

Gas Leakage Monitoring And Alerting System For Industries

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1. INTRODUCTION

1.1 Project Overview

The leakage of any gas has been a problem in recent years, be it in a residential environment, a shop, a cafeteria or a dining room is suggested. This document explains the design of a system that is so intelligent that it intelligently helps to save fuel and avoid accidents. The system must be integrated into the kitchen. The technology includes ultrasonic sensors that determine if the cooker is working whether it is used for cooking or not. When the cooker is determined not to be in use, the system uses an automatic shut-off mechanism to shut off the gas supply. The moment a gas leak is likely to be detected, users will be informed by SMS via GSM so that the user can solve the problem as soon as possible. The system monitors the flame and fire through the flame sensor. When a fire is detected, the buzzer will start to sound. The system also has cloud storage capacity. With the help of this cloud storage solution, daily gas consumption can be tracked for each user. , this procedure will help. Detection of user's natural gas consumption. The system has been tested and is able to monitor gas waste and leaks and send an SMS to the user. The resulting performance demonstrated its effectiveness in saving a significant portion of the Gas wasted at home.

1.2 Purpose

In recent times, home security detection system plays an important role in people's safety. Since everyone in the household goes to work every day, it is impossible to check the appliances in the household, especially the wiring of the LPG cylinder circuits, etc. In the last three years, the demand for liquefied petroleum gas (LPG) and natural gas has increased enormously. To meet these energy needs, replacing oil or coal due to their environmental disadvantages, LPG and natural gas are preferred. These gases are used on a large scale in industry, heating, household appliances and fuels. To track this escaping gas, the system includes an MQ6 gas sensor. This sensor detects the amount of gas leak in the surrounding atmosphere. By doing so, it could avoid the explosion or be affected by the gas leak.

2. LITERATURE SURVEY

2.1 Existing Problem

The Internet of Things aims to simplify life by automating every little task around us. As much as IoT helps in automating tasks, the benefits of IoT can also be extended to improve existing security standards. Security, the core concern of any project, has not been touched by the IoT. Gas leaks in open or closed areas can be dangerous and fatal. Conventional gas leak detection systems fail to detect some factors, although they are precise in the field to alert people to the leak. So we used IoT technology to develop a gas leak detector for society that has intelligent alerting techniques that include sending a text message to the relevant authority and the ability to perform data analysis of the sensor's readings. Our main goal is to propose a gas leak system for a company where each floor has a gas leak detector hardware. This will detect harmful gases in the environment and alert members of society through the alarm and sending notifications.

2.2 References

- 1) Gas Leakage Detection and Smart Alerting and Prediction Using IoT, Asmita Varma, Prabhakar S, Kayalvizhi Jayavel, 2017, The proposed gas leakage detector is promising in safety.
- 2) IOT Based Gas Leakage Detection System with Database Prediction Logging and Smart Alerting, Chaitali Bagwe, Vidya Ghadi, Vinayshri Naik, Neha Kunte, 2018, The system provides constant monitoring and

detection of gas leakage along with storage of data in database for predictions and analysis The IoT components used helps in making the system much more cost effective in comparison with traditional Gas detector systems.

3) Internet of Things (IoT) Based Gas Leakage Monitoring and Alerting System with Mq-6 Sensor, Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu, Saurabh Deshmukh, 2018, A discussion on how the aims and objectives are met is presented An overall conclusion IOT based toxic gas detector is it has become more efficient more applicable to today's applications and smarter.

4) Gas Leakage Detection and Smart Alerting System Using IoT, Shitalmade, Priyanka Rajmanes, AishwaryaGavali, 2018, In this paper we use IOT technology for enhancing the existing safety standards. While making this prototype has been to bring a revolution in safety against the leakage of harmful and toxic gases.

5) Internet of Things (IoT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor, Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu, 2017, This paper choice of using a real time gas leakage monitoring and Sensing the output levels of gas has been clearly observed by the help of this system.

6) Cloud Connected Smart Gas Leakage Detection And Safety Precaution System , Babuprasanth V, 2014, This paper is using a device which offers a complete, low cost, powerful and user friendly way of real-time monitoring and remote control of gas leakages and prevention mechanisms in household and industrial areas.

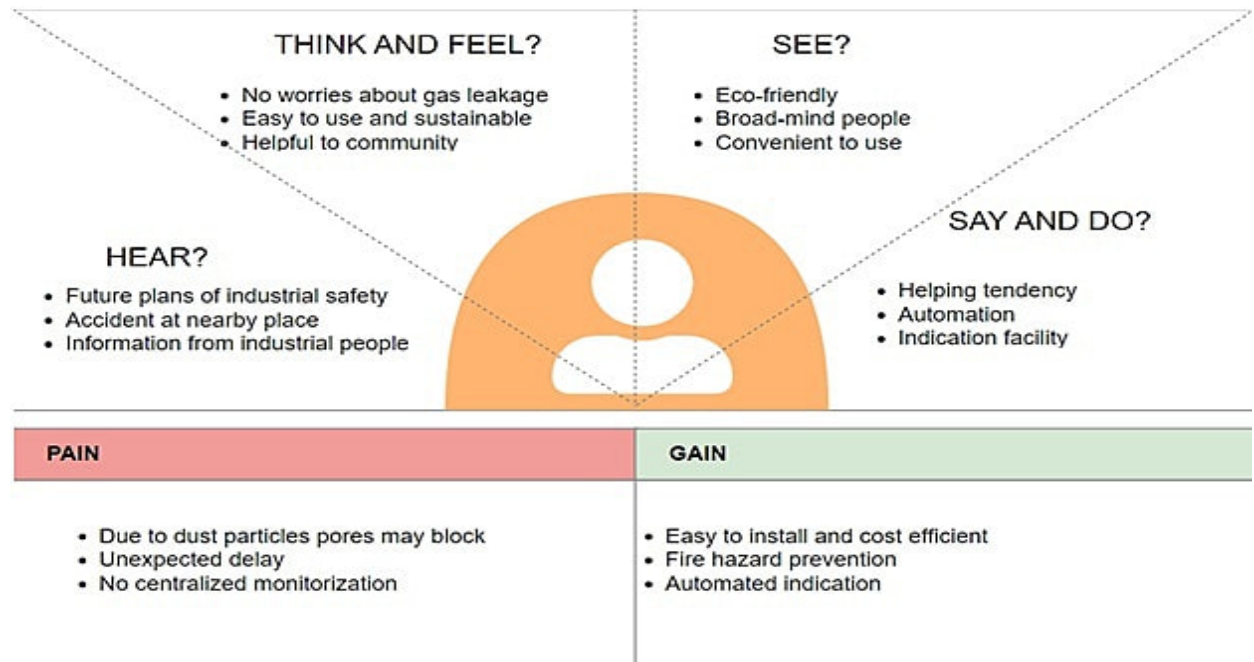
2.3 Problem Statement Definition

LPG is a highly flammable chemical which is used for cooking at home and certain industries. They have certain weakness that makes the gas leakage occur. Gas leakage can be detected by human nearby and if there is no human it cannot be detected. But sometimes it cannot be detected by human that has a low sense of smell. Gas leakage leads to various accidents resulting in financial loss as well as injuries to human. In routine life, the environment has the most significant effect on human health.

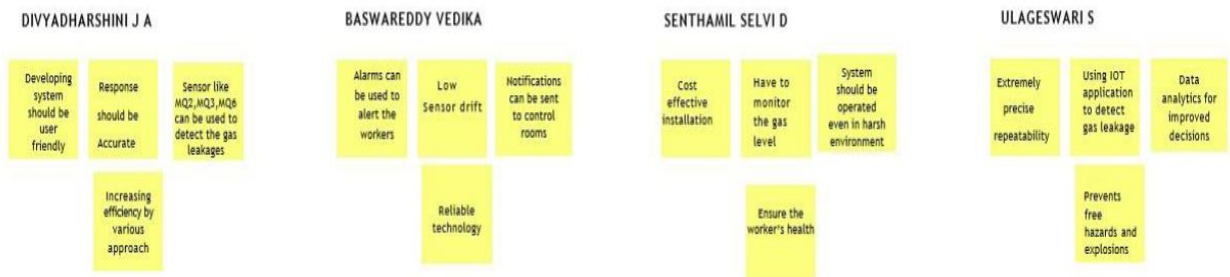


3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



Grouping based on dataset:

- 1) Data analytics for improved decisions.
- 2) Cost effective installation
- 3) High accuracy and reliable technology
- 4) Prevent free hazards and explosions
- 5) Monitor the gas concentrate level
- 6) Ensure the workers health
- 7) Extremely precise repeatability

Idea Prioritization:

- 1) Data analytics for improved decisions.
- 2) Cost effective installation
- 3) Reliable technology
- 4) Extremely precise repeatability
- 5) Monitor the gas concentrate level

- 6) Prevent free hazards and explosions
- 7) Ensure the workers health
- 8) High accuracy and reliable technology

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	<ul style="list-style-type: none"> Gas leakage leads to various accidents resulting in financial loss as well as injuries to human. In routine life, the environment has the most significant effect on human health.
2.	Idea / Solution description	<ul style="list-style-type: none"> Develop an economical system and an application which will monitor and alert the users. This product helps the industries in observance the emission of harmful gases. In many spaces, the gas devices are going to be integrated to observe the gas leakage. If in any area, gas leakage is detected the administrators will be notify along with the location. Within the web application, admins can view the sensor parameters.
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> Convenient to use. Immediate response to the users.
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> Inexpensive Simple installation and supply efficient results. Will work with regardless of fear.
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> The product is marketed all around the platform. Since it's far economical, it even helps small scale industries in the event of a disaster. As the product utilization perhaps understood through everyone, it is simple for them to apply it nicely for his or her secure organisation.
6.	Scalability of the Solution	<ul style="list-style-type: none"> Since the product is profitable, it can be placed in several places within the industries. Even if the gas leakage is larger, the product will detect the accurate values and alert the users effectively.

3.4 Problem Solution fit

Define CS, Fit into CC, Explore AS, differentiate	1. CUSTOMER SEGMENT(S) Engineers, Industrialists, Safety control personal.	6. CUSTOMER CONSTRAINTS According to the square feets, the devices should be installed. Network connection. Affordable budget	5. AVAILABLE SOLUTIONS Upgrade to premium network plan. Man-power is used to monitor the leakage. Availing network connection from a reliable service provider.
Focus on J&P, Tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS The device's ability to withstand harsh environments is questionable. Due to a network problem, the data could not always be uploaded to the cloud.	9. PROBLEM ROOT CAUSE The quality of the material from which the device is made plays a crucial role in the device's ability to function in harsh environments. If the workers do not control properly, the gas may pose a high risk to their health or industrial property. The installation location of device & the network map used by the user pose the cause of network problem.	7. BEHAVIOUR A hostile environment is only prevalent in certain industries; therefore, the frequency of such a problem is low. In such a case, the customer complains several times to get attention. The network problem is wide spread as most of the industries are located in the country side. Here is the contact to both the developers and the service providers. If the leaked gas is very toxic, there is a possibility of causing hereditary health problems.
Identify strong TR & EM,	3.TRIGGERS TO ACT Severe damage or more serious health problem from toxic gases force them to seek a solution as soon as possible. Device usage is displayed in the newsfeed may trigger the people to install it. 4.EMOTIONS: BEFORE/AFTER Before:user feels insecure and deceived After:user feels confident,secured and sincerity of developers.	10.YOUR SOLUTIONS Device can be manufactured in various standards based on the environment. Develop an economical system and an application which will monitor and alert the users.	8.CHANNELS of BEHAVIOUR 8.1 ONLINE Virtual community Social community Email to developer 8.2 OFFLINE Complaint letters

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

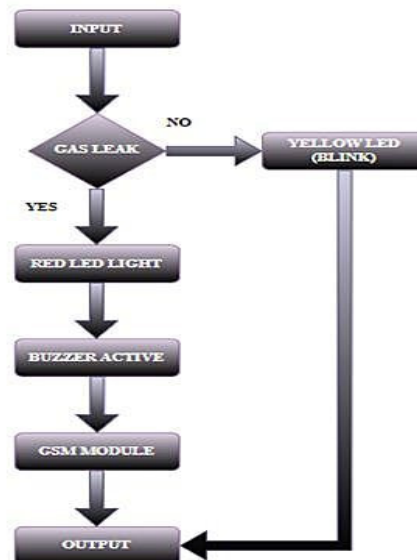
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form
FR-2	User Confirmation	Confirmation via Email
FR-3	User Access	Access the details through web application
FR-4	User Alert	Gets alert messages through SMS and also buzzer/alarm can alert the user.

4.2 Non-Functional requirement

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The user must be able to use the device anywhere.
NFR-2	Security	Data stored in the sensor should be secured and the user details will be hidden from other parties.
NFR-3	Reliability	Data can be called up at any time and no data is discarded without the knowledge of the user.
NFR-4	Performance	No performance degradation with large amounts of data or parameters.
NFR-5	Availability	The system will be accessible to the users request at most of the time.
NFR-6	Scalability	The device must be able to measure conditions even in a large industry.

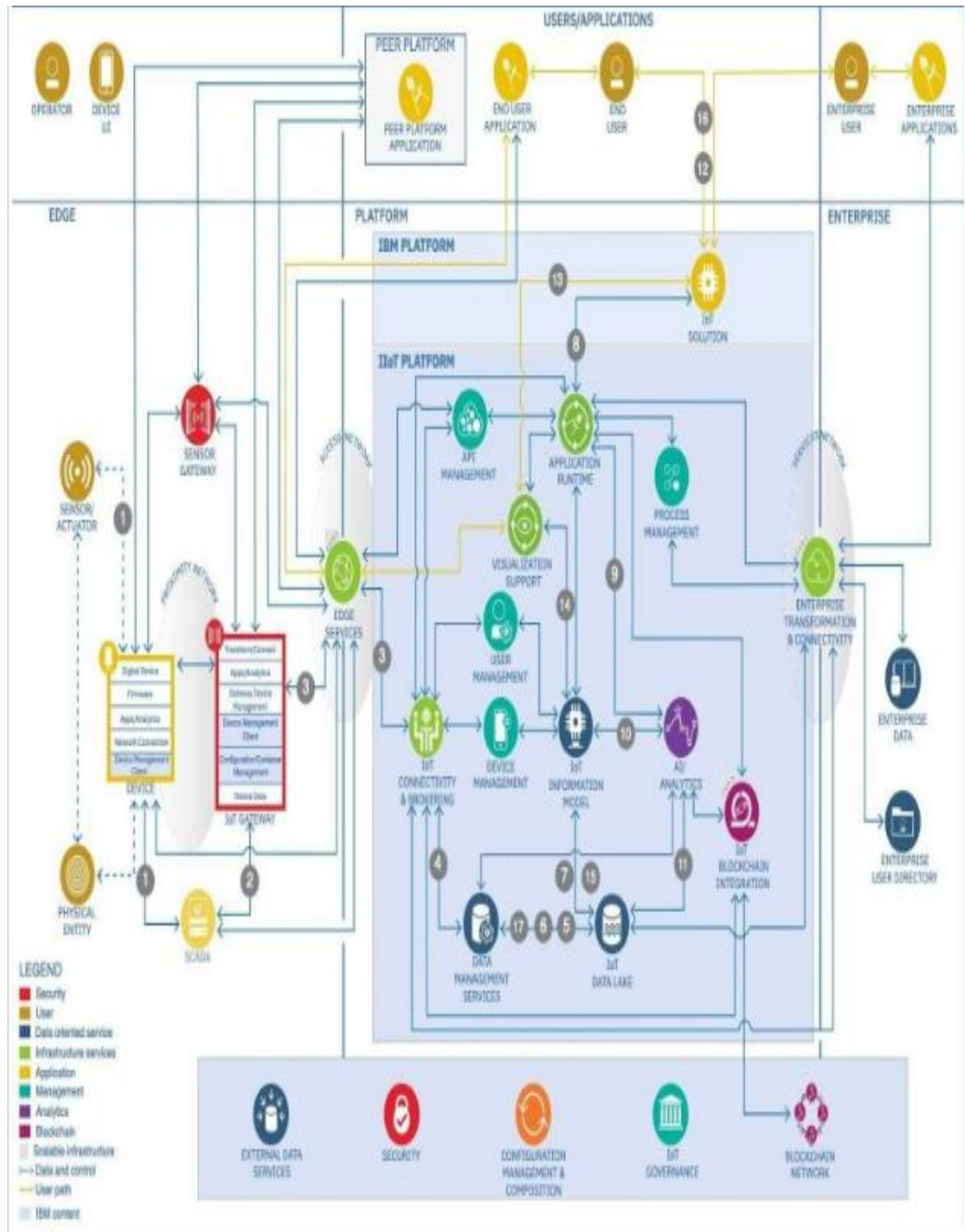
5. PROJECT DESIGN

5.1 Data flow diagram



FLOWCHART: GAS LEAKAGE MONITORING AND ALERTING SYSTEM

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 (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
Customer (higher authority)	Confirmation	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
Customer (mobile user)	Registration	USN-3	As a user, I can register for the application through Facebook.	I can register & access the dashboard with Facebook Login	Low	Sprint-2
Customer (fire service)	Safety measure register	USN-4	As a user, I can register for the application in mobile user.	I can access my account / dashboard	Low	Sprint-2
Customer (credentials)	Login	USN-5	As a user, I can log into the application by entering email & password.	I can access my dashboard	High	Sprint-1
Customer (Web user)	Notification	USN-6	As a user, I can able to receive alert notification via GSM module if gas leaks.	I can receive the notification & locate the place.	High	Sprint-1
Customer Care Executive	Emergency helpline	USN-7	As a user, I can respond to customer queries with the stipulated time.	I can resolve the queries.	Medium	Sprint-2
Administrator	Accessing	USN-8	As a user, I can access the customer's details.	I can access the details.	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 1

Sprint 2

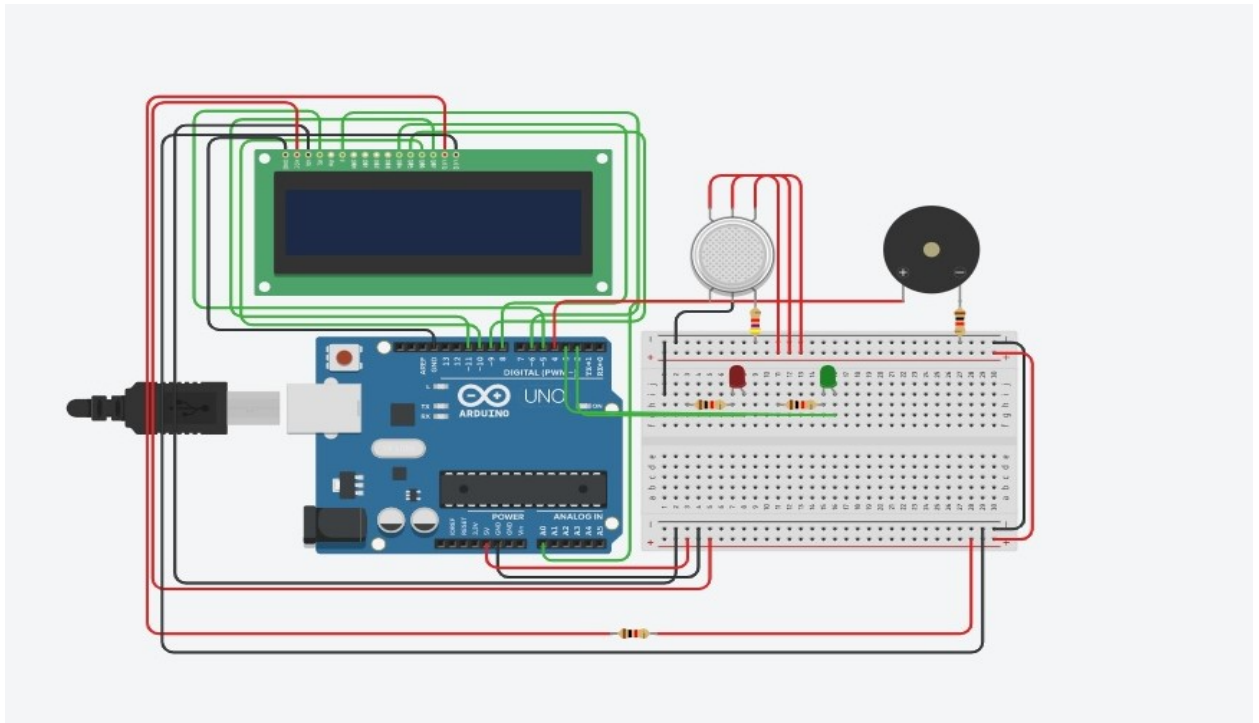
Sprint 3

Sprint 4

We are Developing the code in this Schedule.

7. SCHEMATIC DIAGRAM OF PROJECT & COMPONENTS

7.1 Circuit Diagram



7.2 Components

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 completing this project, can conclude that the gas leak detection in the project system is amazing. Usefully applicable in industry and household. In dangerous situations we can save lives with this system. The GSM module displays an alert. A sensor node detects gases such as CO₂, oxygen, propane. Estimated transmission distance and power consumption are obtained. The sensor is built using simple techniques and the area of the Arduino UNO micro-controller.

9.FUTURE SCOPE

This monitoring system can be further improved by using Bluetooth instead of GSM to send alerts to the user, which is supported by another real-time application. For industrial purposes, mobile robots can be developed to detect multiple gas concentrations.

10. APPENDIX

10.1 Source code

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(5,6,8,9,10,11);
int redled = 2;
int greenled = 3;
int buzzer = 4;
int sensor = A0;
int sensorThresh = 400;
void setup()
{
  pinMode(redled, OUTPUT);
  pinMode(greenled,OUTPUT);
  pinMode(buzzer,OUTPUT);
  pinMode(sensor,INPUT);
  Serial.begin(9600);
  lcd.begin(16,2);
}
void loop()
{
  int analogValue = analogRead(sensor);
  Serial.print(analogValue);
  if(analogValue>sensorThresh)
  {
    digitalWrite(redled,HIGH);
    digitalWrite(greenled,LOW);
    tone(buzzer,1000,10000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("ALERT");
    delay(700);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("EVACUATE");
    delay(700);
  }
  else
```

```
{  
  digitalWrite(greenled,HIGH);  
  digitalWrite(redled,LOW);  
  noTone(buzzer);  
  lcd.clear();  
  lcd.setCursor(0,0);  
  lcd.print("SAFE");  
  delay(700);  
  lcd.clear();  
  lcd.setCursor(0,1);  
  lcd.print("ALL CLEAR");  
  delay(700);  
}  
}
```

10.2 GitHub & Project Demo Link

GitHub link:

<https://github.com/IBM-EPBL/IBM-Project-42684-1660705428>

Demo link:

https://www.tinkercad.com/things/3GZzJWNFBQf-ibmproject/editel?sharecode=sl_zmsaKGdCmYVWTpjWM9S1HhFERHB5Q4JlvRq_-WD8

