Gas Leakage Monitoring and Alerting System

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TEAM ID : PNT2022TMID25221

Abstract

Safety plays a critical role in today's world and it is vital that certain solutions are implemented in places of work and living. Whether it is electricity or oil and gas, working or living in hazardous conditions demand certain safety protocols. Liquified Petroleum Gas (LPG) is a type of natural gas liquified under extreme pressure and contained in a metal cylinder. LPG is extremely sensitive to fire and causes a great disaster if exposed to any fire source without precaution. LPG is more widely available than any other natural gas and is primarily used forcooking. Unfortunately, its broad use makes the event of gas leakage or even a blast standard. Therefore, there is a need to develop a gas leakage detection and monitoring system. The system will monitor flame and fire through flame sensor. When a fire is detected, the buzzer begins to sound.The system has been tested and it is able to monitor gas wastage, leakage and notify the user.The resulting performance indicated its effectiveness toward saving a significant portion of the wasted gas in domestic.

Project Report

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1.INTRODUCTION

Now a days the home safety detection system plays the important role for the security of people. Since all the people from the home goes to work on daily basis, it makes impossible to check on the appliances available at home speciallyLPG gas cylinder, wired circuits, Etc. Since last three years there is a tremendous hike in the demands of 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 large scale in industry, heating, home appliances and motor fuel. So as to track this leakage gas, the system includesMQ6 gas sensor. This sensor senses the amount of leak gas present in the surrounding atmosphere. Through this, explosion or getting affected by the leakage of gas could be avoided.

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 mannerpossible.

1.1 PROJECT OVERVIEW

Project Name	Gas Leakage Monitoring and Alerting Systems
TEAMID	PNT2022TMID25221
Team Lead	Makalakshmi V

Problem Project will Address	Unexpected Hazardous Gas Leakage From Industries which will lead tomany Accidents
Project Goals	To Detect and Alert the industry workers
Project Objectives and Scopes	The objective of this work is to present the design of a cost effective automaticalarming system, which can detect liquefied petroleum gas leakage in various premises.

1.2 PURPOSE

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. If in any area gas leakage is detected the admins will be notified alongwith the location. In the web application, admins can view the sensor parameters.

1. LITERATURE SURVEY

1.1 Existing problem

Gas leakage is nothing but the leak of any gaseous molecule from a stove, or pipeline, or cylinder etc. This can occur either purposefully or even unintendedly. As we are aware that these kinds of leaks are dangerous to our health, and whenit becomes explosive it could cause great danger to the people, home ,workplace,industry and the environment. Few of the major incidents that took place due to gas leakage include the Bhopal Disaster and the Vizag Gas leak. The Bhopal disaster is known to be the worst industrial accident ever. Approximately 45 tons of Methyl Isocyanate was leaked from this insecticide plant. Methyl Isocyanate is an organic compound and a chemical that could come from the carbamate pesticides. This colorless, poisonous and flammable liquid is something thathuman beings have to be away from. Vizag Gas leak was a resultant of the escape of styrene that were unattended for a long period. This colorless oily liquid can spread in fumes. So, a detector must be made in such a way that coulddetect any kind of gas, fume, leak, smoke etc. However harmful and dangerous itcan be, the detector could be attached with certain parameters that could help to prevent the issue.

2,2 REFERENCES

Prof.M.Amsaveni, A.Anurupa, R.S.AnuPreetha, C.Malarvizhi, M.Gunasekaran 23 March 2015; They told in their research paper on “GSM based LPG leakage detection and controlling system” the leakage of LPG gas is detected by the MQ6 gas sensor. Its analog output is given to the microcontroller. It consists of 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.

Advantages:

In this methodology that the system takes an automatic control action after the detection of 0.001% of LPG leakage.

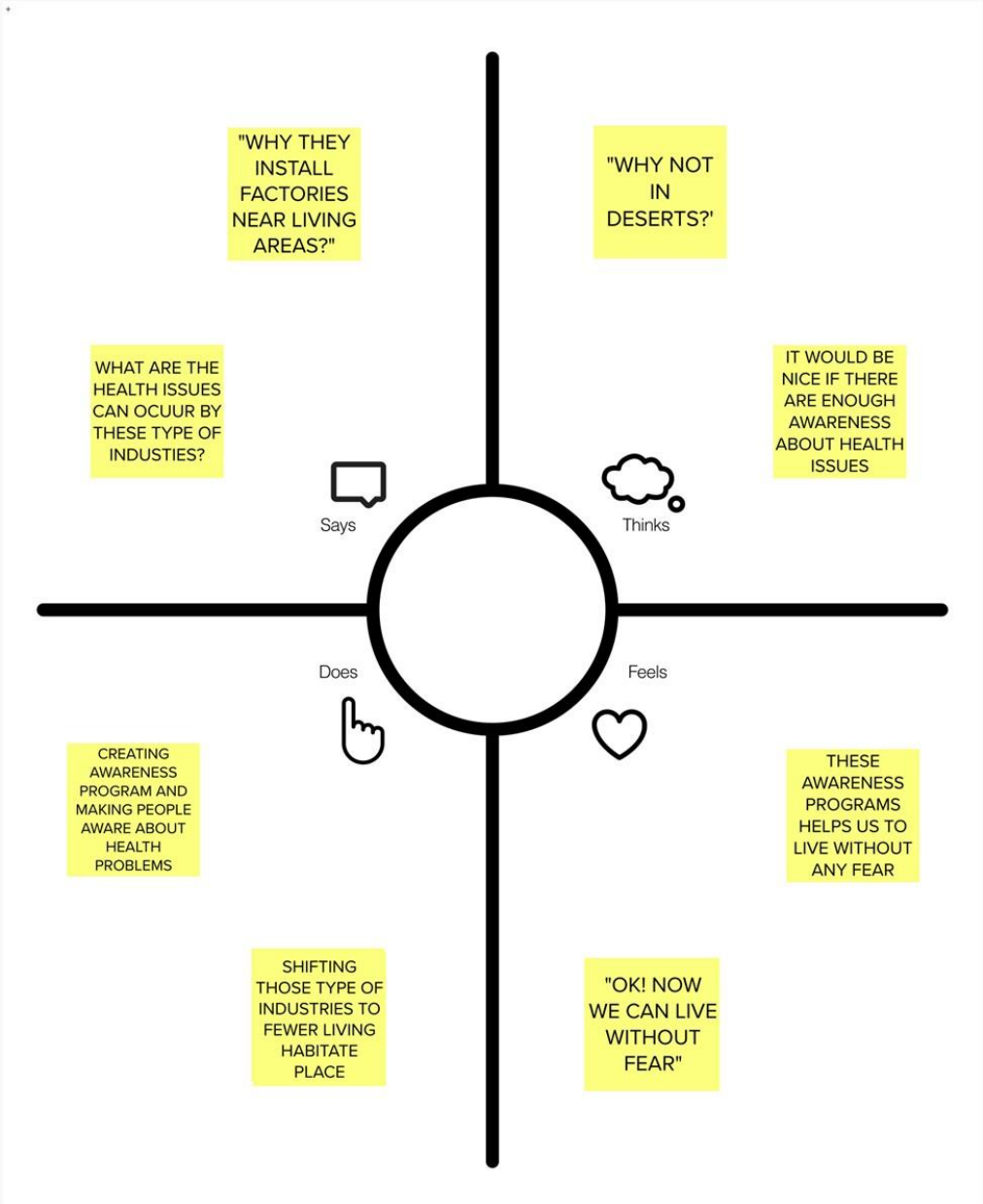
Disadvantages:

(1) System only able to send SMS and alert the user only when the mobile is ON.

(2)This method looks very ordinary and old fashioned.

2.IDEATION & PROPOSED SOLUTION

2.1 Empathy Map Canvas



2.2 IDEATION & BRAINSTORMING

Template

Conducting a brainstorm

Executing a brainstorm isn't unique; holding a productive brainstorm is. Great brainstorms are ones that set the stage for fresh and generative thinking through simple guidelines and an open and collaborative environment. Use this when you're just kicking-off a new project and want to hit the ground running with big ideas that will move your team forward.

- **15 minutes** to prepare
- **30-60 minutes** to collaborate
- **3-8 people** recommended

Created in partnership with Meta

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.

15 minutes

A **Choose your best "How Might We" Questions**

Create 5 HMW statements before the activity to propose them to the team.

B **Set the stage for creativity and inclusivity**

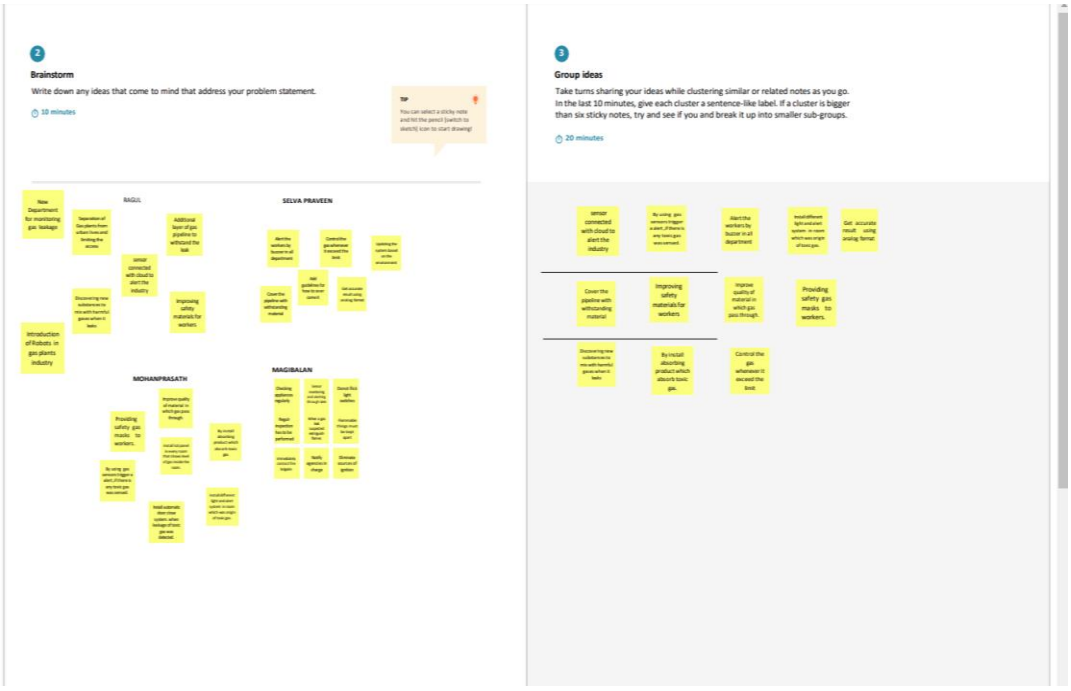
Go over the brainstorming rules and keep them in front of your team while brainstorming to encourage collaboration, optimism, and creativity.

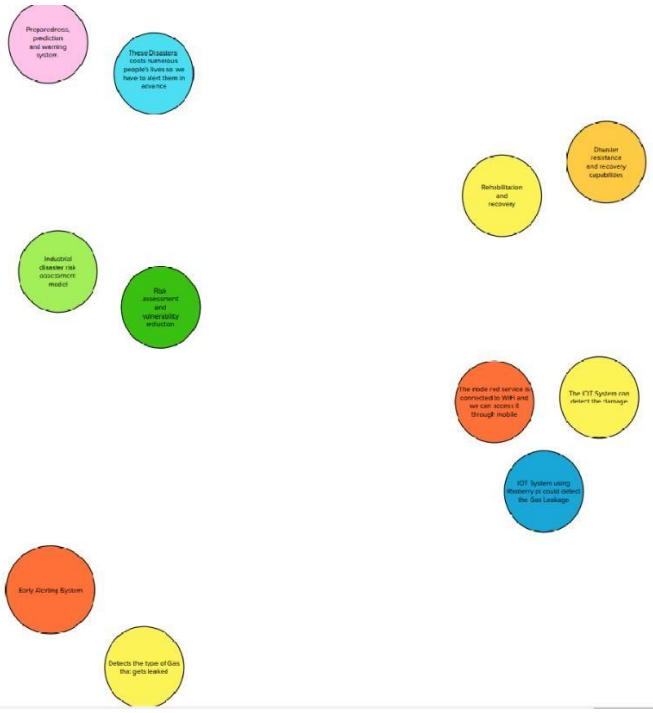
1. **Encourage wild ideas** (If none of the ideas sound a bit ridiculous, then you are filtering yourself too much.)
2. **Defer judgement** (This can be as direct as harsh words or as subtle as a condescending tone or talking over one another.)
3. **Build on the ideas of others** ("I want to build on that idea" or the use of "yes, and...")
4. **Stay focused on the topic at hand**
5. **Have one conversation at a time**
6. **Be visual** (Draw and/or upload to show ideas, whenever possible.)
7. **Go for quantity**

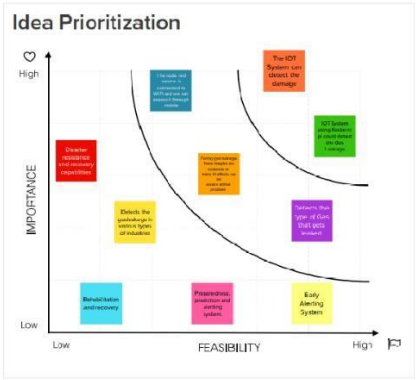
C **Interested in learning more?**

Check out the Meta Think Kit website for additional tools and resources to help your team collaborate, innovate and move ideas forward with confidence.

Open the website →


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.
In the last 10 minutes, 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
RAGUL
SELVA PRAVEEN
MOHANPRASATH
MAGIBALAN
sensor connected with cloud to alert the industry
Improving safety materials for workers
Providing safety gas masks to workers.
Cover the pipeline with withstanding material
Improve quality of material in which gas pass through
By install absorbing product which absorb toxic gas.
Control the gas whatever it exceed the limit


Preparedness, prediction and warning system
These Disasters costs numerous people's lives so we have to alert them in advance
Industrial disaster risk assessment model
Risk assessment and vulnerability reduction
Early Alerting System
Detects the type of Gas that gets leaked
Rehabilitation and recovery
Disaster resistance and recovery capabilities
The node red service is connected to WiFi and we can access it through mobile
The IOT System can detect the damage
IOT System using Rasberry pi could detect the Gas Leakage


Idea Prioritization
High
Low
IMPORTANCE
Low
FEASIBILITY
High
The IOT System can detect the damage
IOT System using Rasberry pi could detect the Gas Leakage
Disaster resistance and recovery capabilities
Detects the type of Gas that gets leaked
Rehabilitation and recovery
Preparedness, prediction and warning system
Early Alerting System

2.3 PROPOSED SOLUTION

Problem Statement (Problem to be solved)

Gas Leakage Monitoring and Alerting System for safety purpose. The Gas Leakage monitoring has a big role in industries and also at many factories where Gas manufacture is happening. This monitoring will help many Gas Leakage related accidents

Idea / Solution description

The idea is the Gas Leakage detection with a Wifi connected so that the alert system will be at a quicker way through IoT. The sensor also should be in the latest upgraded version of MQ 135 sensor .The sensor is designed in such a waythat it can have a huge radius of detecting the gas leakage. The board Arduino orESP866Mod which has an inbuild Wifi.so that the alert system works quickenough to alert the admin.

Novelty / Uniqueness

The Uniqueness of this project is that it has a better accuracy than the previous version alerting systems which are available in the market. By using IoT the range of the alert system will be increased and also it is cost efficient if we built a main Hub for a large scale industries to monitoring

Social Impact / Customer Satisfaction

It will have a great impact in society because gas leakage may lead to many problems to the people and will be affected by many diseases and also costslives

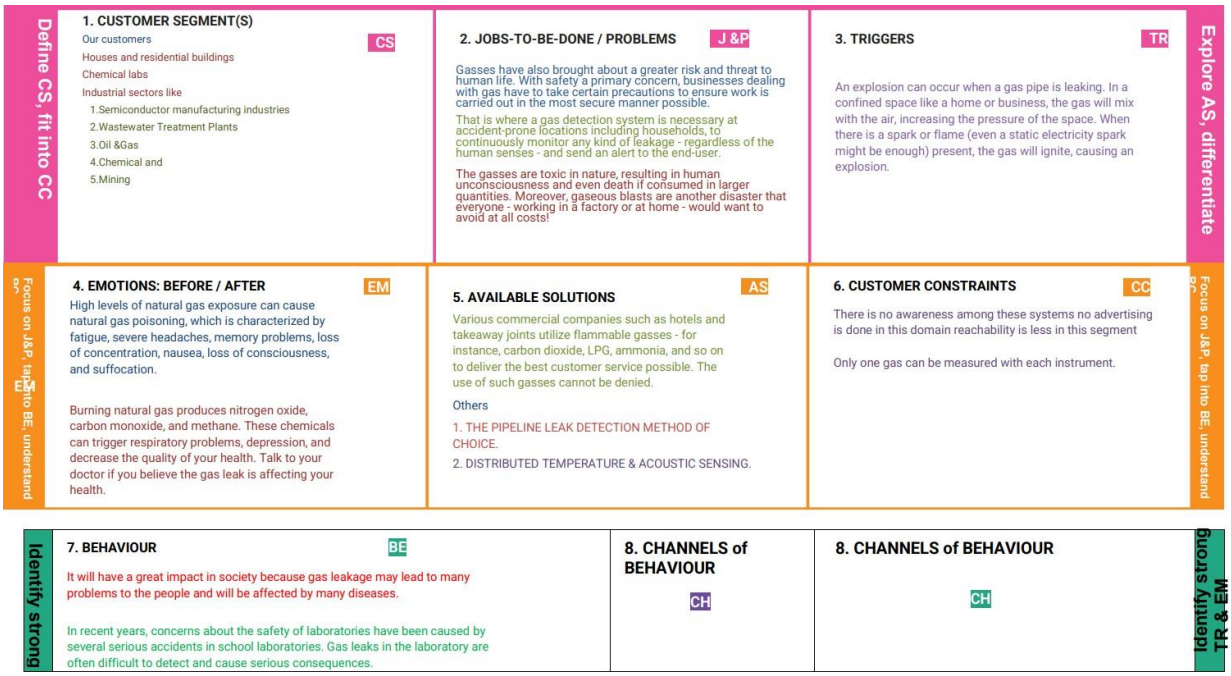
Business Model (Revenue Model)

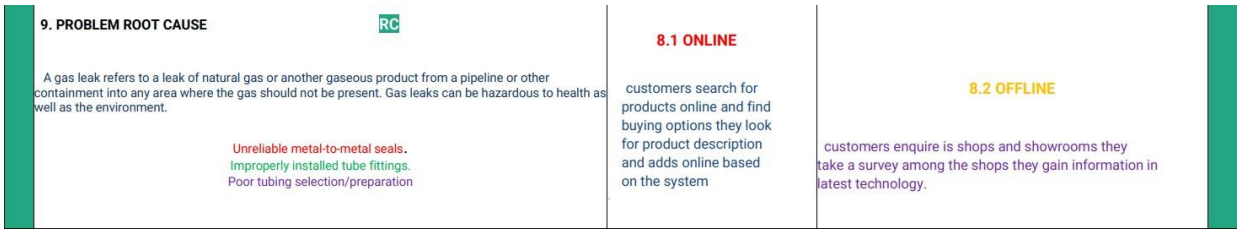
The Targeted customers are Factory owners and also Gas related industries and factories.

Scalability of the Solution

This is highly scalable since the number of accidents by Gas Leakage is reduced and also through IoT the monitoring also can be held

2.4 PROBLEM SOLUTION FIT





3. REQUIREMENT ANALYSIS

3.1 Functional requirement

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	In Industries, we use this device to avoid the fire accidents. The device can be accessed through Wifi.
NFR-2	Security	Only authorised person can access the important details.
NFR-3	Reliability	Prevent from accidents. Avoid false Alarm. It Should avoid the delay alert message.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User SIGN IN	User can sign in with username and password
FR-4	Connect the NODEMCU device	Connect the NODEMCU device with application through Wifi.
FR-5	Update contact details	Update the emergency contact number.
FR-6	REALTIME MONITORING	It display the temperature level in pictorial representation using flow chart.

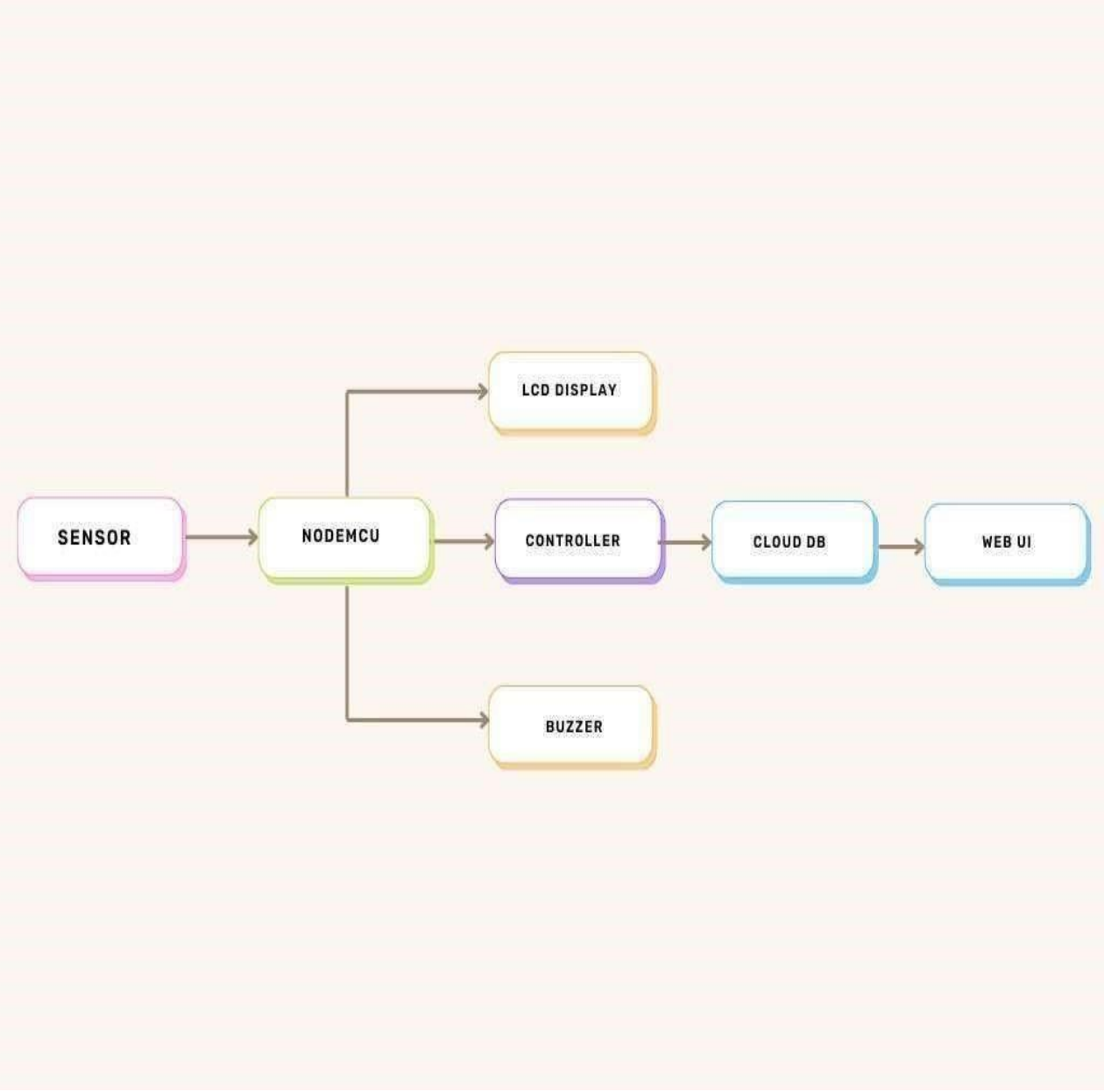
FR-6	Output	□ In Emergency situation, it sends alert message to emergency contact number. □ It sends message to fire service.
FR-7	Review and Feedback	□ User can share their experience about the app usage. □ Provide feedback

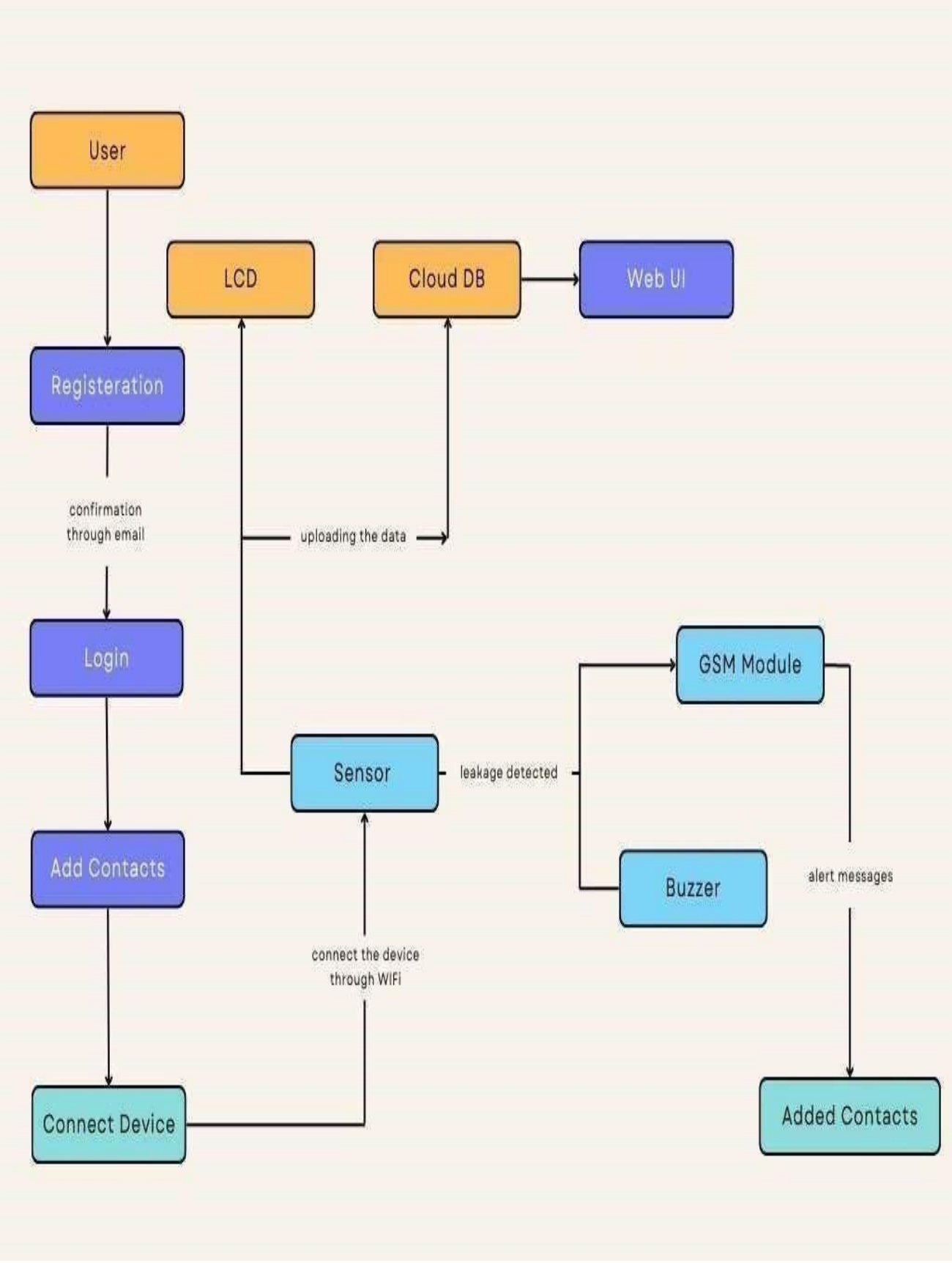
Non Functional requirement

NFR-4	Performance	In a gas usage industries, the gas is transferred from one end to another end through pipes at the time gas leakage is possible. We use this device to detect the gas leakage and gives buzzer alarm and send alert message to nearest police station and fire service department.
NFR-5	Availability	This model is used to continuously monitor and display the gas level and check the gas level is exceed or not.
NFR-6	Scalability	Lot of users can access the application at the same time without any inconvenience.

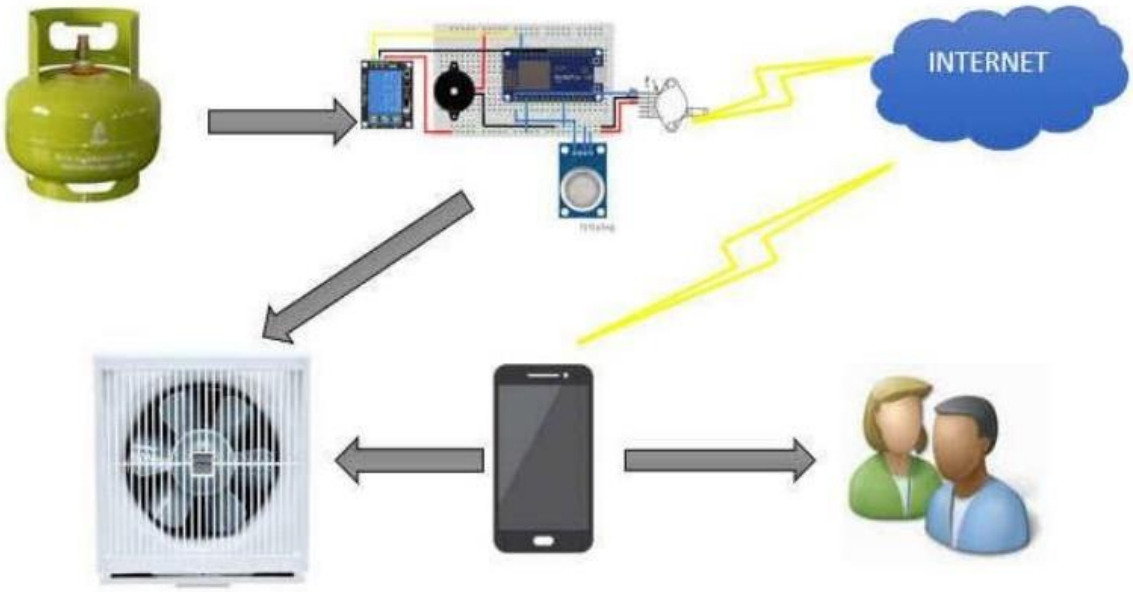
4. PROJECT DESIGN

4.1 Data Flow Diagrams

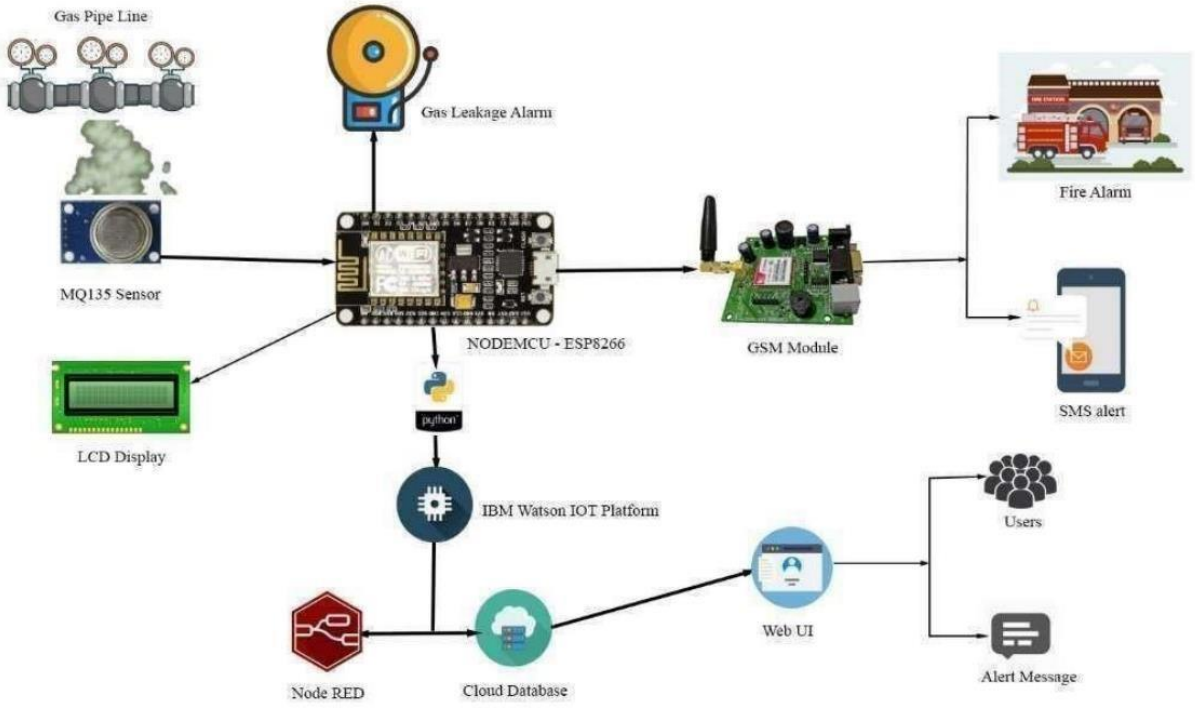



User
LCD
Cloud DB
Web UI
Registeration
confirmation
through email
uploading the data
Login
GSM Module
Sensor
leakage detected
Add Contacts
Buzzer
alert messages
connect the device
through WIFI
Connect Device
Added Contacts

4.2 SOLUTION ARCHITECTURE



5.2 TECHNICAL ARCHITECTURE



5.3 USER STORIES

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	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	High	Sprint-1
	Login	USN-3	As a user, I can log into the application entering email & password	I can login to my web to my email and password.	High	Sprint-1
	Dashboard	USN-4	As a user, I can login into my account and I can add the members to send alert message	Only added contact numbers can receive SMS alerts.	High	Sprint-1
Customer (Web user)	Registration	USN-1	As a user, I can register for to creating account by entering my email, password, and confirming my password.	I can access my account.	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the web user.	I can receive confirmation email.	High	Sprint-1
	Login	USN-3	As a user, I can log into the website entering email & password	Only valid credentials must be acceptable.	High	Sprint-1
	Dashboard	USN-4	As a user, I can login into my account and I can add the members to send alert message	Only added contact numbers can receive sms alerts.	High	Sprint-1
Administrator	Admin	USN-1	As a Admin, He/ She can add the members those who want to receive alert message.	The Admin have authority can add members and edit the details.	High	Sprint-1
		USN-2	As a Admin, He/ She can monitor real time.	The admin can monitor the process by 24/7 hrs.	High	Sprint-1

5. PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Monitoring The Gas leakage	USN-1	The Industrialist have their own industries and it not a compulsory to work because they have workers to work for them. The workers are important for the industries and as well as the family members of the workers. Hence their health is very important and must be take care of the industries. And the industries must give assurance for those workers.	2	High	Magibalan
Sprint-2	Avoiding the Disaster	USN-2	We can't predict the time of disaster hence the fire services must be ready and alert all the time	1	High	Mohanprasath
Sprint-3	Detection of the Gas	USN-3	We have to monitor the gas 24/7 because it has high risk. The industries must have high quality pipes and proper maintenance service once in a month. The industries must take care of all the necessary processes to avoid the gas leakage	2	Low	Ragul
Sprint-4	The model is trained and tested by sample dataset.	USN-4	The programmer design the model to detect the gas leakage	2	Medium	Selva praveen

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 Delivery Schedule

Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

1

6. CODING & SOLUTIONING

7.2 Feature 1

- This project helps the industries in monitoring the emission of harmfulgases
- In several areas, the gas sensors will be integrated to monitor the gasleakage

7.2 Feature 2

If in any area gas leakage is detected the admins will be notified alongwith the location

- In the web application, admins can view the sensor parameters.

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("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();
  }
}
```

9. RESULTS

This technique has been tested by leak of gas almost about sensors, MQ2 gas sensor sends the signal to the Arduino UNO after detecting the gas leakage. Arduino to other externally connected device such as LCD, buzzer. In

practice, results for are noticed by the people surrounding by the area are displayed in the LCD and buzzer sound indicate the danger to the people by making beep sound.

10. ADVANTAGES & DISADVANTAGES

- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Supervise gas concentration levels
- Ensure worker's health
- Real-time updates about leakages
- Cost-effective installation
- Data analytics for improved decisions
- Measure oxygen level accuracy
- Get immediate gas leak alerts

DISADVANTAGES

Gas interference: Cross interference from other gases can compromise the performance of a gas sensor, altering the calibration curve will result in false or inaccurate readings.

11. 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 are able to save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas like CO2, 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.

12. FUTURE SCOPE

The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of 10m radius of the rover and the sensor output data's are continuously transferred to the local server. The accuracy of sensors are 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. Hence in the future we gonna come up with better solutions for these Problems

13. APPENDIX

SOURCECODE

```
#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("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("ALERT! PLEASE EVACUATE");
   delay(1000);

  }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("NORMAL");
   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("ALERT! PLEASE EVACUATE");
    delay(10000);
    lcd.clear();
  }
}
```