Project Report Format

1. INTRODUCTION

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 appliances 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.

1.1 Project Overview

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 thekey driving force for the market over the coming years.

1.2 Purpose

Smoke and gas leakage detectors are very useful in detecting smoke or fire in buildings, and so are the important safety parameters in order to prevent disasters. Bursting cylinders and accidental fires have caused lots of harm to the economies in the past. This circuit triggers the alert system when smoke or gas leakage is detected. The circuit mainly uses the **MQ135 Smoke/Gas sensor and Arduino** to detect and smoke and gas leak. This **MQ135 gas sensor** is sensible to LPG, Alcohol, and Methane etc.It detects the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. The sensor has excellent sensitivity combined with the quick response time. The sensor can also sense iso-butane, propane, LNG, and cigarette smoke. If the LPG sensor senses any gas

leakage from storage the output of this sensor goes low. This low signal is monitored by the **microcontroller** and sends the signal to **GSM module** to send messages as “Gas Leakage” to a mobile number written in code.

2. LITERATURE SURVEY

A system was designed to identify and measure methane gas in the zones of flammable gas stockpile sites. The device measures the air and water quality, including every parameter that can have deviation as the result of gas leakage in the water or air. The sensors measure the amount of CH4 and CO2 gas in the air while the temperature, pH, and electrical conductivity of the water are monitored. The device is controlled by an Arduino UNO microcontroller that transmits measured data to the database on Raspberry Pi 3. Different advancements in pipeline leakage detection were put forward. This includes acoustic emission, optic fiber sensor, ground penetrating radar, Vapour sampling and infrared thermography. A system with sensors are connected to arduino for data collection and it uses LabVIEW as the GUI (graphical user interface). A detailed sensor list for flammable toxic and combustible gases and their possible advantages and disadvantages has been compared. One such example is the SB-95 sensor, which detects sequentially the variation on the methane and carbon monoxide gas concentration and modifies its resistance accordingly. The variation in the filament resistivity is transmitted as a voltage variation on the load resistor. At the same time, metal oxide sensors have a long response time and even longer recovery time. These sensors need to extract the gas by making a hole into the pipe for the gas concentration measurement. Making holes can cause danger such as leakage or explosion of the toxic gas.

2.1 Existing problem

Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for 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 the people about the leakage. Therefore we have used the IoT technology to make a Gas Leakage Detector for society which having Smart Alerting techniques involving sending text message to the concerned authority and an ability performing data analytics on sensor readings. Our main aim is to proposing the gas leakage system for society where each flat have gas leakage detector hardware.

2.2 References

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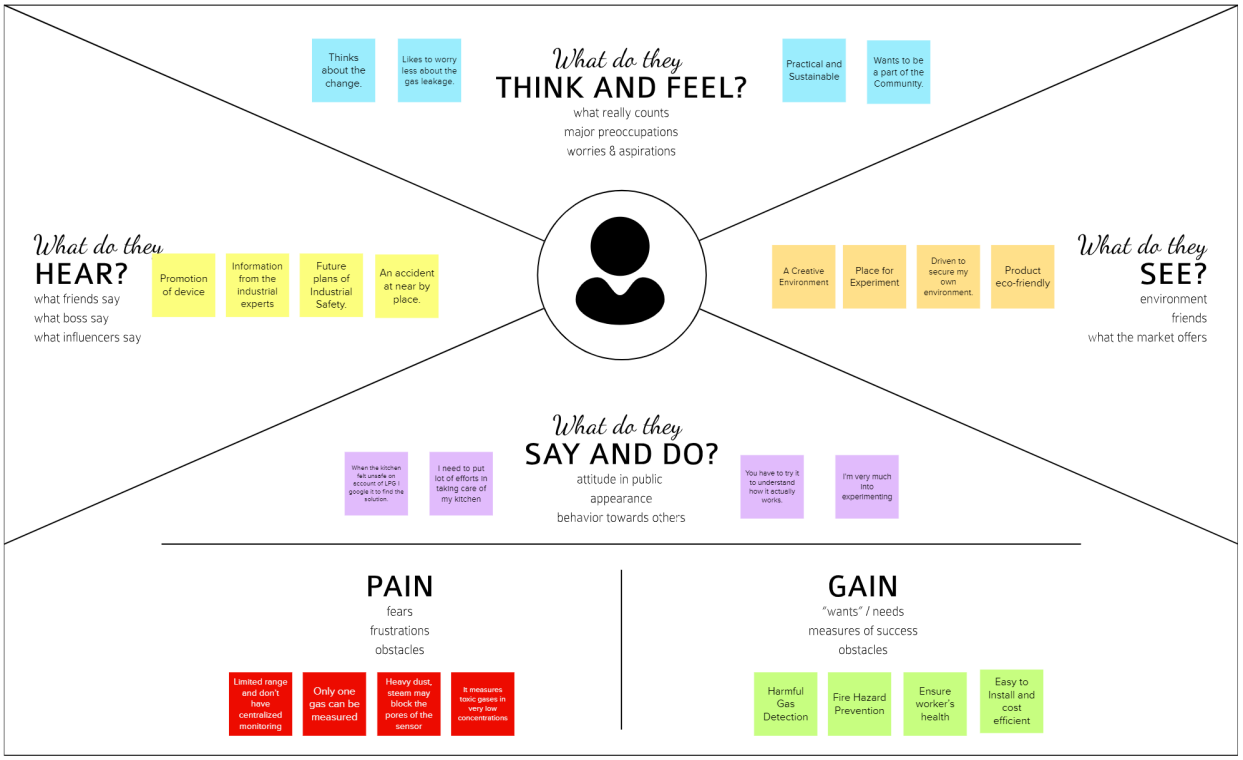
2.3 Problem Statement Definition

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. Few of the major incidents that took place due to gas leakage include the Bhopal Disaster and the Vizag Gas leak. The Bhopal disaster is known to be the worst industrial accident ever. Approximately 45 tons of Methyl Isocyanate was leaked from this insecticide plant. Methyl Isocyanate is an organic compound and a chemical that could come from the carbamate pesticides. This colorless, poisonous and flammable liquid is something that human beings have to be away from. Vizag Gas leak was a resultant of the escape of styrene that were unattended for a long period. This colorless oily liquid can spread in fumes. So, a detector must be made in such a way that could detect any kind of gas, fume, leak, smoke etc. However harmful and dangerous it can be, the detector could be attached with certain parameters that could help toprevent the issue.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for enhancing the existing safety standards. Safety has always been an important criterion while designing 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 also have adverse effect on the health of people. Most of the societies have fire safety mechanism. But it can use after the fire exists. In order to have a control over such conditions we proposed system that uses sensors which is capable of detecting the gases such as LPG, CO2, CO and CH4. 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.

3.3 Proposed Solution

The following information is the proposed solution of our project. S.No. Parameter Description

1. Problem Statement (Problem to be solved) Gas leakage is a major problem with industrial sector and gas powered vehicles like CNG (compressed natural gas) buses, cars. 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 also have adverse effect on the health of people.

2. Idea / Solution description We have used the IoT technology to make a Gas Leakage Detector for society which having Smart Alerting techniques involving sending text message to the concerned authority and an ability performing data analytics on sensor readings. Our main aim is to proposing the gas leakage system for society where each flat have gas leakage detector hardware. This will detect the harmful gases in environment and alerting to the society member through alarm and sending notification.Most of the societies have fire safety mechanism. But it can use after the

fire exists. In order to have a control over such conditions we proposed system that uses sensors which is capable of detecting the gases such as LPG, CO2, CO and CH4. 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.It also monitors the amount of gas leaked in the atmosphere.

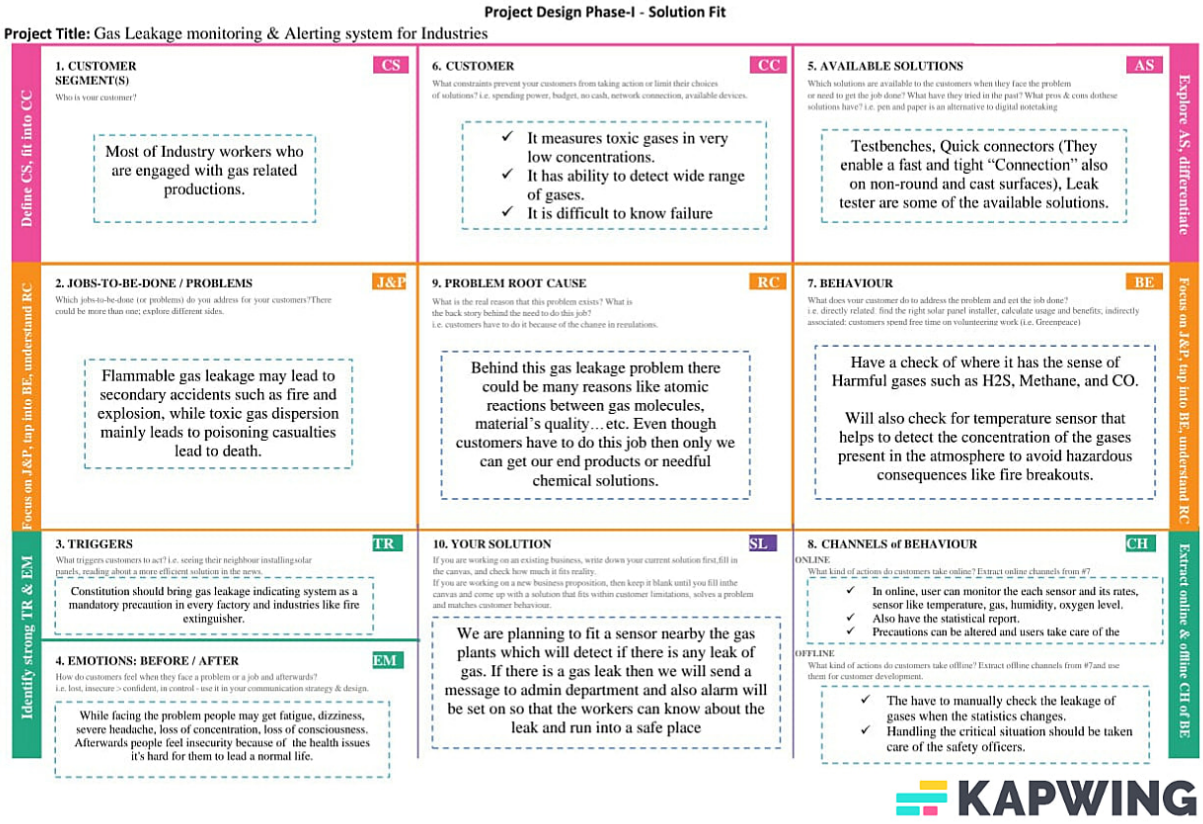
3. Novelty / Uniqueness The novelty of this system is this monitors how much amount of gas is leaked in the atmosphere/ in the industry and it'll send message directly to the admin once it detect the leakage .

4. Social Impact / Customer Satisfaction We all know about the bhopal tragedy, this system will be very much useful for the industries to detect the leakage and the amount of gas leaked , this system will create a great impact in the society as it is easier to find the how much gas leaked and it'll be a necessity to install this system in the industries.

5. Business Model (Revenue Model) IoT technology is developing rapidly as there are various gas sensors available in the market, the model can be created according to the gas used in the environment and can implement model with the sensor which is related to the gas. Based on the usage of gas type the gas sensors should be used in that model.

6. Scalability of the Solution 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 in environment and hence nullify any major or minor hazard being caused due to them. We have used the IOT technology to make a Gas Leakage Detector for society which having Smart Alerting techniques involving sending text message to the concerned authority and an ability performing data analytics on sensor. This system will be able to detect the gas in environment using the gas sensors. This will prevent from the major harmful problem.

3.4 Problem Solution fit



4. <u>REQUIREMENT ANALYSIS</u>

4.1 Functional Requirements:

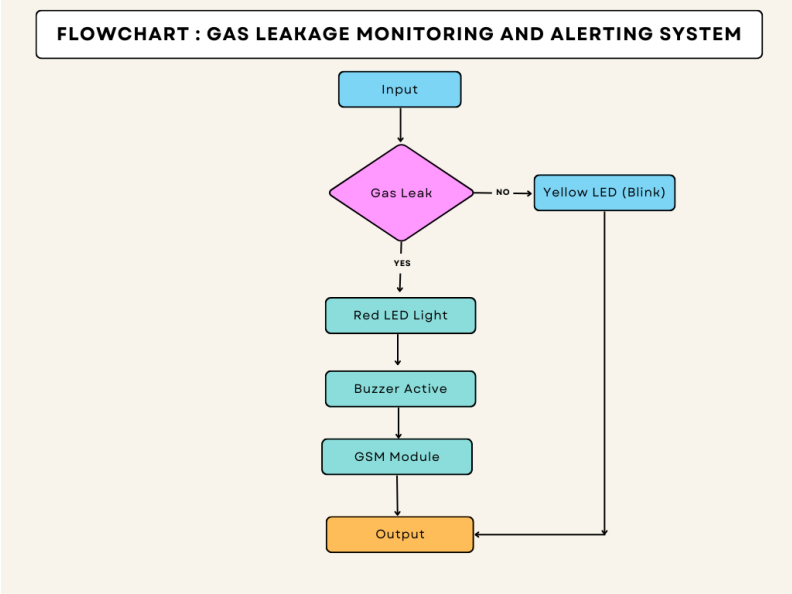
- ➤ To ensure the system works well, it has to support the customer requirements.
- ➤ The user shall be able to receive warning message as quickly as possible.

4.2 Non-functional requirements:

Non-functional requirements "refer to behavioural properties that the system must have, such as performance and usability".

5. PROJECT DESIGN

5.1 Data Flow Diagrams



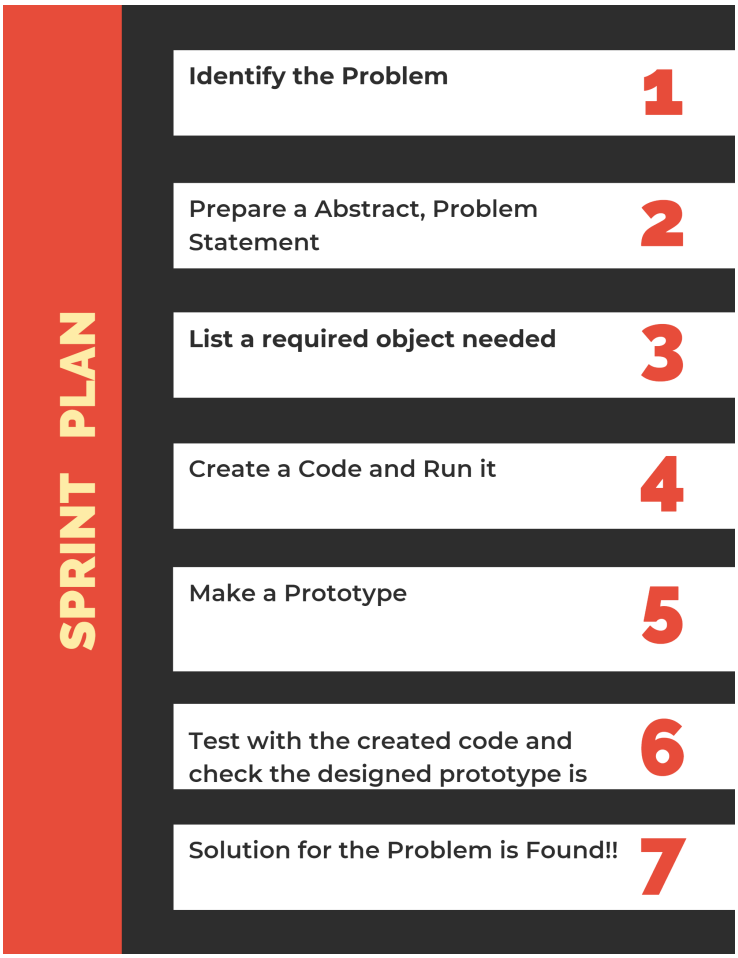
5.2 Solution & Technical Architecture

5.3 User Stories

Customer Journey Map

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
OBJECTIVES	Write a goal or activity	Gas leakage detection systems protect personnel and the environment from potentially hazardous exposure to gases.	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.	Gas Leak Detection System Gas leak detection is the process of identifying potentially hazardous gas leaks by sensors. These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected.	An alarm management system represents the series of actions a system performs in an event of gas leakage.
NEEDS	Write a need you want to meet	Fire hazard prevention	Harmful gas detection	Oxygen level measurement	Prompt gas leak alerts
FEELINGS	Write an emotion you expect the customer to have	Happy about this solution	Embrassed on the solution and promoted the good wordes towords this project	Happy	Encouraging toeords this project and giving good feedbacks.
BARRIERS	Write a potential challenge to your objective	Higher Officials	commercial companies	The gasses are toxic in nature, resulting in human unconsciousness and even death if consumed in larger quantities.	Moreover, gaseous blasts are another disaster that everyone - working in a factory or at home - would want to avoid at all costs!

6. PROJECT PLANNING & SCHEDULING



7. CODING & SOLUTIONING

7.1 Feature 1:

The first feature in our system is to monitor the surrounding to check whether the gas leakage is detected or not.

```
  void loop()
{

data = analogRead(gasValue);
Serial.print("Gas Level: ");
Serial.println(data);
lcd.print ("Gas Scan is ON");
lcd.setCursor(0,1);
lcd.print("Gas Level: ");
lcd.print(data);
delay(1000);
}
```

7.2 Feature 2:

The second feature in our system is to give alertness to the people in the surrounding of the gas leakage.

```
 if ( data > 90) //
{
  digitalWrite(buzzer, HIGH);
  digitalWrite(R_led, HIGH); // Turn LED on.
  digitalWrite(G_led, LOW); // Turn LED off.
SendMessage();
Serial.print("Gas detect alarm");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Gas Level Exceed");
delay(1000);
}
else
{
  digitalWrite(buzzer, LOW);
```

```
  digitalWrite(R_led, LOW); // Turn LED off.
  digitalWrite(G_led, HIGH); // Turn LED on.
Serial.print("Gas Level Low");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Gas Level Normal");
delay(1000);
}
```

8. TESTING

8.1 Test Cases:

The invention discloses an oil and gas leakage detection simulation test system which mainly comprises a gas-liquid storage tank, a buffer tank, a control valve unit, a pump unit, an inlet sensor unit, an outlet sensor unit, a central processor unit, a memory unit, a security valve, a plurality of conveying tubes, and leakage valve units. The system is characterized in that three leakage valve units are distributed at equal intervals along the flowing direction of a fluid pipeline; the openings of the leakage valve units can be adjusted according to scales; gears are distinguished at intervals according to the openings of 10-100%, so that the openings of leakage valves are controlled to as to simulate different leakage situations. The system also comprises the central processor unit and the memory, wherein the sensor unit and the leakage valve units are connected with the processor unit through signal control lines, then the sensor unit transmits detection signals to the processor unit, and meanwhile, the processor unit controls and regulates the leakage valve units.

Analog data	Condition (Output)			explanation
	Red Led	Fan	SMS	
<=199	Off	Off	There is no message sended	Secure
>=200 &<=400	On	On	"Gas content increases, Warning !!!"	Standby
>=400	On	On	"Indicated Gas Leaks !! Danger !! "	Danger

8.2 User Acceptance Testing:

"The overriding principle is: Test it like you use it,". If the component or system will be operated pressurized, leak test it pressurized. If it is intended to operate under vacuum, test it that way.If you pressurize a vacuum system or pull a vacuum in a system intended to operate under pressure, this may induce leaks that would not occur under normal operating conditions and you can get incorrect results.

Another factor in "test it like you use it" is to test at the system or component's operating pressure, if possible. "Sometimes that can be problematic,". Even if testing needs to be done at a lower pressure, "it might simply be a matter of tightening up your specification and looking for a smaller leak."

In some applications, it is clearly necessary to measure the size of leaks, how much gas is flowing. In other applications, their manufacturing process simply calls for a determination of excessive leakage, a pass/fail approach. Pass/fail testing likely takes less time than measurement does.

Another consideration in developing a leak test strategy is the time needed for the whole testing procedure: test cycle, response and clean-up. Instrumentation, method and test configuration depend on what data are required and how much time is available for testing.

9. RESULT

9.1 Performance Metrics:

Reasons to do leak detection generally include dealing positively with accidents, discouraging theft, and mitigating other issues a risk analysis may identify. There is generally one more motivation for effective safety-oriented design – meeting the formal requirements that apply to your situation.
In the U.S., the federal government regulates pipelines via Code of Federal Regulations (CFR) 49: Transportation, Parts 178 to 199. Many states, and even smaller political subdivisions, also regulate pipeline operations. Sometimes these regulations overlap, sometimes they flow from completely different points of view. In one offshore project I recall, 22 agencies had interest in regulating features of the project. Dealing with this became a major and often-confusing task, brought to a good outcome by major effort of some special people.

This technique has been tested by leak of gas almost about sensors,
MQ2 gas sensor sends the signal to the Arduino UNO after detecting the gas leakage. Arduino to other externally
connected device such as LCD, buzzer and GSM send vigorous signals. SMS is sent by GSM module to the provided mobile
number as a result. In practice, results for are noticed by the people surrounding by the area are displayed in the LCD
and buzzer sound indicate the danger to the people by making beep sound.

Performance Measure	Formula
Accuracy (percentage of correct classification)	$\frac{TP+TN}{P+N} \times 100$
Error rate (percentage of incorrect classification)	$\frac{FP+FN}{P+N} \times 100$
Sensitivity to fault	$\frac{TP}{P} \times 100$
Specificity (true normal condition detection)	$\frac{TN}{N} \times 100$
False alarm rate	$1 - \frac{TN}{N} \times 100$
Precision (true fault detection)	$\frac{TP}{TP+FP} \times 100$
F-score	$\frac{2 \times precision \times recall}{precision + recall} \times$

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

• Because of the very narrow 0.3 nm line width of the laser emission, there is no interference from other gases.

• Response times are in the order 1 second. This allow for fine resolution/control when making process measurements.

• The intense laser light concentrated at the absorption wavelength enables path lengths up to 1 km to be measured.

• An average measurement is taken over the total path so that a narrow plume of gas has less chance of escaping detection.

• The range of measurement can be up to 4 orders of magnitude, enabling

concentrations of 0.1 ppm to 1000 ppm to be measured.

DISADVANTAGES:

• Only 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.

11. CONCLUSION

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the GSM module. 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.

12. FUTURE SCOPE

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 to a site. It can be monitored, and preventive measures can be taken to avoid any disaster.

Suppose corrective steps are taken promptly after it is reported over the IoT devices. In that case, that can help save the loss of lives, alleviate any mishaps from happening, and cut down on business expenses.

The gas leakage detection system can be optimized for detecting toxic gasses along with upgrading them with smoke and fire detectors to identify the presence of smoke and fire. Ensuring worker safety is important but making using of the right technology is even more vital.

13. APPENDIX

Source Code:

```
#include
<LiquidCrystal.h>
```

```
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);
  }

}
```

GitHub & Project Demo Link:

- GitHub Link - IBM-EPBL/IBM-Project-33701-1660225642
- Demo Link - https://www.tinkercad.com/things/dSZEmTgkP4C