GAS LEAKAGE MONITORING AND ALERTING SYSTEM

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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 PetroleumGas" (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 societymembers through the alarm and sendingnotification.

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 producesan 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 forhumans 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 monitoringsystem. In this system, the gas leakage is detected and controlled by means of the exhaust fan. Thelevel of LPGin the cylinder is also continuously monitored.

Srinivasan, Leela, Jeya bharathi, Kirthik,Rajasree; in this research paper they told about gas leakagedetection 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 safetymeasure.

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 frameworksends 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 detectionand 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. Intheirsurvey 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 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:

An empathy map is a simple, easy-to-digest visual that capturesknowledge about a user'sbehaviorsand attitudes.It is a useful tool to helps teams better understand their users.Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

3.2 Ideation & Brainstorming:

There have been many incidents like explosions and fire due to LPG gas leakage.Such incidents can cause dangerous effects if the leakage is not detected at an early stage.
Arduino and IOT based LPG leakage detection system is a project which will help in determining gas leakage in the surrounding and send data to an IOT module.

1. **PAVITHRA S**

We can sense the leakage using gas sensor, when the leakage is detected location will be shared through application which is used to prevent from various dangers.
Internet of Things (IoT) is the networking of 'things' by which physical things can communicate with the help of sensors, electronics, software, and connectivity.
These systems do not require any human interaction and same is the case with IOT based gas detection system. It does not require human attention.

2. **POOVIZHI P**

In the proposed system, the sensor which is used to sense many gases is MQ-2 sensor.
After the detection of leakage in the gas, the sensor sends the signal to the Arduino UNO for the further process where other hardware components are connected to each other.
Through Arduino UNO, it sends the signal to the LCD display for displaying the alert message as GAS Detected, accordingly, the buzzer be on so that the surrounding people will the alerted.

3. **NAVANEETHA M**

When the gas/air level in a room exceeds 50, the detection system's buzzer and servo motor will be activated.With the use of the IFTTT (If That Then This) services, user will receive the message via Node MCU.

4. **SANTHIYA P**

In this paper, we use IOT technology for enhancing the existing safety standards. While making thisprototype has been to bring a revolution in the field of safetyagainst the leakageof harmful and toxicgasesin the environment and hence nullify any major or minor hazardbeing caused due to them.

3.3 Proposed Solution:

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	○ Gas Leakage Monitoring and Alerting System.
2.	Idea / Solution description	○ Using a variety of sensor, the environmental parameters such as concentration of the gas can be monitored in realtime ○ If the concentration of gas reacheshazardous level analert message can be sent to theuser.
3.	Novelty / Uniqueness	○ Device being developed can monitor a wide range of gasesthat are highly used in industries. ○ Apart from notifying the user, Safety personnel are also notified in case of emergencies. ○ User friendly in nature.
4.	Social Impact / Customer Satisfaction	○ As the deviceis small, it is easy to installthem in variouslocations based on necessity.

5.	Business Model(RevenueModel)	○ Device can be obtained by paying for the subscription. ○ It can be yearlyor monthly. ○ Based on the term of subscription 5 – 8% discount shall be madeavailable.
6.	Scalability of the Solution	○ In future morevariety of gas can alsobe monitored, by addingthe necessary sensorand monitoring the dataobtained from it.

3.4 Problem Solution fit:

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

4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

Arduino UNO is the main unit of the system which performs the following tasks. Signal conditioning of the Arduino UNO is done by the output signal of the sensor, provided input to Arduino. The detection results are displayed on LCD. Indicates the people of danger in the workplace, factory, and home. Buzzer activity with a beep(siren) sound is made. Also, send alert SMS to the in charge of the plant whose number is saved in a SIM card by using a GSM

modem.The SMS received depends upon the leak of gas in the detection area of the sensor.

Business Requirements	User Requirements	Product Requirements
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 overto a site. It can be monitored, and preventive measures can be taken to avoid any disaster.	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 safetyis important butmaking using of the right technology is even morevital.	Detecting gasses is necessary regardless of your business role or individual purpose. Certaintechnologies at play make such IoT devices what they are, andif you wantto indulgein IoT application development, you must knowwhat they are and what purposethey can fulfill.

4.2 Non-Functional requirements:

Data Gathering:

Using multiplesensors, we are going to gatherthe necessary data.

Data Store:

Collected data is storedin Cloud and Necessary databases.

Data Analysis:

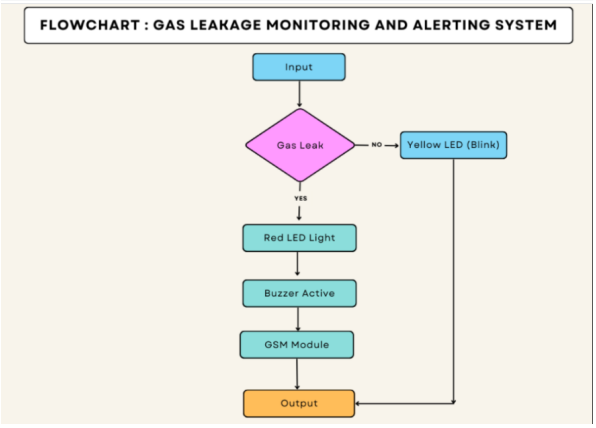
Data from the store must be analyzed for raising alerts in case of necessity.

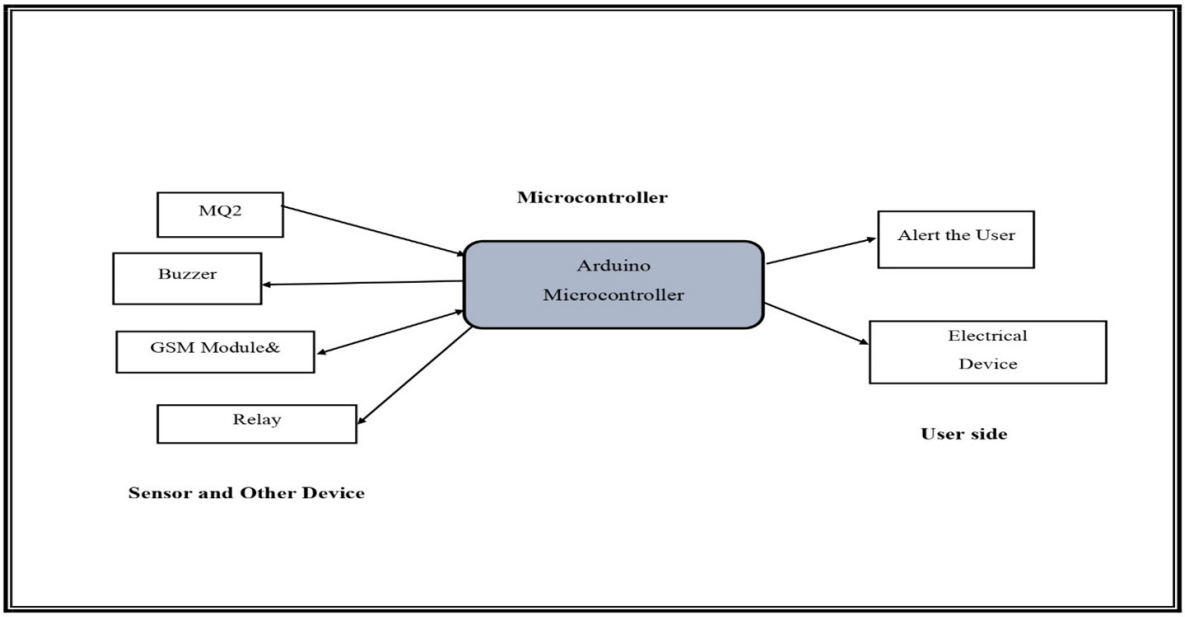
Data Monitoring:

Gathered data must be displayed to the user for monitoring.

5. PROJECT DESIGN:

Data Flow Diagrams:





5.2 Solution & Technical Architecture:

5.3 User Stories

The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of a 1m radius of the roverand the sensor output data are continuously transferred to the local server. The accuracy of sensors is not up to the mark thus stray gases are also detectedwhich creates an amount of error in the outputs of thesensors, especially in the case of methane.Further, the availability and storage of toxic gaseslike hydrogensulfide also create problems for testing the assembled hardware.As the system operates outsidethe pipeline,the complication of system maintenance and material selection of the system in case of corrosive gases is reduced.Thus, the system at this stagecan only be used as a primary indicatorof leakage inside a plant.

6. PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning & Estimation:

i. SPRINT PLAN
ii. ANALYZE THE PROBLEM
iii. PREPARE An ABSTRACT, PROBLEMSTATEMENT
iv. LIST A REQUIRED OBJECTNEEDED
v. CREATE A PROGRAM CODE AND RUN IT
vi. MAKE A PROTOTYPE TO IMPLEMENT

vii. TEST WITH THE CREATEDCODE AND CHECK THE DESIGNEDPROTOTYPE IS

6.2 Sprint DeliverySchedule:

viii. Sprint 1

ix. Sprint 2

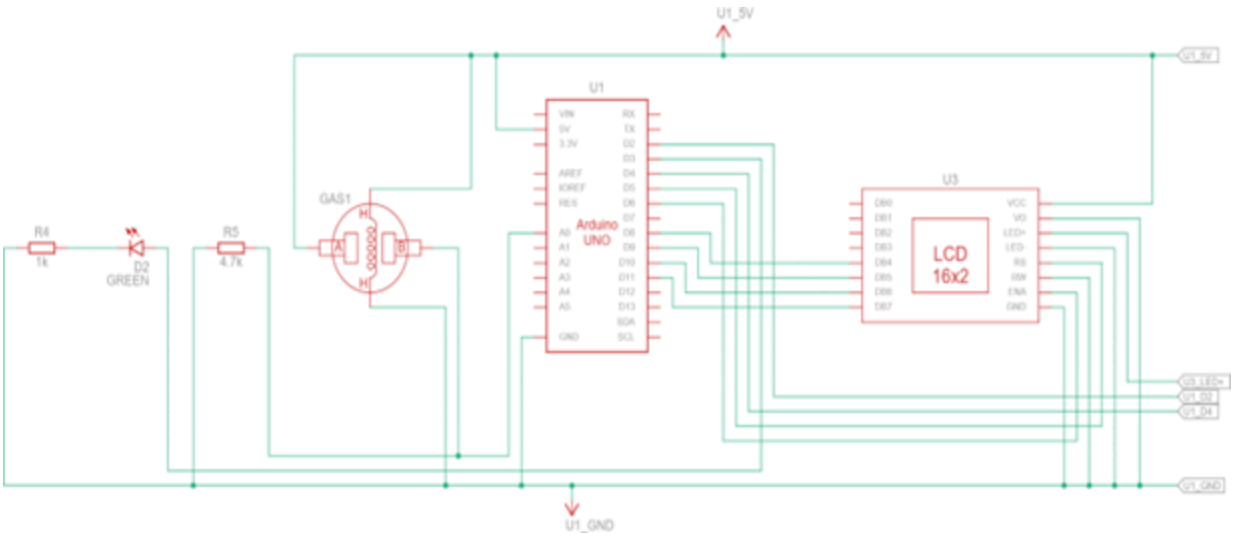
x. Sprint 3

xi. Sprint 4

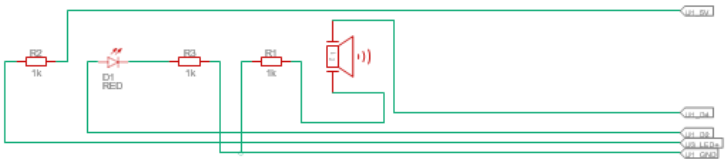
We are Developing the code in this Schedule.

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

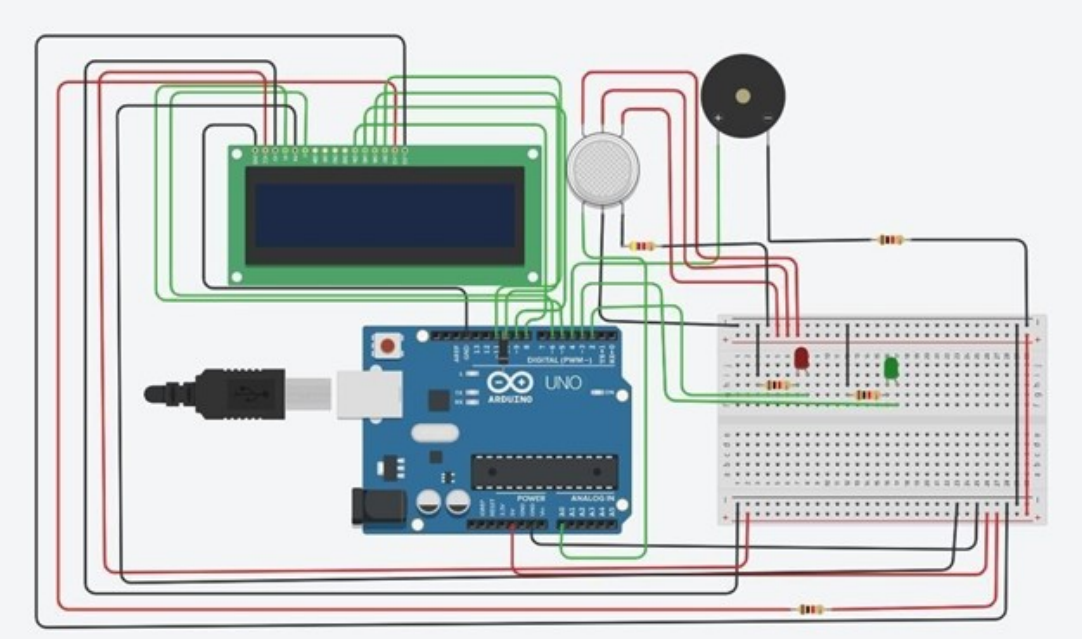
7.1 Feature 1:

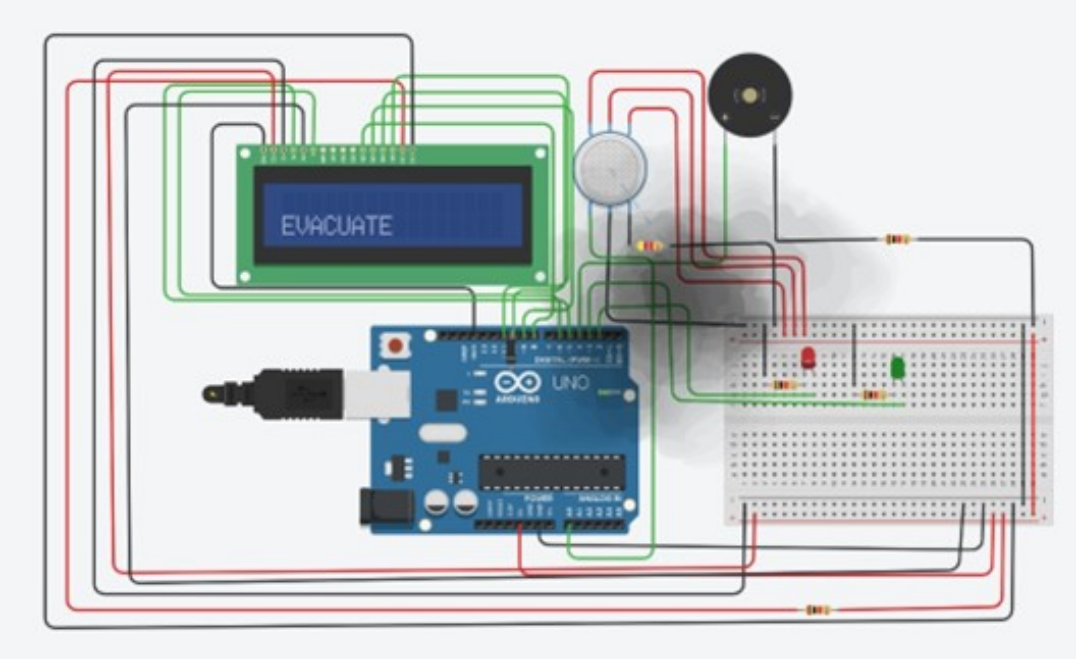


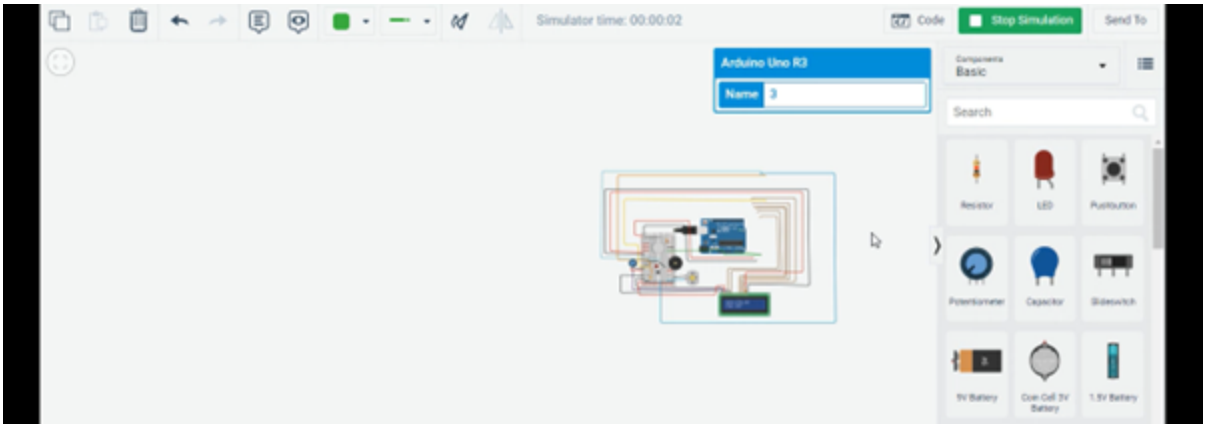
7.2 Feature 2:



7.3 Database Schema (If Applicable)




EVACUATE
UNO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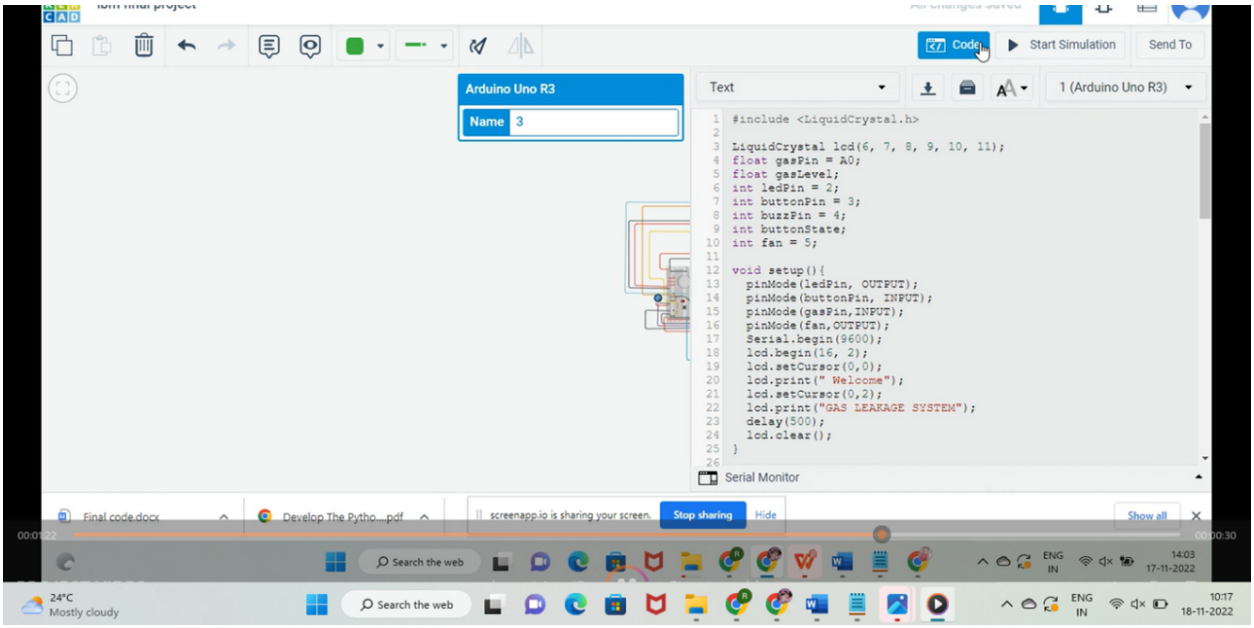
Code
Stop Simulation
Send To
Arduino Uno R3
Name 3
Basic
Search
Resistor
LED
Pushbutton
Potentiometer
Capacitor
Slideswitch
9V Battery
Coin Cell 3V Battery
1.5V Battery



Components:

The designof a sensor-based automatic gas leakage detectorwith an alert and controlsystem. Thecomponents are

S. No.	Name of the Component	Quantity
1.	Arduino UNOR3	1
2.	Breadboard	1
3.	LED	2
4.	Resistor	5
5.	Piezo	1
6.	Gas Sensor	1
7.	LCD (16x2)	1

8.TESTING:

8.1 Test Cases:

This report shows the number of test casesthat have passed,failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2

Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

8.2 User Acceptance Testing:

Purpose of Document

The purpose of this documentis to briefly explain the test coverageand open issues of the [ProductName] project at the time of the releaseto User Acceptance Testing (UAT).

Defect Analysis

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8

Totals	24	14	13	26	77

9. RESULTS:

9.1 Performance Metrics

After this project performance can conclude that the detection of the LPG gas leakage is incredible in the project system. Applicable usefully for industrial and domestic purposes. In dangerous situations, we can save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas likeCO2, oxygen, and propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to buildthe sensor.

10.ADVANTAGES AND DIASADVANTAGES:

Advantages:

1. Because of the very narrow 0.3 nm line width of the laser emission, there is no interference from other gases.
2. Response times are in the order 1 second.

Disadvantages:

1. Only one gas can be measured with each instrument.
2. When heavy dust, steam or fog blocks the laser beam, the system will not be able to take measurements.

11. CONCLUSION:

In danger situations we have 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:

We propose to build the system using an MQ6 gas detection sensor and interface it with an

Aurdino Uno microcontroller along with an LCD Display.

Our system uses the gas sensor to detect any gas leakages. The gas sensor sends out a signal to the microcontroller as soon as it encounters a gas leakage. The microcontroller processes this signal and a message is displayed on the LCD to alert the user.

13. APPENDIX:

Source Code:

```
#include<LiquidC
rystal.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(buttonPi
n, INPUT);

pinMode(gasPin,I
NPUT);

pinMode(fan,OUT
```

```
PUT);

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(gasPi
n);
 buttonState =
digitalRead(butto
nPin);

 // call the
function for gas
detection and
```

```
button work

gasDetected(gasLe
vel);
 buzzer(gasLevel);

exhaustFanOn(bu
ttonState);
}

// Gas Leakage
Detection &
Automatic Alarm
and Fan ON
void
gasDetected(float
gasLevel){
 if(gasLevel >=
300){

digitalWrite(buzz
Pin,HIGH);

digitalWrite(ledPi
n,HIGH);

digitalWrite(fan,H
IGH);

lcd.setCursor(0,0);

lcd.print("GAS:"
```

```
);

lcd.print(gasLevel
);

lcd.setCursor(0,2);
  lcd.print("FAN
ON");
  delay(1000);
  lcd.clear();
 }else{

digitalWrite(ledPi
n,LOW);

digitalWrite(buzz
Pin,LOW);

digitalWrite(fan,L
OW);

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,H
 IGH);

 lcd.setCursor(0,0);
```

```
                lcd.print("Button
                State:");

                lcd.print(buttonSt
                ate);

                lcd.setCursor(0,2);
                  lcd.print("FAN
                ON");
                  delay(10000);
                  lcd.clear();
                 }
                }
```

GitHub & Project Demo Link:

https://github.com/IBM-EPBL/IBM-Project-14402-1659585131

https://github.com/IBM-EPBL/IBM-Project-14402-1659585131/blob/1e639b6c1f677ec27e9c4eef9dd7f95ce3de05e8/Final%20Deliverables/Project-video.mp4