

PROJECT REPORT

Team ID	PNT2022TMID19009
Project Name	Gas leakage monitoring and alerting system for Industries

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TABLE OF CONTENTS:

S.NO	CONTENT	PAGE NO.
1.	INTRODUCTION	1
	1.1 Project Overview	1
	1.2 Purpose	1
2.	LITERATURE SURVEY	2
	2.1 Existing problem	2
	2.2 References	2
	2.3 Problem Statement Definition	3
3.	IDEATION & PROPOSED SOLUTION	4
	3.1 Empathy Map Canvas	4
	3.2 Ideation & Brainstorming	4
	3.3 Proposed Solution	5
	3.4 Problem Solution fit	6
4.	REQUIREMENT ANALYSIS	7
	4.1 Functional requirement	7
	4.2 Non-Functional requirements	7
5.	PROJECT DESIGN	8
	5.1 Data Flow Diagrams	8
	5.2 Solution & Technical Architecture	8
	5.3 User Stories	9
6.	PROJECT PLANNING & SCHEDULING	10
	6.1 Sprint Planning & Estimation	10
	6.2 Sprint Delivery Schedule	10
7.	CODING & SOLUTIONING (Explain the features added in the project along with code)	11
	7.1 Feature 1	11
	7.2 Feature 2	11
8.	TESTING	12
	8.1 Test Cases	12
9.	RESULTS	13
	9.1 Performance Metrics	13
10.	ADVANTAGES & DISADVANTAGES	13
11.	CONCLUSION	13
12.	FUTURE SCOPE	13
13.	APPENDIX	14
	13.1 Source Code	14
	13.2 GitHub & Project Demo Link	16

1. INTRODUCTION

1.1 Project Overview

In homes and in various commercial areas, LPG is used for various purposes, such as cooking, Heating, Lighting, Cooling, etc. This energy source consists mainly of propane and butane, highly flammable chemical compounds. LPG loss can occur, albeit rarely, in a home, business or gas vehicle. The loss of this gas can be dangerous because it increases the risk of explosion. An odor such as ethanol is added to the LPG so that the losses can be easily detected by most people. However, some people with a reduced sense of smell may not rely on this intrinsic safety mechanism. In these cases, a gas leak detector becomes vital and helps protect people from the dangers of gas leaks. A number of research papers have been published on gas leak detection techniques. We have studied a research article about our topic "LPG GAS WARNING DETECTION AND LOSS SYSTEM". This document presents the detection and alarm system for LPG gases to prevent fire accidents and ensure the safety of the home.

1.2 Purpose

The LPG leak detection and reporting system has been introduced so that it can also be used with alternating current. To support this last case, it has a bridge rectifier with a capacitor filter. This is followed by a controller that provides regulated power of + 5V. MQ-5 gas is used to detect LPG. This sensor can be used at + 5V. the sensitivity of this sensor is very high and its response time is fast. There are about 30 crore users of LPG in the country where the majority of 40% of the population. Several standards have been put in place for the gas leak detection system. The existing system provides an alarm system primarily to detect a gas leak in domestic and commercial premises. The main objective of this system is to monitor the leakage of liquefied petroleum gas (LPG) in order to avoid serious fire accidents and facilitate safety measures. The system detects LPG leaks from the gas sensor and informs the consumer of the gas leak by sending a text message.

When the system determines that the LPG concentration in the air reaches the specified level, tell the consumer by sending text messages to the registered mobile phone and informing people in your home by activating the alarm including the alarm and the message display the message on the LCD screen to take required action.

2 LITERATURE SURVEY

2.1 Existing problem

We design and develop a propose system which include some safety factors. A safety has been a major issue in today's day to day life. LPG and CNG i.e. petroleum gas and compressed natural gas are most commonly used in residential and commercial places for cooking purpose and in various vehicles as a replacement for costly fuels like diesel, petrol . These gases are filled in cylinders which are easily un-damageable. But leakage can take place through pipes or regulators or knobs which may cause accidents like suffocation, uneasiness or sometimes may catch fire and short circuit as well. The main aim of this project is developing a system that can detect gas leakage . On detection it will send an alert SMS and the gas supply knob of cylinder will be switched off automatically.

2.2 References

Sr. No.	Paper Title	Author Name	Publication Year	Result
1	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.
2	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 the Field of safety.
3	IOT Based Gas Leakage Detection System with Database Logging, Prediction 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.
4	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.
5	Gas Leakage Detection and Smart Alerting System Using IoT	Shital Imade, Priyanka Rajmanes, Aishwarya Gavali	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 the field of safety against the leakage of harmful and toxic gases

2.3 Problem Statement Definition

User Story Number	User Story / Task	Story Points	Priority
USN-1	As a customer, I might ensure login credential through Gmail ease manner for the purpose of sending alert message to the owner.	2	High
USN-2	As a user, I have to registered my details and tools details in a simple and easy manner in case of fire, this registered system sends notification to the industrialist.	2	High
USN-3	As a user, in case of Fire in the industry I need the sprinkler to spray water on the existing fire automatically.	2	Low
USN-4	As a user, I need to safeguard my properties as well as and it will be better to send alert message to the fire department.	2	Medium
USN-5	As a user, its good to have a IOT based system to extinguish the fire without human presence.	2	High

3 IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



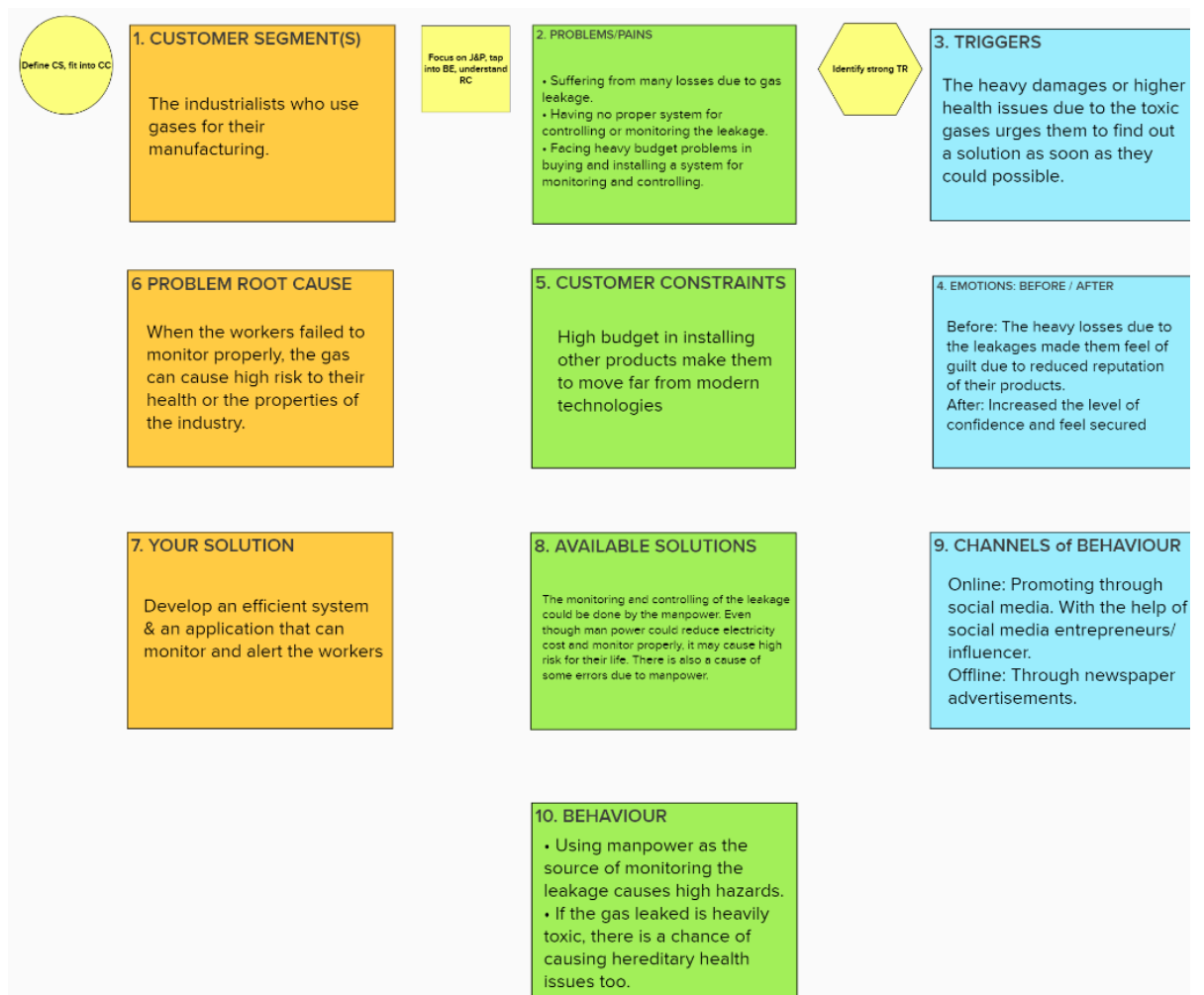
3.2 Ideation & Brainstorming

The proposed system takes an automatic control action after the detection of 0.001% of LPG leakage. This automatic control action provides a mechanical handle driven by stepper motor for closing the valve. The closing of the cylinder knob stops the flow of gas and prevents fire outbreak. We are increasing the security for human by using the combination of a relay and the stepper motor which will shutdown the electric power of the house. Also by using a GSM module, we are sending an alert message i.e SMS (Short messaging services) to warn the users about the LPG leakage and a buzzer is provided for alerting the neighbors in case of the absence of the users about the LPG leakage. The aim of this system is to reduce the probability of explosion due to gas leakage. The main advantage of this system over the manual method is that, it does all the process automatically and has a quick response time.

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	➤ Develop an efficient system & an application that can monitor and alert the users(workers) From gas leakage
2.	Idea / Solution description	<ul style="list-style-type: none"> ➤ This product 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 along with the location ➤ In the web application, admins can view the sensor parameters.
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> ➤ Fastest alerts to the workers ➤ User friendly
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> ➤ Cost efficient ➤ Easy installation and provide efficient results ➤ Can work with irrespective of fear
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> ➤ The product is advertised all over the platforms. Since it is economical, even helps small scale industries from disasters. ➤ As the product usage can be understood by everyone, it is easy for them to use it properly for their safest organization
6.	Scalability of the Solution	<ul style="list-style-type: none"> ➤ Since the product is cost efficient, it can be placed in many places in the industries. ➤ Even when the gas leakage is more, the product sense the accurate values and alerts the workers effectively

3.4 .Problem Solution fit



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 Registration	Registration through Form. Online payment for the service.
FR-2	User Access	Access the details using web browser. Access the details using mobile application.
FR-3	User alert	Gets alert as an SMS message. Gets alert alarm in the working area.

4.2 Non-Functional requirements

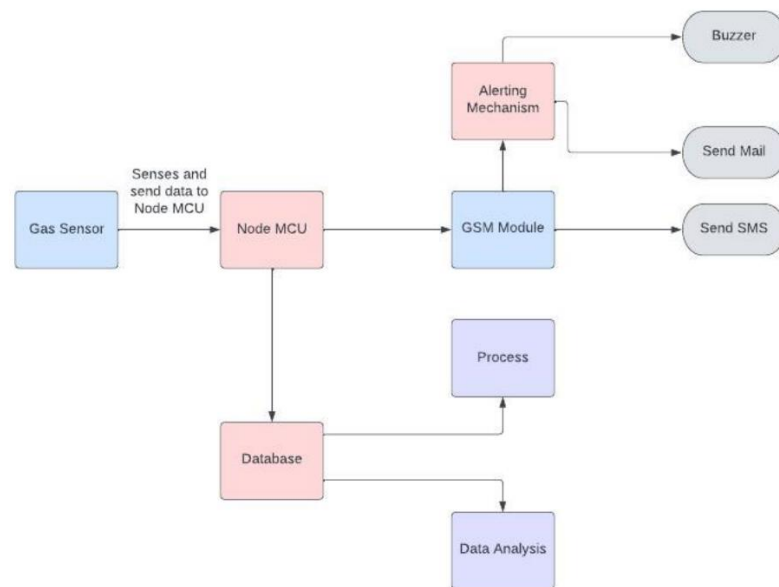
Following are the non-functional requirements of the proposed solution.

NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	The device must be usable by the customer anywhere from the world.
NFR-2	Security	Data from the sensor are stored securely and very far from other data.
NFR-3	Reliability	Data can be retrieved anytime and no data is discarded without customer knowledge.
NFR-4	Performance	Performance delay is very less in case of large number of data or parameters.
NFR-5	Scalability	Device must be capable of measuring conditions even in large industry.

5 PROJECT DESIGN

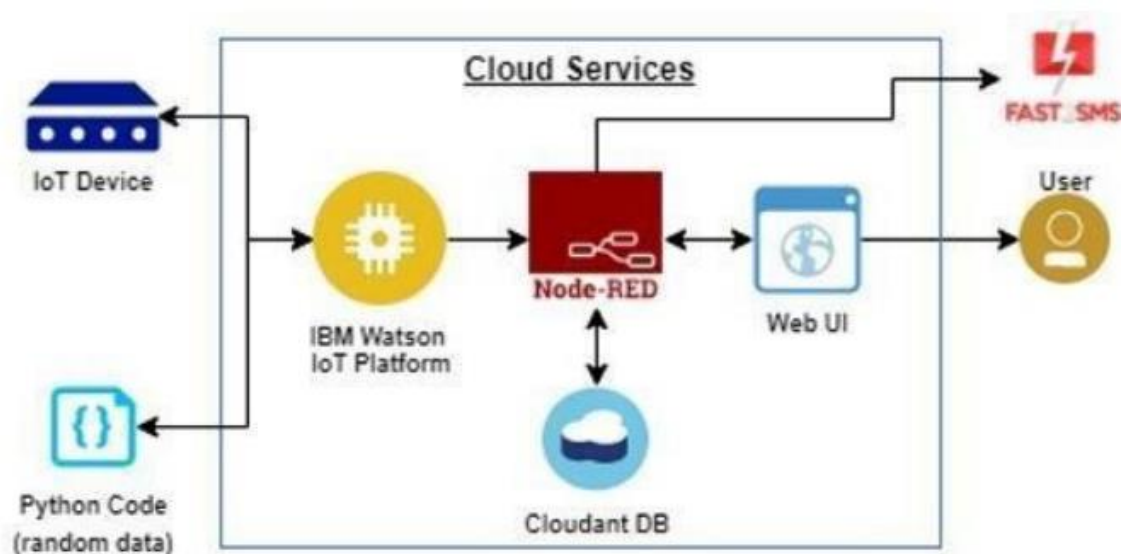
5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 Solution & Technical Architecture

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Family member/industry owner)	Registration	USN-1	As a user, I can register for the device in the owner's mobile application by entering my email and password	I can access my account / dashboard	High	Sprint-1
Customer (higher authority)	Confirmation	USN-2	As a user I will receive confirmation message via email and once received I can install the device in the owners place	I can receive confirmation email & click confirm	High	Sprint-1
Customer (fire service 101)	Safety measure register	USN-3	As a register I can register the application in owner/family members mobile phone	I can register & access the dashboard with Facebook Login	Low	Sprint-2
Customer (mobile user)	Mobile application	USN-4	As a user I can register by mobile application	I can register for gas detection device with owner's mobile number and the alert message will be send by SMS	Medium	Sprint-2
Customer (credential)	Login	USN-5	As a user I can log into the device by entering email & password in the owner's mobile application	Mail address and passwords are default	High	Sprint-3
Customer (Web user)	Notification	USN-7	As a user when there is a critical situation regarding gas explosion the alert notification will be received through GSM module	Alert message is sent to owner's mobile as an SMS	High	Sprint-3
Customer Care Executive	Network Connectivity	USN-8	When there is a gas leakage is detected in the surrounding	Sensor detect the leakage and notifies the owner via message	High	Sprint-4
Administration	Accessing	USN-9	When there is an issue in accessing the device	Admin/Device operator's advice should be undertaken	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

- 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 IS
- SOLUTION FOR THE PROBLEM IS FOUND

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Login	USN-1	As a customer, I might ensure login credential through Gmail ease manner for the purpose of sending alert message to the owner.	2	High	Paranthama A K Gomighaa R Jeevitha S Aravind M
Sprint-1	Registration	USN-2	As a user, I have to registered my details and tools details in a simple and easy manner in case of fire, this registered system sends notification to the industrialist.	2	High	Paranthama A K Gomighaa R Jeevitha S Aravind M
Sprint-2	Dashboard	USN-3	As a user, in case of Fire in the industry I need the sprinkler to spray water on the existing fire automatically.	2	Low	Paranthama A K Gomighaa R Jeevitha S Aravind M
Sprint-3	Dashboard	USN-4	As a user, I need to safeguard my properties as well as and it will be better to send alert message to the fire department.	2	Medium	Paranthama A K Gomighaa R Jeevitha S Aravind M
Sprint-4	Dashboard	USN-5	As a user, its good to have a IOT based system to extinguish the fire without human presence.	2	High	Paranthama A K Gomighaa R Jeevitha S Aravind M

6.2 Sprint Delivery Schedule

TITLE	DESCRIPTION	DATE
IDEATION PHASE		
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	19 OCT 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements.	19 OCT 2022
Problem Statement	List of problem in the project.	19 OCT 2022
Brainstorm And Idea Prioritization	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	19 OCT 2022
Project Design Phase - II		
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	30 OCT 2022
Functional Requirement	Prepare the functional requirement document.	30 OCT 2022
Data Flow Diagrams	Draw the data flow diagrams and submit for review.	30 OCT 2022
Technology Architecture	Prepare the technology architecture diagram.	30 OCT 2022
Project Planning Phase		
Prepare Project Planning & Sprint Delivery Plan	Prepare the Product Backlog, Sprint Planning, Stories, and Story points.	8 NOV 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	8 NOV 2022
Project Development Phase		
Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	IN PROGRESS

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1

If any gas leakage is detected by the sensor, it sends signal to the entire module and the Buzzer added in our system gives signal as an alarm sound to alert people in the place.

7.2 Feature 2

The data represented previously will be stored in the IBM cloud as entire database is connected with our app. We have created our device with these specification listed below:

Organization ID: ntcjrf

Device Type: Nodemcu

Device ID: 12345

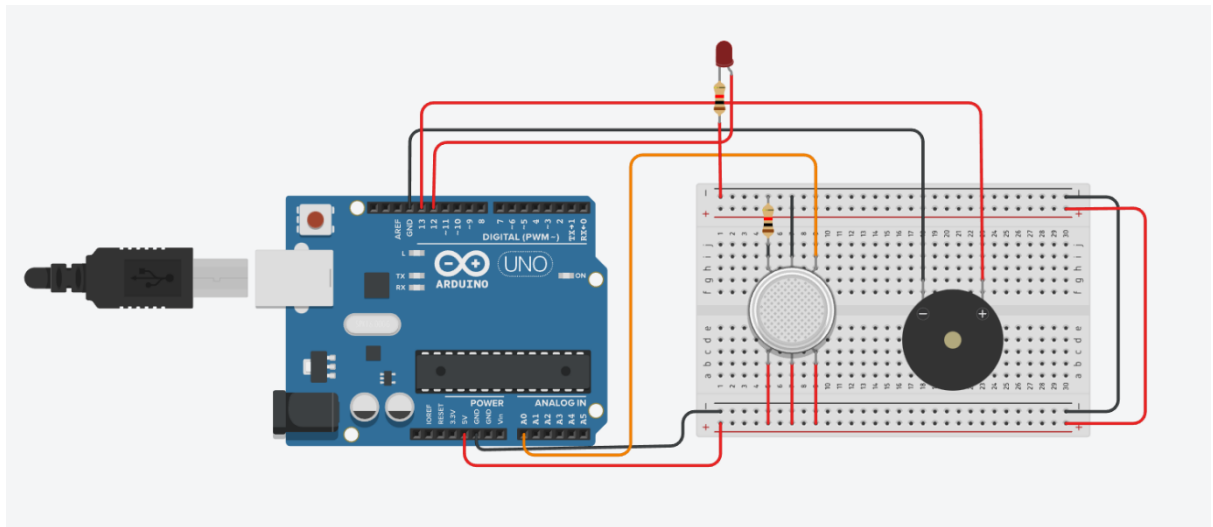
Authentication Method: use-token-auth

Authentication Token: ST352*NNHU8mR+P?_O

8. TESTING

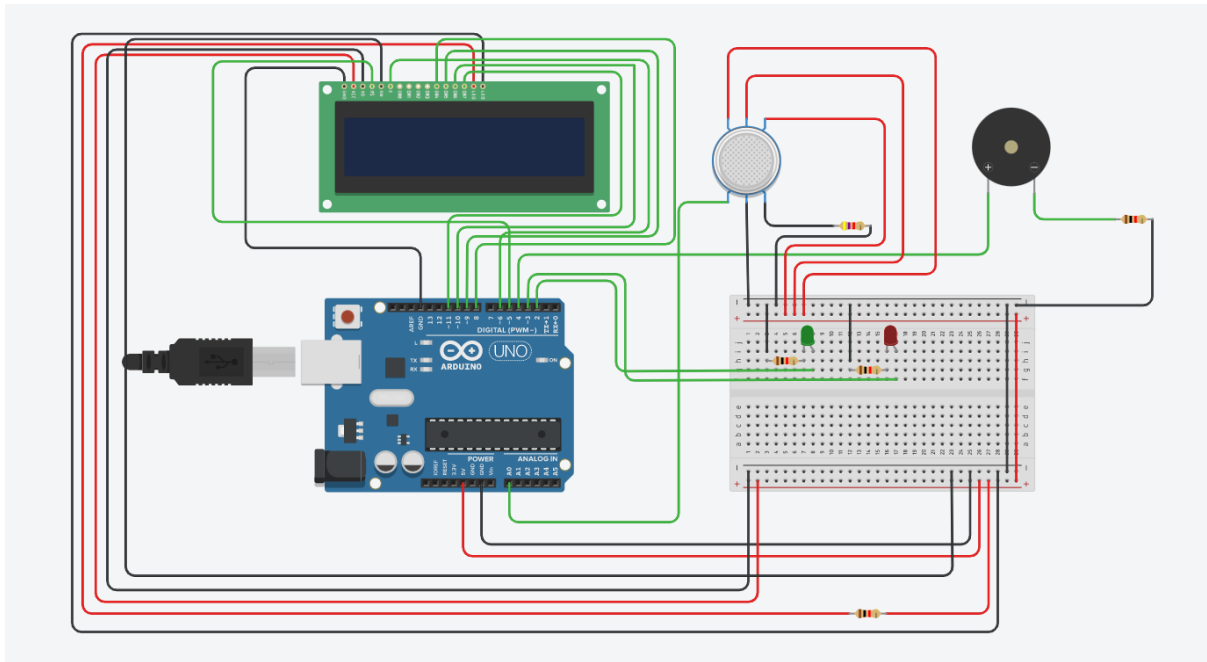
8.1 Test Cases

As every connections are made and verified, the entire module is simulated to check its working. The sensor keeps on detection if any gas leakage is there. If there is no leakage is happened no alert signals are sent.



9. RESULTS

If any gas leakage is detected the buzzer goes ON and alert signals are sent to the consent devices



10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

1. The gas detectors can be used for the detection of combustible, flammable and poisonous gases and for loss of oxygen, and also to detect a gas leak or other pollutants.
2. It makes the area where the leak occurs an warning sound and instructs operators to leave the area.
3. Provides alerts at faster rate and stores the prior data for references.
4. Manual monitoring is not necessary as we use smart solutions for detection.

DISADVANTAGES

1. If any technical issue and detection failure causes Poor stability and greater environmental impact.
2. The output parameters cannot be determined. Therefore, it should not be used in places where accurate measurement is required.
3. Only one gas can be measured with each instrument.
4. 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.

11. CONCLUSION

The proposed gas leakage detector is promising in the field of safety. The attempt while making this prototype has been to bring a revolution in the field of safety against the leakage of harmful and toxic gases to minimize and hence nullify any major or minor hazard being caused due to them. Nevertheless there is always scope of improvement and some of the features that will improve the system and make it even better and reliable have been mentioned below

12. FUTURE SCOPE

The behaviour of the gases is dependent on the temperature and humidity of the air around. A gas at certain concentration might not be flammable at low temperature but might have explosive nature at high temperature. For this reason addition of a Temperature and Humidity Sensor will be very helpful

13. APPENDIX

1.Source Code

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(5,6,8,9,10,11);

int redled = 3;

int greenled = 2;

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(1000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("EVACUATE");
    delay(1000);
}
else
{
    digitalWrite(greenled,HIGH);
    digitalWrite(redled,LOW);
    noTone(buzzer);
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("SAFE");
    delay(1000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("ALL CLEAR");
    delay(1000);
}

```

}

2.GitHub & Project Demo Link

Github link-<https://github.com/IBM-EPBL/IBM-Project-24372-1659942107>

Demo link- [https://drive.google.com/file/d/118QilyhIvR0aQIAHetNRUv33c0g-SOm7/view?usp=share link](https://drive.google.com/file/d/118QilyhIvR0aQIAHetNRUv33c0g-SOm7/view?usp=share_link)