Gas Leakage Monitoring and Alerting System

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1. INTRODUCTION:

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

1.2 Purpose:

Safety plays a critical role in today's world and it is vital that certain solutions 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.

2. LITERATURE SURVEY:-

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.

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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.

2.3 Problems statement definition:

The world is moving at a rapid pace. The pandemic is long behind us, and businesses across domains are gearing up to catch up with the two years they lost due to the Coronavirus outbreak. Now is the time to embrace excellence and reduce unnecessary expenses with **scalable IoT solutions** - and this also holds true for the oil and gas domain.

Various commercial companies such as hotels and takeaway joints utilize flammable gasses - for instance, carbon dioxide, LPG, ammonia, and so on - to deliver the best customer service possible. The use of such gasses cannot be denied.

However, they have also brought about a greater risk and threat to human life. With safety a primary concern, businesses dealing with gas must take certain precautions to ensure work is carried out in the most secure manner possible.

3. IDEATION AND PROPOSED SOLUTION:-

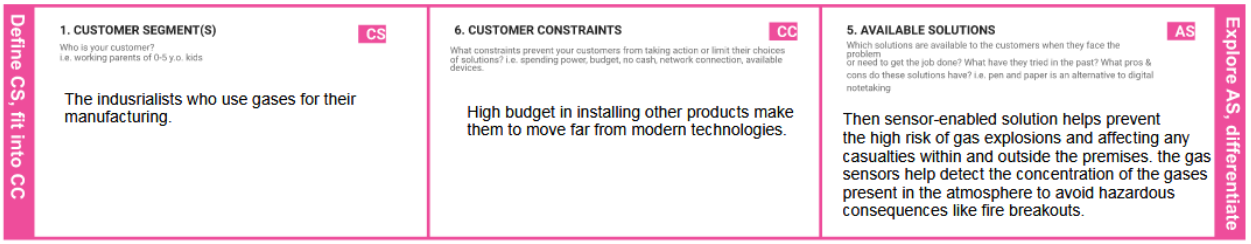
3.1 Empathy map Canvas:-

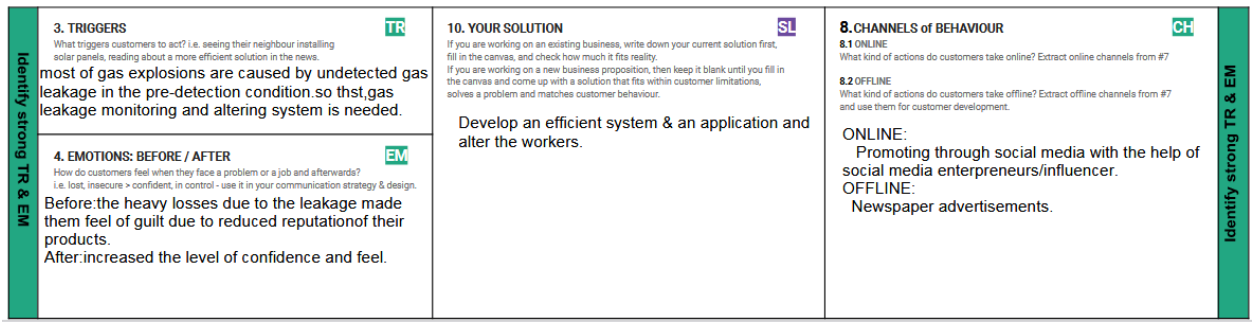
3.2 Proposed solution:-

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	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.Furthermore, gas leakage can cause fire that will lead to serious injury or death and it also can destroy human properties.

2.	Idea / Solution description	• When the gas leakage is detected it will alert the user by alarm/buzzer • It can send the sms to the user also • We can also make the exhaust fan on while during the gas leakage • Detection of the gas leakage is important and halting leakage is important equally.
3.	Novelty / Uniqueness	• instant detection of gas leakage • send sms to the concerned user • easy to access and operate
4.	Social Impact / Customer Satisfaction	• Cost efficient • Easy to access and operate • Easy installation and detect the gas leakage fastly • Prevent fires and explosions
5.	Business Model (Revenue Model)	• This project is mainly for Industries so we can visit to the industries and explain them about the benefits of our

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	Monitoring	Level of gas is monitored using sensor and if there is any leakage, alert can be sent through messages and with a buzzer sound.
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 of the data. If there is an increase in gas level then the alert will be given by message or buzzer sound.
FR-4	User Performance	When the user gets notified, they could take precaution steps like turning the gas off, turn on the exhaust fan/sprinkler and avoid serious accidents.

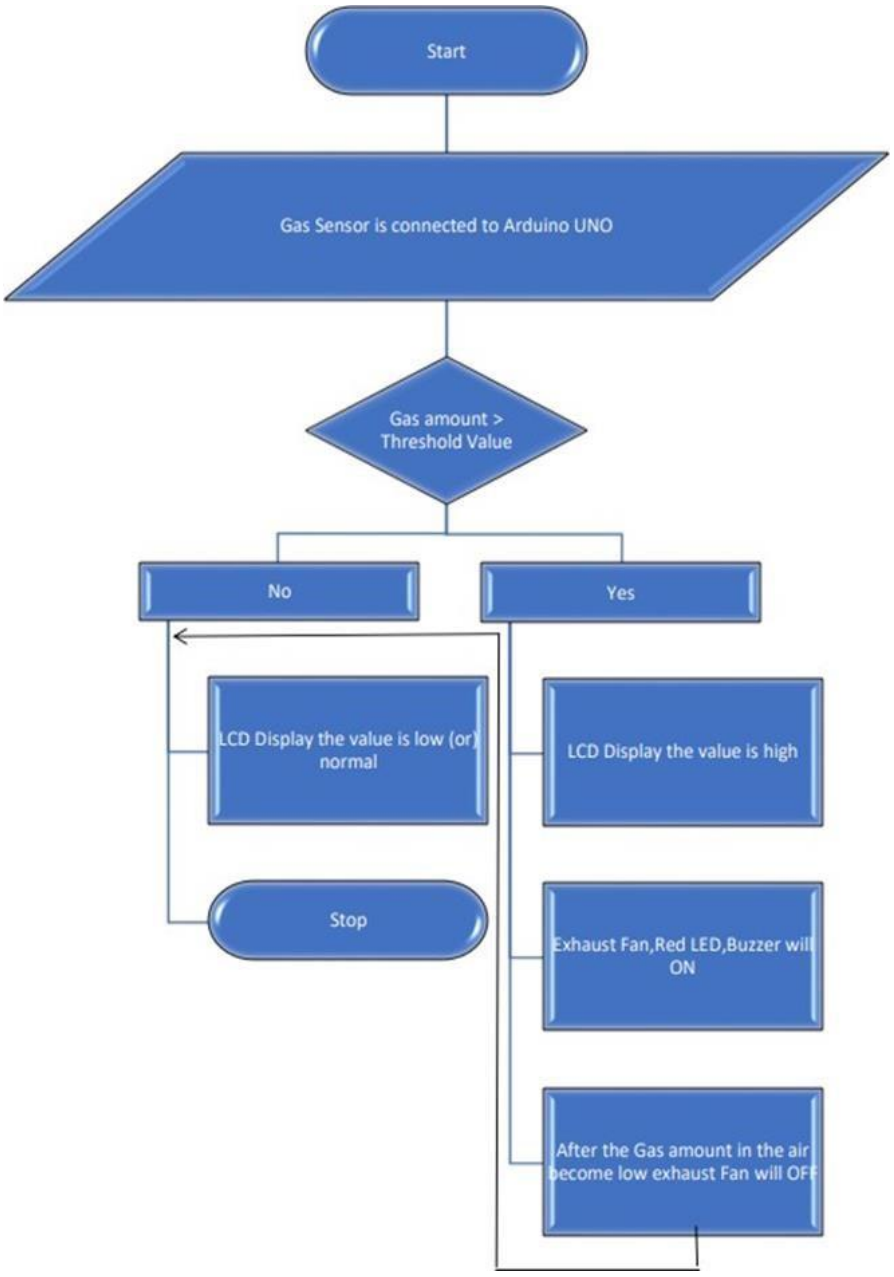
4.2 Non-functional Requirements:

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

FR No.	Non-Functional	Requirement Description
FR-1	Usability	It updates the data regularly as well as protects the workers.
FR-2	Security	As a result of emergency alert, we can be able to protect both the humans and properties. Precaution steps could be taken.
FR-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
FR-4	Performance	Sprinklers and exhaust fans are used in case of emergency
FR-5	Availability	It can be used for everyday; it includes day and nights.
FR-6	Scalability	Sensors can be replaced every time it fails

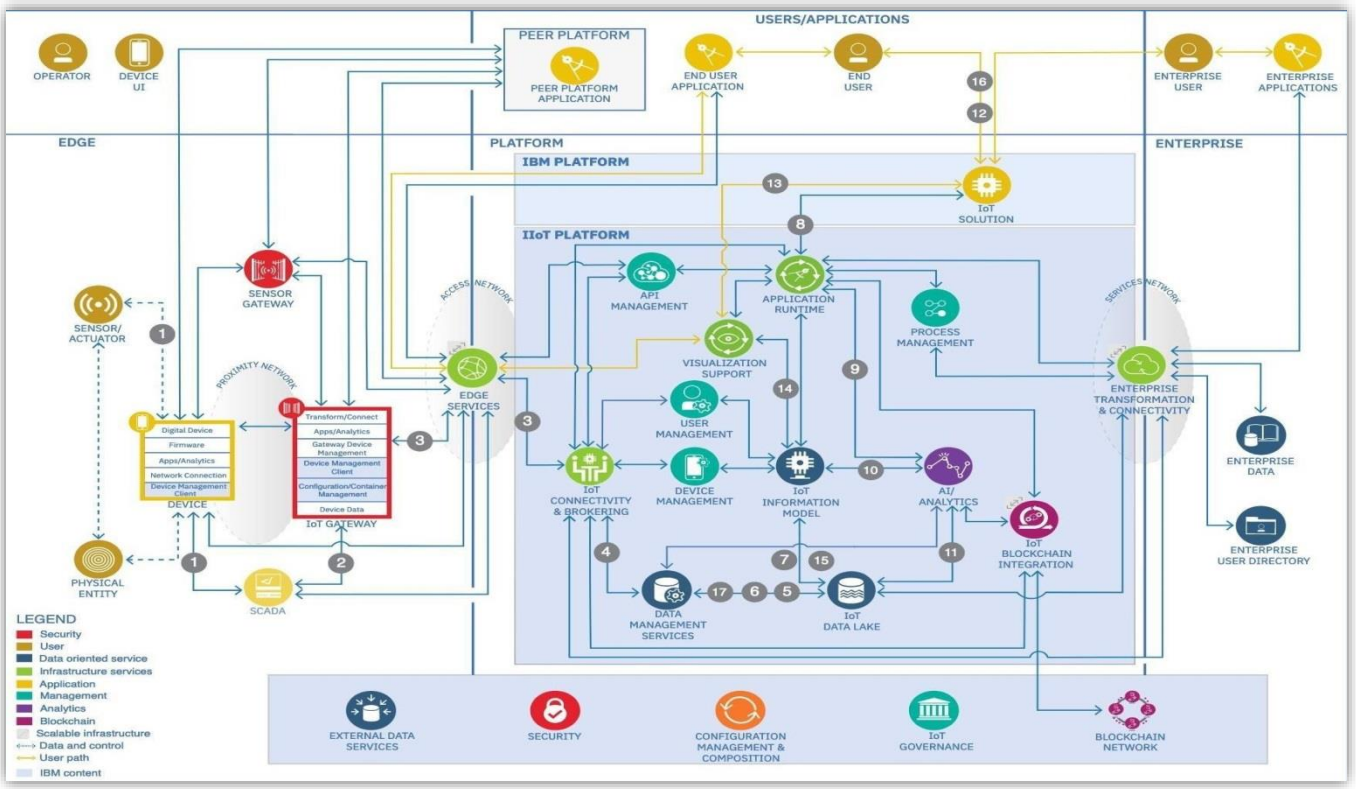
5. PROJECT DESIGN:-

5.1 Data flow diagrams:

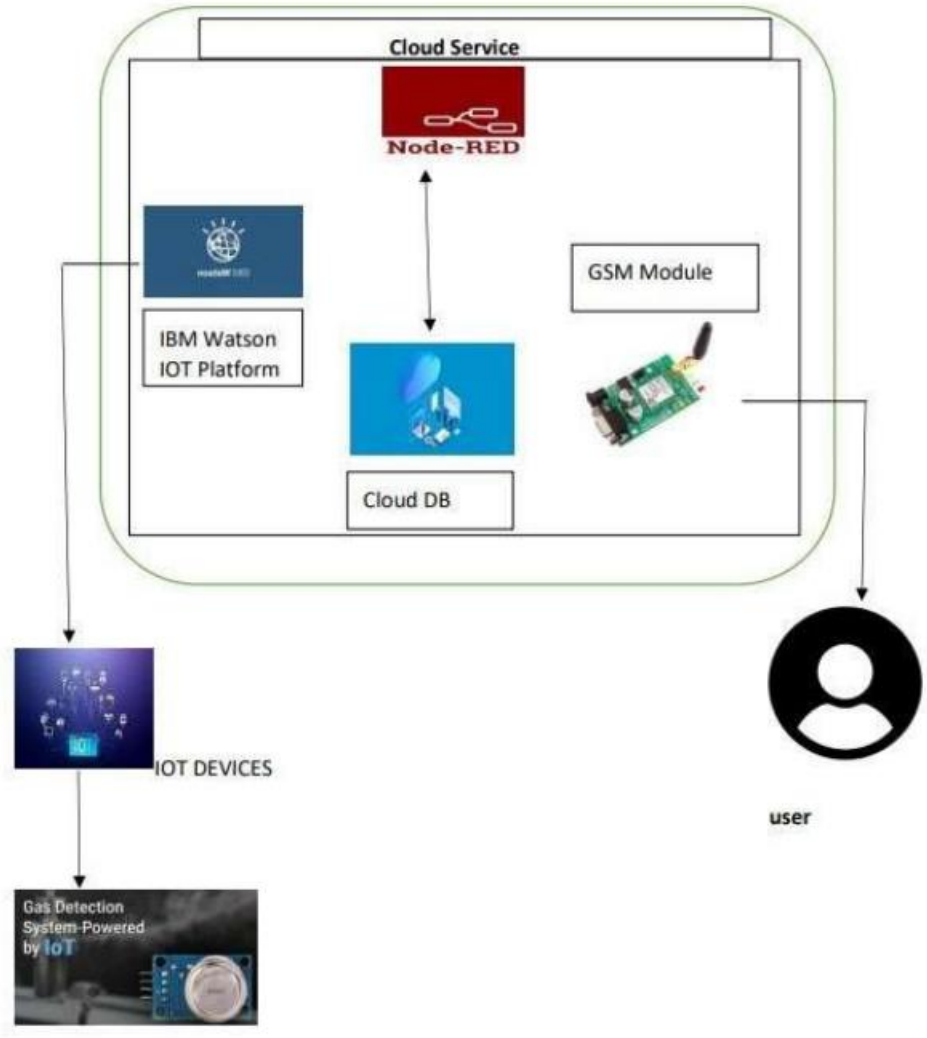

Start
Gas Sensor is connected to Arduino UNO
Gas amount > Threshold Value
No
Yes
LCD Display the value is low (or) normal
Stop
LCD Display the value is high
Exhaust Fan,Red LED,Buzzer will ON
After the Gas amount in the air become low exhaust Fan will OFF

5.2 Solution and Technical Architecture:

Solution Architecture:



Technology Architecture:



5.3: User Stories:

- In recent years there has been rapid development in technology which has made human life easier in several aspects. LPG is a need of every household but many accidents happen every year due to domestic gas leakage, so it should be used carefully. This new system helps to avoid accidents happening knowingly or unknowingly.

- Automatic gas leakage alerting and monitoring system plays a significant time and age in the field of kitchen home automation.

6. PROJECT PLANNING AND SCHEDULING:-

6.1: Sprint planning and estimation:

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Device that removes much of the manual work needed to write and configure code. It provides rapid development ,is easy to setup and has a strong support base	IOT Zeta for nonstop streaming of detecting gas leakage level,
2.	Security Implementations	Alert notification Enabled with GPS module received in owner mobile.	e.g. SHA-256, Encryptions of data regarding gas level, firewalls, Antivirus, data loss prevention etc.,
3.	Scalable Architecture	If a problem arises owner can see the problems and check gas level simultaneously	Multiple Data store Technologies , Reliable, Micro services Automated Bootstrapping
4.	Availability	*sensor to detect the leakage and LCD Display to show gas level	GSM module, raspberry pi
S.No	**Characteristics**	**Description**	**Technology**
		*whenever the gas leakage is sensed the message is delivered to the owner	
5.	Performance	*the alert notification is sent to the owner without any delay when leakage is detected *immediate actions are taken after detection.	High durable device battery

6.2: Sprint delivery schedule:

7. CODING AND SOLUTIONING:-

7.1: 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 List of Components :-

1	Arduino UNO
2	Breadboard
3	LED
4	Gas Sensor
5	LCD 16*2
6	DC motor
7	Rotary potentiometer
8	Buzzer
9	Push Button
10	Resistors(1k ohm, 330 ohm)
11	Jump wires

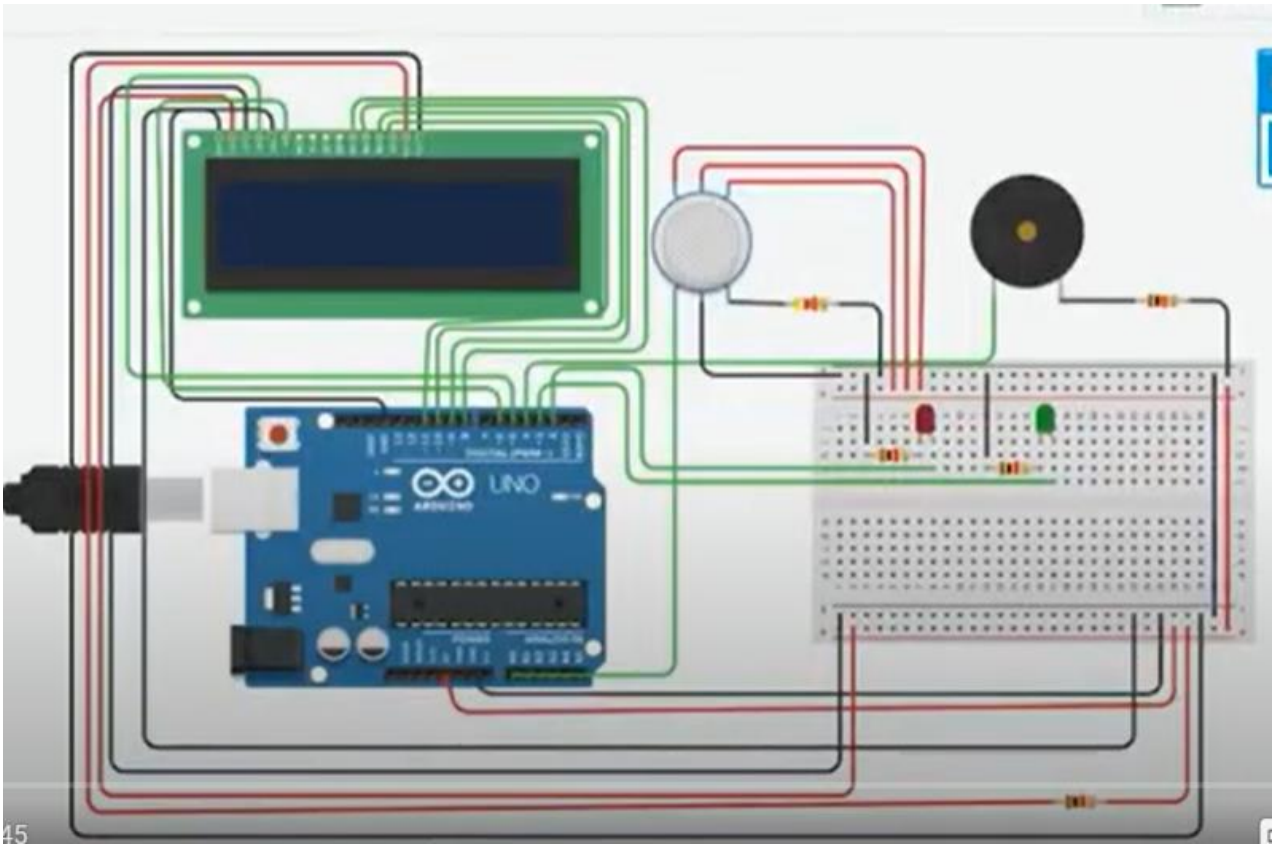
- **ARDUINO UNO :-**

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The term Uno means "one" in the language of "Italian" and was selected for marking the release of Arduino's IDE 1.0

software. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the reference versions of Arduino and currently progressed to new releases. The Uno-board is the primary in a sequence of USB-Arduino Board, & the reference model designed for the Arduino platform.

8.RESULT:-

Circuit Diagram :-



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 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.

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 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:-

Future scope includes the upgradation of the system gas leakage monitoring and alerting system includes SMS notification through internet. This can also help in predicting the location of the leakage earlier, which in turn will be much useful to avoid hazards caused due to leaks. Further development can be made in the part of improving the accuracy of the gas sensing, spreading of gas over areas and can also give some control actions when detected with a Leak.

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12. APPENDIX:-

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();
    }
}
```

Demo link:-
https://drive.google.com/file/d/1kiSdEni1Nb88SMmnt4Cwc5sDolwAZt_3/view?usp=share_link