Project Report Format

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Gas Leakage Monitoring and Alerting System for Industries using IOT

PSNA College of Engineering and Technology

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

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1. INTRODUCTION:

1.1 Project overview:

The design of a sensor-based automatic gas leakage detector withan 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 raiseour 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.

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 andnotify the user.The resulting performance indicated its effectiveness toward saving a significant portion of the wasted gas in domestic.

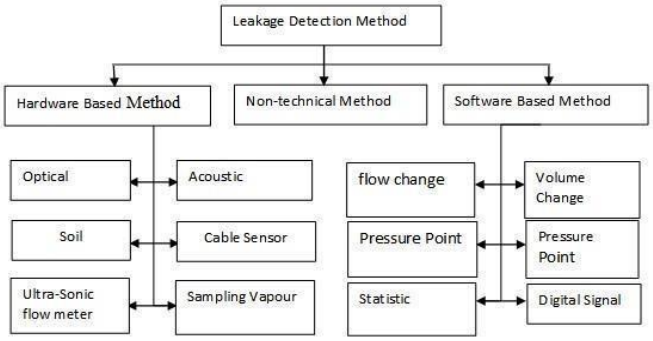
Index Terms: Gas Leakages, Gas Leakage Detector, Gas Sensor, Internet of Things

1.2 Purpose:

The Internet of Things is a developing theme of specialized, social, and monetary centrality. Customer items, tough goods, cars and trucks, modern and utility segments, sensors, and other regular articles are being joined with Internet availability and amazing information systematic capacities that guarantee to change the manner in which we work, live, and play. The Internet of Things (IoT) is an essential theme in innovation industry, strategy, and designing circles .Safety plays a critical role in today's world and it is vital that certainsolutions 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 for cooking.
- 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.

Gas Leakage Detection Method Based on Technical Nature



OBJECTIVES:

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.

METHODS AND MATERIAL:

System: Input, Output, Function, Success/Failure Conditions(Gas ON/OFF).

Input: Sensor data signal which is not regular or Change in Signal.

Output: End User get informed with alert buzzer and Display to LCD Functions:

- **Access () :-** In this module we are going to access the feature provided by the module which Will include Sensor data access.
- **Control () :-**In this module we are controlling the Alert System by using System which is connected to hardware or sensor data.
- **Broadcast () :-**In this module we are going to broadcast the alert Display to LCD.

Success Conditions: If such data which is received through sensors are not stable or are more than threshold it will predict that there is leakage situation.
Failure Conditions: Desired output is not generated due to following failures:Network Connection Failure

2. LITERATURE SURVEY:

ARDUINO BASED GAS LEAKAGE DETECTION SYSTEM USING IOT: It has become important factor nowadays to bring the technology into our home and office. By making the place smart, the day-to-day activities are becoming more and easier. The development of home automation has become mandatory in homes as people are moving towards to the smart home concepts. The supply gas will also be stopped with the use of solenoid, ultimately preventing the chance of accident. 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 can notify to society admin about the condition before mishap takes place through a message. 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. The people in the neighbors can also be included in case of an emergency. LPG gas sensor is used for input. A buzzer is connected along with the circuit to indicate the use of the output.

2.1 Existing problem:

Gas leakage is nothing but the leak of any gaseous molecule from a stove, or a 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 when it becomes explosive it could cause great danger to the people, home, workplace, industry and the environment. We design and develop an propose system which include some safety factors. A safety has been a major issue today's day to day life. LPG is a petroleum gas are the most commonly used in residential and commercial places. For industrial plants it has been used fuels like petrol, diesel. 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.

2.2 References:

[1]Kumar Keshamoni and Sabbani Hemanth. “Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT” International Advance Computing Conference IEEE, 2017.

[2]Internet of Things (IOT) Based “ Gas Leakage Monitoring and Alerting System with MQ-2 Sensor ” by Rohan Chandra Pandey , Manish Verma , Lumesh Kumar Sahu.

[3]“GAS LEAKAGE DETECTION AND SMART ALERTING SYSTEM USING IOT” by Shital Imade, Priyanka Rajmanes, Aishwarya Gavali , Prof. V. N. Nayakwadi.

[4]“Gas Leakage Detection and Alert System using IoT” by Sayali Joshi, Shital Munjal, Prof. Uma B. Karanje.

[5]Asmita Varma, Prabhakar S, Kayalvizhi Jayavel. “Gas Leakage Detection and Smart Alerting and Prediction Using IoT".Internet of Things and Applications (IOTA), International Conference on. IEEE, 2017.

[6]Hina Ruqsar , Chandana R , Nandini R , Dr. T P Surekha, have proposed a system that along with monitoring and detection of gas leakage.

[7]B. B. Did paye, Prof. S. K. Nanda; in this paper they told about their research on leakage detection and review of“Automated unified system for LPG using microcontroller and GSM module”.

2.3 Problem Statement Definition:

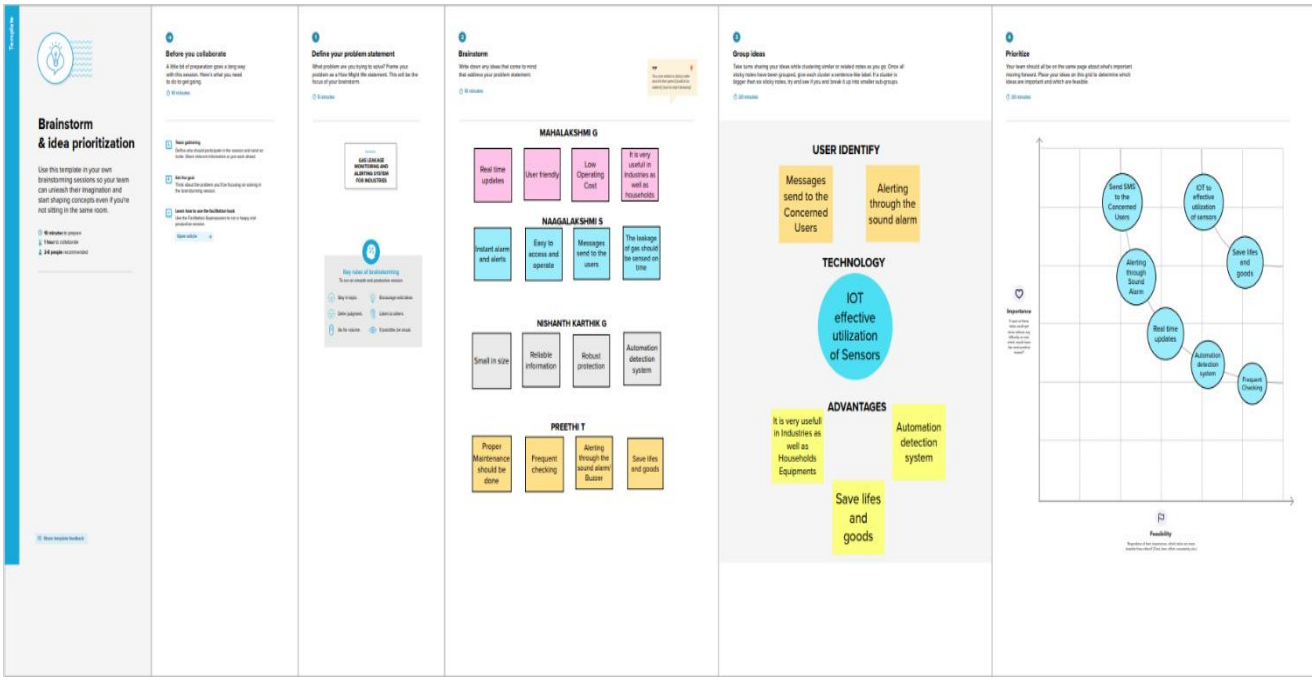
This project mainly focuses on the detection of gas leakage and providing security when the user is around or away from home. The use wireless technology for providing security against gas leakage to users hence cost effective and more adaptable. The system comprises of sensors for detecting gas leak interfaced to microcontroller that will give an alert to user whenever there is a gas leakage, display warning information by using Liquid Crystal Display (LCD). This will enable the user to take precaution of explosion disaster which may result on Liquefied Petroleum Gas (LPG) cookers like loss of properties, injury or even death. GLDS provides ideal solution to gas leakage problems faced by home owners in daily life.

Problem Statement (PS)	I am (Customer)	I am trying to	But	Because	Which makes me feel
PS-1	Industrialist	Monitor gas leakage in the industry	I don’t have any system for monitoring	The affordable of the system is high and the systems are sometimes making disasters	Unsafe
PS-2	Industrialist	Control the gas leakage	Also, the installation process is too complicated	The number of sensors is unpredictable and the positioning of equipment is improper	Disastrous

3.IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming:

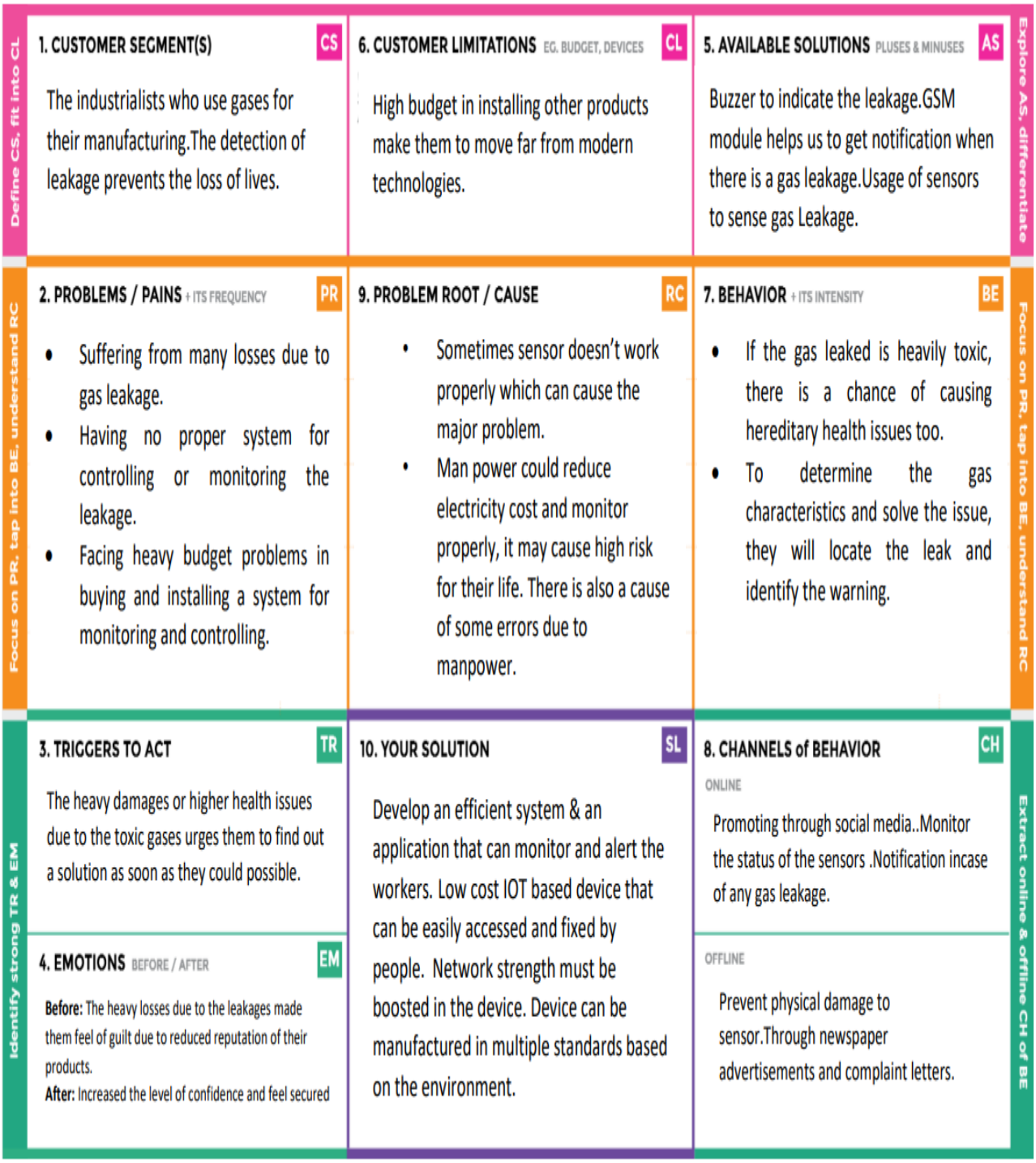


3.3 PROPOSED SOLUTION:

S. No.	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	Gas leakage prompts different mishaps coming about into both monetary misfortune as well as human wounds. In human's everyday existence, the environment gives the main effect on their medical problems. The risk of firing, explosion, suffocation all depend on their actual properties such combustibility, harmfulness and so on. The number of deaths because of the blast of gas cylinders has been expanding as of late. The justification behind such explosions is because sub-standard cylinders, old valves, worn out regulators and absence of mindfulness utilizing gas cylinders add to the dangers.
2.	**Idea / Solution description**	Workers who are engaged with a busy industry work with gas either harmful or harmless needs a way to monitor their gas pipelines continuously and detect early if there is any leakage of gas in their surroundings so that they can work efficiently on major crises rather than worrying about monitoring or leakage of gas, this will indeed reduce the manpower of that industry and create a peaceful environment.
3.	**Novelty / Uniqueness**	Even though there are many existing solutions for this problem they failed to satisfy the needs of customer. Some of the solutions are only detecting some gases where some others failed to alert the main department and other solutions are with some delays.
4.	**Social Impact / Customer Satisfaction**	Our solution will be very helpful for the workers and the society which is associated or located nearby the industries. Our solution will prevent great disasters like Bhopal Gas Tragedy so that so many lives can be saved. Through this project the workers mental pressure will be reduced so that they can concentrate on other works or by relaxing them. It is cost efficient and easy for installation.
5.	**Business Model (Revenue Model)**	The main target of our solution is Industries so we have planned to visit industries and explain them about the benefits of our products. So that they can aware of the importance of this solution and use it properly for their safest organization.

6.	**Scalability of the Solution**	Our solution can be integrated for further future use because the solution we have provided will be lay on the basic or initial stage of any upgraded version. It will give the accurate values.

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 Visibility	Level of gas can be monitored by users if there is any leakage, alerts can be sent through messages.
FR-2	User Reception	The data like the level of gas can be send through messages
FR-3	User Understanding	The user can monitor the level of gas with the help ofthe data. If there is an increase in gas level then the alert will be given. They also get notified by the alert
FR-4	User Convenience	Through message we can easily get data of gas level and in case of gas leakage, it can directly send notifications to nearby police station and hospital.
FR-5	User Performance	When the user gets notified, he could turn on the exhaust fan/sprinkler

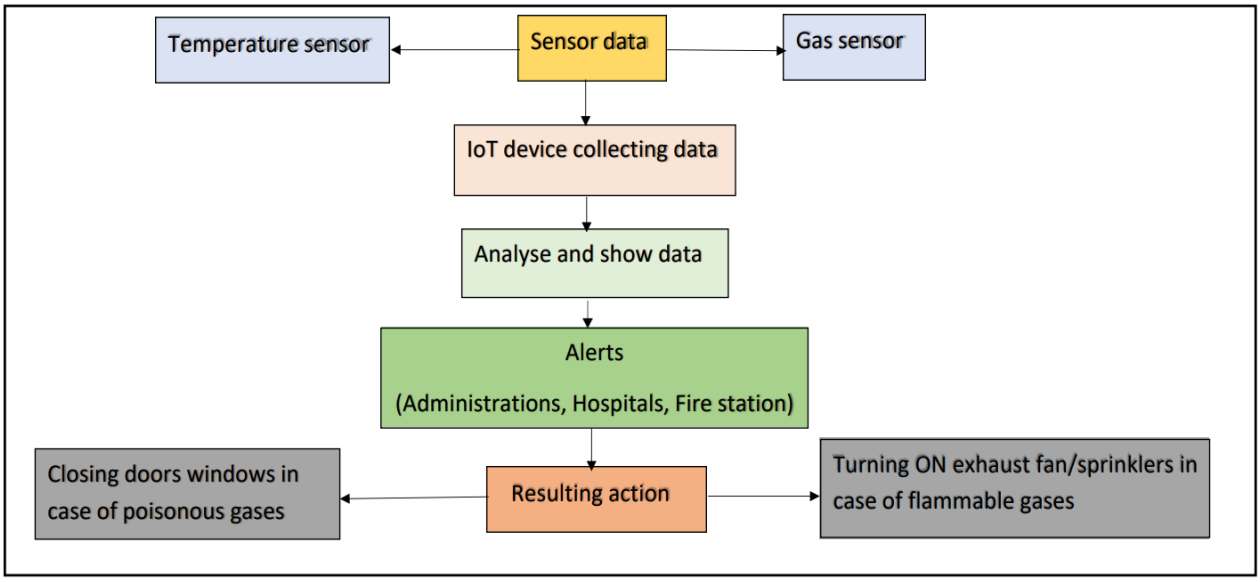
4.2 Non-Functional requirements:

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

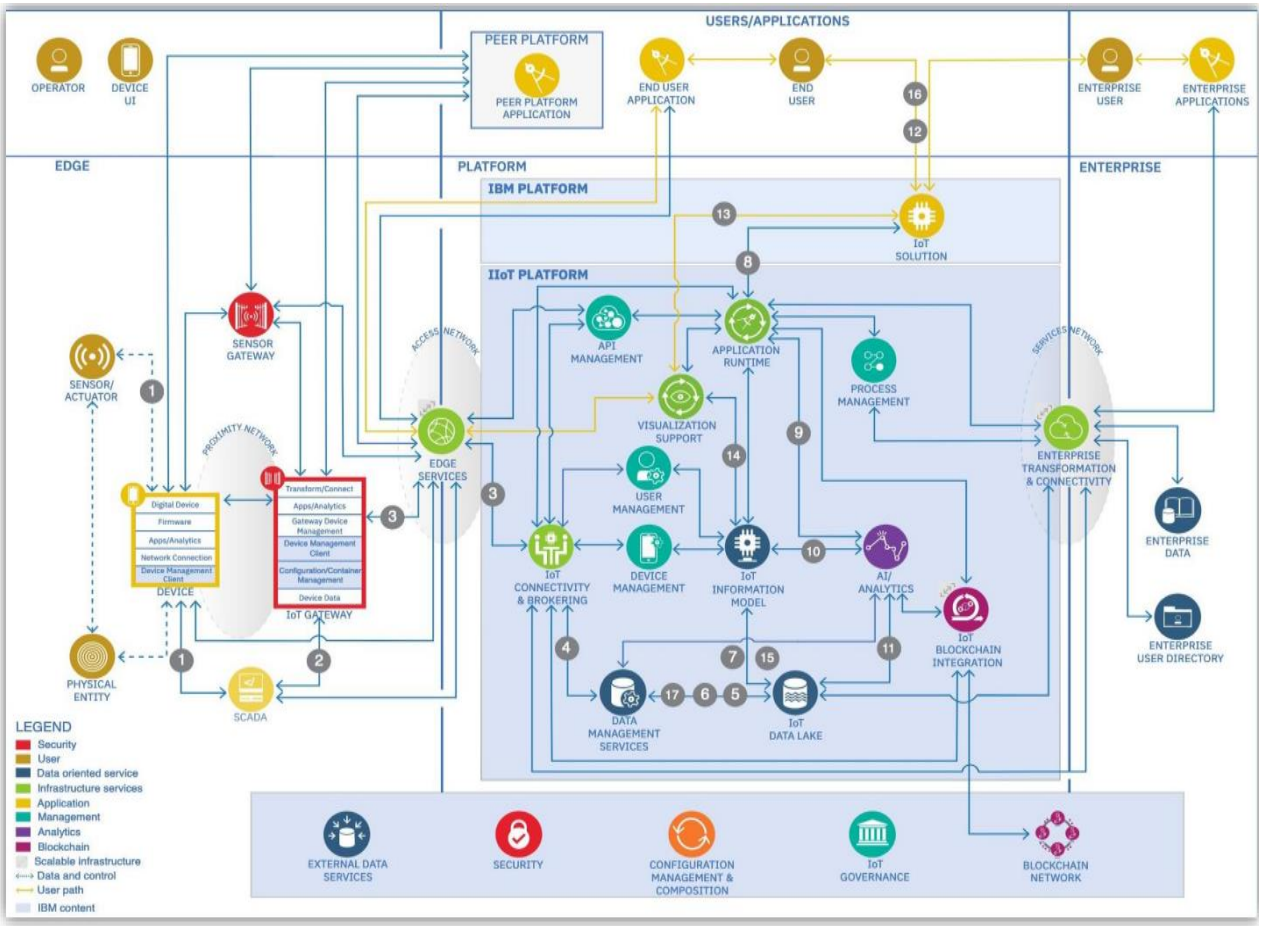
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It updates the data regularly as well as protects the workers.
NFR-2	**Security**	As a result of emergency alert, we can be able to protect both the humans and properties.
NFR-3	**Reliability**	Can be able to provide accurate values. It might have a capacity to recognize the smoke accurately and does not give a false
NFR-4	**Performance**	Sprinklers and exhaust fans are used in case of emergency.
NFR-5	**Availability**	It can be used for everyday; it includes day and nights.
NFR-6	**Scalability**	Sensors can be replaced every time it fails.

5. PROJECT DESIGN:

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:

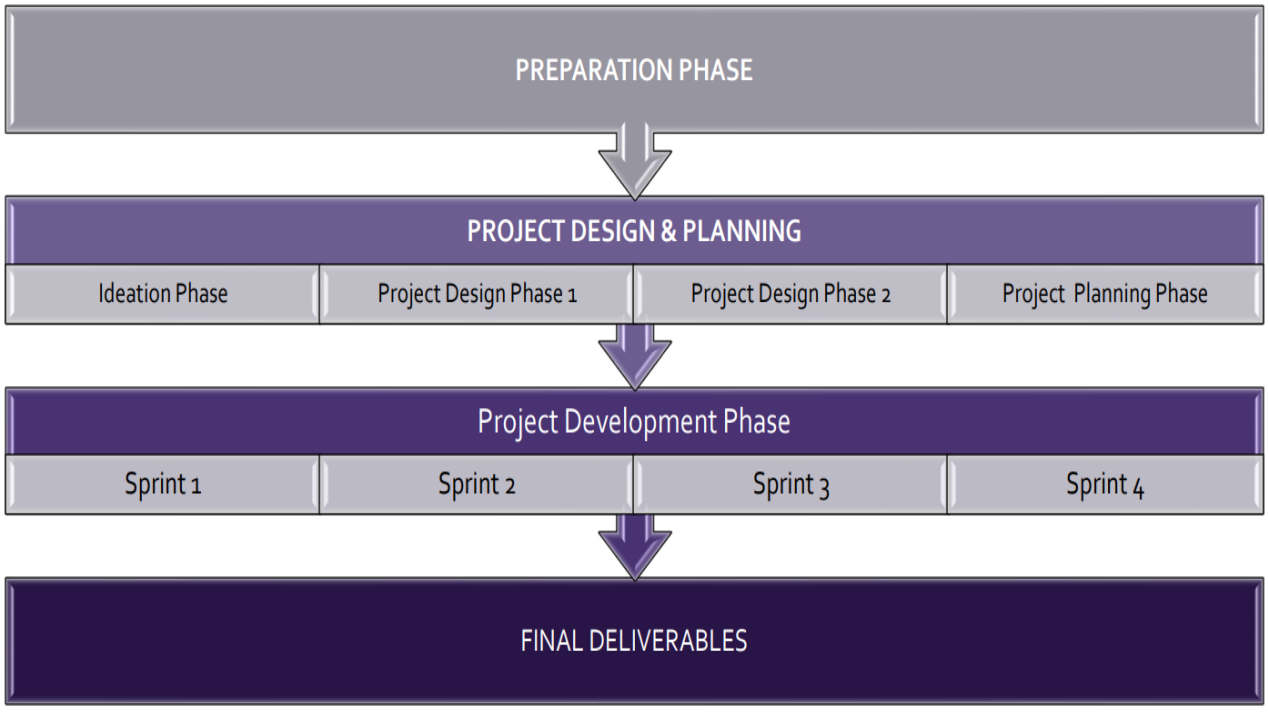


5.3 User Stories:

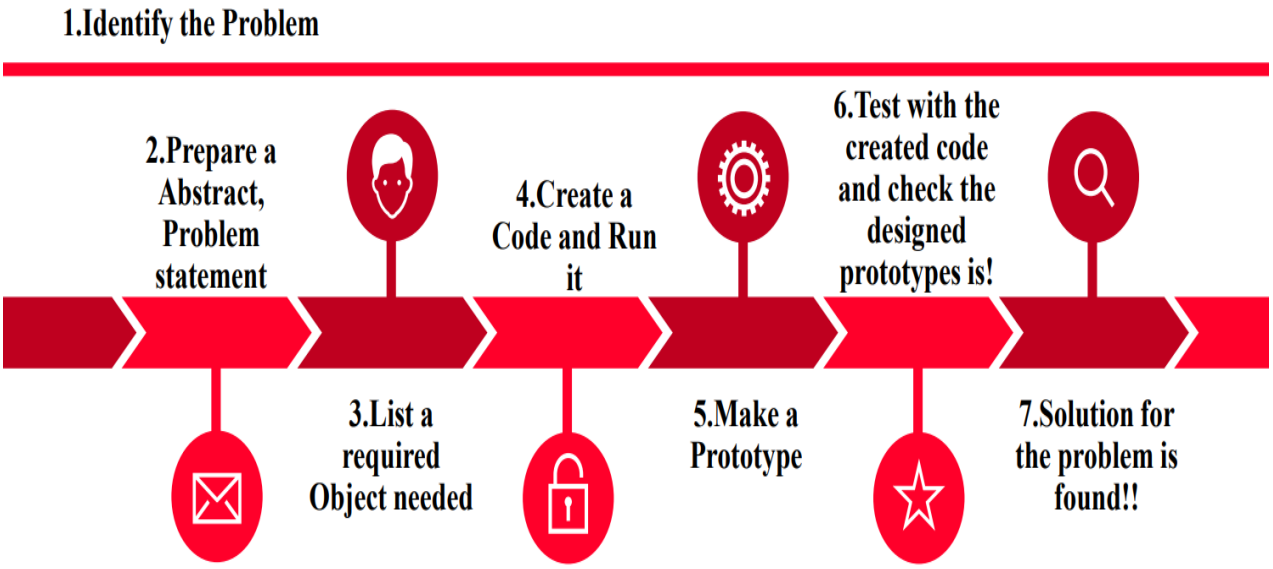
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	User can enter into the web application	I can access my account / dashboard	High	Sprint-1
		USN-2	User can register their credentials like email idand password	I can receive confirmation email & click confirm	High	Sprint-1
	Login	USN-3	User can log into the application by entering email & password	I can login to my account	High	Sprint-1
	Dashboard	USN-4	User can view the temperature	I can view the data givenby the device	High	Sprint-2
		USN-5	User can view the level of gas	I can view the data givenby the device	High	Sprint-2
Customer (Web user)	Usage	USN-1	User can view the web page and get the information	I can view the data givenby the device	High	Sprint-3
Customer	Working	USN-1	User act according to the alert given by the device	I can get the data work according to it	High	Sprint-3
		USN-2	User turns ON the exhaust fan/sprinkler whenthe leakage occurs	I can get the data work according to it	High	Sprint-4
Customer Care Executive	Action	USN-1	User solve the problems when someone facesany usage issues	I can solve the issues when some one fails to understand the procedure	High	Sprint-4
Administrator	Administration	USN-1	User stores every information	I can store the gained information	High	Sprint-4

6.PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning & Estimation:



6.2 Sprint Delivery Schedule:



7. CODING AND SOLUTIONING:

7.1 Feature 1:

Tinker Cad:
Tinkercad is a free-of-charge, online 3D modeling program that runs in a web browser. Since it became available in 2011 it has become a popular platform for creating models for 3D printing as well as an entry-level introduction to constructive solid geometry in schools.

7.2 Feature 2:

LIST OF COMPONENTS:

S.No.	Name of the Component	Quantity
1.	Arduino UNO R3	1
2.	DC Motor	1
3.	LED(Red)	1
4.	330 Ω Resistor	1
5.	Piezo	1
6.	Gas Sensor	1
7.	LCD 16 x 2	1

8.	1 kΩ Resistor	2
9.	250kΩ Potentiometer	1
10.	Pushbutton	1

HARDWARE INFORMATION :

ARDUINO UNO:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-toDC adapter or battery to get started .

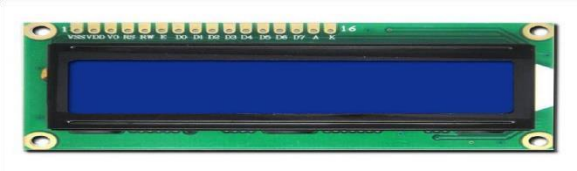
RESISTOR:

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

PIEZO:

A piezo is a device that generates a voltage when force is applied or becomes deformed when voltage is supplied.

LCD (Liquid Crystal Display):

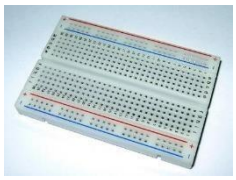


LCD stands for Liquid Crystal Display. 16×2 LCD is one kind of electronic device used to display the message and data. The display is named 16×2 LCD because it has 16 Columns and 2 Rows.

These LCD modules are low cost, and programmer-friendly, therefore, is used in various DIY circuits, devices, and embedded projects. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

BREAD BOARD:



A breadboard is a widely used tool to design and test circuit. You do not need to solder wires and components to make a circuit while using a bread board. It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle. It consist of an array of conductive metal clips encased in a box made of white ABS plastic, where each clip is insulated with another clips. There are a number of holes on the plastic box, arranged in a particular fashion. A typical bread board layout consists of two types of region also called strips. Bus strips and socket strips. Bus strips are usually used to provide power supply to the circuit. It consists of two columns, one for power voltage and other for ground. Socket strips are used to hold most of the components in a circuit. Generally it consists of two sections each with 5 rows and 64 columns. Every column is electrically connected from inside.

GAS SENSOR:

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential

difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.

LED:

LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electroluminance. Electro-luminance is the property of the material to convert electrical energy into light energy and later it radiates this light energy. In the same way, the semiconductor in LED emits light under the influence of electric field. The symbol of LED is formed by merging the symbol of P-N Junction diode and outward arrows. These outward arrows symbolise the light radiated by the light emitting diode.

DC MOTOR:

DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation.

ROTARY POTENTIOMETER:

The rotary type potentiometers are used mainly for obtaining adjustable supply voltage to a part of electronic circuits and electrical circuits. The volume controller of a radio transistor is a popular example of a rotary potentiometer where the rotary knob of the potentiometer controls the supply to the amplifier. This type of potentiometer has two terminal contacts between which a uniform resistance is placed in a semi-circular pattern. The device also has a middle terminal which is connected to the resistance through a sliding contact attached with a rotary knob. By rotating the knob one can move the sliding contact on the semi-circular resistance.

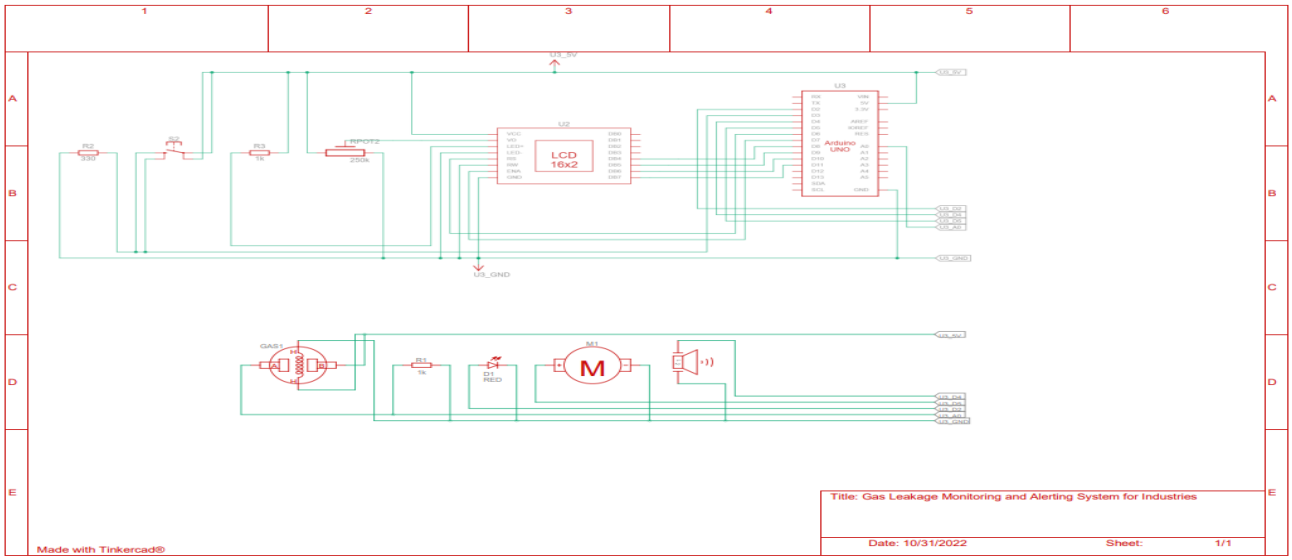
PUSH BUTTON:

A **push-button** (also spelled **pushbutton**) or simply **button** is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal.

JUMPER WIRE:

Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering.

7.3 Database schema:

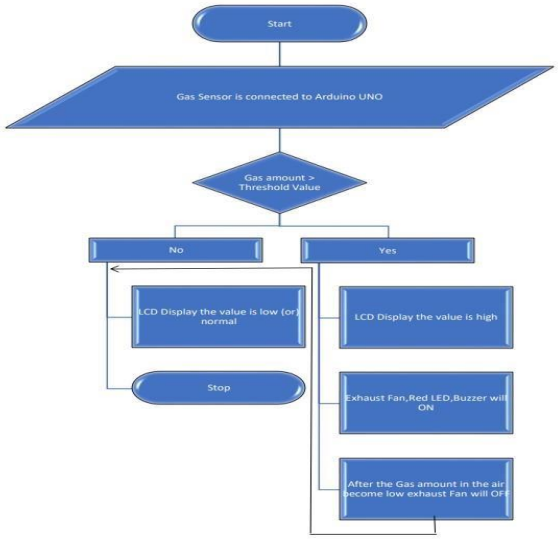


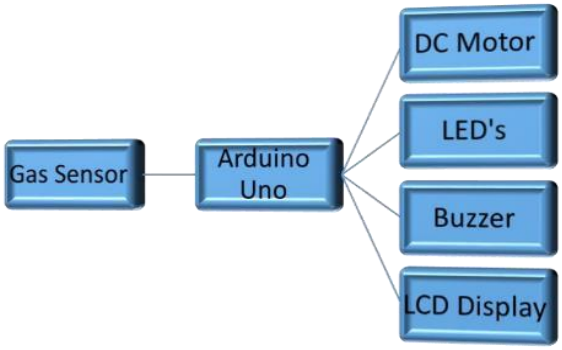
PROPOSED METHOD :

In this project our central component is Arduino UNO. Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. Arduino will make decision when the gas amount is more than the threshold value, an automatic fan will ON and deduct the extra gas from the room or kitchen.

Here, we have a gas sensor that will connect with the Arduino. The gas sensor will read the gas amount from the air. Then we must set a gas threshold value. When the gas value of the air of our home or kitchen is more than the threshold value. The exhaust fan will automatically ON. After eliminating the gas amount from the air, the exhaust fan will automatically OFF. Arduino UNO is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. The detection results displayed on LCD. Indicates the people of danger in work place, factory, home. Buzzer activity with beep sound is made.

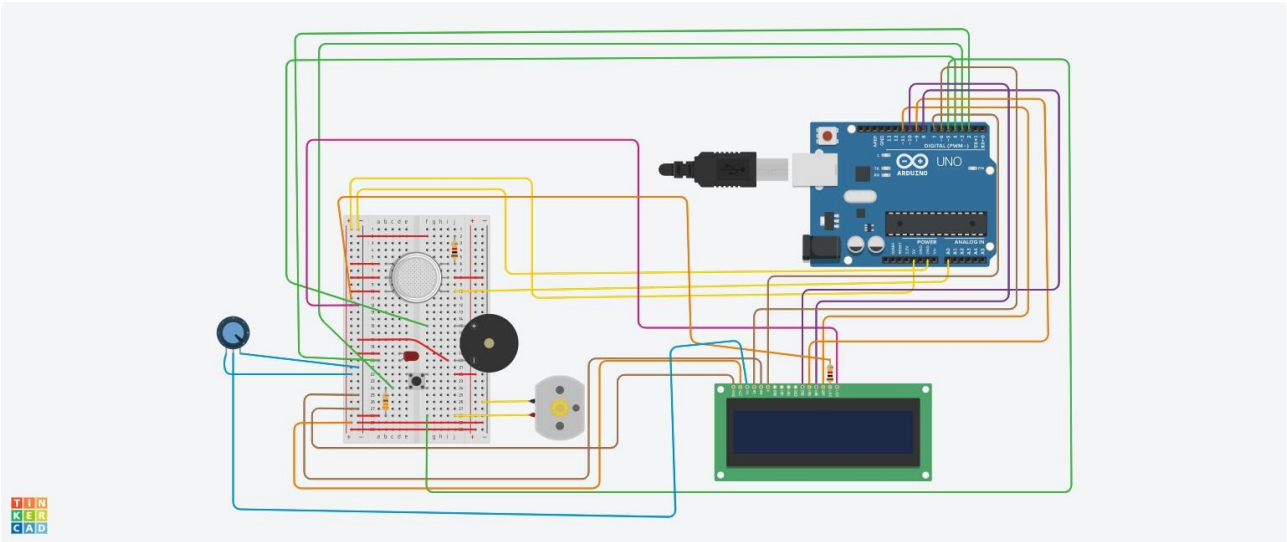
BLOCK DIAGRAM:





8.RESULTS:

8.1 CIRCUIT DIAGRAM:



Finally, the device was tested by using a gas to simulate flame to ensure everything was working fine and it did.

9. ADVANTAGES AND DISADVANTAGES

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

Disadvantages:

- Only one gas can be measured with each instrument.
- When heavy dust, steam or fog blocks the laser beam, the system will be able to take measurements

10. CONCLUSION:

This work presents the design and implementation of gas leakage detection system. Various works on gas leakages detection system was reviewed and presented. The purpose of implementation of gas leakages detection at individual/domestic uses, and not easy to be further modified.An advantage of this simple gas leak detector is its simplicity and its ability to warn about the leakage of the LPG gas. In danger situations we can save the life by using this system. 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**.**

11. FUTURE SCOPE:

1. A Mobile Application can be created for this system which can give information about the concentration of gas present in the area, setting reminders to check gas level, also to predict the gas leak by giving values.
2. The use of Pressure sensor along with the system can provide an extra feature of Automatic Gas Booking. Like other sensors, the pressure sensor can constantly monitor the amount of gas present in cylinder and send a booking SMS if it reaches certain level.
3. Relay motors can be added into the system to provide more safety. These motors can switch off the Main Gas Supply and Main Power supply in case the gas concentration exceeds certain limit.

12. APPENDIX:

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();
  }
}
```

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-8527-1658922292

TINKERCAD LINK:

https://www.tinkercad.com/things/cRl5hzjYGgl-gas-leakage-monitoring-and-alerting-system-forindustries-final

PROJECT DEMO LINK:

Circuit Design_GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES:
https://drive.google.com/drive/folders/1_38-L2hEIAaEFQOK9yLnSr_IKjo3czqS