaks The practise of detecting potentially harmful gas leaks using sensors is known as gas leak detection. When a harmful chemical is discovered, these sensors often emit an audible warning to alert people.	An alarm management system depicts the sequence of activities that a system takes in the case of a gas leak.
NEEDS	Create a list of needs that you want to be met.	Preventing fire hazards	Detection of hazardous gases	Measurements of oxygen levels	Prompt notification of gas leaks
FEELINGS	Emotion we expect the customer to have	Happy about this solution	Embossed on the solution and encouraged the positive phrases about this project	Happy	Encouragement and positive feedback for this project.
BARRIES	Write about the potential obstacle to the objective.	higher-ranking officials	Commercial companies	The gases are poisonous in nature and, if taken in sufficient quantities, can cause human unconsciousness and even death.	Furthermore, gaseous blasts are another occurrence that everyone wishes to avoid at all costs.

6.Project Planning and Scheduling:

6.1Sprint Planning and Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Objective	USN-1	As a system, the gas sensor should detect the gas	8	High	KOWSIK
Sprint-1	Features	USN-2	As a system, the gas sensor values should be displayed in a LCD screen	2	Low	BAALA
Sprint-1	Features	USN-3	As a system, as soon as the detected gas reaches the threshold level, the red color LED should be turned ON.	5	High	MANOJ
Sprint-1	Features	USN-4	As a system, as soon as the detected gas reaches the threshold level, the siren should be turned ON.	5	High	KOGUL
Sprint-2	Focus	USN-5	As a system, it should the send the location where the gas is detected	8	High	KOWSIK
Sprint-2	Focus	USN-6	As a system, it should also send the alerting SMS to the registered phone number	2	Low	MANOJ

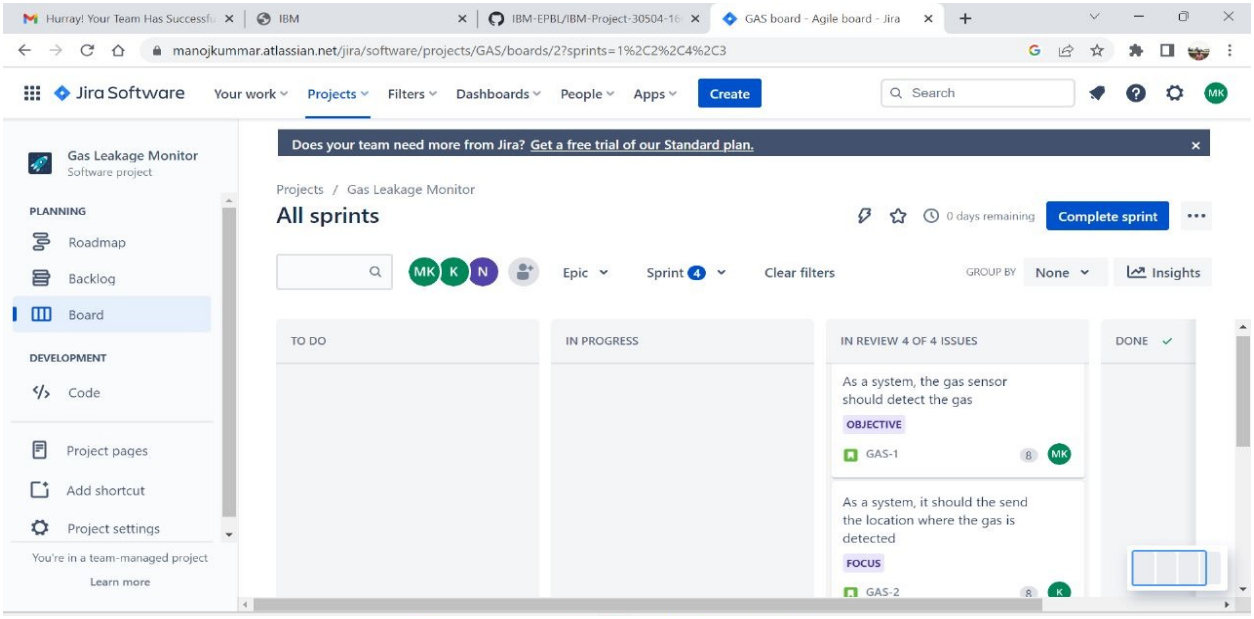
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Features	USN-7	As a system, the gas leakage pipe should be closed automatically once there it attains the threshold value	5	Medium	KOGUL
Sprint-2	Features	USN-8	As a system, it will indicate that the gas leakage pipe is closed in the LCD screen and send SMS to the registered mobile number.	5	Medium	BAALA
Sprint-3	Data Transfer	USN-9	As a program, it should retrieve the API key of the IBM cloud to send the details of the system.	2	Low	BAALA
Sprint-3	Data Transfer	USN-10	As a system, it should send the data of sensor values along with latitudes and longitudes to the IBM cloud	5	Medium	KOWSIK
Sprint-3	Data Transfer	USN-11	As a cloud system, the IBM cloud should send the data to NodeRed	2	Medium	MANOJ
Sprint-3	Data Transfer	USN-12	As a system, it should collect the data from the NodeRed and give it to the backend of the mit app.	3	Medium	MANOJ
Sprint-3	Data Transfer	USN-13	As an application, it should display the details of the gas level and other details to the user through the frontend of the mit app.	8	High	KOGUL
Sprint-4	Registration	USN-14	As a user, I must first register my email and mobile number in the website	2	High	KOWSIK

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Registration	USN-15	As a user, I must receive confirmation mail and SMS on registration	2	Medium	MANOJ
Sprint-4	Login	USN-16	As a user, I can login into the web application through email and password.	3	High	BAALA
Sprint-4	Dashboard	USN-17	As a user, I can access the dashboard and make use of available resources.	2	Medium	KOGUL
Sprint-4	Focus	USN-18	As a user, I must receive an SMS once the leakage is detected.	5	High	MANOJ
Sprint-4	Allocation	USN-19	As an admin, I must receive information about the leakage along with location and share exact location and route to the person.	3	High	BAALA
Sprint-4	Allocation	USN-20	As an admin, I must allot particular person to look after the leakage in a particular location.	3	High	MANOJ

6.2 Sprint Delivery Schedule:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date	Sprint Release Date
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	19 Nov 2022

6.3 Reports From JIRA:



7. Coding And Solutioning:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(6, 7, 8, 9, 10, 11);
float gasPin = A0;
float gasLevel;
int ledPin = 2;
int buttonPin = 3;
int buzzPin = 4;
int buttonState;
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("PNT2022TMID33446");
```

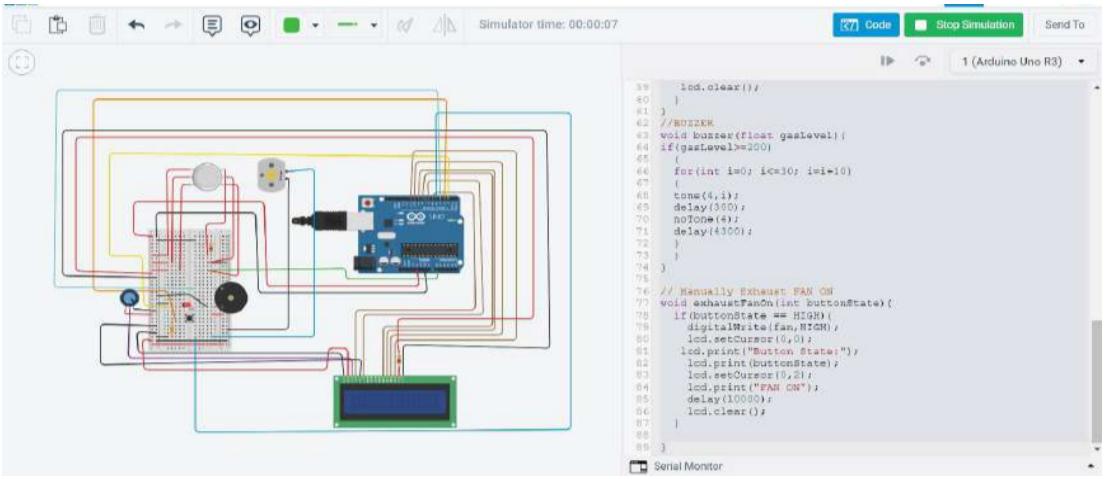
```
delay(500);
lcd.clear();
}
void loop(){
// Read the value from gas sensor and button
gasLevel = analogRead(gasPin);
buttonState = digitalRead(buttonPin);
// call the function for gas detection and button work
gasDetected(gasLevel);
buzzer(gasLevel);
exhaustFanOn(buttonState);
}
// Gas Leakage Detection & Automatic Alarm and Fan ON
void gasDetected(float gasLevel){
if(gasLevel >= 200){
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(100);
lcd.clear();
}
}
```

```
//BUZZER
void buzzer(float gasLevel){
if(gasLevel>=200)
{
for(int i=0; i<=30; i=i+10)
{
tone(4,i);
delay(300);
noTone(4);
delay(4300);
}
}
}
// 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.Testing

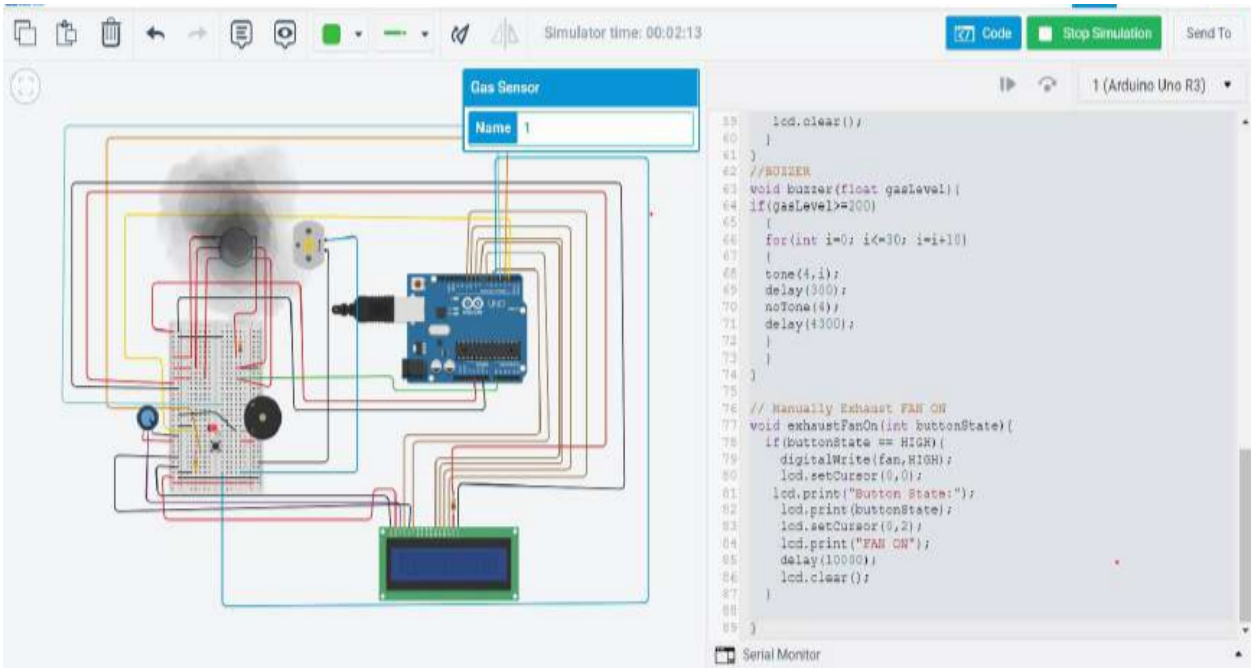
8.1 Test Case 1:

Industries at normal temperature, it is not alerted.



Test Case 2:

Due to gas leakage in industries, this circuit model is alerting the worker through their mobile phone. It will be monitor and rectify by workers in industries.



8.2 User Acceptance Testing:

Purpose of the Document

The purpose of this document is to briefly explain the test coverage and open issues of the[ProductName] project at the time of the release to User Acceptance Testing (UAT)

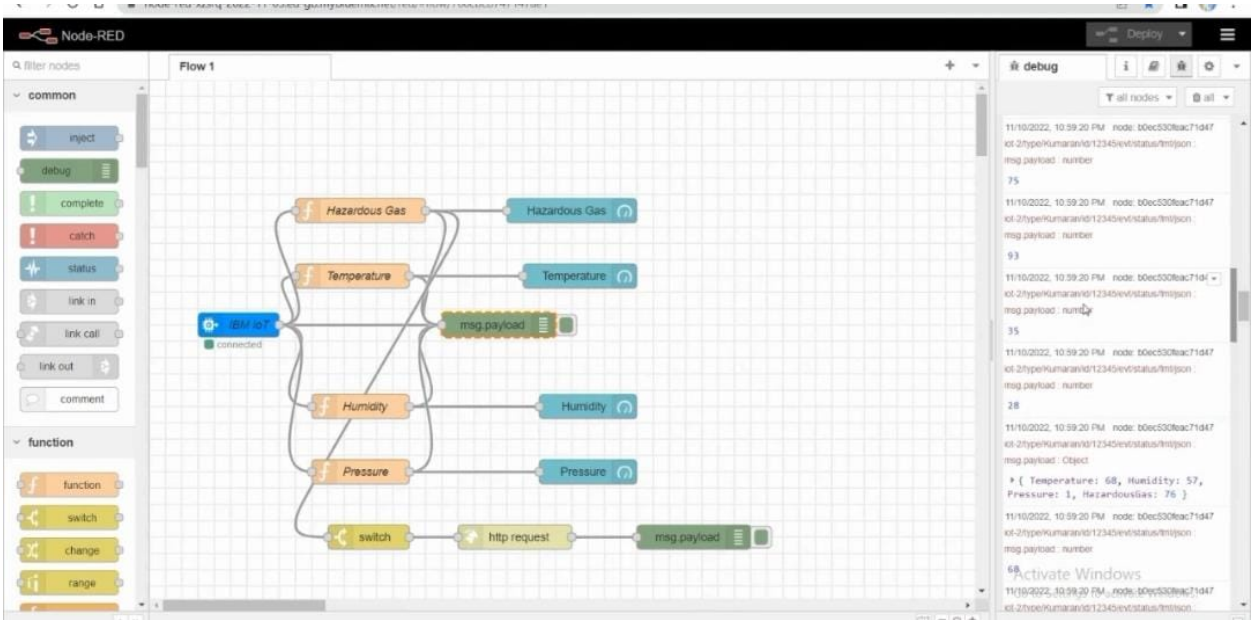
Defect Analysis

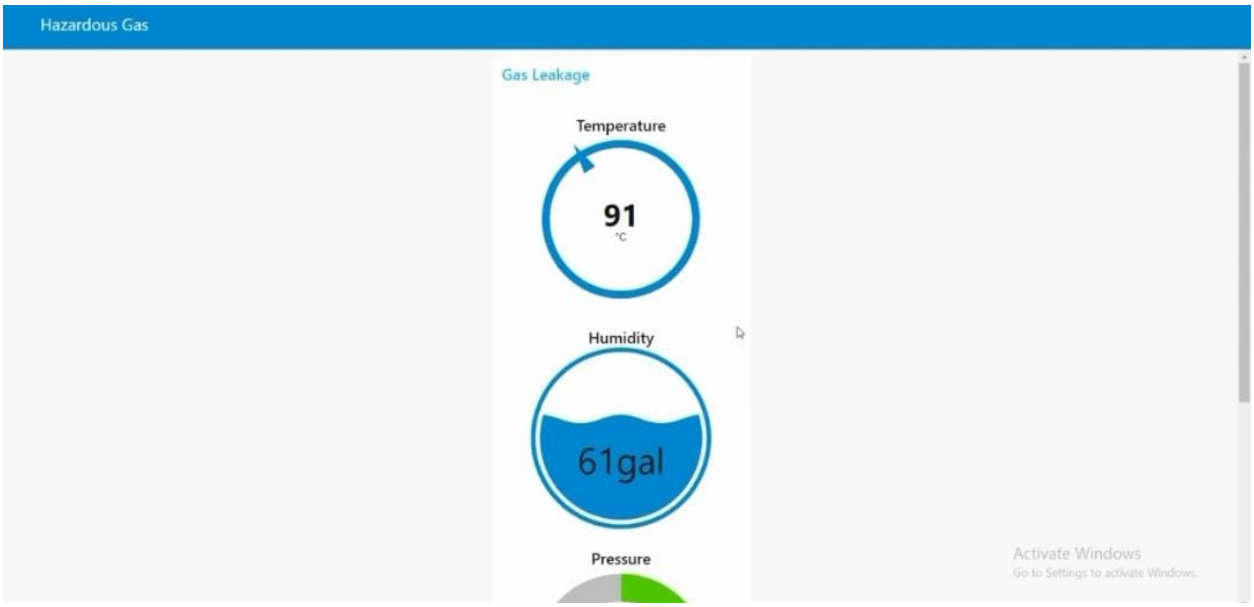
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	19
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	10	2	4	20	36
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	23	14	13	24	74

Test Case Analysis:

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	50	0	0	50
Security	2	0	0	2
Outsource Shipping	3	0	0	3

Results:


Node-RED
Deploy
Flow 1
debug
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
range
Hazardous Gas
Temperature
IBM IoT
connected
msg.payload
Humidity
Pressure
switch
http request
msg.payload
Hazardous Gas
Temperature
msg.payload
Humidity
Pressure
Activate Windows


Hazardous Gas
Gas Leakage
Temperature
91
°C
Humidity
61gal
Pressure
Activate Windows
Go to Settings to activate Windows.

10.Advantages and Disadvantages:

10.1 Advantages:

1) Cost Effective- this Particular model can be purchased for a low cost or one can able to build it on their own.
2) Response time is in order of 1 to 2 seconds.
3) Easy to assemble and maintain- Connections and programming are not much difficult and much maintenance is required.
4) High accuracy- The level of the gas in the air, and the amount of gas leaked can be recorded and intimated.
5) The Sensor has excellent sensitivity.

10.2 Disadvantages:

1)Detected Any Moisture
2)Will not Find Very small Leak
3)Accuracy of Location need to be carefully verified

11.Conclusion:

Using this monitoring and alerting system, we can be able to save lives in dangerous situations. Gases like Carbon dioxide, Oxygen, and Propane will be sensed using the gas sensor node. Arduino UNO micro-controller and a simple procedure in connecting the components and a bit of coding are used to build this monitoring and alerting system. This is a cost-effective operating IoT system that can be used in factories, industries, or for household purposes, to detect any gas leak from the cylinder.

12.Future Scope:

The present model is just for detecting gas leakage and alerting the user about the incident. But this monitoring system should be installed at all critical points of gas pipelines where there may be a chance for gas leaking. Therefore, multiple devices needed to be installed to make this work. In order to make this simple and much more effective, modifying the present model to advance where a single monitoring system is enough to monitor the gas flow throughout the gas line of the whole industry. This modification may include a few other sensors that can measure the pressure of the gas that is flowing in the pipes. When there is a gas leak, the pressure in pipes will decrease, and the pipe which is responsible for the leakage will also be detected. Also, with further research and work, a model can be developed where it can possess the capability to shut the valve automatically and to put off the fire, in case any fire emergence.

13.Appendix:

Source Code:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(6, 7, 8, 9, 10, 11);
float gasPin = A0;
float gasLevel;
int ledPin = 2;
int buttonPin = 3;
int buzzPin = 4;
int buttonState;
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("PNT2022TMID33446");
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 >= 200){
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(100);
lcd.clear();}
}
//BUZZER
void buzzer(float gasLevel){
if(gasLevel>=200)
{
for(int i=0; i<=30; i=i+10)
{
tone(4,i);
delay(300);
noTone(4);
delay(4300);
}
}
```

```
}
// 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();
}
}
```

GITHUB LINK:
https://github.com/IBM-EPBL/IBM-Project-30504-1660147627
Simulation Link:
https://www.tinkercad.com/things/jKLP8fX65Ge-pnt2022tmid16099/editel?sharecode=cdKUwhwJK7oimjNo6--eqezvDNiy-MKpeUULMgqwF5g
Video Link:
https://drive.google.com/drive/folders/1BXCzydTV5bFt9FQxebS0v8iYuq6K2O8l?usp=share_link