PROJECT REPORT

PROJECT NAME	GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES
TEAM ID	PNT2022TMID04029
TEAM MEMBERS	1. Devaprakash S 2. Boobalan H 3. Sathish V 4. Sathishkumar K
BRANCH	ELECTRONICS AND COMMUNICATION ENGINEERING

1. INTRODUCTION

1.1 Project Overview:

In today's world, safety is of the utmost importance, and certain measures must be taken at both work and home to e ensure it. Working or living in a dangerous environment necessitates specific safety measures, whether the subject is electricity or oil and gas. A type of natural gas known as "Liquified Petroleum Gas" (LPG) is compressed under high pressure and stored in a metal cylinder. LPG is extremely vulnerable to fire and can result in catastrophic damage if left unprotected near any fire source. LPG is primarily utilized for cooking and is more readily available than any other natural gas. Sadly, its widespread use makes gas leakage or even a blast a common occurrence. As a result, a system for detecting and monitoring gas leaks is required. Through a flame sensor, the system will keep an eye on fire and flame. The buzzer begins to ring when a fire is detected. Tests have shown that the system can keep track of the wastage of gas and leaks and notify the user. The performance that was produced showed that it was successful in reducing the amount of domestic gas that was wasted.

1.2 Purpose:

Nowadays the home safety detection system plays an important role in the security of people. Since all the people from the home goes to work on a daily bases, it makes it impossible to check on the appliances available at home especially LPG gas cylinder, wired circuits, Etc. In the last three years, there is a tremendous hike in the demand for liquefied petroleum gas (LPG) and natural gas. To meet this access amount of demand for energy and replace oil or coal due to their environmental disadvantage, LPG and natural gas are preferred. These gases are mostly used on a large scale in industry, as heating, home appliances, and motor fuel. To monitor this gas leak, the system includes an MQ6 gas detector. This sensor detects the amount of leaking gas present in the surrounding atmosphere. In this way, the consequences of an explosion or gas leak can be avoided.

2. LITERATURE SURVEY

2.1 Existing Problem:

The Internet of Things aims towards making life simpler by automating every small task around us. As much as IoT helps in automating tasks, the benefits of IoT can also be extended to enhancing the existing safety standards. Safety, the elementary concern of any project, has not been left untouched by IoT. Gas Leakages in open or closed areas can prove to be dangerous and lethal. The traditional Gas Leakage Detector Systems though have great precision, fail to acknowledge a few factors in the field of alerting people about the leakage. Therefore, we have used IoT technology to make a Gas Leakage Detector for society which has Smart Alerting techniques involving sending a text message to the concerned authority and the ability to perform data analytics on sensor readings. Our main aim is to propose a gas leakage system for a society where each flat has gas leakage detector hardware. This will detect the harmful gases in the environment and alerting to society members through the alarm and sending notifications.

2.2 References:

Prof. M.Amsaveni, A.Anurupa, R.S.Anu Preetha, C.Malarvizhi, M.Gunasekaran; they told in their research paper on "GSM-based LPG leakage detection and controlling system" the leakage of LPG gas is detected by the MQ-6 gas sensor. Its analog output is given to the microcontroller. It consists of a predefined instruction set. Based on this, the exhaust fan is switched on. So, the concentration of gas inside the room gets decreased. Then, the stepper motor is rotated thus closing the knob of the cylinder. Because of this process, the leakage of gas is stopped. The relay is switched to off the power supply of the house. The buzzer produces an alarm to indicate the gas leakage. Then, the user is alerted by SMS through the GSM module. They proposed their methodology that the system takes an automatic control action after the detection of 0.001% of LPG leakage. This automatic control action provides a mechanical handle for closing the valve. We are increasing the security for humans by means of a relay which will shut down the electric power to the house. Also, by using GSM, we are sending an alert message to the users and a buzzer is provided for alerting the neighbors about the leakage.

P.Meenakshi Vidya, S.Abinaya, G.Geetha Rajeswari, N.Guna, "Automatic LPG detection and hazard controlling " published in April 2014 proposed the leakage detection and real-time gas monitoring system. In this system, the gas leakage is detected and controlled by means of the exhaust fan. The level of LPG in the cylinder is also continuously monitored.

Srinivasan, Leela, Jeya bharathi, Kirthik,Rajasree; in this research paper they told about gas leakage detection and control. In this paper, the gas leakage resulting in fatal inferno has become a serious problem in households and other areas where household gas is handled and used. It alerts the subscriber through the alarm and the status display besides turning off the gas supply valve as a primary safety measure.

Hitendra Rawat, Ashish Kushwah, Khyati Asthana, Akanksha Shivhare, in the year 2014 planned a framework, they gave security issues against hoodlums, spillage, and fire mishaps. In those cases, their framework sends an SMS to the crisis number given to it

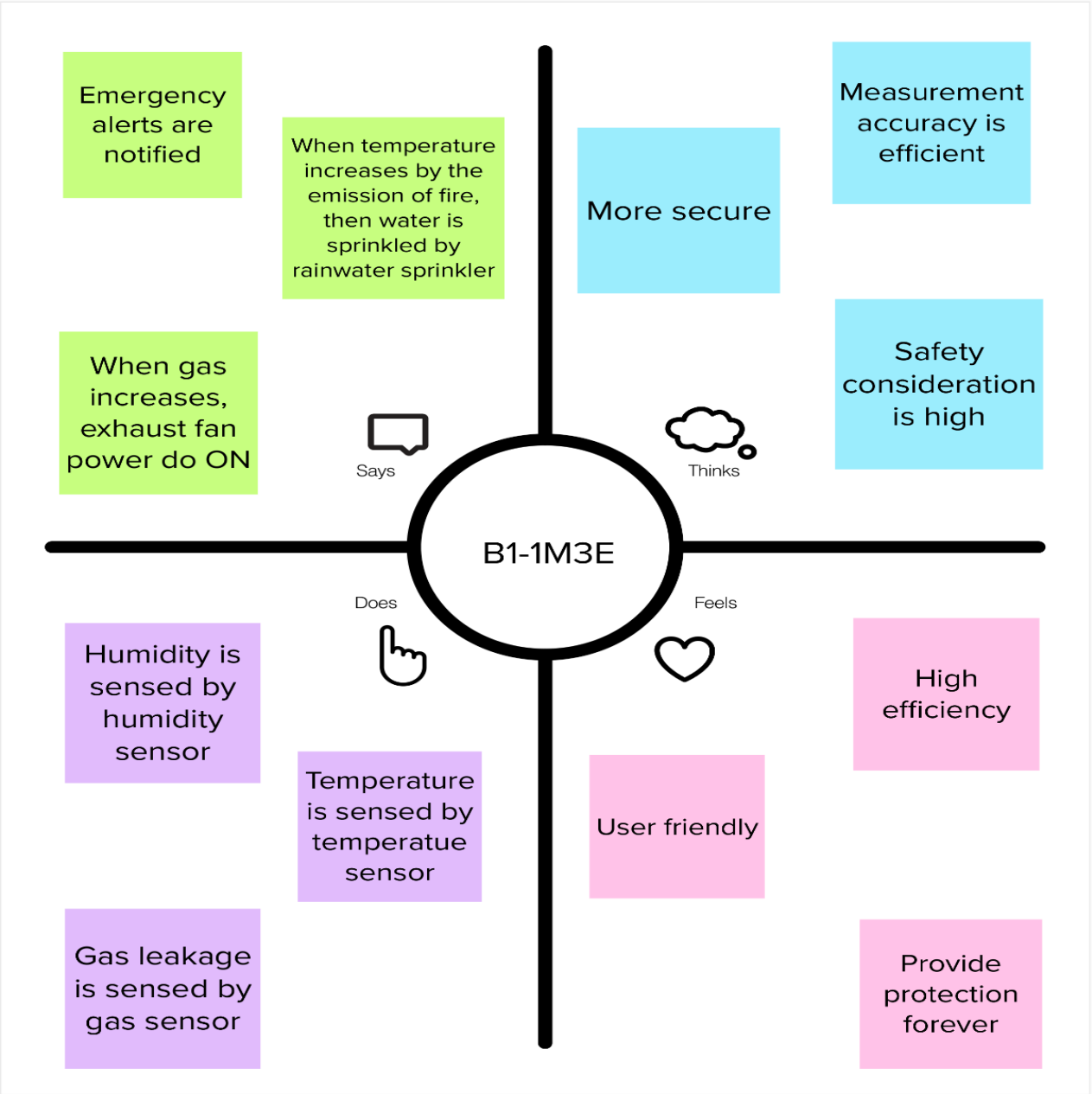
B. B. Did paye, Prof. S. K. Nanda; in this paper, they talked about their research on leakage detection and review of “Automated unified system for LPG using microcontroller and GSM module”. Their paper proposed an advance and innovative approach for LPG leakage detection, prevention, and automatic booking for a refill. In advance, the system provides the automatic control of the LPG regulator also if leakage is detected the system will automatically turn off the main switch of the power supply. Hence it helps to avoid explosions and blasts.

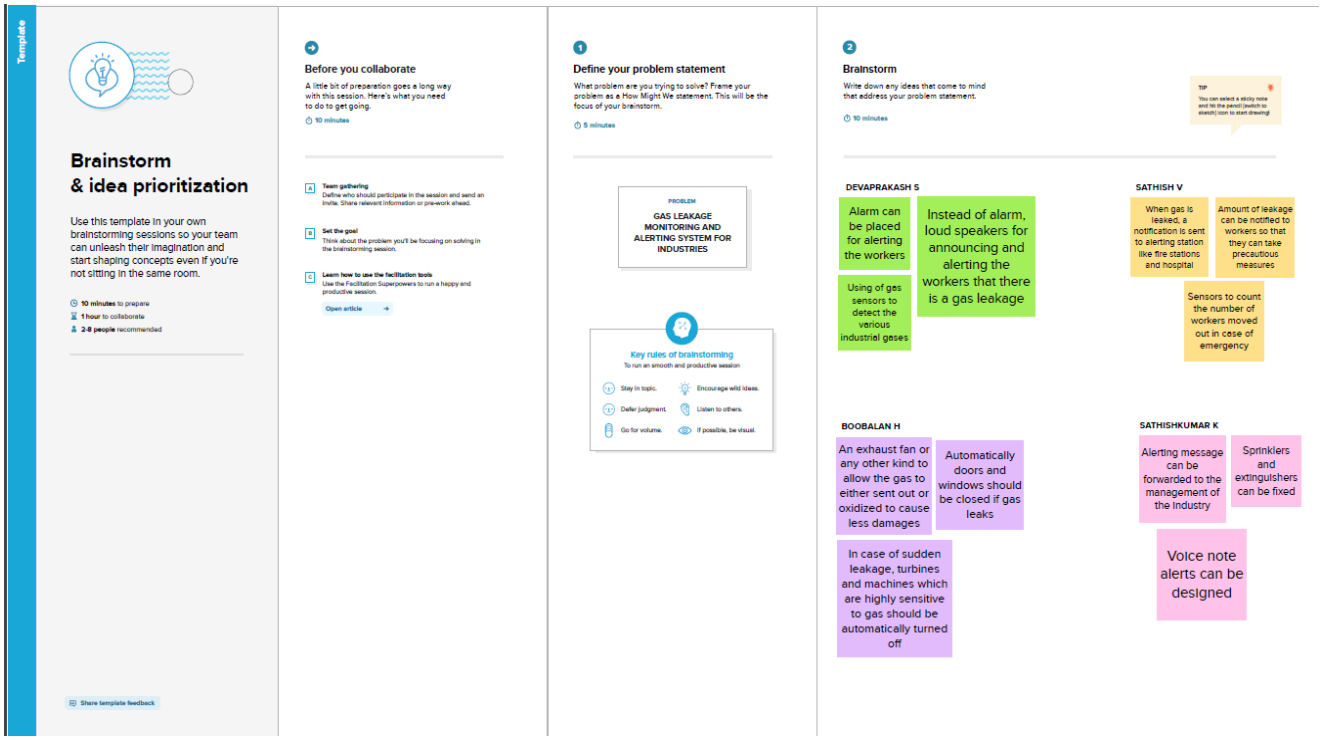
Pal-Stefan Murvaya, Ioan Sileaa, 2008, they told in their survey on gas leak detection and localization techniques various ways to detect gas leakage. They introduce some old or new techniques to detect the gas. The proposed techniques in this paper are nontechnical methods and hardware-based methods which include acoustic methods, optical methods, and active methods. In their survey they told a wide variety of leak-detecting techniques is available for gas pipelines.

2.3 Problem Statement Definition:

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



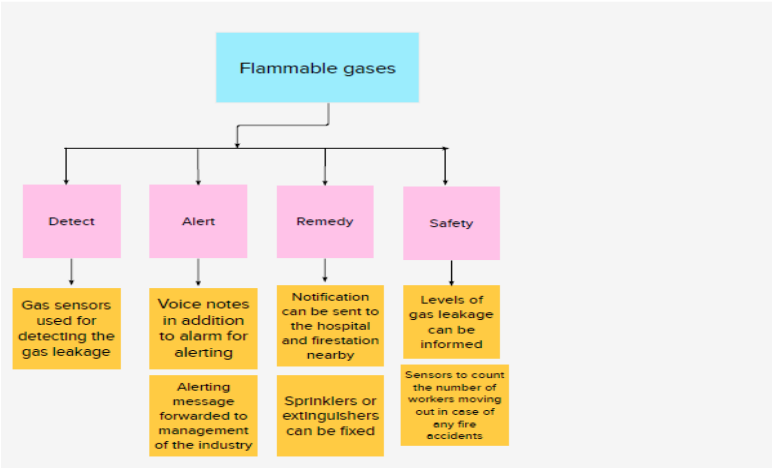


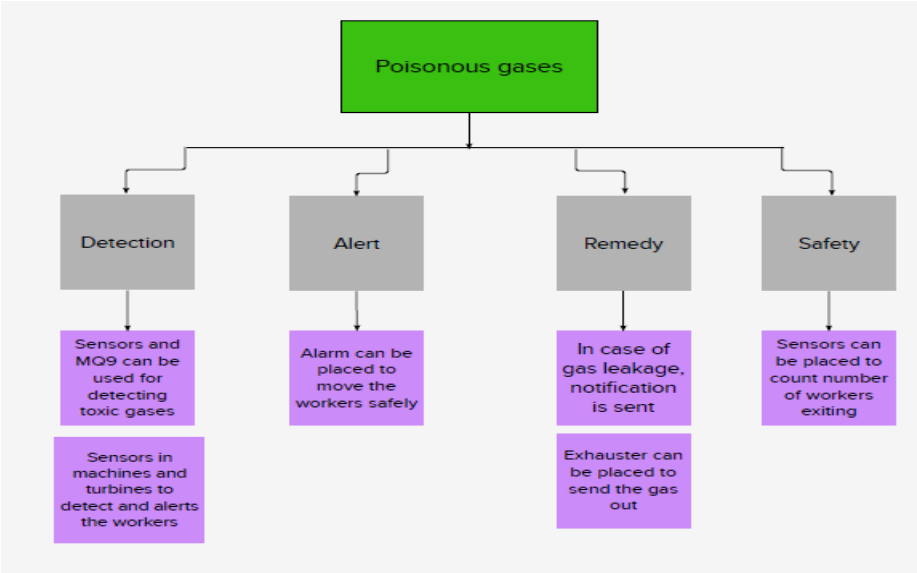
3

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



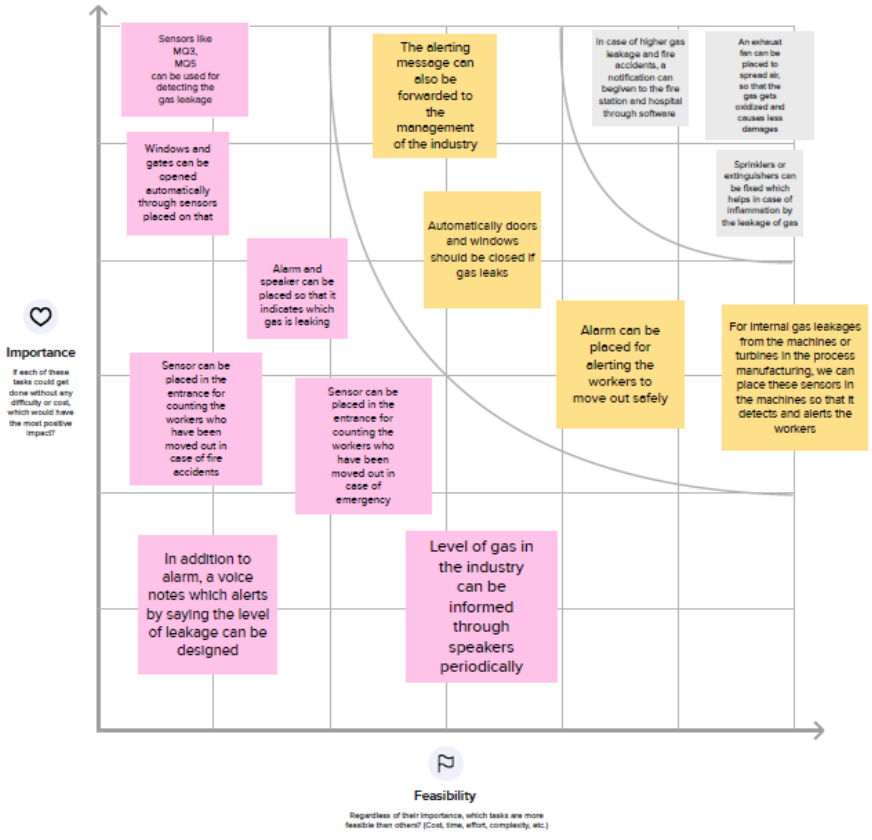


4

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



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

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

B **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in 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:

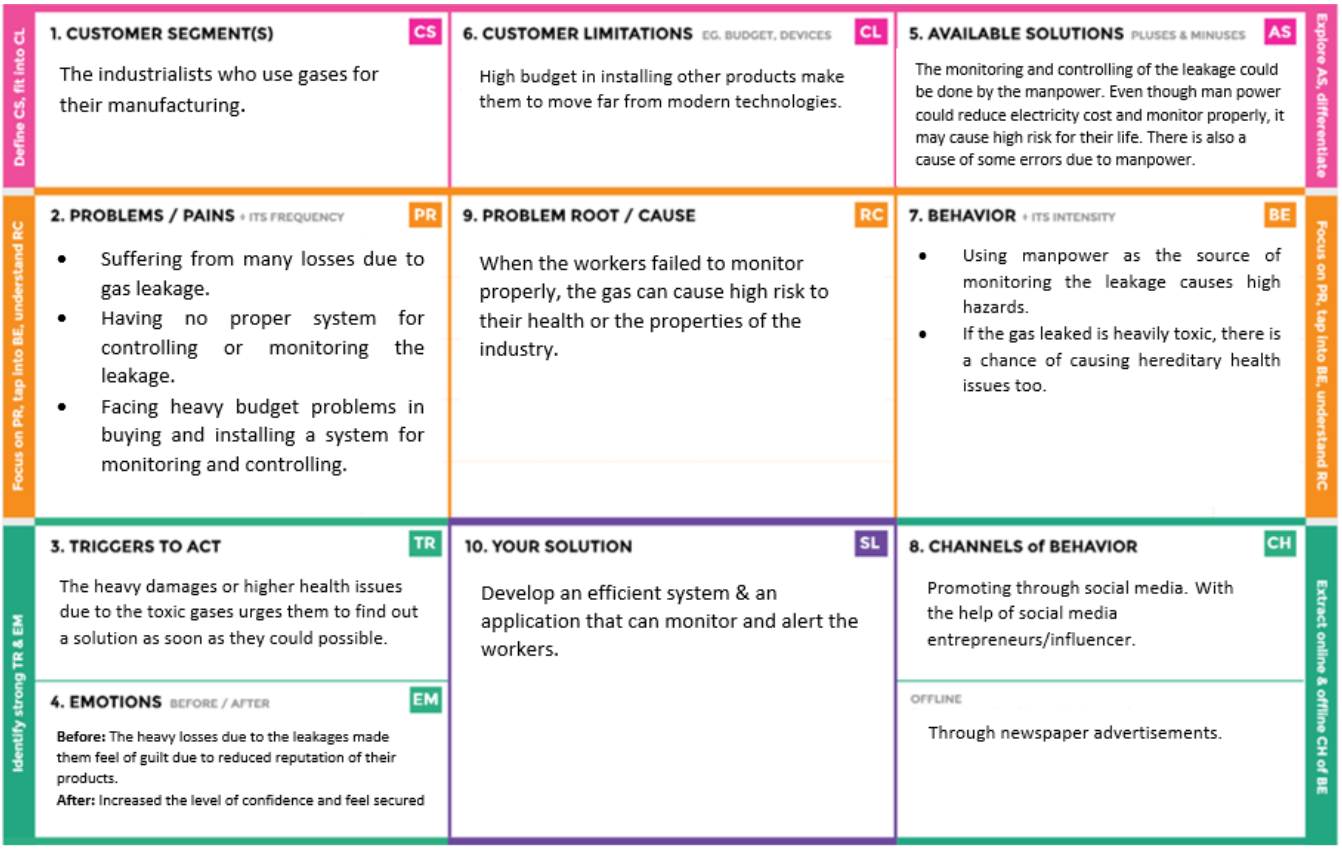
The Internet of Things (IoT) is used to design this industrial monitoring system. The gas sensor (MQ-5) captures the information about the gas levels and posts this into a data cloud. The sensor detects the leakage of gas under various atmospheric conditions. All the components are controlled by an Arduino (UNO-1) which acts as a central processor unit in the setup. As soon as a gas leakage is detected by the sensor, the alarm is raised in the form of a buzzer. This system is also supported by an LCD to display leakage, alert the observer, and activate the exhaust fan in the particular section to evacuate leaked gas.

The purpose of this gas detection system is to not only monitor the environment continuously, but also to prevent gas leaks, so that fire and damage can be minimized.

A system that detects the presence of natural gases and sends alerts to users and nearby people about leakage occurrences as well as showing a dashboard to the operator With this system, natural gases will be detected and alert signals will be sent to the users and those nearby about the leakage occurrence, and the operator will see a dashboard about it. The difference between the proposed system and the previous work is that it shows a full screen dashboard in a 24-hour basis, which is connected to Wi-Fi that allows faster information transfer to the dashboard. In another previous work, the GSM is not efficient to be read all the time. It takes time and the reading is done by a mobile and not an industry application. This system allows the user to be able to take immediate actions against the gas leakage. In addition, it makes the gas leakage information available, accessible, and monitored from the DCS room. Additionally, the information about gas leakage is available, accessible, and monitored from the DCS room. This system can be used in oil and gas industries and even in kitchen. The requirement of this gas detection system is not only to monitor the surroundings continuously but also to prevent the gas leakage thus minimizing the chances of fire and damage.

Conventional gas measurement and control systems are commonly used to ensure a safe working environment. However, these systems have very high installation costs due to expensive components and further, this cost increases depending on the size of the site, the number of measurement points and the gas types. So, a new low-cost gas leak detection system that has a simple control structure with a single sensor set have been carried out. There are some ways to design a cost-efficient system. This can be achieved by measuring points in the area, where gas leaks are being detected, are combined with pipelines in a single measurement centre. The air samples are taken from the measurement points
through the pipes to the measuring centre with a certain sequence starting from the first point to the last and are measured by a single sensor unit consisting of different gas sensors. Compared to the conventional system, this system detects gas leaks with a delay of about three to nine seconds depending on the distance from the point at which the gas leak occurred to the measurement centre. As a result, the proposed system provides a similar measurement performance at a cost of approximately 75% less than conventional systems.

3.4 Problem Solution fit:



4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

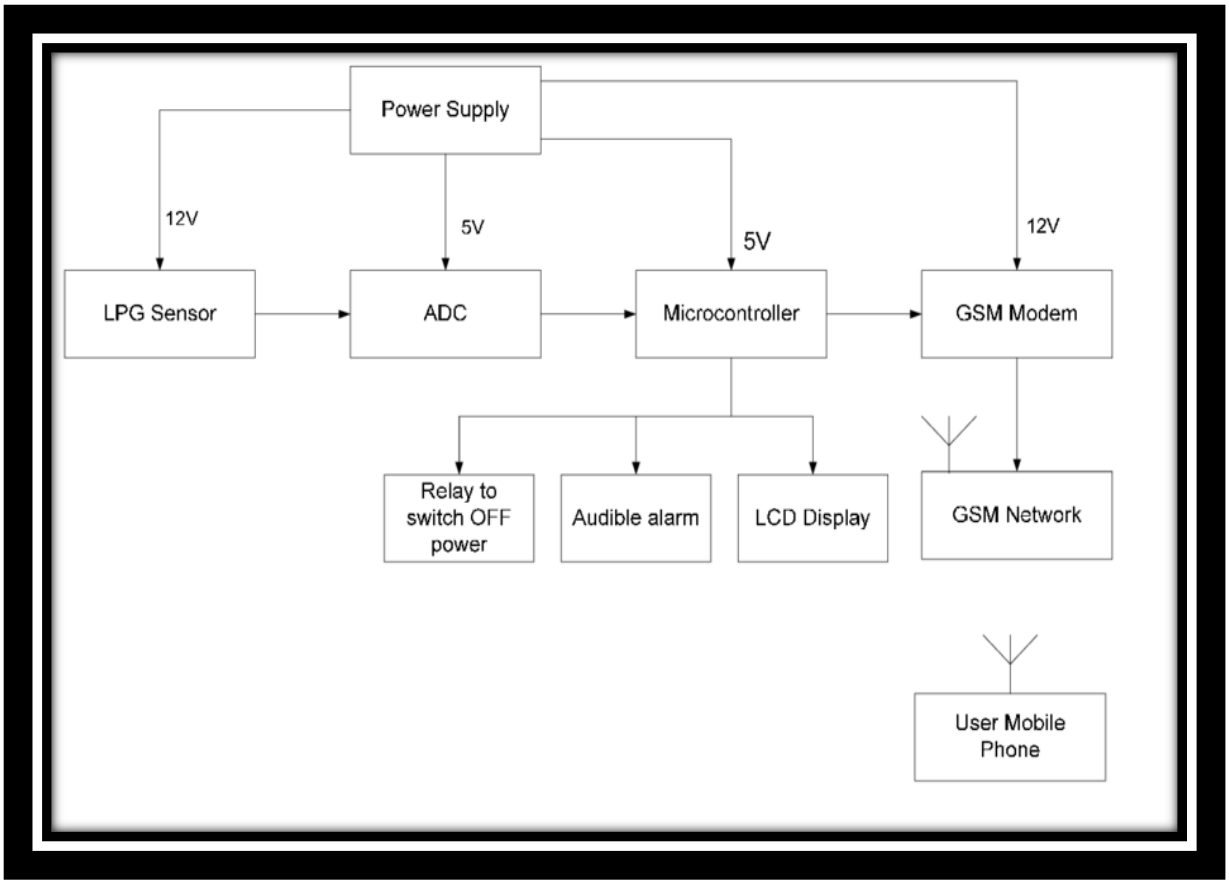
S.NO	Functional Requirements	Sub Requirements (sub tasks)
1	User Understanding	The user can monitor the level of gas with help of data or using sensor. If the gas level exceeds the threshold value the system alerts the user.
2	User Performance	When the user gets notified by the alert message .User can take precautions measure such as turning on the ventilation ,alerts the surrounding .
3	User Alert	User can get alert message through SMS and alarm by buzzer.

4.2 Non-Functional requirements:

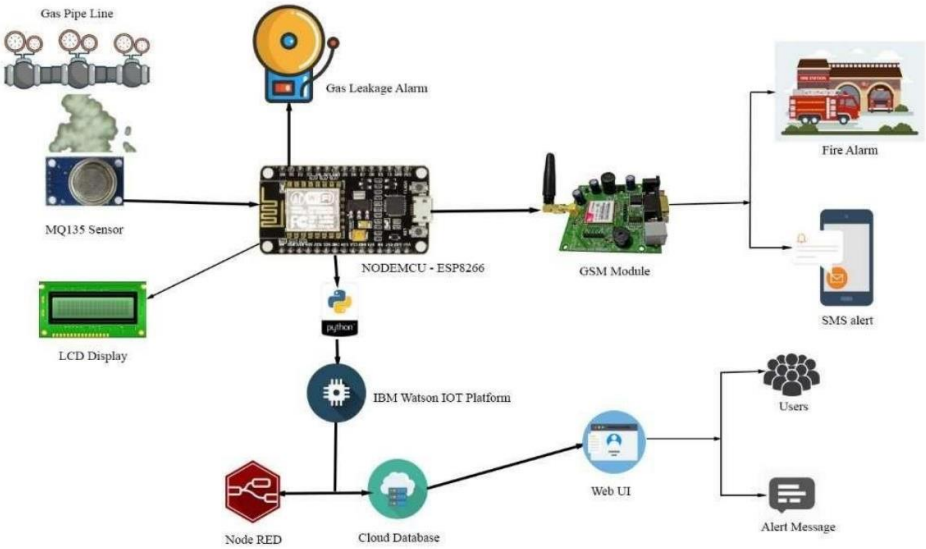
S.NO	Non - functional Requirements	Requirement Description
1	Usability	The device must be easily usable by the customers and the device keeps on updating the data.
2	Security	Data from the device stored securely and in emergency situations the customer can able to protect both human and physical properties in the environment.
3	Reliability	The device must be able to provide accurate data and sense the gas with accurately and not to give false alert.
4	Performance	Exhaust fans and alarm can be used in case of emergency. Turning off the gas valve or fix the gas leaking area can also be done.
5	Availability	The device must with stand in harsh condition environment too. The device must continuously monitored the gas leakage day and night.
6	Scalability	The device must be capable of measuring the gas leakage even in large industries and sensors can be replaced.

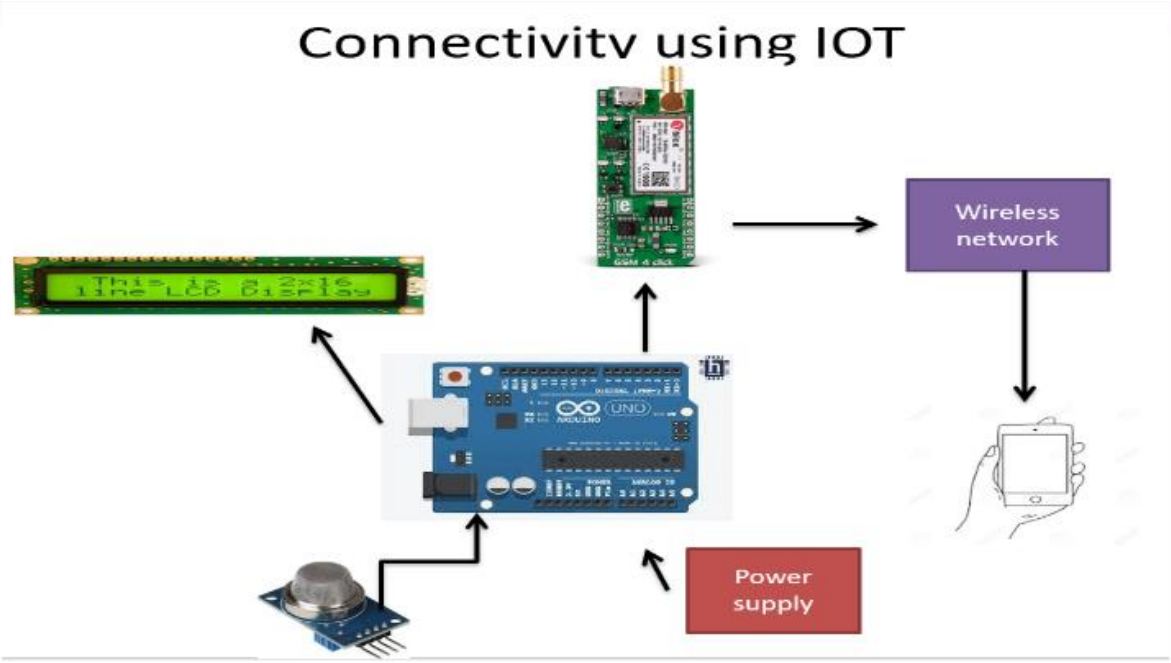
5. PROJECT DESIGN

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:





5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Industry owner)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	Register to the application by email and password with password confirmation.	High	Sprint-1
Customer (Industry Owner)	Confirmation	USN-2	I will receive confirmation email once Ihave registered for the application	Receive confirmation email & click confirm	High	Sprint-1
Customer (Industry Owner)	Authorize	USN-3	As a user, I will enable the supervisor to monitor the gas leakage system status.	Provide access to supervisor.	High	Sprint-1
Customer (Supervisor)	Login	USN-4	As a user, I can log into the application by entering email & password.	Get access to dashboard.	High	Sprint-1
Customer (Supervisor)	Monitor	USN-5	As a user, I can monitor the status of the gas leakage system.	Status of gas leakage system.	High	Sprint-1
Customer (Line Workers)	Notification	USN-6	As a user, I can get (alarm system) alert about gas leakage.	Get alert about gas leak.	Medium	Sprint-2
Customer (Supervisor)	Notification	USN-7	As a user, I can get SMS notification & alarming alert about gas leakage.	Get alert about gas leakage.	Medium	Sprint-2
Customer (Industry Owner)	Sign-Up	USN-9	As a user, I can sign-up using Facebook login.	I can sign-up with the application using Facebook.	Low	Sprint-3
Customer (Supervisor)	Sign-Up	USN-10	As a user, I can sign-up using Google login.	I can sign-up with the application Google using.	Low	Sprint-3
Administrator	Service Request	USN-11	As a user, I can request for service in case of any issue with gas leakage monitoring system	Get service from provider	Low	Sprint-3
Administrator	Increase dservice	USN-12	As a user, I can request for scaling up the gas leakage monitoring system.	Get service from the provider.	Low	Sprint-4
Customer (Industry Supervisor)	Leakage detection	USN-13	Look for gas leakage in any other container	Access the monitor Display	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation:

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

6.2 Sprint Delivery Schedule

Sprint Delivery Plan

1. Identify the Problem

2. Prepare an abstract and Problem Statement

3. List a required Objects needed

4. Create a code and run it

5. Test with a created code and check the designed Prototype

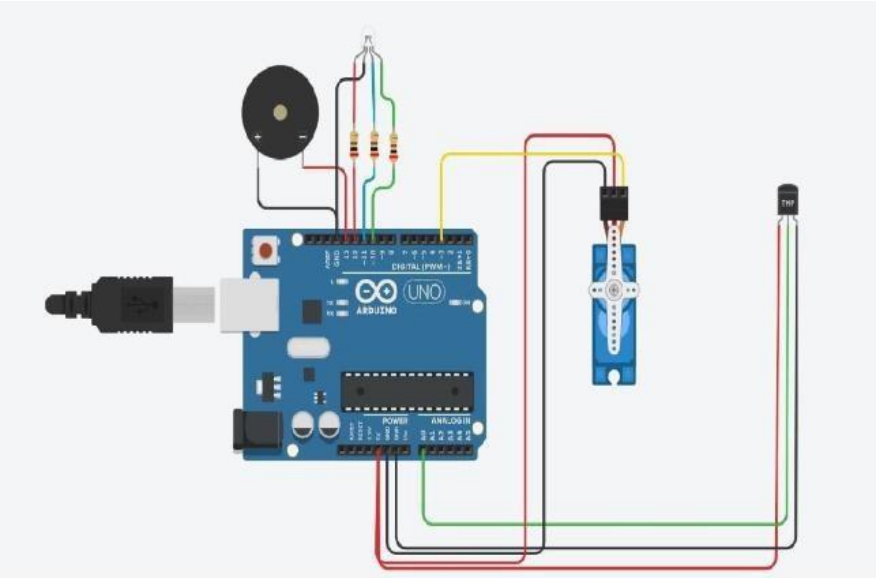
6. Solution for the problem is found

- **Sprint 1**
- **Sprint 2**
- **Sprint 3**
- **Sprint 4**

We are Developing the code in this Schedule.

7. Schematic Diagram of project & Components:

7.1 Circuit Diagram:



7.2 Components:

The design of a sensor-based automatic gas leakage detector with an alert and control system. The components are

S. No	Name of the Component	Quantity
1.	Arduino UNO R3	1
2.	Breadboard	1
3.	LED	2
4.	Resistor	5
5.	Piezo	1
6.	Gas Sensor	1
7.	LCD 16*2	1

8. CONCLUSION:

After this project performance can conclude that the detection of the LPG gas leakage is incredible in the project system. Applicable usefully for industrial and domestic purposes. In dangerous situations, we can save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas like CO2, oxygen, and 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.

9. FUTURE SCOPE:

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

10. APPENDIX:

```
#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("PNT2022TMID04007");
  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(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();
  }
}
```

GitHub & Project Demo Link: https://github.com/IBM-EPBL/IBM-Project-17408-1659669102