PNT2022TMID31885

Project Report
GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES

1. INTRODUCTION

1.1 Project Overview

Gas leakage leads to various accidents resulting in both material loss and human injuries. The risk of explosion, firing, suffocation are based on their physical properties such toxicity, flammability, etc. The number of deaths due to explosion of gas cylinders has been increasing in recent years. The reason for such explosion is due to substandard cylinders, old valves, worn out regulators and lack of awareness in handling gas cylinders. The LPG or propane is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and meager harm to the environment. Natural gas is another widely used fuel in homes. Both gases burns to produce clean energy, however there is aserious problem of their leakage. Being heavier than air, these gases do not disperse easily. It may lead to suffocation when inhaled and may lead to explosion [1]. Due to the explosion of LPG, the number of deaths has been increased in recent years. To avoid this problem there is a need for a system to detect the leakage of LPG. Gas leak detection is the process of identifying potentially

hazardous gas leaks by means of various sensors [2]. Several designs of LPG detection and alert system have been proposed in the literature. Apeh et al. designed kitchen gas leakage detection and automatic gas shut off system [3]. T.Soundaryaet al. presented the cylinder LPG gas leakage detection system [4]. Wireless and GSM technology [5] based gas detectors have also been proposed. This paper presents a LPG leakage detection and alert system to avoid fire accidents and to provide house safety. The rest of the paper is organized as follows. Section 2 presents the LPG leakage detection and alert system and Section 3 concludes the paper.

1.2 Purpose

There are lots of devices to avoid accidents of gas leakage. Like smoke detectors, fire extinguishers etc. These devices can prevent fire exposure only, they can't protect people from getting injured. In past, accidents like Bhopal gas tragedy, On December 1984, more than 3,000 people were killed when methyl isocyanate leaked out. Nagaram, Andhra Pradesh, On June 2014, the pipe was rusty which led to a gas leak, blast in Gas Authority of India Limited's plant, killed 29 people etc. So to protect people from this hazardous disaster need to upgrade the technologies. Major damage can cause, if gas outflow is not detected early. MQ6 sensor is a device which will not only detect also it will prevent accident by turning the main supply off. It has a high sensitivity and fast response time. This detector contains a sensitive filament made from SnO2. This filament keeps electrical conductivity lower in the presence of clean air. The filament's conductivity increases when a combustible gas commenced like LPG. This sensor can simply interfaced with arduino. So its a Arduino based gas leakage detection, in which device can get connected to WIFI using ESP8266 WiFi module, the maximum and mininum variable will be set consequently. After detection the alert SMS will be sent to the owner.

2. LITERATURE SURVEY

2.1 Existing problem

The objectives among others if the design is implemented
are:
i. To prevent loss of lives and properties when gas leakages occur
ii. To enable prompt action by the premises owner and safety organization towards avert problems that
may be associated with gas leakages.
iii. To enable people around the gas leakages premises take action to prevent damages escalation

2.2 References

[1.] Punch newspaper 2021, Panic as gas leakage occurs in Ikeja. Available at https://punchng.com/breaking-panic-as-gas-leakage-occurs-in-ikeja retrived January 17, 2021.
[2.] A., L. (2017). Wireless gas leak detection improves employee protection, environs, and production

2.3 Problem Statement Definition

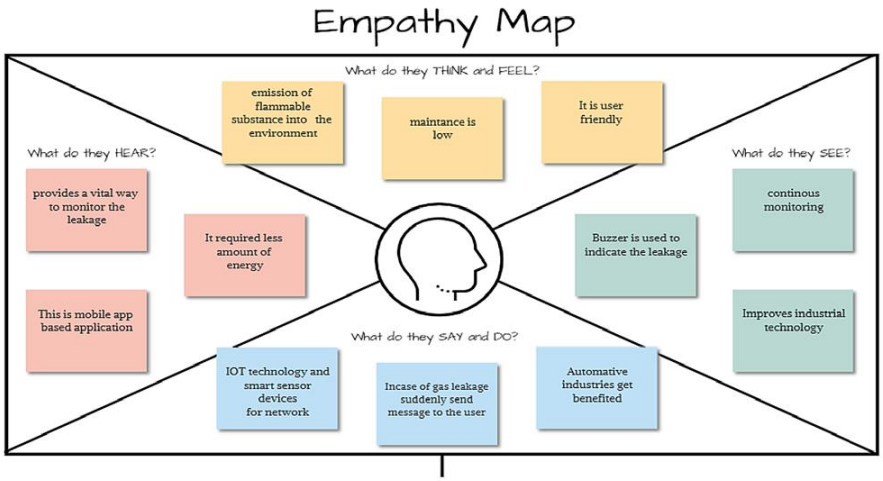
Liquid Petroleum Gas (LPG) is a highly flammable chemical that consists of mixture of propane and butane. LPG is used for cooking at home, restaurant, and certain use for industry. They have certain weaknesses that make the gas leakage occur. The leakage of gases only can be detected by human nearby and if there are no human nearby, it cannot be detected. But sometimes it cannot be detected by human that has a low sense of smell. Thus, this system will help to detect

the presence of gas leakage. Furthermore, gas leakage can cause fire that will lead to serious injury or death and it also can destroy human properties. This system was developed by using IoT to give real-time response to the user and the nearest fire station

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

Empathy Map on gas leakage monitoring and alerting system



3.2 Ideation & Brainstorming

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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 flathave gas leakage detector hardware. This will detect the harmful gases in environment and alertingto the society member through alarm and sending notification.

Reference : https://www.mdpi.com/2673-4591/2/1/28/pdf

3.3 Proposed Solution

S.No.	Parameter	Description

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1.	Problem Statement (Problem to be solved)	Workers who are engaged with a busy industries packed with gas either harmfulor harmless needs awayto 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 crisesrather than worrying about monitoringor leakage of gas, this will indeed reduce themanpower of that industry and create a peaceful environment.
2.	Idea / Solution description	Workers who are engaged with a busy industries packed with gas either harmfulor harmless needs awayto 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 crisesrather than worrying about monitoringor 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 detectingsome particular gases where some others failed toalert the main department and other solutions are with somedelays. Our solution not only notify the industry person but also notify the fire fighters so that can take control over the situation and our solution willalert the workerseven there is a small leak of gases.
4.	Social Impact / Customer Satisfaction	Our solution will be very helpful for the workers andthe society which is associated or located nearby the industries. Our solution will prevent great disasters like Bhopal Gas Tragedy so that so many livescan be saved.Through this project the workersmental pressure will bereduced so that they can concentrate on other works or by relaxing them.

5.	Business Model (RevenueModel)	The main target of our solution is Industries so wehave planned to visit industries and explain them about the benefitsof our products. So that they can aware of the importance of this solution and use it.
6.	Scalability of the Solution	Our solution can be integrated for further future use because the solution we have provided will be layon the basicor initial stage of any upgraded version.

3.4 Problem Solution fit

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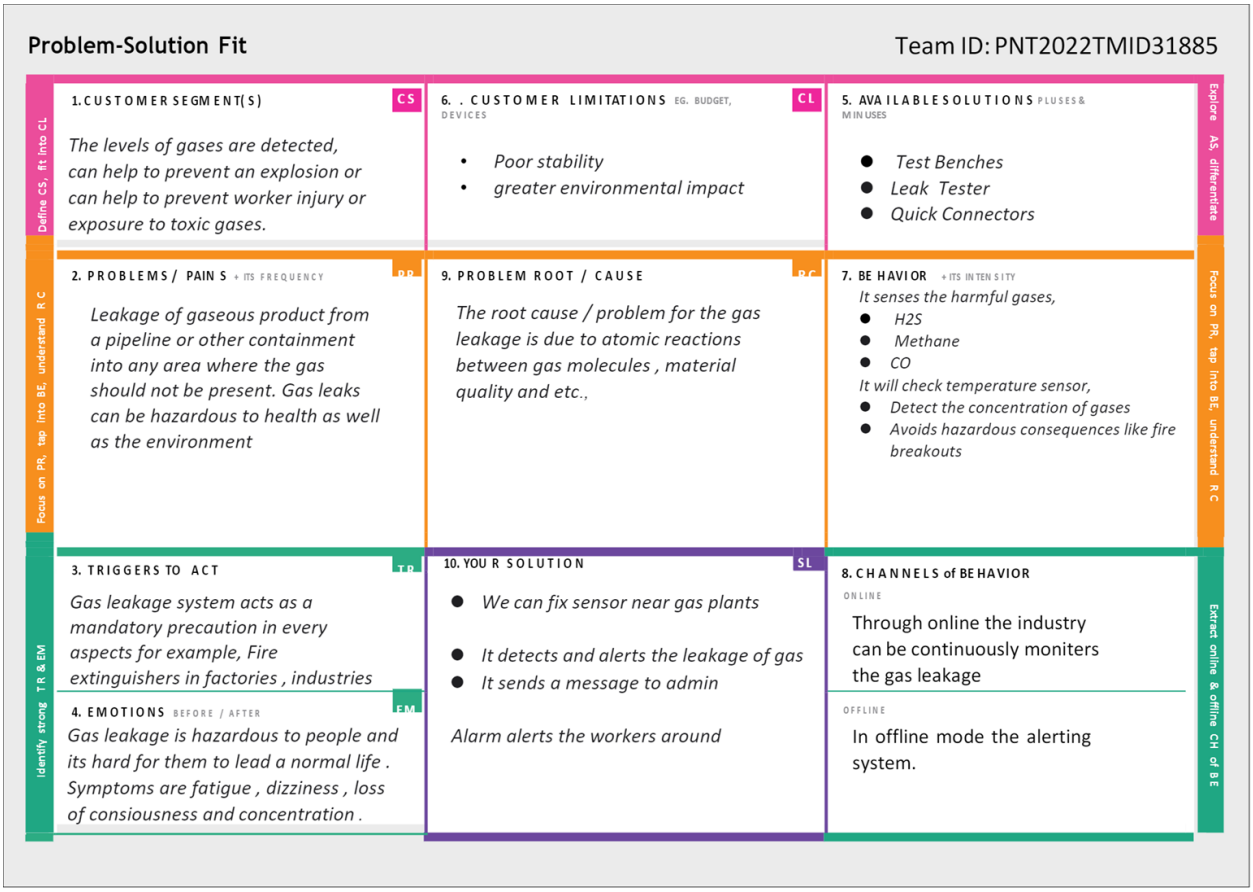


4. REQUIREMENT ANALYSIS

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 convenience	Through messagenotification we caneasily get dataof gas leveland in caseof gas leakage, it can directly send notification to nearbyhospitals and policestation
FR-2	User visibility	Gas level can be monitored by users if there is any leakage andthey will be receiving alertnotification.
FR-3	User reception	The notification for the gas level and leakage can be sendthrough messages.
FR-4	User understanding	User can monitor the level of gas with help of the data. If there is an increase in gas levelthen the alertswill be given
FR-5	User performance	When the user getsnotified ,they couldturn on thewater sprinkler or exhaust fan.

4.2 Non-Functional requirements

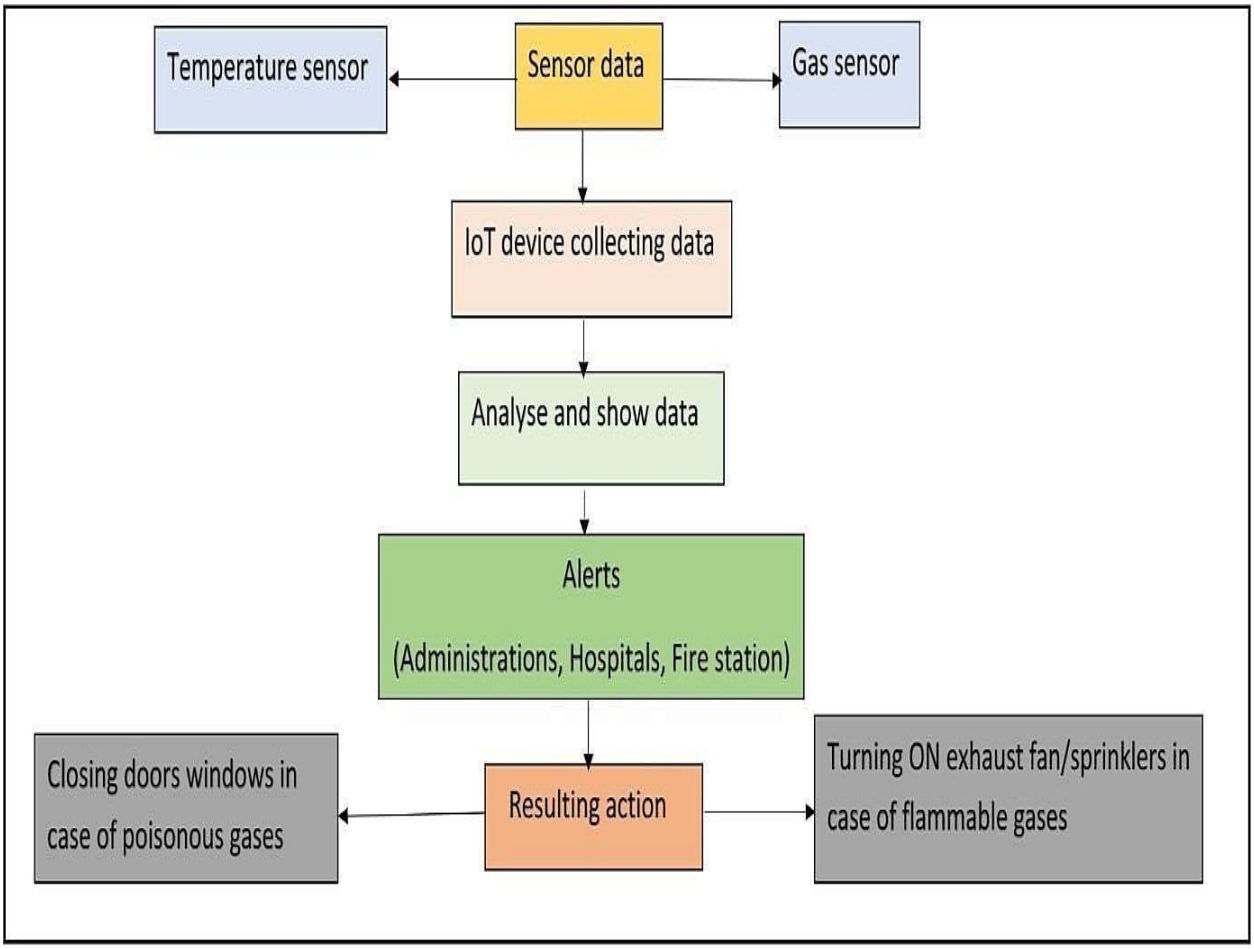
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It updates data periodically and protects theworkers in industries.

NFR-2	Security	In case of emergency alerts, industrial properties and human beingsare protected fromfire accidents.
NFR-3	Reliability	It will provide mostaccurate information and have Capacity to recognize the hazardous gas which istrue or not.
NFR-4	Performance	During fire, water sprinklers and exhaust fansareused .
NFR-5	Availability	Itcan be accessed both day and night.
NFR-6	Scalability	Once the sensor got fails it can be easily replaced.

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution &Technical Architecture

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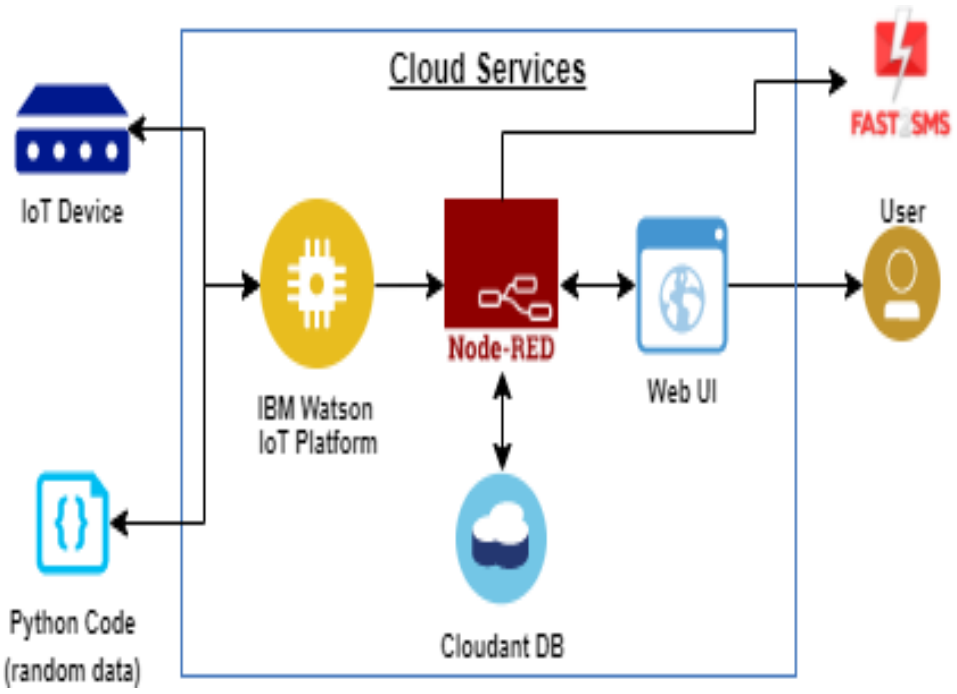

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5.3 User Stories

CUSTOMER JOURNEY MAP

	STAGE 1	STAGE 2	STAGE 3	STAGE4	STAGE5
OBJECTIVES	Write a goal or activity	This system alerts the user from the environmental exposure to the harmful gases	This system comprises of sensors which alerts the micro-controller for the leakage of gases that will alert the user by displaying warning information.	Gas leakage detection is the process of detecting the environmental exposure of harmful gases and alerting the user by the notification	The alarm management system is the main role in this system that will notify the user in case of any gas leakage
NEEDS	Write a need that you want to meet	Hazardous gas leakage	Fire hazard preventing	Oxygen level monitoring	Prompts leakage alerts
FEELINGS	Write an emotion that you expect from the customer	Happy for the solution	Using the system and feels no complexity	Happy and excited	Encourage the solution and giving good feed backs
BARRIER	Sad Write the challenges to your objectives	Higher officials	Company managements	Government towards this implementation	Harmful gases that may cause unconsciousness to the people

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6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation

Use the below templateto create productbacklog and sprintscheme

Sprint	Functional Requirement(Epic)	User Story / Task	Story Points	Priority	Team Members
Sprint -1	Resources Initialization	Create and initialize accounts in various public APIs like OpenWeather Map API.	1	LOW	Santhosh T GowthamS Muralitharan SSakthivel R
Sprint -1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location.	1	MEDIUM	Santhosh T GowthamS Muralitharan S Sakthivel R
Sprint -2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it canbe accessed from anywhere	2	MEDIUM	Santhosh T Gowtham S Muralitharan SSakthivel R
Sprint -3	Hardware initialization	Integrate the hardware to beable to access thecloud functions and provide inputs to the same.	2	HIGH	Santhosh T GowthamS Muralitharan S Sakthivel R

Sprint -4	UI/UX Optimization & Debugging	Optimize all the shortcomings and provide better user experience.	2	LOW	Santhosh T GowthamS Muralitharan S Sakthivel R

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)

Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	07 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14 Nov 2022

Velocity

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story pointsper day)

6.3 Reports from JIRA

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

7.1 Feature 1

```
int triggerPin = 7;
int echoPin= 6;
unsigned long duration;
int distance;
int pinSensor =2;
int pinLed=12;
int pinBuzzer =13;
```

```
int pirSensor =0;
void setup()
{

  pinMode(triggerPin, OUTPUT);
  pinMode (echoPin, INPUT);
  Serial.begin(9600);
  pinMode(pinSensor, INPUT);
  pinMode(pinLed, OUTPUT);
  pinMode(pinBuzzer, OUTPUT);
}

void loop()
{

  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  //clearing the trigger

  digitalWrite(triggerPin,
  HIGH);delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
    // capturing the time duration for sound wave to travel in microseconds
  duration = pulseIn(echoPin, HIGH);
  distance = 0.01723 * duration;
  Serial.print(distance);
  Serial.println("cm");
  pirSensor = digitalRead(pinSensor);if
  (pirSensor == HIGH)
  {
```

```
  digitalWrite(pinLed, HIGH);
   tone(pinBuzzer, 1000, 500);
  }
  else {
   digitalWrite(pinLed, LOW);

  }
  delay(10);
}
```

7.2 Feature 2

```
import os
import random
for i in range (30,80):
        h=   random.randint(65,75)
        t=   random.randint(35,40)
        temp = t
        humidity = h
        print (t) print
        (h)
        if (humidity >=75or temp >=40):
                print (“! ! HIGH ALERT ! !”)
        else:
```

```
print("LOW")
```

8. TESTING

8.1 User Acceptance Testing

8.1.1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Gas leakage monitoring and alerting system project

8.1.2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolve

9. RESULTS

9.1 Performance Metrics

After all the data had been gathered, analyzed and processed, the proponents arrived at the succeeding conclusion.Therefore, the researchers concluded that the "LPG Leakage Detector Using Arduino with SMS Alert and Sound Alarm" will help a lot in terms of preventing any danger caused by gas leakage and useful as part of safety to avoid the gas leak that can cause harmful result. It will also improve the safety of all users of Liquefied Petroleum Gas.

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.

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

This is a arduino based system designed and implementedto detect the gas leakage in home, hotels, and in industrialapplications. This system has a sensing range is set via IOT

platform site if it is low then set range system is not on ordoesn’t turn the valve and exhaust on, and it is in the 200-1000ppm range or greater than that the system detects a gas leak and alerts user via buzzer sound and if user can’t able to turnoff the valve manually under 1 min. the system turns off thevalve automatically and exhaust fan is on until the gas levels in ppm present in the room is decreased and fan is automatically off.

12. FUTURE SCOPE

The study limits itself in detecting the presence ofnatural gas, butane, and liquid petroleum gas in the airat a close distance from the possible source of gas leak.It is assumed that the volume of air in the room isgreater than the volume of gas present. For fire, thesensor used is capable of detecting fire in its line ofsight and 180-degree view of the infrared LED. The system also requires to be installed in an area with strong network signal.The GSM, after sending the required number of SMS need resetting through the physical button from the Arduino board.This will initialize the system and the GSM as well

13. APPENDIX

Source Code

```
#define BLYNK_TEMPLATE_ID "TMPLnqO-Ntp1"
#define BLYNK_DEVICE_NAME "Gas Leakage"
#define BLYNK_AUTH_TOKEN "byQC3r-BovnbvTFoTk7O1Uk2J6AyfXnW"

#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>


char auth[] = BLYNK_AUTH_TOKEN;

char ssid[] = "gautam";  // type your wifi name
char pass[] = "123456789";  // type your wifi password
int smokeA0 = A0;
int data = 0;
int sensorThres = 100;


BlynkTimer timer;

void sendSensor(){

 int data = analogRead(smokeA0);
 Blynk.virtualWrite(V0, data);
  Serial.print("Pin A0: ");
  Serial.println(data);


  if(data > 20){
```

```
    Blynk.email("gowtham.9894.gh@gmail.com", "Alert", "Gas Leakage Detected!");
    Blynk.logEvent("gas_alert","Gas Leakage Detected");
  }
}

void setup(){
  pinMode(smokeA0, INPUT);
   Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
  //dht.begin();
  timer.setInterval(2500L, sendSensor);
}

void loop(){
  Blynk.run();
  timer.run();
}
```

Project Demo Link :

https://drive.google.com/file/d/1im2NrLay8V2biL72jRF2WzOTLOpDL5TN/view?usp=drivesdk