

PROJECT REPORT

**PROJECT TITLE: GAS LEAKAGE MONITORING & ALERTING
SYSTEM**

TEAM ID : PNT2022TMID14363

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1.INTRODUCTION

1.1 Project overview

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 bases, it makes impossible to check on the appliance available at home specially LPG 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 includes MQ6 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.

1.2 Purpose

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed. This is an affordable, less power using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere, but also wastage of gases will hurt our economy. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.

2.LITERATURE SURVEY

2.1 Existing problem

Gas leakage monitoring systems have usually been based on a single sensor such as smoke or gas. These single sensor systems have been unable to distinguish between true and false presence of gas . Consuming energy all day long and being dependent on one sensor that might end with false alert is not efficient and environmentally friendly. We need a system that is efficient not only in sensing gas accurately, but we also need a solution which is smart. In order to improve upon the results of existing single sensor systems , the gas leakage monitoring & alerting system includes a Gas sensor and a temperature sensor . This system also requires a proper network with individual smart devices connected to various panels .

2.2 References

- [1]. Mr. Sameer Jagtap, Prajkta Bhosale, Priyanka Zanzane, Jyoti Ghogare, LPG Gas Weight and Leakage Detection System Using IoT”, International Journal or Research in Applied Science & Engineering Technology”, Volume 4, Issue 3, March 2016, Pg – 716 to 720.

- [2]. Arun Raj, Athira Viswanathan, Athul T S, “LPG Gas Monitoring System”, International Journal of Innovative Technology and Research, Volume 3, Issue 2, February 2015, Pg – 1957 to 1960.

- [3]. S Shyamaladevi, V. G. Rajaramya, P. Rajasekar, P. Sebastin Ashok, “ARM7 based automated high-performance system for lpg refill booking & leakage detection”, Journal of VLSI Design and Signal Processing”, Volume 3, Issue 2, 2014.

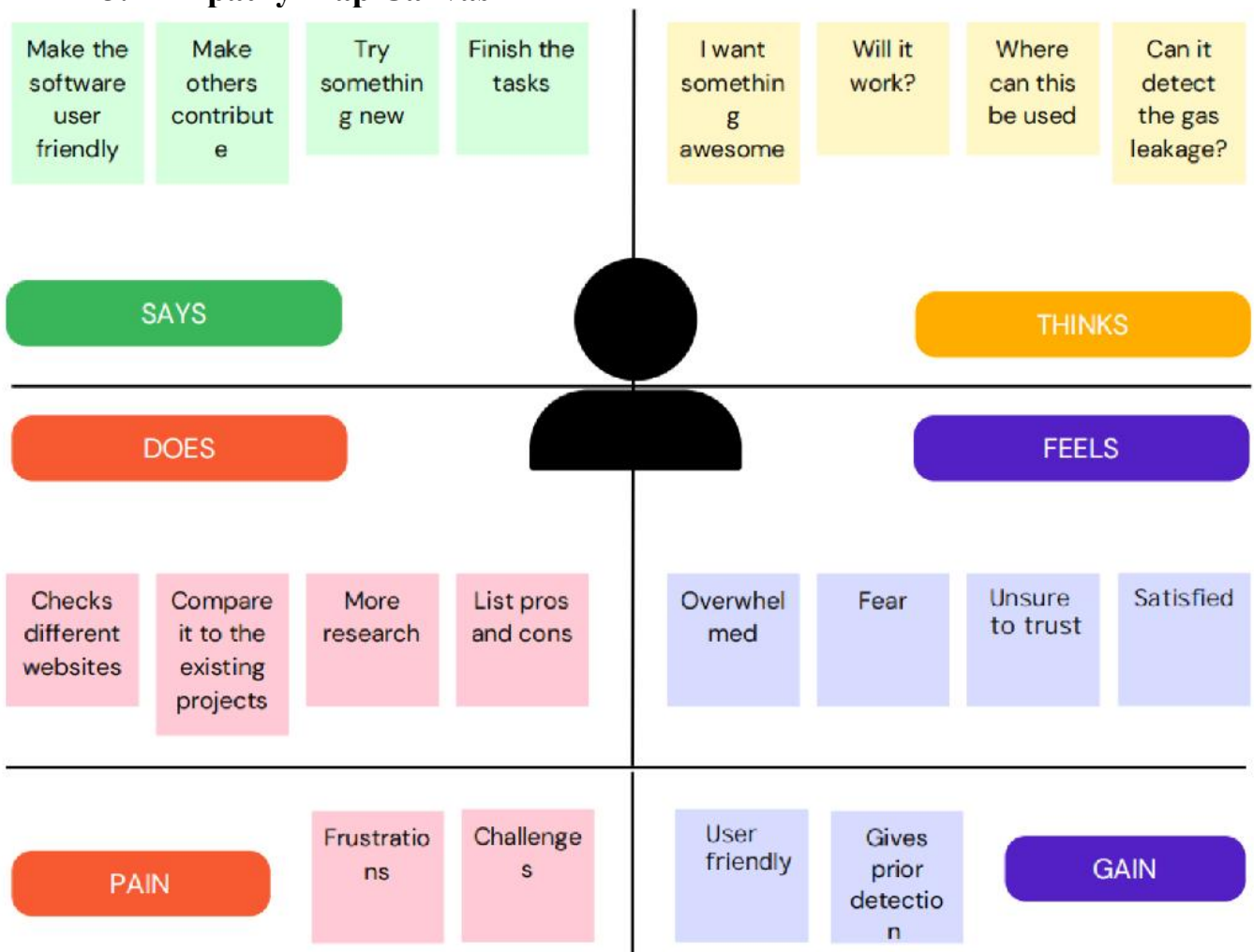
- [4]. S. Sharma, V. N. Mishra, R. Dwivedi, R. Das, “Classification of gases/odours using Dynamic Response of Thick Film Gas Sensor Array”, IEEE Conference on Sensors Journal, 2013.

2.3 Problem Statement Definition

Industry Specific gas leakage monitoring and alerting system are designed to Prevent gas leakage in industries and houses.

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation &Brainstorming

1. RAGHUL S

There have been many incidents like explosions and fire due to LPG gas leakage.

Such incidents can cause dangerous effects if the leakage is not detected at an early stage.

Arduino and IOT based LPG leakage detection system is a project which will help in determining gas leakage in the surrounding and send data to an IOT module, which prevents the environmental exposure to the harmful gases.

2. MOUNESHWARA G

We can sense the leakage using gas sensor, when the leakage is detected location will be shared through application which is used to prevent from various dangers.

Internet of Things (IoT) is the networking of 'things' by which physical things can communicate with the help of sensors, electronics, software, and connectivity.

These systems do not require any human interaction and same is the case with IOT based gas detection system.

It does not require human attention.

3. MOTHILAL K

In the proposed system, the sensor which is used to sense many gases is MQ-2 sensor.

After the detection of leakage in the gas, the sensor sends the signal to the Arduino UNO for the further process where other hardware components are connected to each other.

4.MUKESH L

When the gas/air level in a room exceeds 50, the detection system's buzzer and servo motor will be activated.

With the use of the IFTTT (If That Then This) services, user will receive the message via Node MCU.

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Gas leakage monitoring and alerting system.
2.	Idea / Solution description	Use IoT to build an LPG gas detecting system in houses and industries.
3.	Novelty / Uniqueness	Cost efficient, high accuracy, easy to use.
4.	Social Impact / Customer Satisfaction	Customer would feel safe working in an environment with gas cylinders and no complexity in its processing.
5.	Business Model (Revenue Model)	The device would be low cost and effective. Should be advertised well.
6.	Scalability of the Solution	First the Solution should work for the intended purpose of detecting LPG gas in household areas. It can then be scaled to other gases and industry level detection.

3.4 Problem Solution Fit

Problem-Solution fit canvas 2.0			Purpose / Vision		
Define CS, fit into	1. CUSTOMER SEGMENT(S) CS Industries are the end customers because the Gas Leakage monitoring and Alerting systems are used to detect the leakage of gas in industries and to prevent the industrial injury.	6. CUSTOMER CC In order to monitor and indicate the leakage of gases which cause gas explosion such as Bhopa tragedy various health issue for human beings by breathing of the leakage toxic gases and also causes atmospheric pollution.	5. AVAILABLE SOLUTIONS AS gas leakage in the machinery is possible when their a fault in the machinery ,to avoid this before the process is carried out through machines a high pressure should be passed through the machines if any leak is present the pressure gas will come out through that leakage part.	Explore AS,	
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Non- availability of actions to ensure the service of machineries as per the given period of time and the reverse osmosis process is carried out. Once before the gas is released it should be undergone several methods to remove the toxic present in the gas	9. PROBLEM ROOT CAUSE RC Gas leakage leads to various accidents resulting in both material loss and human injuries. The Risk of explosion, firing, suffocation are based on their physical properties such toxicity, flammability etc. The reason of such Explosion is due to substandard cylinders, old valves, worn out regulators and lack of awareness in handling	7. BEHAVIOUR BE Customers will address the problems to the government and they will assign a project to product developing companies, those companies will develop a project and finish as a product. The end product will sell to the customers by the Government.	Focus on J&P, tap into BE, understand	
Identify strong TR & EM	3. TRIGGERS TR The gas detector can sound an alarm to operators in the area where the leak is occurring giving them the opportunity to leave. This kind of device is very important because their may many gases that are harmful to organic life	10. YOUR SOLUTION SL 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 consists of gas detector sensors, Arduino board, ESP8266 and Cloud server	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE Through the company official website they can share the queries in their customer satisfaction section and can also individually express through their personal rating options which in turns convey as feedback to the end user. 8.2 OFFLINE If they buy the product by in person then they can convey directly to the product directing manager through who they have contract and can convey their problem even in a more efficient way.	Extract online & offline CH of BE	
	4. EMOTIONS: BEFORE / AFTER EM BEFORE : When they face a problem, they feel insecure,Discomfort, confused and lose their confident. They don't know what to do next and how to overcome this problem. AFTER : Afterwards they address the problem to the government and get the product for their problem from the government. This end product will regain their confidence, gives comfortness , happiness and feels gratitude towards it				

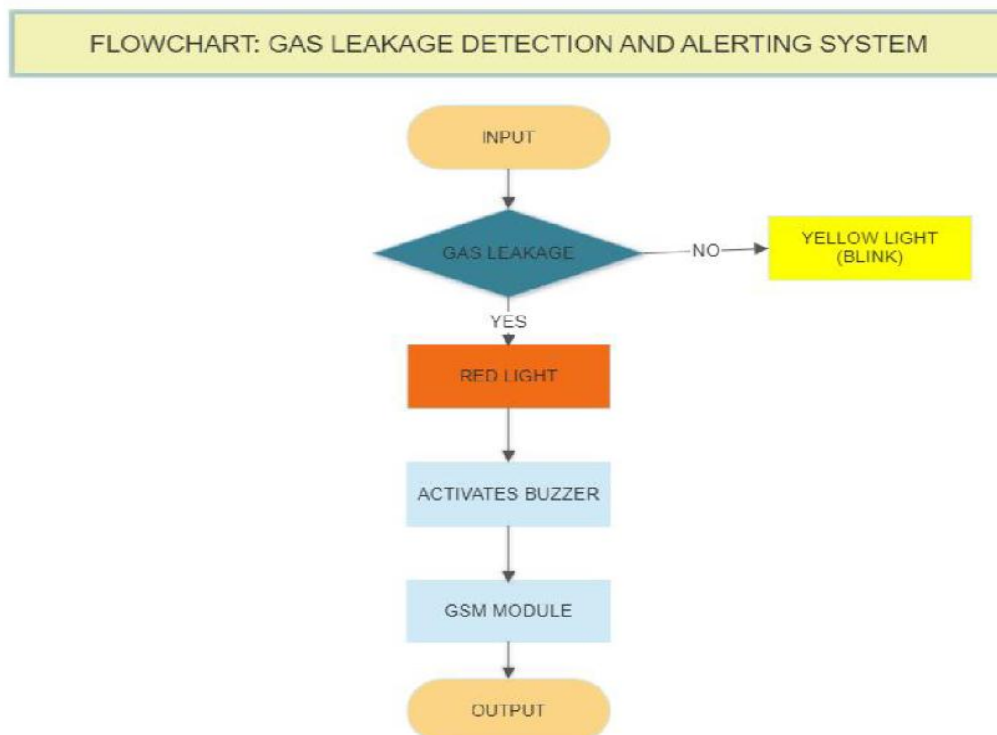
4.REQUIREMENT ANALYSIS

4.1 Functional requirement

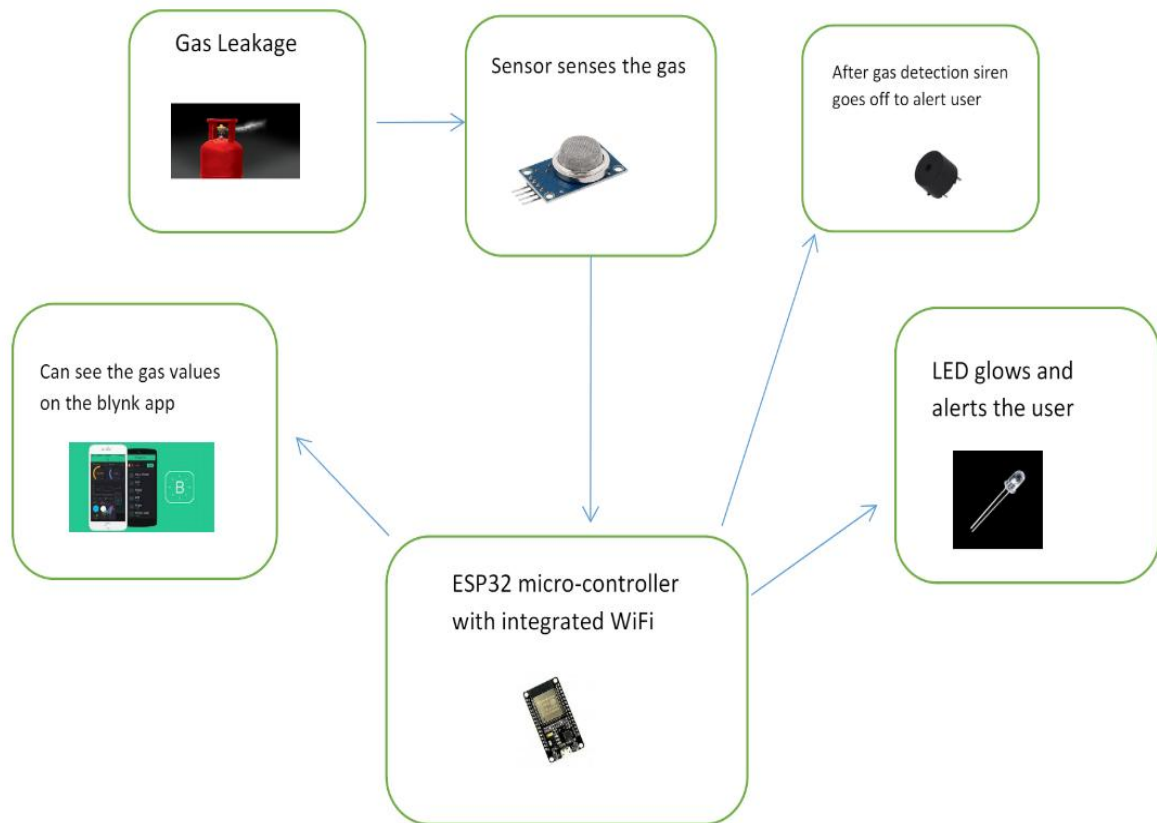
Business Requirements	User Requirements	Product Requirements
The said system can be deployed in homes, hotels, factory units, LPG cylinder storage areas, and so on. The main advantage of this IoT and Arduino-based application is that it can determine the leakage and send the data over a site. It can be monitored, and preventing measures can be taken to avoid any disaster.	The gas leakage detection system can be optimized for detecting toxic gases along with upgrading them with smoke and fire detectors to identify the presence of smoke and fire. Ensuring worker safety is important but making use of the right technology is even more vital.	Detecting gases is necessary regardless of your business role or individual purpose. Certain technologies at play make such IoT devices what they are, and if you want to indulge in IoT application development, you must know what they are and what purpose they can fulfill.

5.PROJECT DESIGN

5.1 Data Flow Diagram



5.2 Solution Architecture



5.3 User Stories

	STAGE 1	STAGE 2	STAGE 3	STAGE4	STAGES5
OBJECTIVES	Write a goal or activity	This system alerts the user from the environmental exposure to the harmful gases	This system comprises of sensors which alerts the micro-controller for the leakage of gases that will alert the user by displaying warning information.	Gas leakage detection is the process of detecting the environmental exposure of harmful gases and alerting the user by the notification	The alarm management system is the main role in this system that will notify the user in case of any gas leakage
NEEDS	Write a need that you want to meet	Hazardous gas leakage	Fire hazard preventing	Oxygen level monitoring	Prompts leakage alerts
FEELINGS	Write an emotion that you expect from the customer	Happy for the solution	Using the system and feels no complexity	Happy and excited	Encourage the solution and giving good feed backs
BARRIER	Sad Write the challenges to your objectives	Higher officials	Company managements	Government towards this implementation	Harmful gases that may cause unconsciousness to the people

6.PROJECT PLANNING &SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	Connect Sensors and Arduino with python code	2	HIGH	Raghul S Mouneshwara G Mothilal K Mukesh L
Sprint-2	Software	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	HIGH	Raghul S Mouneshwara G Mothilal K Mukesh L
Sprint-3	Dashboard	Design the modules and test the app	2	HIGH	Raghul S Mouneshwara G Mothilal K Mukesh L
Sprint-4	Web UI	To make the user to interact with software	2	HIGH	Raghul S Mouneshwara G Mothilal K Mukesh L

7.CODING & SOLUTIONING

7.1 Feature 1

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

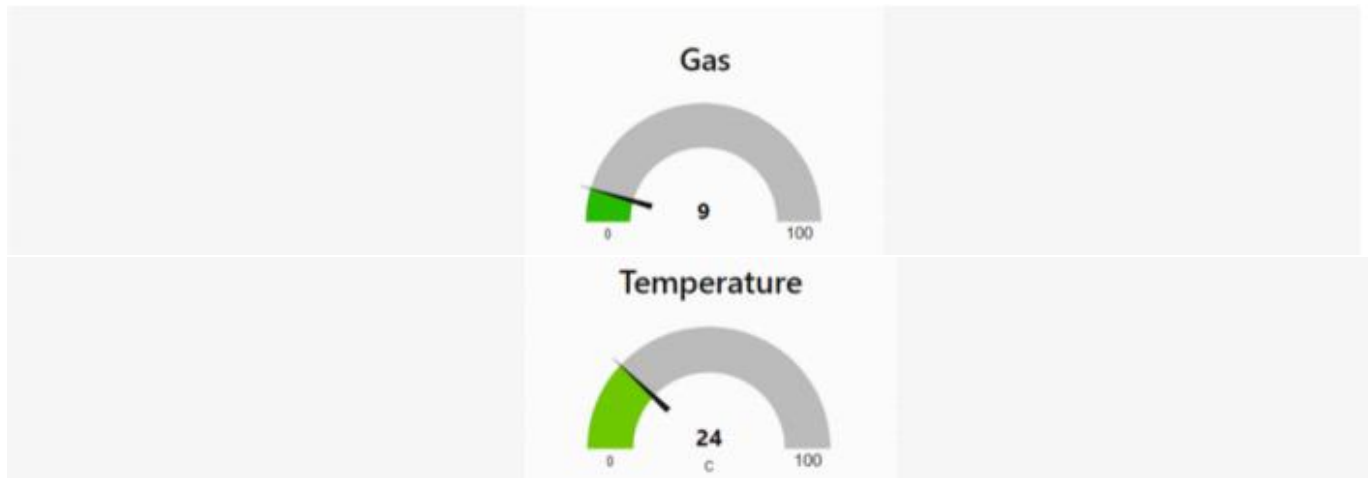
7.2 Feature 2

- Login
- Wokwi

8. TESTING AND RESULTS

8.1 Test Cases

TEST CASE 1



9. ADVANTAGES

- Reduced installation cost.
- They monitor 24/7.
- Improved security in homes, industries and Offices.
- It pin points location of the gas leakage.

10. DISADVANTAGES

- Gas detectors are not considered as life saving devices because they are sensitive only to gas.
- High battery or current consumption will need for these detectors.
- Control pannel may need to be replaced if it becomes damaged.

11. CONCLUSION

This gas leakage system can be applied for household safety and many other applications in the industry . Gas leakages in industries as well as houses have lead to wide destruction and losses in the past. Gas leakages spread widely and lead to even greater loss of life and property if proper action is not taken on time. So here we proposed a system that detects gas and alert us accordingly so that proper action may be taken to control it.

12. FUTURE SCOPE

Smoke detectors and alarms are migrating from just the detection of smoke, to combination detectors and multicriteria detector. The future will be with

multicriteria detection in which the detector will be more of a sensor, with the detection more for the products of combustion, such as carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen dioxide in addition to heat and particulate matter. Within the next decade, video image detection (VID) will become more mainstream in which, through analytics, the image of either smoke or flame will be able to be isolated and detected from within a room or space. The VID system would also be able to detect if an individual is within the space and through the integration with the notification appliances, provide a path of exit.

13. APPENDIX

13.1 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();  
}  
}
```

13.2 GitHub

GitHub Link:

<https://github.com/IBM-EPBL/IBM-Project-10264-1659154547>