Gas Leakage Monitoring and Alerting System for Industries

PROJECT TITLE	Gas Leakage Monitoring and Alerting Systemfor Industries
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BRANCH	Electronics and Communication Engineering

ABSTRACT :

The Internet of factors (IoT) is the device of devices, vehicles, and domestic machines that comprise hardware, programming, actuators, and community which permits this stuff to interface, collaborate and trade information. IoT consists of broadening Internet community beyond preferred tool, for example, paintings areas, workstations, mobileular telephones and tablets, to any scope of commonly silly or non-net empowered bodily tool and regular articles. Installed with innovation, those devices can bring and join over the Internet, and that they may be remotely determined and controlled . The which means of the Internet of factors has superior due to union of severa innovations, ongoing examination, AI, ware sensors, and implanted frameworks. Conventional fields of hooked up frameworks, far off sensor systems, manage frameworks computerization (counting domestic and constructing mechanization), and others all upload to empowering the Internet of factors. A fueloline spill alludes to a hollow of petroleum fueloline or special vaporous object from a pipeline or different law into any territory in which the fueloline ought now no longer be available. Since a bit hollow can also additionally progressively develop a risky convergence of fueloline, spills are perilous. Notwithstanding causing flame and blast dangers, holes can slaughter vegetation, which include massive trees, and might discharge terrific ozone harming materials to the surroundings. Gas leakage ends in diverse injuries ensuing into each monetary loss as well as human injuries. In human's each day life, surroundings offer the most large effect to their fitness issues. A fueloline detector can sound an alarm to operators withinside the place in which the leak is occurring, giving them the possibility to leave. This kind of tool is vital due to the fact there are numerous gases that may be dangerous to natural life, inclusive of people or animals.

1. INTRODUCTION

1.1 Project Overview:

In today's world, safety is of the utmost importance, and certain measures must be taken at both work and home to e ensure it. Working or living in a dangerous environment necessitates specific safety measures, whether the subject is electricity or oil and gas. A type of natural gas known as "Liquified Petroleum Gas" (LPG) is compressed under high pressure and stored in a metal cylinder. LPG is extremely vulnerable to fire and can result in catastrophic damage if left

unprotected near any fire source. LPG is primarily utilized for cooking and is more readily available than any other natural gas. Sadly, its widespread use makes gas leakage or even a blast a common occurrence. As a result, a system for detecting and monitoring gas leaks is required. Through a flame sensor, the system will keep an eye on fire and flame. The buzzer begins to ring when a fire is detected. Tests have shown that the system can keep track of the wastage of gas and leaks and notify the user. The performance that was produced showed that it was successful in reducing the amount of domestic gas that was wasted.

1.2 Purpose

Nowadays the home safety detection system plays an important role in the security of people. Since all the people from the home goes to work on a daily bases, it makes it impossible to check on the appliances available at home especially LPG gas cylinder, wired circuits, Etc. In the last three years, there is a tremendous hike in the demand for 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 a large scale in industry, as heating, home appliances, and motor fuel. To monitor this gas leak, the system includes an MQ6 gas detector. This sensor detects the amount of leaking gas present in the surrounding atmosphere. In this way, the consequences of an explosion or gas leak can be avoided.

2.LITERATURE SURVEY

2.1 Existing Problem

The Internet of Things aims towards making life simpler by automating every small task around us. As much as IoT helps in automating tasks, the benefits of IoT can also be extended to enhancing the existing safety standards. Safety, the elementary concern of any project, has not been left untouched by IoT. Gas Leakages in open or closed areas can prove to be dangerous and lethal. The traditional Gas Leakage Detector Systems though have great precision, fail to acknowledge a few factors in the field of alerting people about the leakage. Therefore, we have used IoT technology to make a Gas Leakage Detector for society which has Smart Alerting techniques involving sending a text message to the concerned authority and the ability to perform data analytics on sensor readings. Our main aim is to propose a gas leakage system for a society where

each flat has gas leakage detector hardware. This will detect the harmful gases in the environment and alerting to society members through the alarm and sending notifications.

2.2 References

Prof. M.Amsaveni, A.Anurupa, R.S.Anu Preetha, C.Malarvizhi, M.Gunasekaran; they told in their research paper on "GSM-based LPG leakage detection and controlling system" the leakage of LPG gas is detected by the MQ-6 gas sensor. Its analog output is given to the microcontroller. It consists of a predefined instruction set. Based on this, the exhaust fan is switched on. So, the concentration of gas inside the room gets decreased. Then, the stepper motor is rotated thus closing the knob of the cylinder. Because of this process, the leakage of gas is stopped. The relay is switched to off the power supply of the house. The buzzer produces an alarm to indicate the gas leakage. Then, the user is alerted by SMS through the GSM module. They proposed their methodology that the system takes an automatic control action after the detection of 0.001% of LPG leakage. This automatic control action provides a mechanical handle for closing the valve. We are increasing the security for humans by means of a relay which will shut down the electric power to the house. Also, by using GSM, we are sending an alert message to the users and a buzzer is provided for alerting the neighbors about the leakage.

P.Meenakshi Vidya, S.Abinaya, G.Geetha Rajeswari, N.Guna, "Automatic LPG detection and hazard controlling " published in April 2014 proposed the leakage detection and real-time gas monitoring system. In this system, the gas leakage is detected and controlled by means of the exhaust fan. The level of LPG in the cylinder is also continuously monitored.

Srinivasan, Leela, Jeya bharathi, Kirthik,Rajasree; in this research paper they told about gas leakage detection and control. In this paper, the gas leakage resulting in fatal inferno has become a serious problem in households and other areas where household gas is handled and used. It alerts the subscriber through the alarm and the status display besides turning off the gas supply valve as a primary safety measure.

Hitendra Rawat, Ashish Kushwah, Khyati Asthana, Akanksha Shivhare, in the year 2014 planned a framework, they gave security issues against hoodlums, spillage, and fire mishaps. In those cases, their framework sends an SMS to the crisis number given to it B. B. Did paye, Prof. S. K. Nanda; in this paper, they talked about their research on leakage detection and review of "Automated

unified system for LPG using microcontroller and GSM module". Their paper proposed an advance and innovative approach for LPG leakage detection, prevention, and automatic booking for a refill. In advance, the system provides the automatic control of the LPG regulator also if leakage is detected the system will automatically turn off the main switch of the power supply. Hence it helps to avoid explosions and blasts.

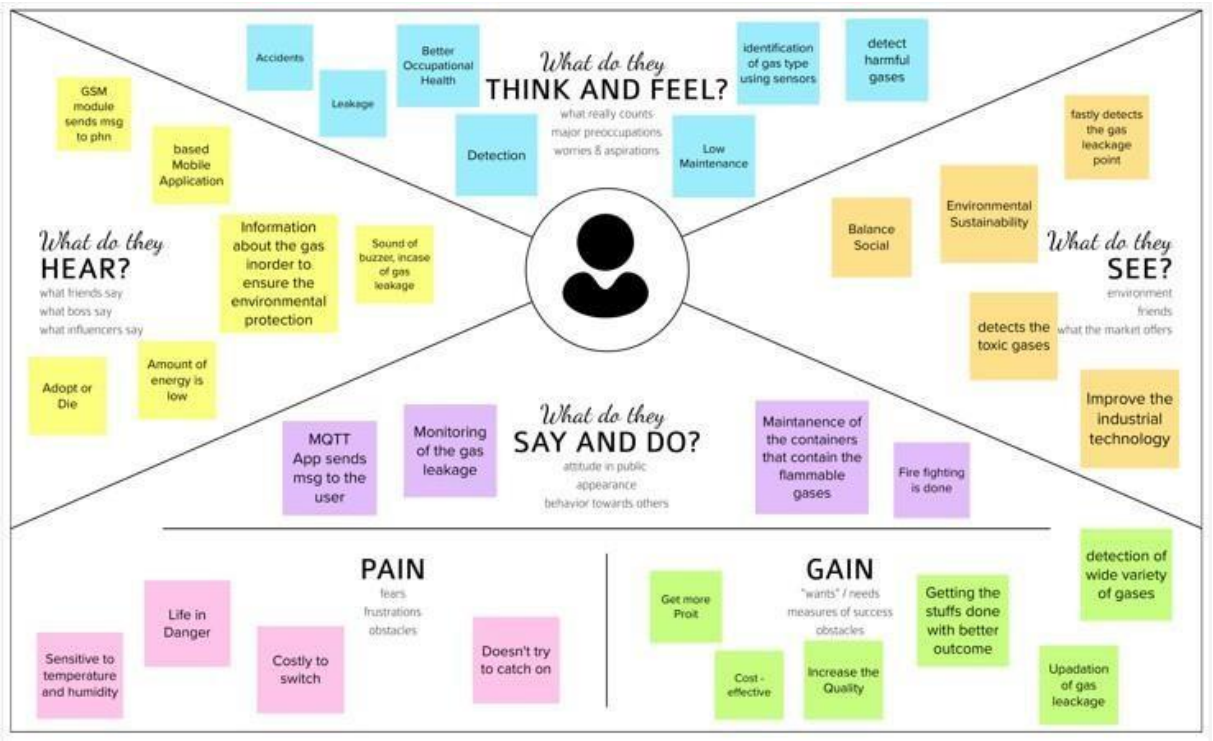
Pal-Stefan Murvaya, Ioan Sileaa, 2008, they told in their survey on gas leak detection and localization techniques various ways to detect gas leakage. They introduce some old or new techniques to detect the gas. The proposed techniques in this paper are nontechnical methods and hardware-based methods which include acoustic methods, optical methods, and active methods. In their survey they told a wide variety of leak-detecting techniques is available for gas pipelines.

2.3 Problem Statement Definition

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 have no efficient system for monitoring	High cost and Complicated process of Installing	Disappointed
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	Frustrated

3.IDEATION & PROPOSED SOLUTION

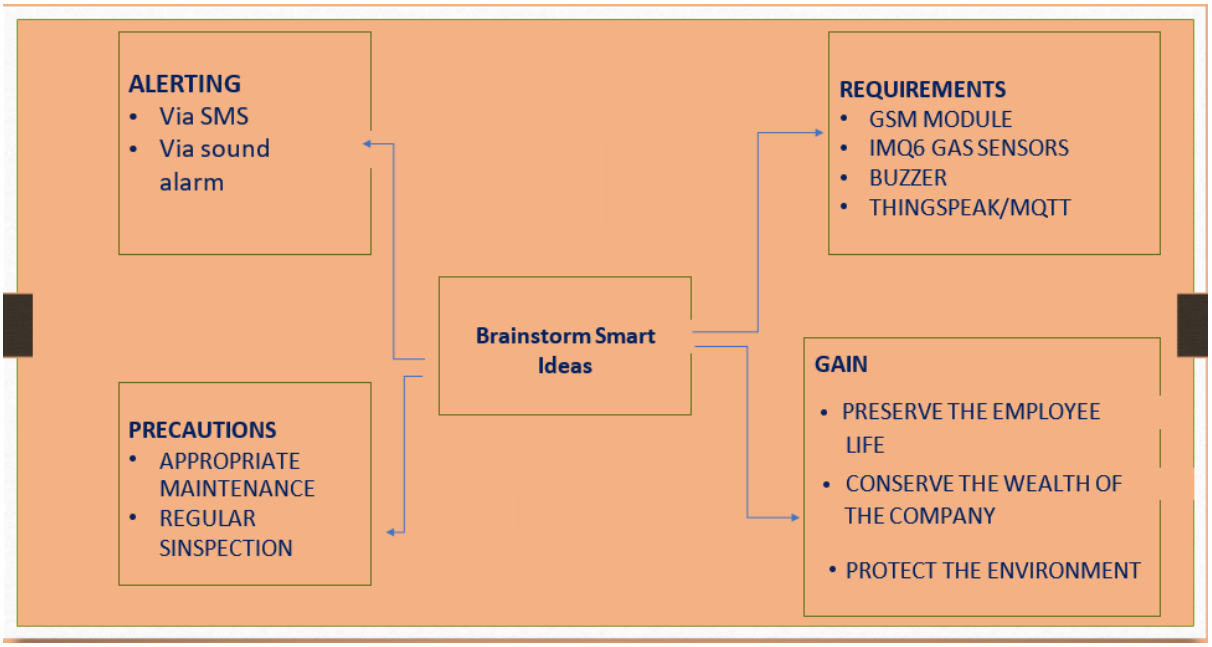
3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

The Internet of Things aims towards making life simpler by automating every small task around us. As much as IoT helps in automating tasks, the benefits of IoT can also be extended to enhancing the existing safety standards. Safety has always been an important criterion while designing a home, buildings, industries as well as cities. The increased concentration of certain gases in the atmosphere can prove to be extremely dangerous. These gases might be flammable at certain temperature and humidity conditions, toxic after exceeding the specified concentrations limits, or even a contributing factor in the air pollution of an area leading to problems such as smog and reduced visibility which can in turn cause severe accidents and have an adverse effect on the health of people. Most societies have a fire safety mechanism. But it can use after the fire exists. In order to have control over such conditions we proposed a system that uses sensors that can detect the gases such as LPG, CO2, CO, and CH4. This system will not only able to detect the leakage of gas but also alert through audible alarms. The presence of excess amounts of harmful gases in the environment then this system can notify the user. The system can notify to society admin about the condition before a mishap takes place through a message. The system consists of gas detector sensors, an Arduino board, ESP8266, and a Cloud server. One Society authority person can register the all-flat member user to our system. Society admin can add the details of per flat user such as user name, mobile number, and per-user flat

sensor details information. Society admin can configure the threshold value of each sensor. System hardware can be deployed on each flat. Sensors can sense the value per time. The system can send the values to the cloud server. The server can Check that the sensor values existed in the threshold value. If the sensor value can cross the limit the server can send the command to the hardware for buzzing the alarm. The server also sends the notification message to the user.



3.4 Proposed Solution

S. No.	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	➢ Leaks are thought to be extremely harmful because they have the potential to build up to an explosive concentration. The suggested solution is utilised to construct an effective system and an application that can watch for leaks and notify the workers.

2.	**Idea / Solution description**	➢ The gas sensors will be fitted at different locations to track gas leaks. ➢ The suggested system initiates an automatic control response upon 0.001% LPG leakage Detection. ➢ With the help of a stepper motor-driven mechanical handle, the valve can be closed automatically. ➢ By employing a relay and stepper motor in tandem to cut off the house's electric power, we are able to increase human security. We are also employing a GSM module to send an alarm message via SMS (Short Messaging Services) to the users informing them of the LPG leak, and a buzzer is given to notify the neighbours in case the customers are not there.
3.	**Benefit of this System**	➢ The key benefit of this system over the manual approach is that it completes every step automatically and responds quickly. ➢ And the buzzer will work efficiently to reduced the level of hazardous range due to the leakage.
4.	**Novelty / Uniqueness**	➢ User friendly and easy to operate ➢ Instigating the study of CCD technology for visible-range natural gas detection ➢ Buzzer will have more alerting range
5.	**Social Impact / Customer Satisfaction**	➢ It is economical ➢ Simple installation and the efficient results are guaranteed and ensured.

6.	**Business Model (Revenue Model)**	➢ Energy security is currently one of the objectives in actual practise due to the broad deployment of the urban natural gas industry. ➢ The analysis of the pressure, temperature, and flow rate of gas leakage over time under steady-state and dynamic settings was done using the gas leakage model. ➢ Because everyone can understand how to utilise the product, it is simple for them to use it correctly for their safest organisation.
7.	**Scalability of the Solution**	➢ Setting up quick communication tools with the closest fire station and other relief station to ensure the quickest reaction in the event of an accident and in the emergency situations. ➢ Even when there is a greater gas leak, the product detects precise readings and successfully warns the workers and will help the people to alert more quickley.

3.4 Problem Solution

1. CUSTOMER SEGMENT(S)

- ✓ For the gas godown owner, it is necessary to assure the safety of the workers.
- ✓ It is a great process to identify the leakage of the gas from the particular cylinder.

6. CUSTOMER CONSTRAINT(S)

- ✓ Proper maintenance of the cylinders prevents it from leakage of gases.
- ✓ High cost of the cylinder makes the customers to move afar from this technologies.
- ✓ Proper delivery of cylinders without any faults.

5. AVAILABLE SOLUTIONS

- ✓ Using sensors and technology gives better solution than manpower.
- ✓ Using of buzzer or alarms helps the nearby people to get attention and take necessary steps.
- ✓ GSM module sends the message to the fire station so that they can arrive faster

2. PROBLEMS/PAINS

- ✓ Suffering numerous losses as a result of gas leaks.
- ✓ Not having a suitable mechanism in place to monitor or control the leak.
- ✓ Having significant financial difficulties while purchasing and implementing a monitoring and control system.

9. PROBLEM ROOT CAUSE

- ✓ Can cause high risk to the lives of the workers.
- ✓ If sensor doesn't work properly there occurs a major loss to the society.
- ✓ Proper information must be sent to the fire station through GSM module, and workers must be aware of every possible attacks.

7. BEHAVIOR

- ✓ High risks are associated with using human resources to monitor leaks, and if highly hazardous gas is released, there is a probability that inherited health problems may also result.
- ✓ Determines the gas characteristics and locates the leak area and solve the issue.

10.

3. TRIGGERS

- ✓ Organisations must bring some of the mandatory pre-cautionary measures when the gas smell is sensed.

4.EMOTIONS:BEFORE/ AFTER

- ✓ They felt guilty because their products' reputation suffered as a result of the significant losses brought on by leaks.
- ✓ The user feels duped and deceived before taking the action.
- ✓ After the issue is fixed, the user gains more assurance and feels more comfortable since they can see the developer's sincerity.

YOUR SOLUTION

- ✓ Create a reliable system and application that can track and notify the workers.
- ✓ Low-cost, easily accessible, and repairable IoT-based device.
- ✓ The device needs to strengthen the network.
- ✓ Depending on the surroundings, a gadget can be produced to a variety of standards.

8. CHANNELS OF BEHAVIOUR

ONLINE:

- ✓ promoting on social networks. through the aid of social media influencers and entrepreneurs.
- ✓ Check the sensors' status to be alerted if there are any gas leaks.

OFFLINE:

- ✓ By adverts in newspapers.
- ✓ Ensure that sensors have a proper network and power supply to prevent physical harm.
- ✓ Dispute letters

4. REQUIREMENT ANALYSIS

4.1 Functional Requirement

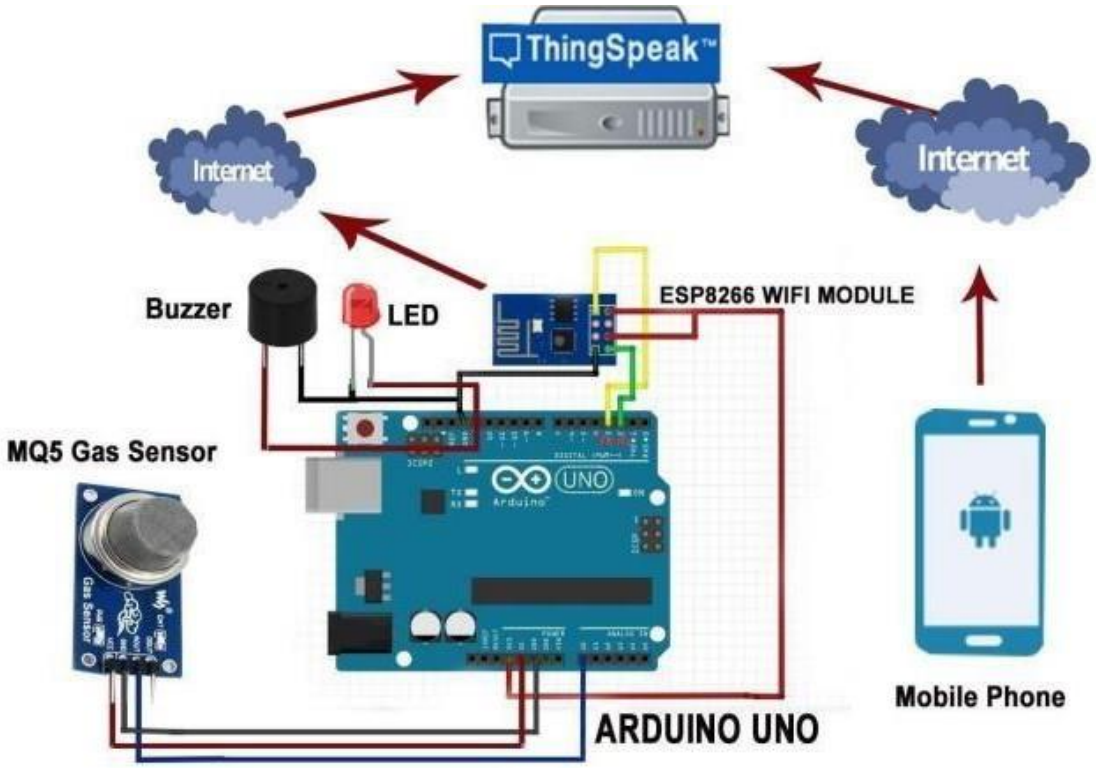
The system's primary component, the Arduino UNO, carries out the following functions. The output signal of the sensor, which serves as input to Arduino, performs signal conditioning. The findings of the detection are shown on LCD. warns individuals of danger in the home, the office, and the factory. There is buzzer activity and a beep (siren) sound. Additionally, using a GSM modem, send alert SMS to the plant manager whose number is saved on a SIM card. The SMS you receive is based on whether there is a gas leak in the sensor's field of detection.

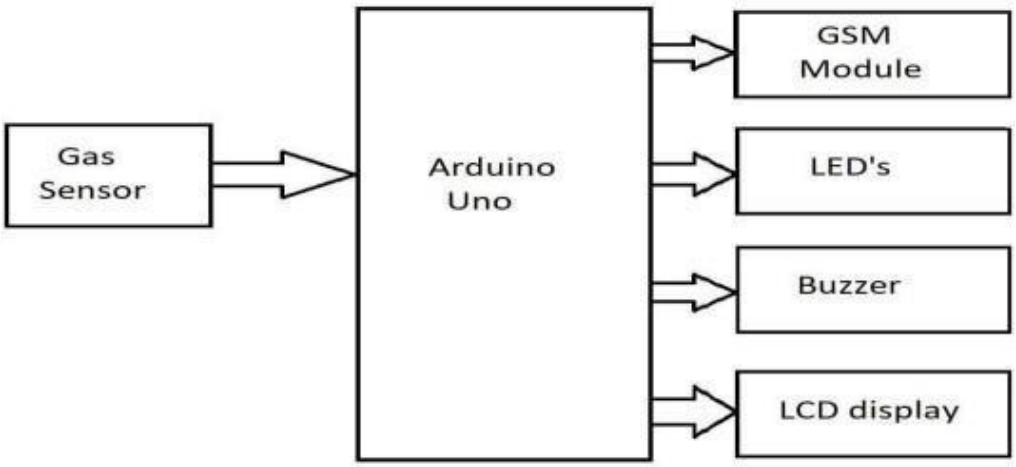
4.2 Non-Functional Requirement

- Data Collection:
    - We will collect the required data using a variety of sensors.
- Data Store:
    - The necessary and cloud databases are used to store the collected data.
- Data analysis:
    - Store data must be examined in order to raise alarms as needed.
- Data monitoring:
    - The user must be shown the collected data for monitoring.

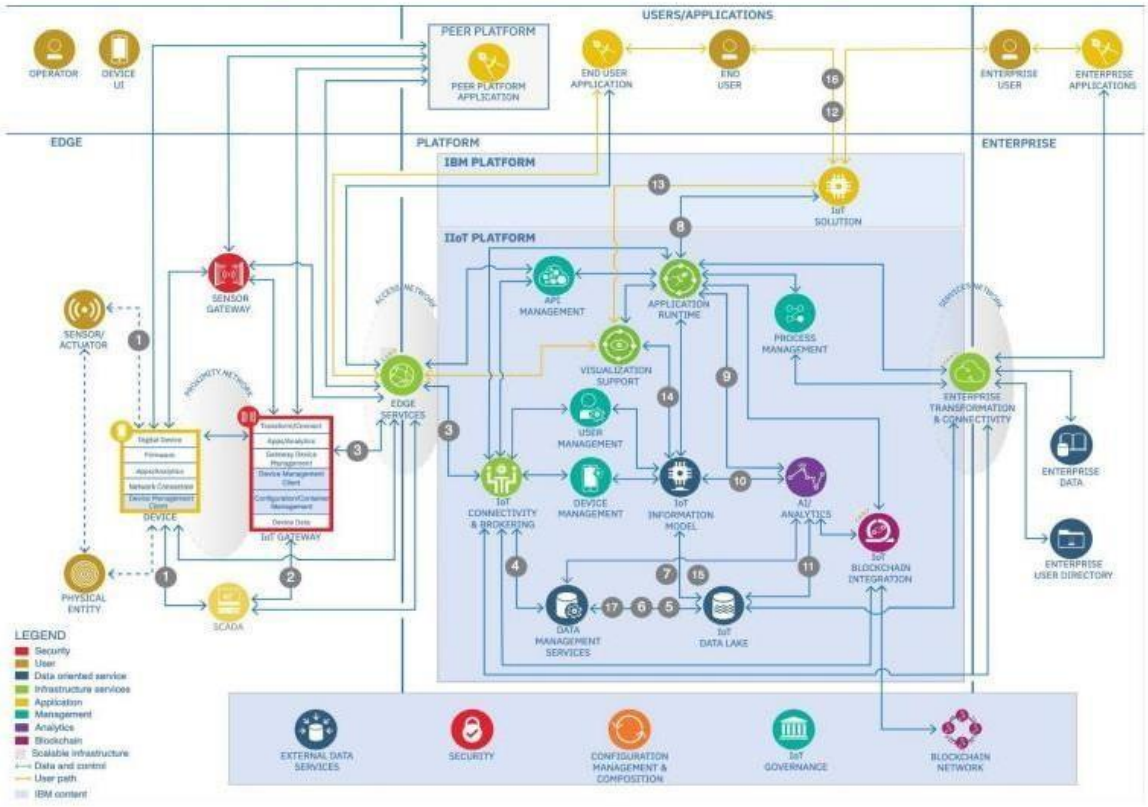
5. PROJECT DESIGN

5.1 Data Flow Diagram





5.2 Solution & Technical Architecture



5.3 User Stories

The system might be viewed as a modest attempt to link up the principal gas detection techniques now in use with a mobile platform coupled with IoT

platforms. Within a 1 m radius of the rover, gases are detected, and data from the sensor output is continually sent to a nearby server. Stray gases are also identified by sensors because of their subpar precision, which introduces some inaccuracy into their outputs, particularly in the case of methane. Testing the completed gear is additionally hampered by the availability and storage of harmful gases like hydrogen sulphide. The complexity of system maintenance and material selection for the system in the event of corrosive gases is decreased because the system runs outside the pipeline. The technology can only be utilised as a major indicator of leakage inside a plant at this point.

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 IS

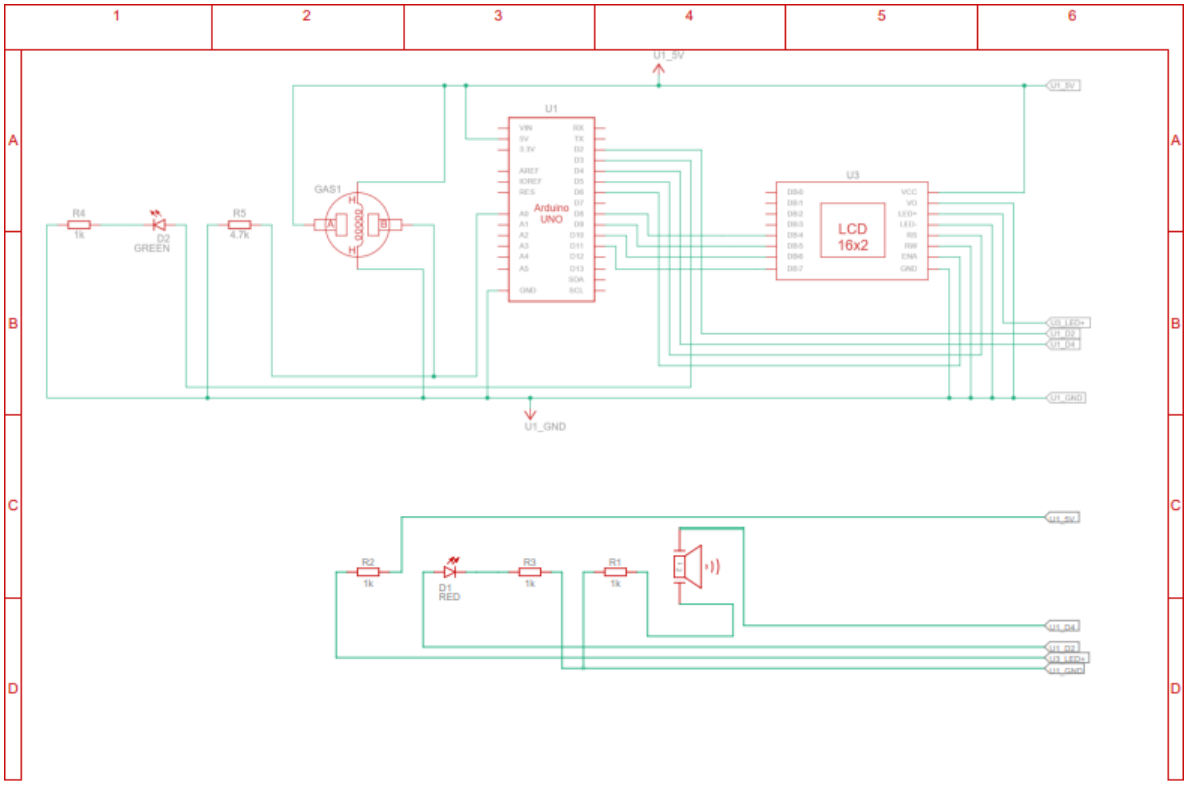
6.2 Sprint Delivery Schedule

- 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


1
2
3
4
5
6
A
B
C
D
U1_5V
U1
Arduino
UNO
U3
LCD
16x2
GAS1
R4
1k
D2
GREEN
R5
4.7k
U1_GND
R2
1k
D1
RED
R3
1k
R1
1k
Made with Tinkercad®
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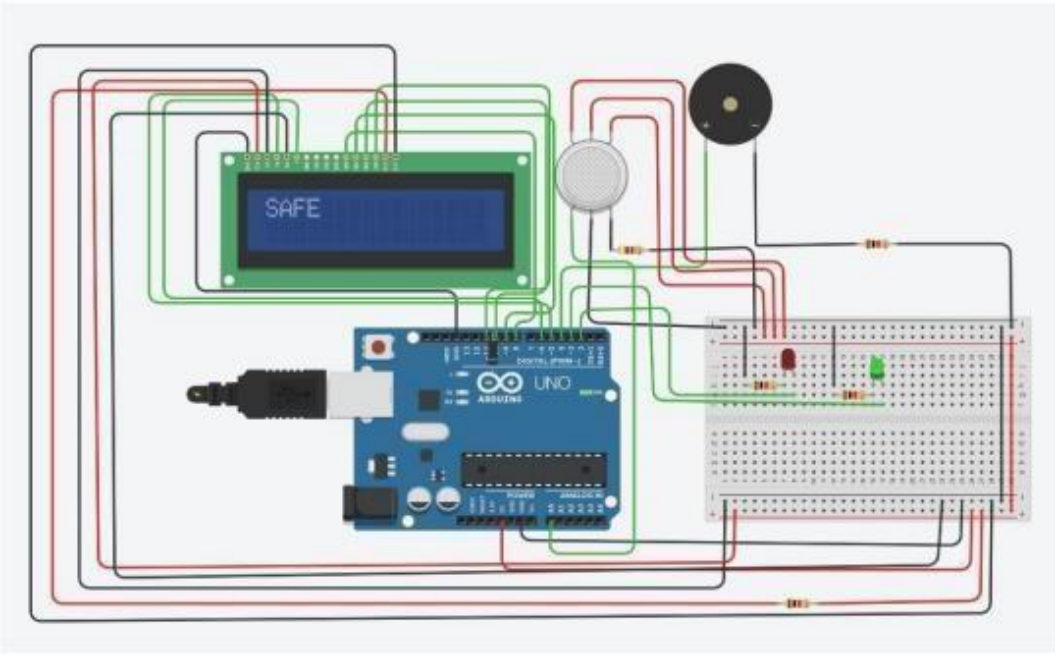
SAFE
UNO

7.2 Components Used

The design of a sensor-based automatic gas leakage detector with an alert and control system. The components are

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 (16x2)	1

8. CONCLUSION

One can draw the conclusion from this project's performance that the project system's detection of LPG gas leakage is remarkable. Useful for both domestic and professional needs. We can use this technology to save lives in risky situations. The GSM module indicates an alert. Gases as CO2, oxygen, and propane are detected by a sensor node. Power usage and transmission range estimates are made. The sensor was constructed using straightforward techniques and an Arduino UNO Micro controller.

9. FUTURE SCOPE

We suggest utilising a MQ6 gas detection sensor to build the system, connecting it to an Arduino Uno microcontroller and LCD display.
The gas sensor in our system is used to find any gas leaks. As soon as it detects a gas leak, the gas sensor sends a signal to the microcontroller. This signal is processed by the microcontroller, and an alert message is then shown to the user on the LCD.

10. APPENDIX

Source Code:

```
#include 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(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);
    }
}
```