

PROJECT REPORT

PROJECT TITLE: GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES

TEAM ID: PNT2022TMID14274

TEAM MEMBERS:

1. DHARUN KUMAR WA (TEAM LEADER)
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3. DHATSENAAGIRI S
4. DURAISELVI M

1. INTRODUCTION

1.1PROJECT OVERVIEW

Home fires have been taking place frequently and the threat to human lives and properties is growing in recent years. Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. Most fire accidents are caused because of a poor-quality rubber tube or the regulator is not turned off when not in use. Therefore, developing the gas leakage alert system is very essential. Hence, this paper presents a gas leakage alert system to detect the gas leakage and to alarm the people onboard.

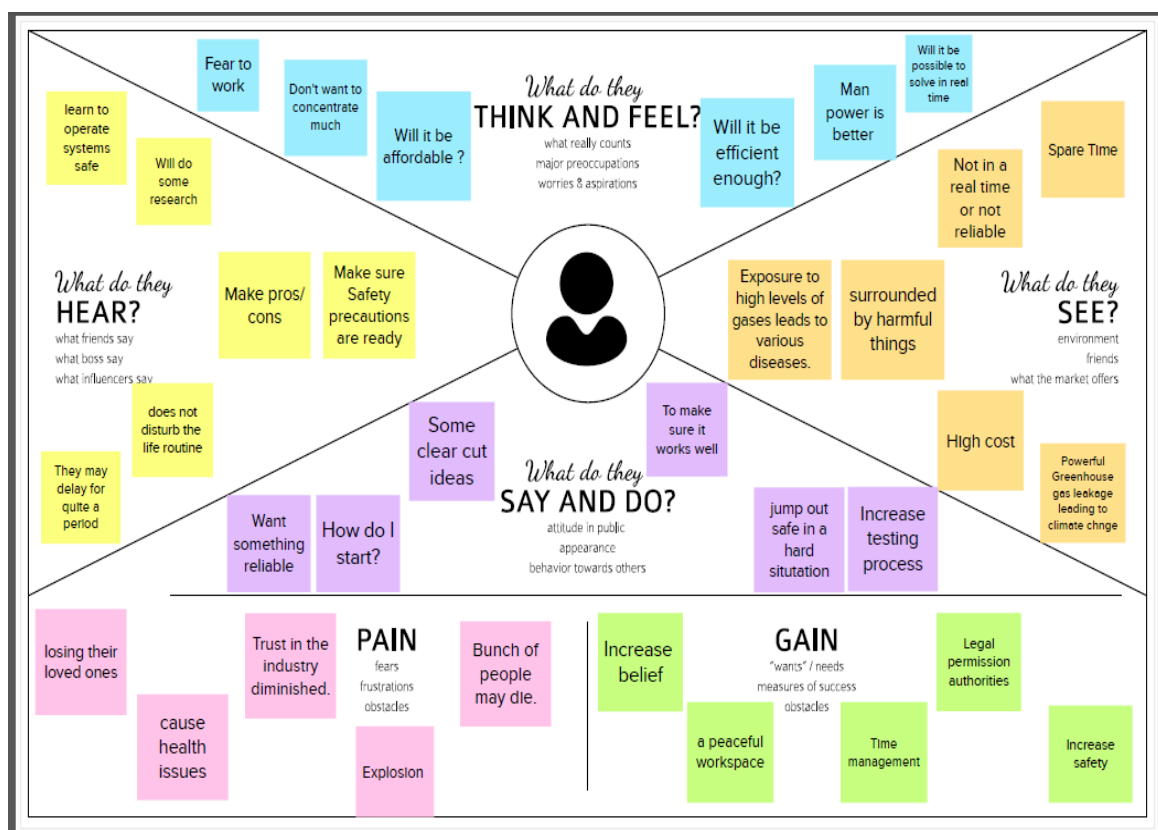
2. LITERATURE SURVEY

1. Rohan Chandra Pandey, Manish Verma, LumeshKumar Sahu 2017. Internet of Things (IOT) Based Gas LeakageMonitoring and Alerting System with MQ-2 Sensor. Thispaper choice of using a real time gas leakage monitoringandSensing the output levels of gas has been clearly observedbythe help of this system.
2. Asmita Varma, Prabhakar S, Kayalvizhi Jayavel 2017. GasLeakage Detection and Smart Alerting and PredictionUsingIoT. The proposed gas leakage detector is promisingintheField of safety.
3. Chaitali Bagwe, Vidya Ghadi, Vinayshri Naik, NehaKunte2018. IOT Based Gas Leakage Detection SystemwithDatabase Logging, Prediction and Smart Alerting. Thesystemprovides constant monitoring and detection of gasleakagealong with storage of data in database for predictionsandanalysis. The IOT components used helps in makingthesystem much more cost effective in comparisonwithtraditional Gas detector systems.
4. Rohan Chandra Pandey, Manish Verma, LumeshKumar Sahu, Saurabh Deshmukh 2018. Internet of Things(IoT) Based Gas Leakage Monitoring and Alerting SystemwithMq-6 Sensor. A discussion on how the aims and objectivesaremet is presented. An overall conclusion IOT basedtoxicgasdetector is it has become more efficient, more applicabletotoday's applications and smarter.
5. Shital Imade, Priyanka Rajmanes, Aishwarya Gavali 2018. Gas Leakage Detection and Smart Alerting SystemUsingIoT.In this paper we use IOT technology for enhancingtheexisting safety

standards. While making this prototype has been to bring a revolution in the field of safety against the leakage of harmful and toxic gases


3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map



3.2 IDEATION & BRAINSTORMING

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 🕒 10 minutes to prepare
- 🕒 1 hour to collaborate
- 👤 2-8 people recommended

➔

Before you collaborate

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

🕒 10 minutes

- A Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.
- B Set the goal**
Think about the problem you'll be focusing on solving in the brainstorming session.
- C Learn how to use the facilitation tools**
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) ➔

1


Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

PROBLEM

How might we [your problem statement]?



Key rules of brainstorming

To run a smooth and productive session

- 🗣️ Stay in topic.
- 💡 Encourage wild ideas.
- ⏸️ Defer judgment.
- 👂 Listen to others.
- 🗣️ Go for volume.
- 👁️ If possible, be visual.

Step-2: Brainstorm, Idea Listing and Grouping

2

Brainstorm

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

10 minutes

TIP

You can select a sticky note and hit the pencil (switch to sketch) icon to start drawing!

Team Leader

CHANDRA C

Continuous monitoring for gas detection	Affordable market price	Elimination of all hazardous gases
Simple circuit construction	Continuous emergence of new technologies	Reducing health related problems
Reducing the detection capability	Reduction of mechanical moving parts	Clear ventilation

Team Member 1

SELVASANTHIA M

Reducing the cost	Reduce number of used detectors	Increasing accuracy
everyday monitoring	remote wireless control for wireless device	hire experienced employees
reduce power consumption	simple connections	Check all components

Team Member 2

MANISHA S

Health checkup for all employees	Avoid spreading of gases	Oxygen supply
Reducing errors	Increase the awareness	Use less detectors for monitoring
Avoid silly mistakes	Using affordable components	Keep warning when operation

Team Member 3

SATHYAPRIYA N

Increase the chance of rescue results	Increase the stability	Analyze the test gases
Reducing the limitations	or replacement for same	Security
pollution level checking	Accurate measures	Minimize fire

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

PUBLIC



TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

GOVERNMENT



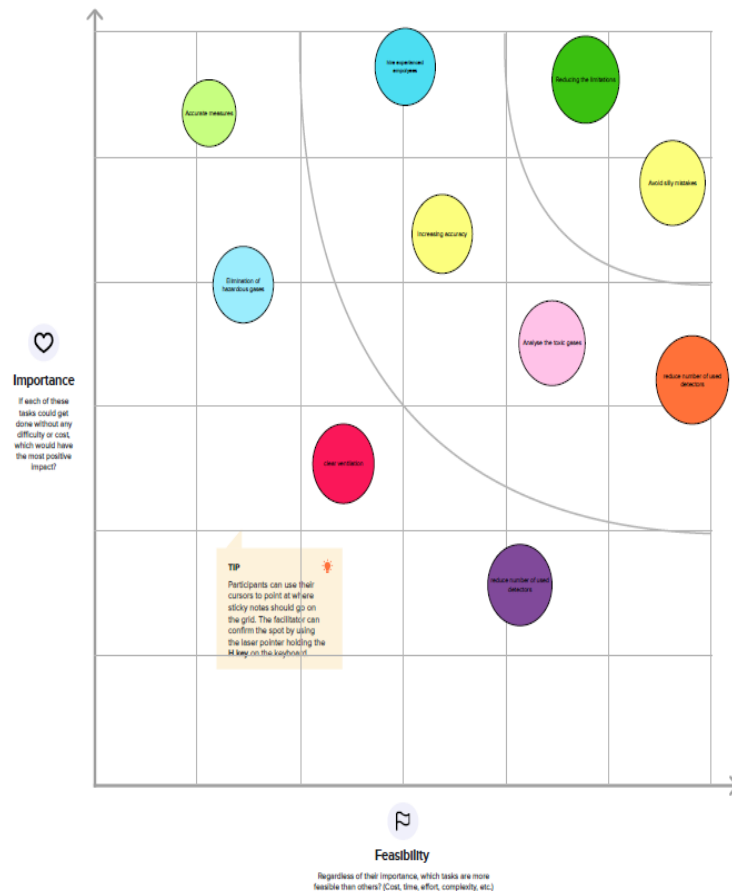
Step-3: Idea Prioritization

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



5

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The leakage of gases only can be detected by human nearby and if there are no human nearby, it cannot be detected. But sometimes it cannot be detected by human that has a low sense of smell. Thus, this system will help to detect the presence of gas leakage.
2.	Idea / Solution description	If the system detects the level of gas in the air that exceeds the safety level it will activate the alarm which includes the buzzer to alert the users at industries of the abnormal condition and to take any necessary action.
3.	Novelty / Uniqueness	Reducing the cost of the gas leakage detector and increasing the accuracy percentage.
4.	Social Impact / Customer Satisfaction	These leaks <i>cause safety threats and secondary accidents</i> for those working in industry and the environment

5.	Business Model (Revenue Model)	The gas detector market is forecast to reach \$2.96 billion by 2025, growing at a CAGR of 4% during 2019-2025.
6.	Scalability of the Solution	A wide range of <i>industrial</i> fixed gas detectors featuring flexible integration, simple installation, user-friendly operation

3.4 Problem Solution Fit

Define CS, fit into CC Focus on J&P, tap into BE, understand RC	1. CUSTOMER SEGMENT(S) <small>Who is your customer?</small> Industries or Organizations who having risks of gas leakage	6. CUSTOMER CONSTRAINTS <small>What constraints prevent your customers from taking action or limit their choices of solutions?</small> Measurement accuracy is less if gas is with heavy dust, High cost.	5. AVAILABLE SOLUTIONS <small>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 do these solutions have?</small> Placing sensors in leak points and using multiple sensors for prior detection In the past, flame safety lamp is used to detect presence of methane Advantage of solution - reduce time Disadvantages of solution - effort needed	Explore AS, differen Focus on J&P, tap into BE, understand RC
	2. JOBS-TO-BE-DONE / PROBLEMS <small>Which jobs-to-be-done (or problems) do you address for your customers?</small> Late detection sometimes.	9. PROBLEM ROOT CAUSE <small>What is the real reason that this problem exists?</small> Because of inaccuracy in measurement, fire or explosion may occur if it is not carefully detected	7. BEHAVIOUR <small>What does your customer do to address the problem and get the job done?</small> Find the best strategy to increase the accuracy in measurement.	

3. TRIGGERS <small>What triggers customers to act?</small> Considering safety measures for workers and in think of future impacts due to that.	10. YOUR SOLUTION If you are working on an industries having chance of gas leakage, prior measurement strategies for detecting gas leakage is important. And for increasing accuracy in measurement, placing of sensors at leak point.	8. CHANNELS of BEHAVIOUR 8.1 ONLINE What kind of actions do customers take online? Expecting equal solution as other customers get through offline. 8.2 OFFLINE What kind of actions do customers take offline? Use the solutions given by
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4.REQUIREMENT ANALYSIS

4.1 Functional requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User convenience	Through message notification we can easily get data of gas level and in case of gas leakage, it can directly send notification to nearby hospitals and police station
FR-2	User visibility	Gas level can be monitored by users if there is any leakage and they will be receiving alert notification.
FR-3	User reception	The notification for the gas level and leakage can be send through messages.
FR-4	User understanding	User can monitor the level of gas with help of the data. If there is an increase in gas level then the alerts will be given
FR-5	User performance	When the user gets notified ,they could turn on the water sprinkler or exhaust fan.

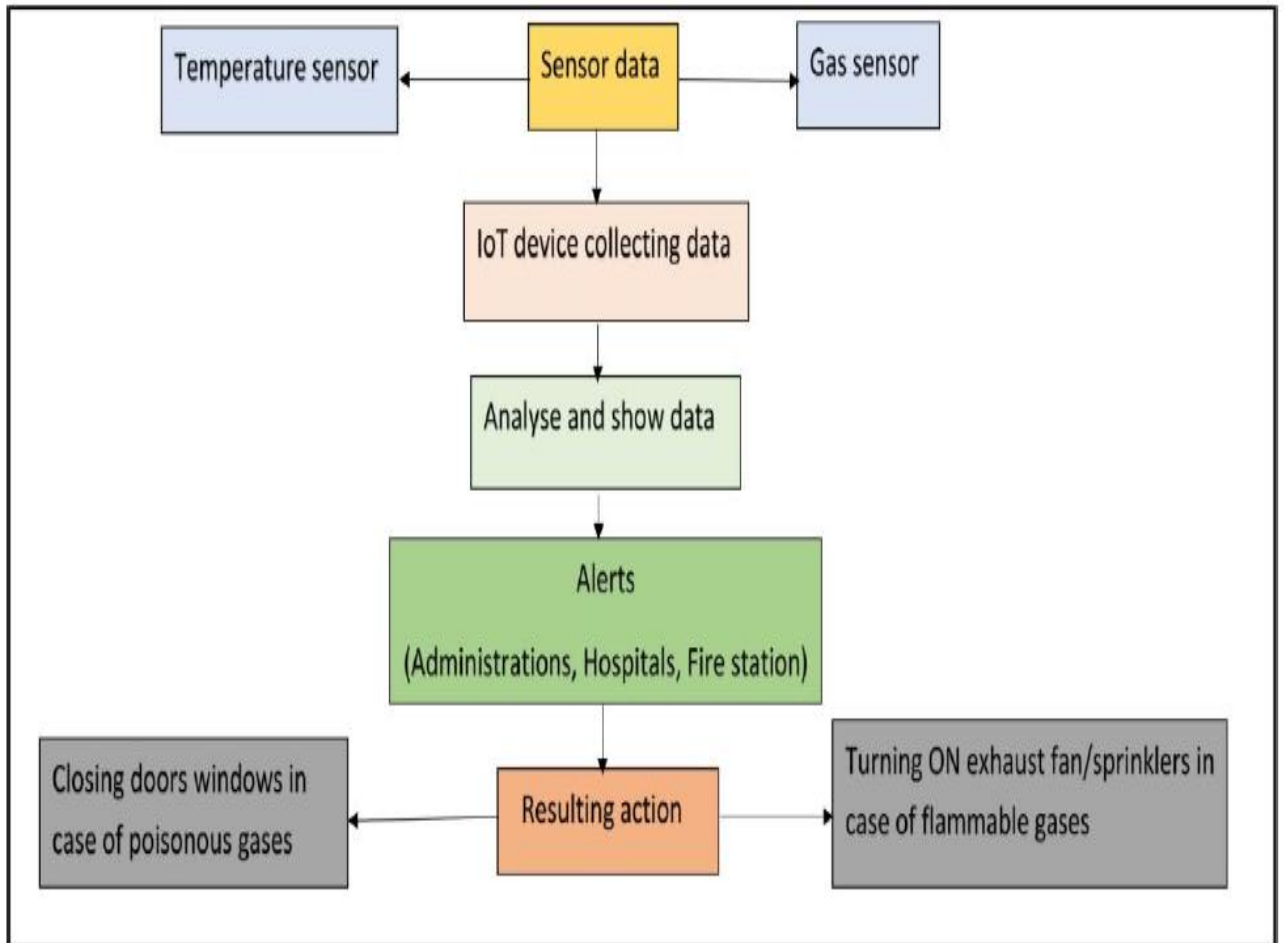
Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It updates data periodically and protects the workers in industries.
NFR-2	Security	In case of emergency alerts, industrial properties and human beings are protected from fire accidents.
NFR-3	Reliability	It will provide most accurate information and have Capacity to recognize the hazardous gas which is true or not.
NFR-4	Performance	During fire, water sprinklers and exhaust fans are used .
NFR-5	Availability	It can be accessed both day and night.
NFR-6	Scalability	Once the sensor got fails it can be easily replaced.

5.PROJECT DESIGN

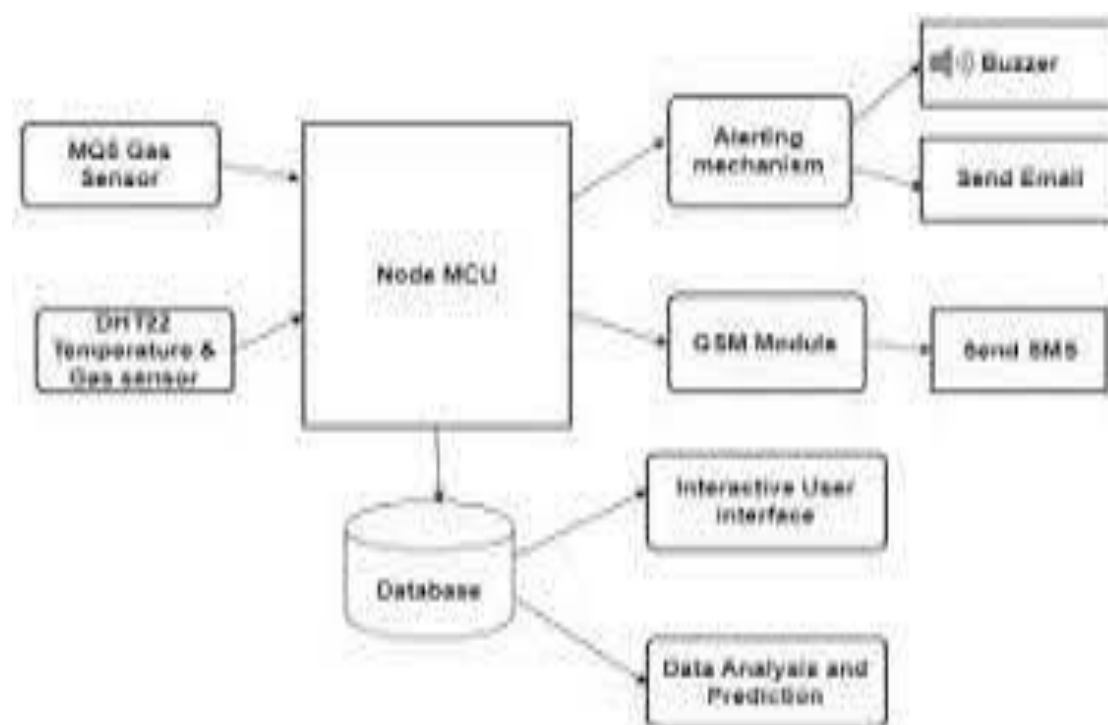
5.1 Data Flow Diagram



5.2 Solution Architecture

Solution architecture is a complex process – with many sub-processes that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.



6.PROJECT PLANNING &SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Resources Initialization	Create and initialize accounts in various public APIs like OpenWeatherMap API.	1	LOW	Dharun kumar WA David kirubakaran I Dhatsenaagini S Duraiselvi M
Sprint-1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location.	1	MEDIUM	Dharun kumar WA David kirubakaran I Dhatsenaagini S Duraiselvi M
Sprint-2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it can be accessed from anywhere	2	MEDIUM	Dharun kumar WA David kirubakaran I Dhatsenaagini S Duraiselvi M
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the cloud functions and provide inputs to the same.	2	HIGH	Dharun kumar WA David kirubakaran I Dhatsenaagini S Duraiselvi M
Sprint-4	UI/UX Optimization & Debugging	Optimize all the shortcomings and provide better user experience.	2	LOW	Dharun kumar WA David kirubakaran I Dhatsenaagini S Duraiselvi M

6.2 MILESTONE AND ACTIVITY LIST

Sprint	Functional Requirement (Epic)	UserStory Number	UserStory / Task	Story Points	Priority	Team Members
Sprint-1	IDE	USN-1	Installing all the software which is required like python IDE	2	High	Dharun kumar WA David kirubakaran I Dhatsenaagiri S Duraiselvi M
Sprint-1	Checking the simulation with conditions	USN-1	Simulating the circuits and experimenting	2	High	Dharun kumar WA David kirubakaran I Dhatsenaagiri S Duraiselvi M

7. CODING & SOLUTIONING

7.1 Feature 1

- IoT device
- IBM Watson Platform
- Node red
- Cloudant DB
- Web UI
- MIT App Inventor
- Python code

8. ADVANTAGES

- 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

9. DISADVANTAGES

- Individual one gas can be measured with each instrument.
- When heavy dust, steam or fog blocks the laser beam, the system will not be able to take measurements.
- This is also the case when a person or vehicle blocks the path.

10. CONCLUSION

The advantage of this simple gas leak detector is its simplicity and its ability to warn about the leakage of the LPG gas. This system uses GSM technique to send alert message to respective person if no one is there in the house and then gas leaks occurs, GSM module is there to send immediate messages to the respective person regarding the gas leak. The main advantage of this system is that it off the regulator knob of the cylinder automatically when gas leakage detected.

11.APPENDIX

11.1 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("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();
```

```
  }
```

```
}
```

12. GitHub

GitHub Link:

<https://github.com/IBM-EPBL/IBM-Project-9805-1659076305>