PROJECT-BASED EXPERIENTIAL LEARNING PROGRAM (NALAIYA THIRAN)

GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

A PROJECT REPORT

Submitted by

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ABSTRACT

Leakage of any kind of gas has been a concern in recent years, whether it is in a residential setting, a business, a cafe, or a canteen. In this paper development of an IoT based gas wastage monitoring, leakage detecting and alerting system is proposed. This paper elaborates design such an intelligent system that will help save gas and smartly prevent accidents. The system needs to be integrated with the cooker. The technology includes ultrasonic sensors that determine if the cooker is being utilized for cooking purposes or not. If it is discovered that the cookeris not in use, the system uses an automatic switching off mechanism to cutoff the gas supply. The moment gas leakage will probably be recognized, users will be informed via SMS through GSM, and so that user can solve theissue as soon as possible. The system will monitor flame and fire through flame sensor. When a fire is detected, the buzzer begins to sound. Aside from that, the system also has a cloud storage capability. The usage of gasfor each user each day may be tracked with the aid of this cloud storage solution. At the end of the day, this procedure will assist in detecting per- user natural gas usage. The system has been tested and it is able to monitor gas wastage, leakage and send a SMS to the user. The resulting performance indicated its effectiveness toward saving a significant portion of the wasted gas in domestic.

1. INTRODUCTION

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 daily bases, it makes impossible to check on the appliancesavailable at home especially LPG gas cylinder, wired circuits, Etc. Since the last three years, there is a tremendous hike in the demand 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. To track this leakage gas, the system includes an MQ6 gas sensor. This sensor senses the amount of leak gas present in the surrounding atmosphere. Through this, explosions or getting affected by the leakage of gas could be avoided.

1.1. OBJECTIVE

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 use, 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 a raise in our economy because when gas leaks it not only contaminates the atmosphere but also the waste 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.

1.2. PURPOSE

The Internet of Things further helps Industrialists to make better decisions and analyze situations for enhanced productivity and less infrastructure damage due to gaseous explosions.

A gas monitoring solution not only detects toxic gases but also identifies changes in air quality. It can also be used commercially in in-house buildings to detect the presence of carbon dioxide and other combustible gases. This can be used to prevent explosions and fire disasters in the facilities and thus save human lives.

2. Literature Survey

Several reviews about gas leakage detection techniques were done in the past either as part of research papers/technical reports on a certain leak detection method and other gas-related subjects

S.NO	TITLE OF PAPER	YEAR OF PUBLICATION	JOURNAL NAME(AUTHOR)	INTERFERENCE
1	Sensor based gas leakage detectorsystem.	2022	Neha Chourasia, PapihaAjmire, Saurabh Shambharkar, Shraddha Khobragade, Sanket Bhajgaware, Shivani Janbandhu	1. The systems are oftenenhanced by adding an impact element which controls the gas leakage. 2. If it exceeds the required upper explosive level for the varied gaseswithin the plant area.
2	A survey paper ongas leak detection using iot	2019	Manichandana,simrah ummeRuman,Harshavardhini Biderkota,Ms.Pr Anisha,Dr. B.V Ramana Murthy,And Mr.C Kishor Kumar	1. Large-scale implementation of iotdevices promises to transform many aspects of the way we live. 2. System ensures continuous monitoring of the gaslevels.

3	Gas Leakage Detectionand prediction using iot	2019	Nagabhushan Adiga,Meghana S.Naik,Avinash.B,Mamath a.G,Sadananda.L	1. Increased concentration of certaingases in the atmosphere can prove to be extremely dangerous 2. GSM module is used for making a call as wellas sending text message
4	Gas Leakage detection and smart alerting system using iot	2018	Shital Imade,Priyanka Rajmanes,Aish warya Gavali, prof.V.N.Nayak wadi.	1. System Can send the values to cloud server. 2. Smart alerting technique involving sending text message to the concerned authority and an ability performing data analytics on sensorreadings
5	Automatic Gas LeakageDetection using iot	20 20	Rajat Kumar Dwibedi,V.Vanitha,Sagar R D, P Phanisai,GanjikuntaYeshwanth	1.It can detect the leakage Lpg and shut down the house's power supply automatically 2.MQ-2 sensor is highly sensitivity to propane.

2.1. Existing Problem

A gas leak refers to a leak of natural gas or another gaseous product from a pipeline or other containment into any area where the gas should not be present. Gas leaks can be hazardous to health as well as the environment. Even a small leak into a building or other confined space may gradually build

up an explosive or lethal concentration of gas. Leaks of natural gas and refrigerant gas into the atmosphere are especially harmful due to their global warming potential and ozone depletion potential.

2.2. Problem Statement

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 includethe 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 to prevent the issue.

Workers who are engaged in a busy industry packed with gas either harmful or harmless needs a way to 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 crises rather than worrying about monitoring or leakage of gas, this will indeed reduce the manpower of that industry and create a peaceful environment.

How does the Problem affect?

The main consequences are the emission of flammable substances into the environment,fire, explosion, and distribution of toxic substances

Serious risks of carbon monoxide poisoning in people and animals.

What is the issue?

Improper use of gas furnace, stove, or appliance.Fault in the gas pipeline

What is the impact of the issue?

Create potential hazards for the workers in the industry Create Pollution to the environment

Diseases prone

What would happen if this problem is not solved?

Emission of toxic gases which is harmful to the environment Leads to explosion or other types of fire hazard

Rusted and poor pipelines create hazards.

What would happen if this problem is fixed?

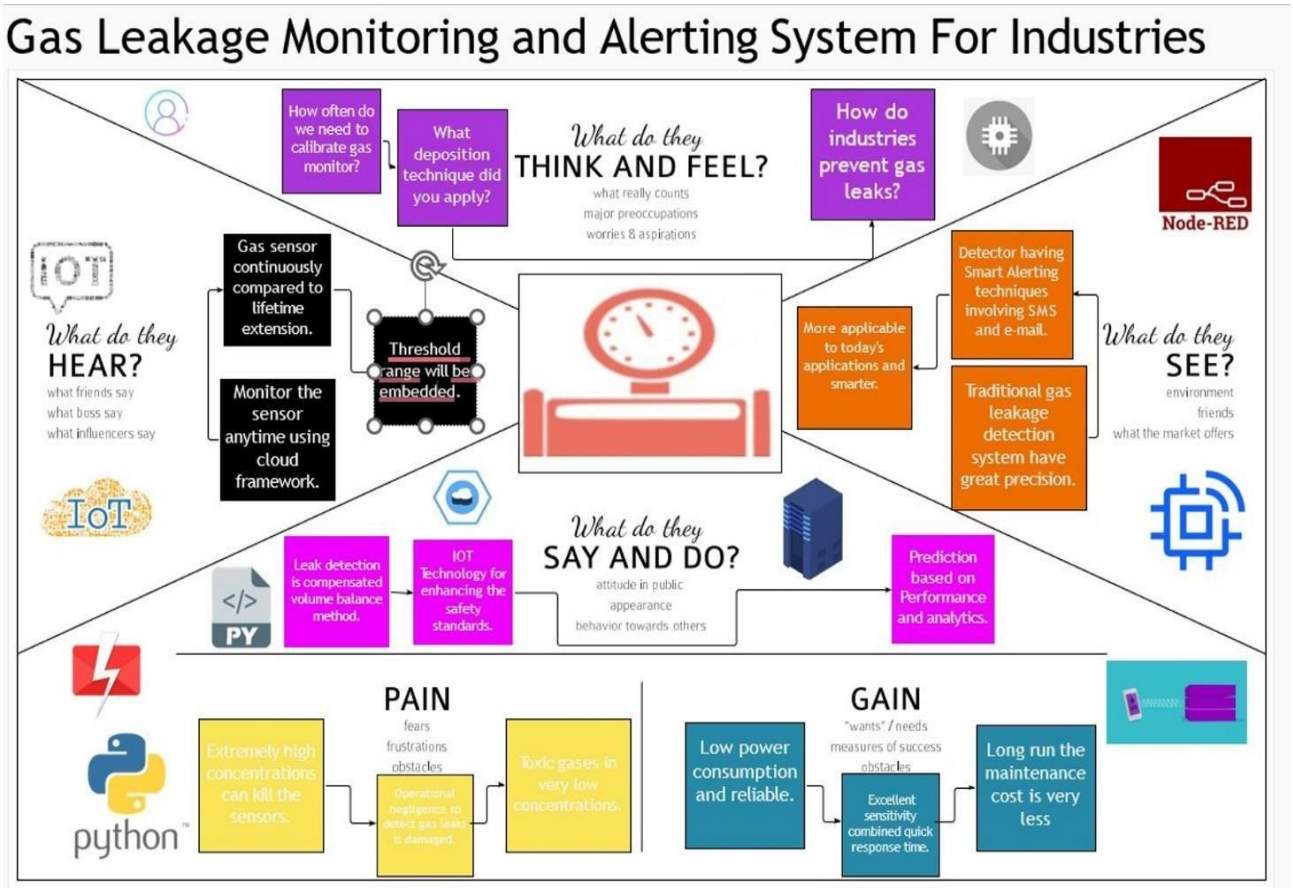
By identifying and solving the issue parameters like pollution and the spreading of poisonous gas, we canfix the problem.

Why it is important to fix the problem?

Emission of harmful gases leads to varying of environmental weather and affects the earth layerwhich is protected by the UV radiation.

3. IDEATION AND PROPOSED SOLUTION

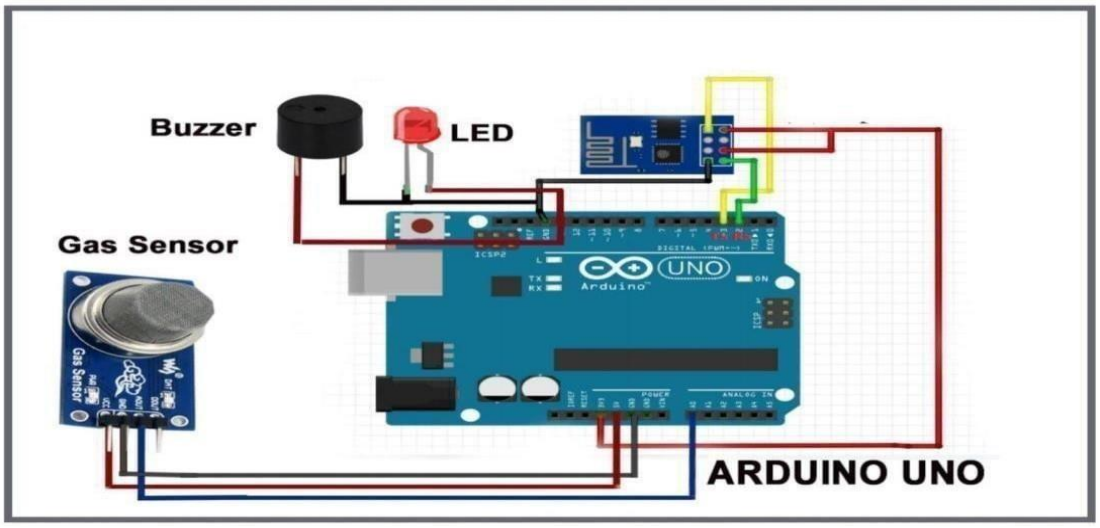
3.1. Empathy map



3.2. IDEATION

The Internet of Things aims towards making life simpler by automating every small task around us. Asmuch as IoT helps 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 the 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 a 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 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.

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. System consists of gas detector sensors, Arduino board, ESP8266 and 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, 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 cloud server. The server can Check that the sensor values existed the threshold value. If the sensor value can cross the limit the server can send the command to hardware for buzzing the alarm. Server also sends the notification message to user. In this paper 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 form the major harmful problem.

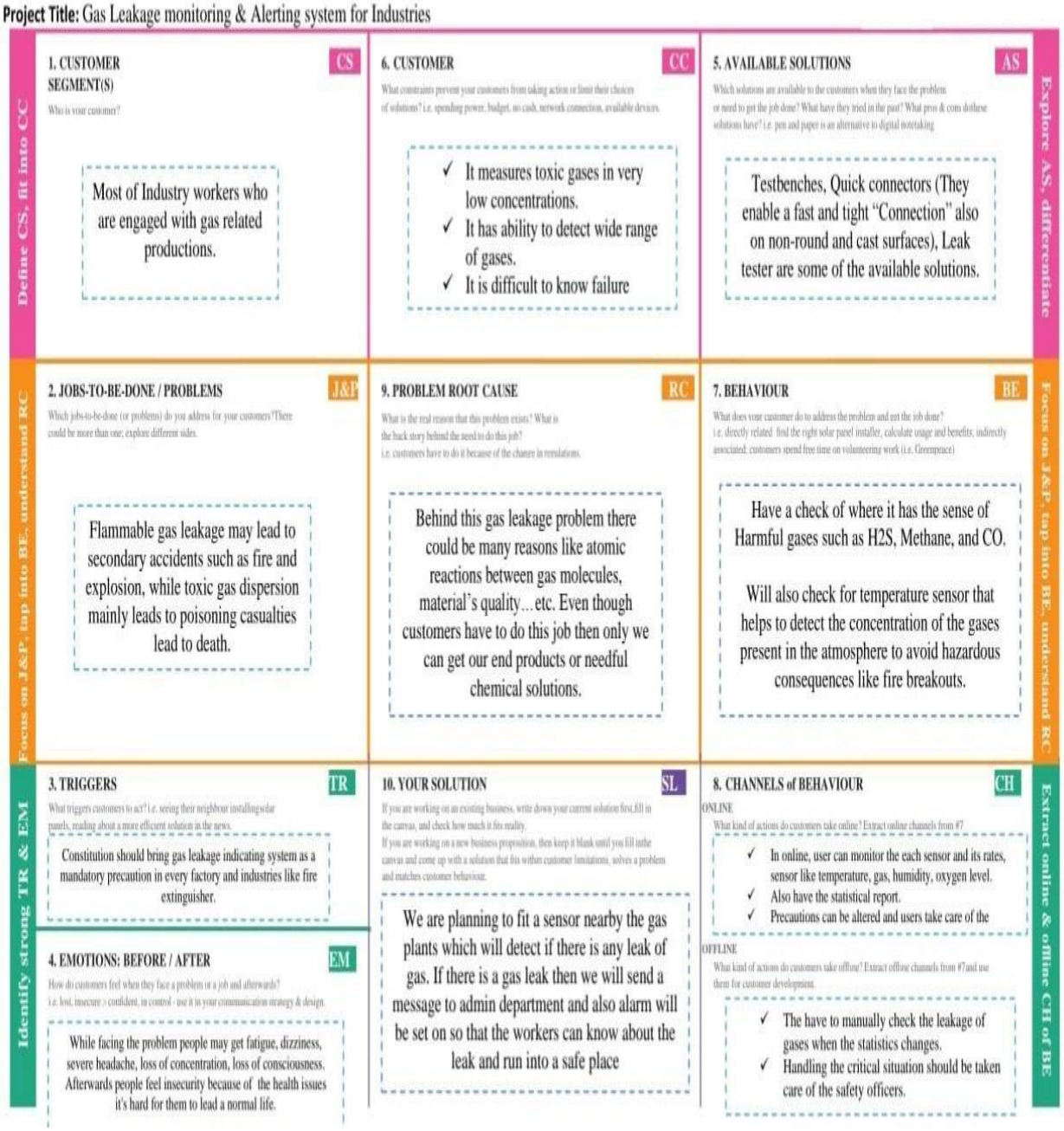
3.3 PROPOSED SOLUTION

S.No:	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	Workers who are engaged with a busy industries packed with gas either harmful or harmless needs a way to 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 crises rather than worrying about monitoringor leakage of gas, this will indeed reduce the manpowerof that industry and create a peaceful environment.
2.	**Idea / Solution description**	Workers who are engaged with a busy industries packed with gas either harmful or harmless needs a way to 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 crises rather than worrying about monitoringor leakage of gas, this will indeed reduce the manpowerof that industry and create a peaceful environment.

3	**Novelty / Uniqueness**	Even though there are many existing solutions forthis 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 arewith some delays. Our solution not only notify theindustry person but also notify the fire fighters so that can take control over the situation and our solution will alert the workers even there is a small leak of gases.
4	**Social Impact / Customer Satisfaction**	Our solution will be very helpful for the workers and the society which is associated or located nearby the industries. Our solution will prevent great disasters like Bhopal Gas Tragedy so that so manylives can be saved. Through this project the workersmental pressure will be reduced 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 benefits of 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 usebecause the solution

		we have provided will be lay onthe basic or initial stage of any upgraded version.

3.4. PROPOSED SOLUTION FIT



4. REQUIREMENTS

4.1. FUNCTIONAL REQUIREMENTS

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 over to a site. Itcan 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 safety is important but making use of the right technology is even more vital.	Detecting gasses is necessary regardless of yourbusiness role or individual purpose. Certain technologies at play make such IoT devices what they are, and if you want to indulgein IoT application development, you must knowwhat they are and what purpose they can fulfill.

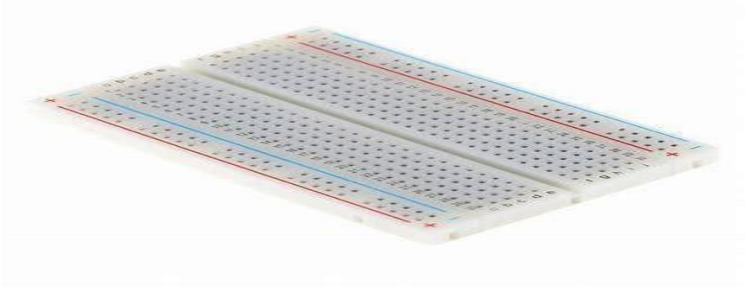
4.2. COMPONENTS REQUIRED

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 16*2	1

ARDUINO UNO R3

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attachit 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’sIDE 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.

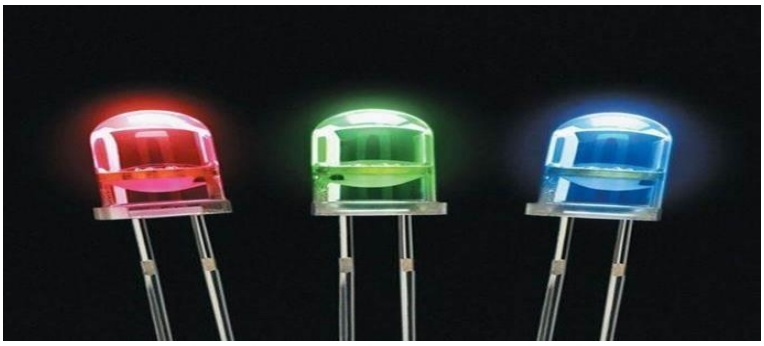
BREADBOARD



A breadboard is a widely used tool to design and test circuit. You do not need to solder wires and components to make a circuit while using a breadboard. It is easier to mount components & reuse them. Since, components are not soldered

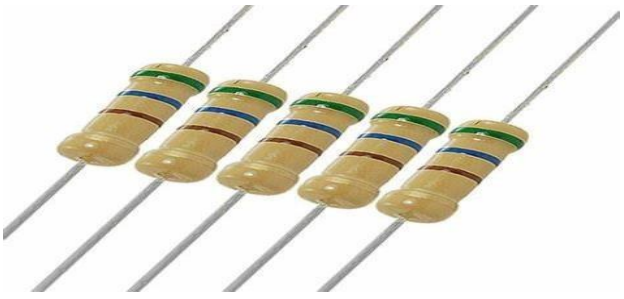
you can change your circuit design at any point without any hassle. It consist of an array of conductive metal clips encased in a boxmade of white ABS plastic, where each clip is insulated with another clips. There are a number of holes on the plastic box, arranged in a particular fashion. A typical bread board layout consists of two types of region also called strips. Bus strips and socket strips. Bus strips are usually used to provide power supply to the circuit. It consists of two columns, one for power voltage and other for ground. Socket strips are used to hold most ofthe components in a circuit. Generally it consists of two sections each with5 rows and 64 columns. Every column is electrically connected from inside.

LED



LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electro-luminance. Electro-luminance is the property of the material to convert electrical energy into light energy and later it radiates this light energy. In the same way, the semiconductor in LED emits light under the influence of electric field. The symbol of LED is formed by merging the symbol of P-N Junction diode and outward arrows. These outward arrows symbolise the light radiated by the light emitting diode.

RESISTOR



A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

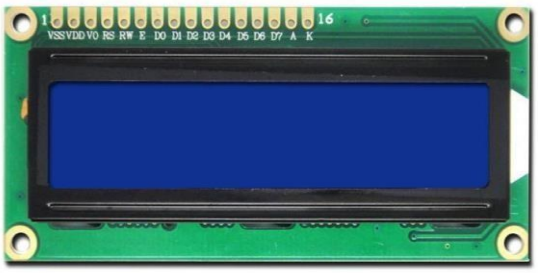
PIEZO

A piezo is a device that generates a voltage when force is applied or becomes deformed when voltage is supplied.

GAS SENSOR

A gas sensor is a device that detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensorproduces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage.Based on this voltage value the type and concentration of the gas can be estimated. Can detect 300 to 5000ppm of natural gas. Good sensitivity to combustible gas.

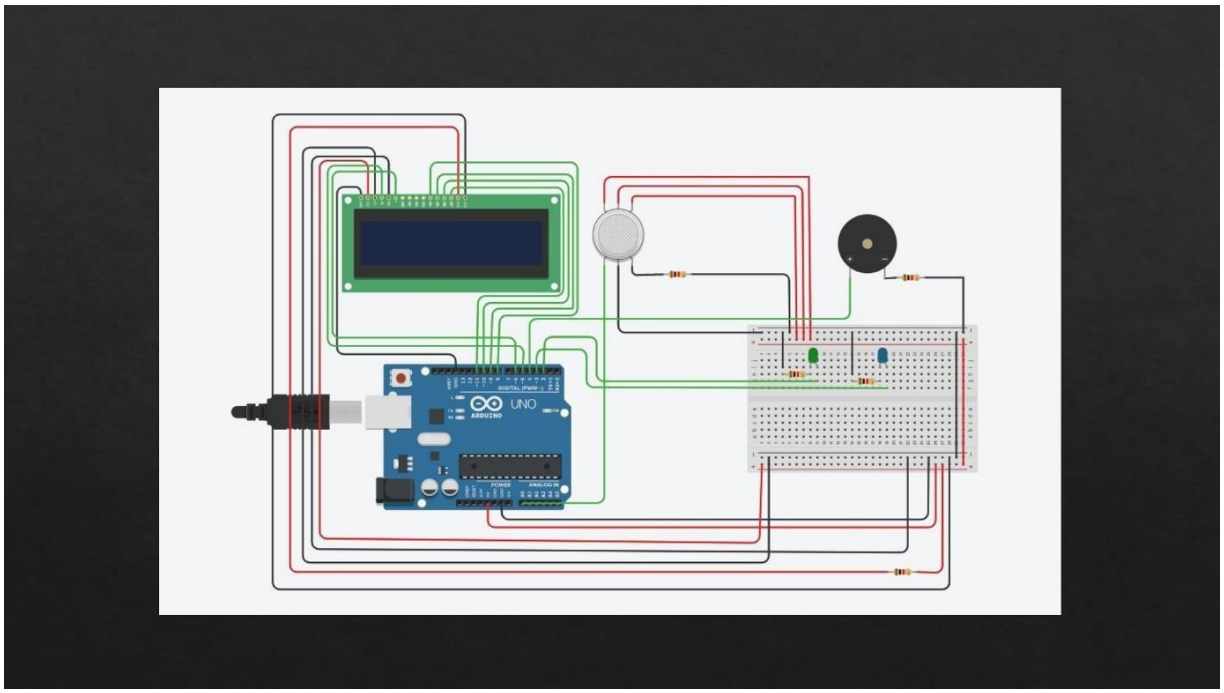
LCD 16*2



16×2 LCD is one kind of electronic device used to display the message anddata. The term LCD full form is Liquid Crystal Display. The display is named 16×2 LCD because it has 16 Columns and 2 Rows. it can be displayed (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots. These displays are mainly based on multi-segment light- emitting diodes. There are a lot of combinations of display available in themarket like 8×1, 8×2, 10×2, 16×1, etc. but the 16×2 LCD is widely used. These LCD modules are low cost, and programmer-friendly, therefore, is used in various DIY circuits, devices, and embedded projects.

METHOD

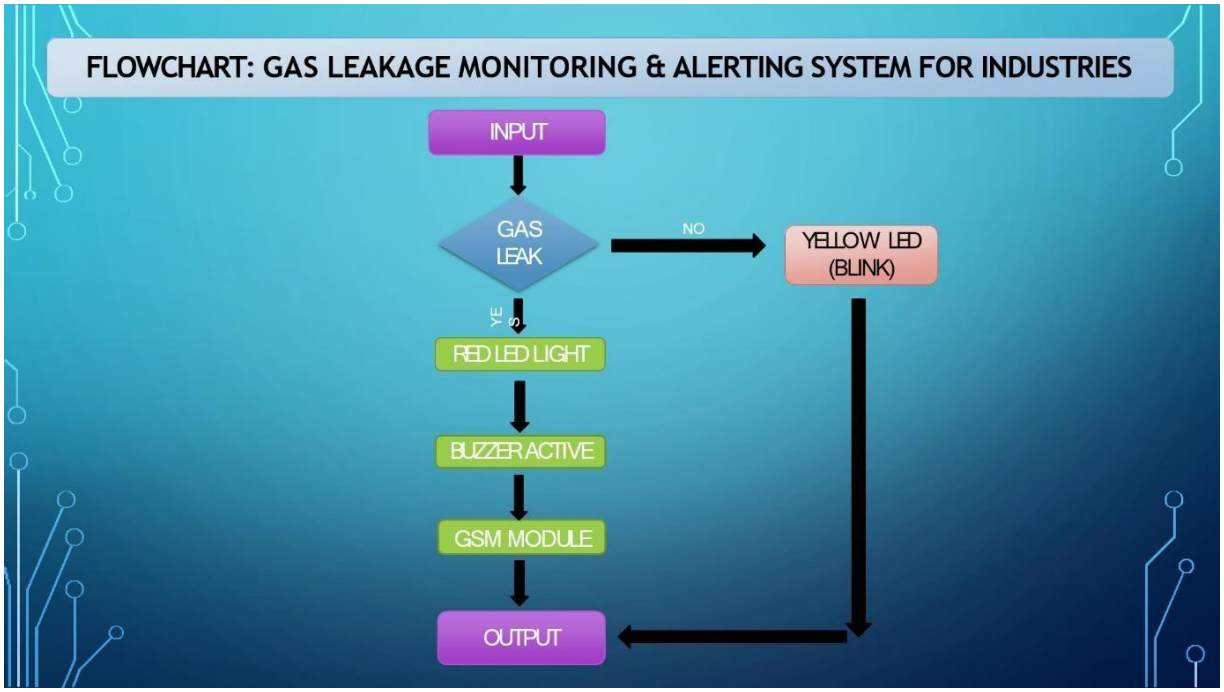
Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. The detection results displayed on LCD. Indicates the people of danger in work place, factory, home. Buzzer activity with beep(siren) sound is made. Also send alert SMS to the in charge of the plant whose number is saved in SIMcard by using GSM modem. The SMS received depends upon the leak of gas in the detection area of the sensor.



Gas sensors work on the principle of transforming the gas absorption effects on the surface of active material into a detectable signal in terms of its changed electric, magnetic, thermal, mechanical, and piezoelectric properties. When the gas sensor detects the gas presence in the atmosphere or a change is gaseous concentration in the atmosphere, the red LED light glows while giving a beep sound that can be heard and a SMS is send to user’s mobile to notify about the gas leakage.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

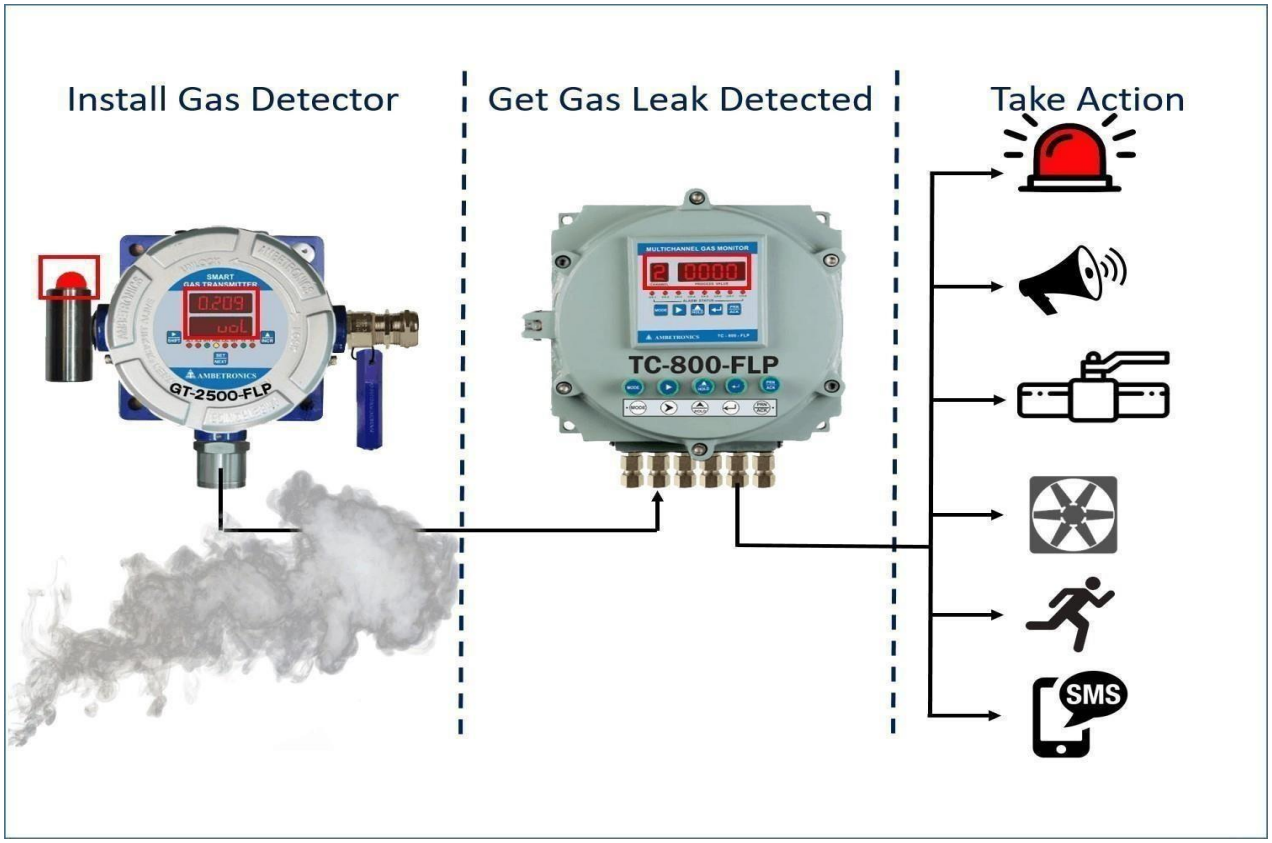


Above data flow diagram give a brief process how the gas is detected upon leakage. As you see, here gas acts as input. When there is a gas leak in the working environment, the gas sensor detects the disturbance. A red light is integrated to indicate the state of emergency. Also a buzzer is connected so workers can get notified immediately when they are so busy that they ignore checking the LED lights. Based on the circumstances, necessary precautions will be taken in order to be safe from explosions or any other effects caused by the gas leakage.

5.2. SOLUTION ARCHITECTURE

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 1m radius of the rover and the sensor output data are continuously transferred to the local server. The accuracy of MQ sensors is not up to the mark thus stray gases are also detected which creates an amount of error in the outputs of the sensors, especially in case of methane. Further the availability andstorage of toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware. As the system operates outside the pipeline, the complication of system maintenance and material

selection of the system in case of corrosive gases is reduced. Thus, the system at this stage can only be used as a primary indicator of leakage inside a plant.



There are several actions can be followed in order to make a safe move away from the danger. As soon as the gas is detected, the control panel would let know all the workers using a siren. Using the long range sirens with high noise would help to let know the people around the factory or industry about the danger. One can step forward to close the valve that is supplying the gas to the gas leaking point. Exhaust fans can be immediately turned on , so the gas which has been into the air already, can be ventilated out into the surrounding atmosphere rapidly, decreasing the concentration of gas leak in the air. Also using the audible speakers, a safe precautions can be announced in mike, that helps people who do not know what steps to be followed in these hectic situations. Also a SMS can be sent to the authorities, where they can finally send a team that would help in fixing the pipe line that caused the gas leakage.

Technology Architecture

The above will be the overall glance regarding how the system works. A gas sensor will be installed in the factory at all the points of gas supply and passage. As soon as there is gas leak, gas detector would detect the leakage and intimate the control panel as well as to our mobiles.

5.3. CUSTOMER JOURNEY MAP

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 of gases.	The system comprises of sensors for detecting gas leaks interfaced to the microcontroller that will give an alert to the user whenever there is a gas leakage, display warning information by using liquid.	Gas leak Detection system: Gas leak detection is a process of identifying potentially hazardous gas leaks by sensors. These sensors usually employ an audible alarm to alert people when gas leak been detected.	An alarm management system represents a 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 leaks alerts
FEELINGS	Write an emotion that you expect the customer to have	Happy about this solution	Embraced on the solution and prompted the good words towards the project	Happy	Encouraging towards this project and giving good feedbacks
BARRIERS	Write a potential challenge to your objective	Higher officials	Commercial companies	The gases 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!.

5.4. User Stories

User type	Functional requirements (Epic)	User Story Number	User Story/ Task	Acceptance criteria	Priority	Release
Customer	Gas detection and level monitoring	USN-1	As a user, I can get the gas leakage alert when gas leaking.	I can notice gas leakage	HIGH	SPRINT-1
		USN-2	As a user, I can get the different gas level when gas leaking	I can observe the level of gas leakage	MEDIUM	SPRINT-1
	Exhaust fan on	USN-3	As a user, I can turn on exhaust fan	I can operate exhaust fan anytime	MEDIUM	SPRINT-2
		USN-4	As a user I can turn on exhaust fan when gas leaking	I can turn on fan when there is a leakage of gas	HIGH	SPRINT-2

	Node-Red Creation	USN-5	As a user, I can receive gas leaking levels with send to alert message.	I can receive alerting message when there is a gas leak	HIGH	SPRINT-3
		USN-6	As a user, I can receive gas leaking levels with alerting messages	I can receive message instantly when there is a gas leak	MEDIUM	SPRINT-3
	Documentation	USN-7	As user, I can get gas level and documentation	I can receive documentation With gas levels.	MEDIUM	SPRINT-4
			As a user, I can receive alert message and documentation	Documentation with Gas leak levels and amount of gas leak.	HIGH	SPRINT-4

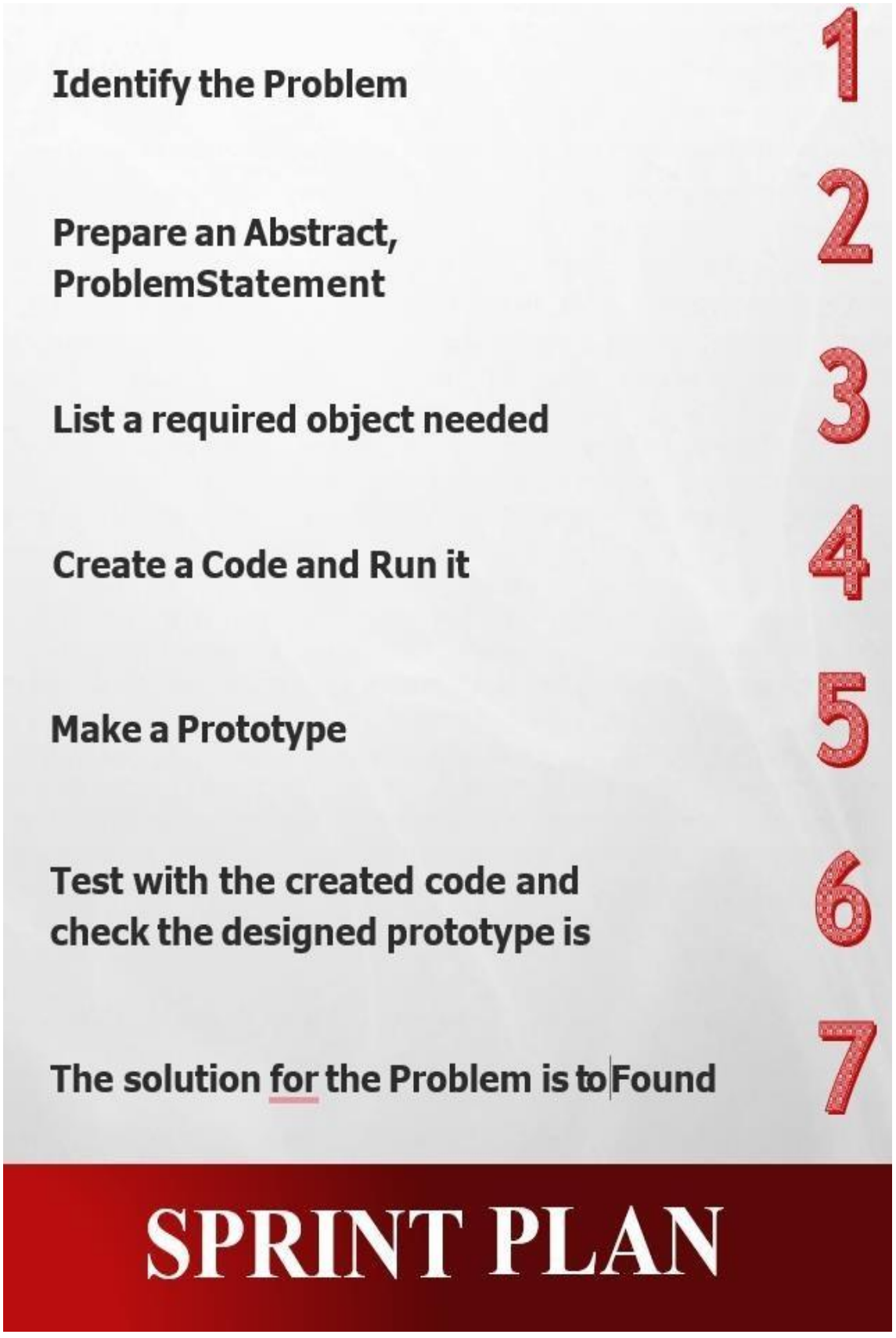
6. PROJECT PLANNING AND SCHEDULING

6.1. SPRINT PLANNING AND ESTIMATION

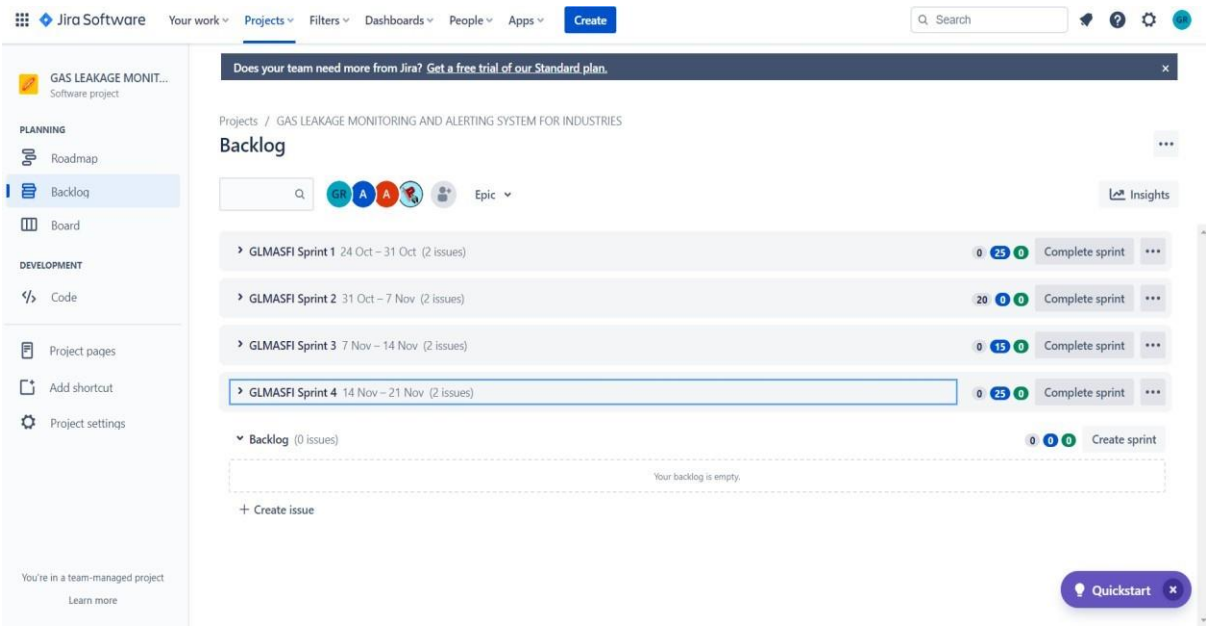
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Total Story Points	Priority	Team Members
Sprint-1	Gas detection and level monitoring	USN-1	As a user, I can get the gas leakage alert when gas leaking.	10	High	Bhermal Adarsh Jain
Sprint-1		USN-2	As a user, I can get the different gas level when gas leaking.	15	Medium	Bhermal Adarsh Jain
Sprint-2	Exhaust fan on	USN-3	As a user, I can turn on exhaust fan.	10	Medium	Guvvala Nikhil Reddy
Sprint-2		USN-4	As a user, I can turn on exhaust fan when gas leaking.	10	High	Guvvala Nikhil reddy
Sprint-3	Node red creation	USN-5	As a user, I can receive gas leakage level with send to alert message.	10	High	A. Lalth Kumar
Sprint-3		USN-6	As a user, I can receive gas leakage level with alert message through mobile.	5	Medium	A. Lalith Kumar
Sprint-4	Documentaion	USN-7	As a user ,I can get the gas level and leakage documentation	10	Medium	Jay Baldiya Jain
Sprint-4		USN-8	As a user ,I can receive alert message and documentation	15	High	Jay Baldiya Jain

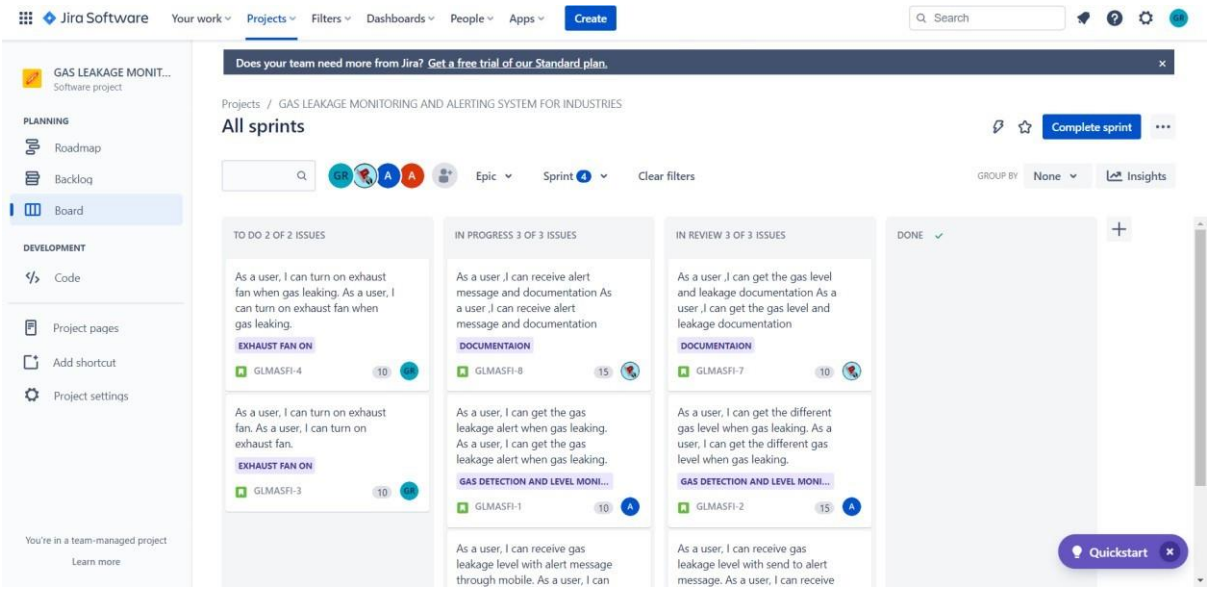
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	25	6 Days	24 Oct 2022	29 Oct 2022	25	31 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	15	6 Days	07 Nov 2022	12 Nov 2022	15	17 Nov 2022
Sprint-4	25	6 Days	14 Nov 2022	19 Nov 2022	25	19 Nov 2022

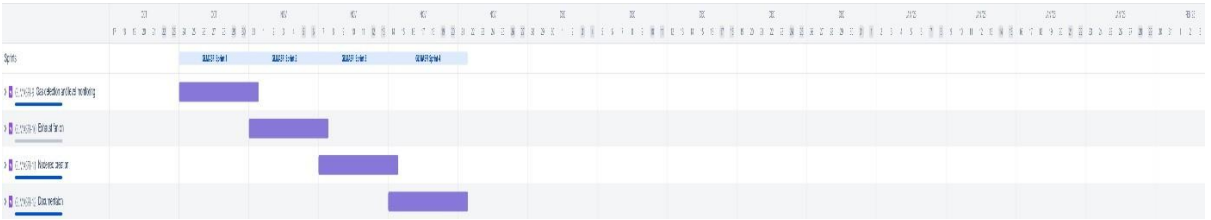
6.2. SPRINT DELIVERY SCHEDULE



6.3. REPORT FROM JIRA

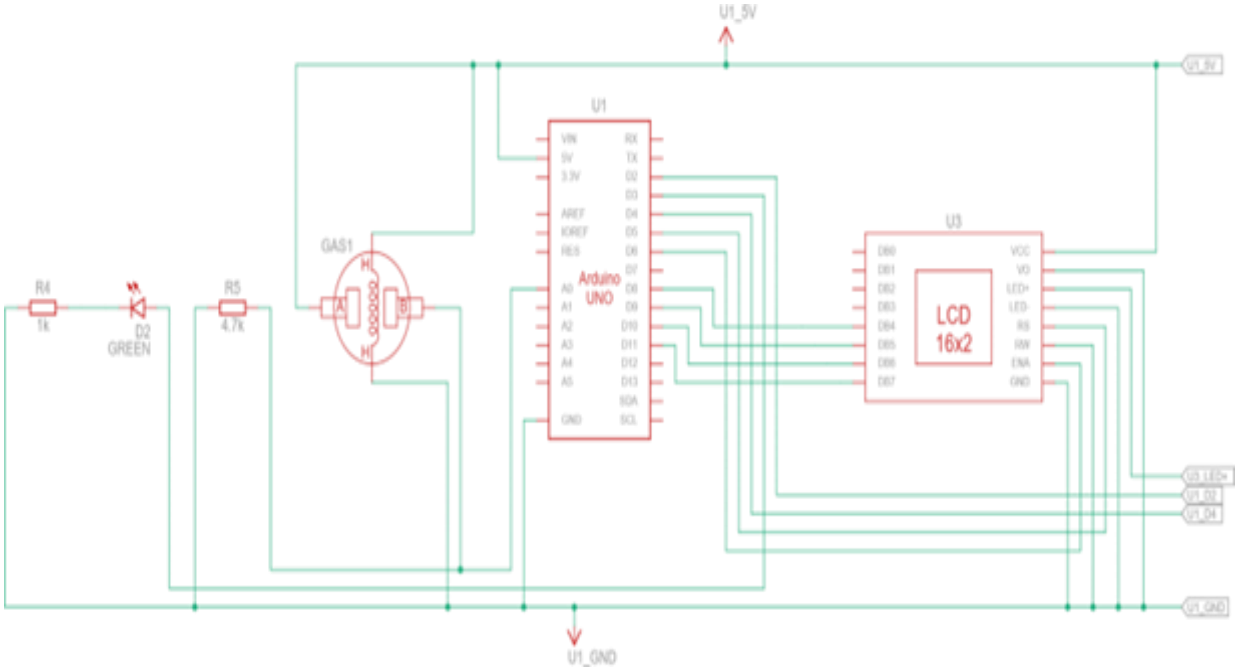




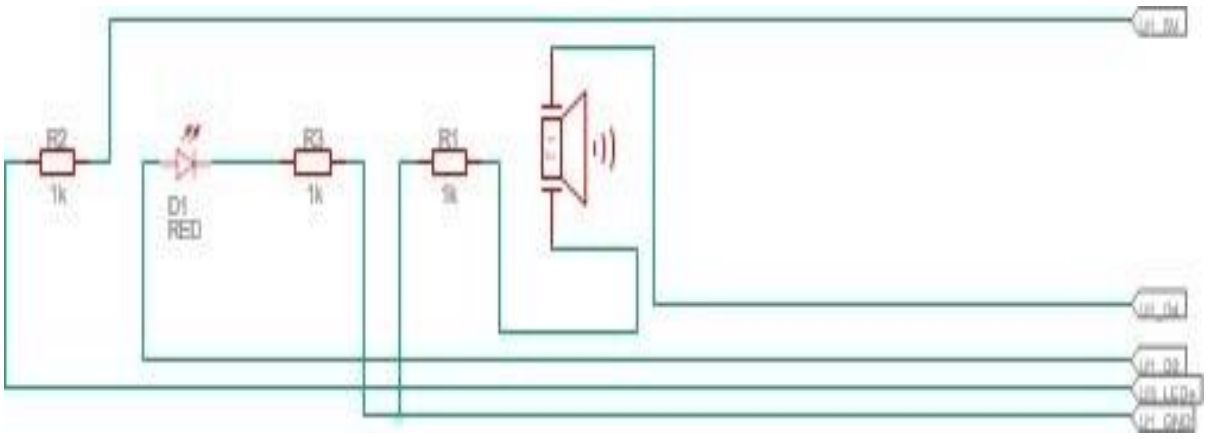


7. CODING AND SOLUTIONING

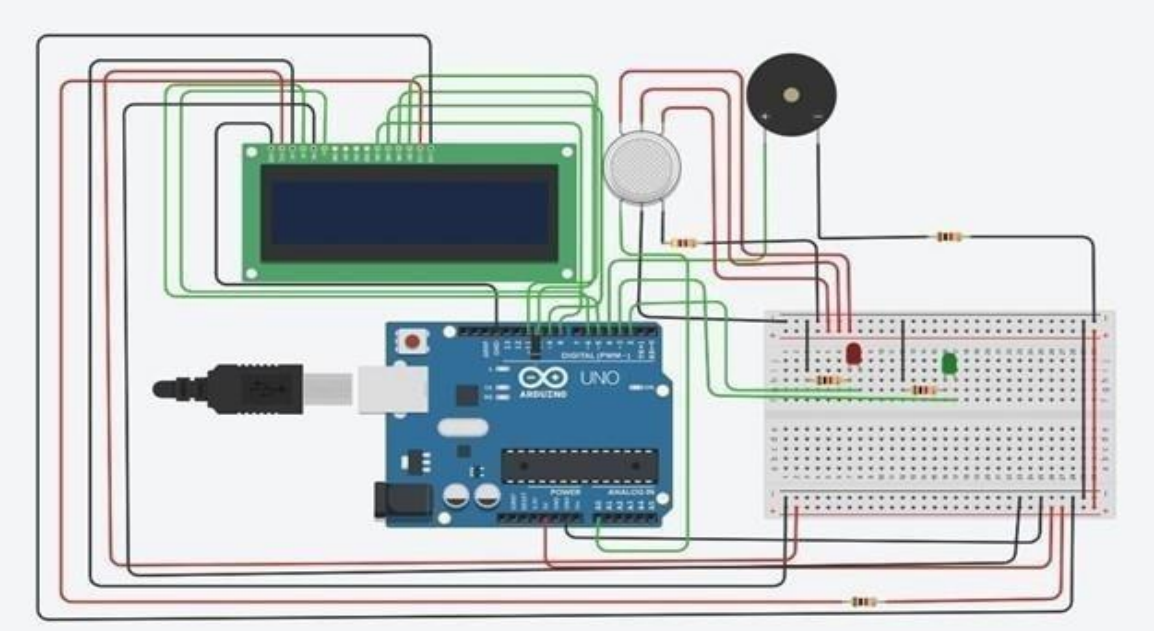
7.1. Feature 1

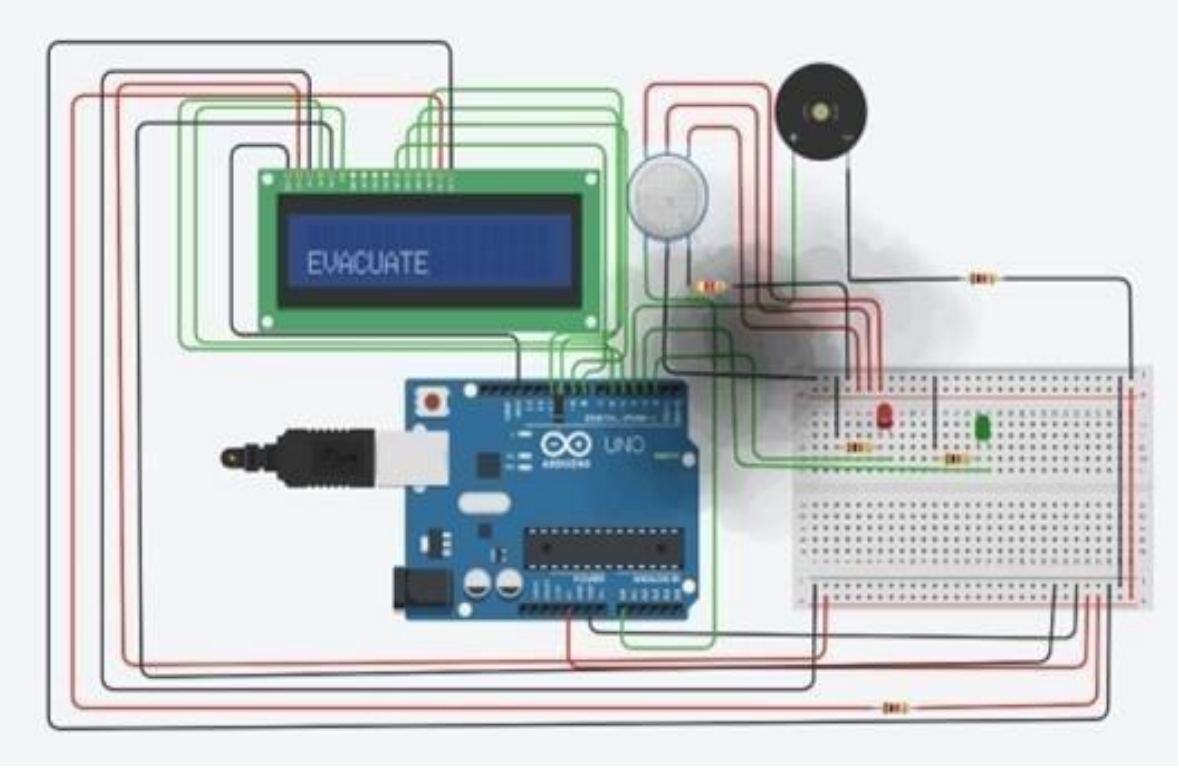


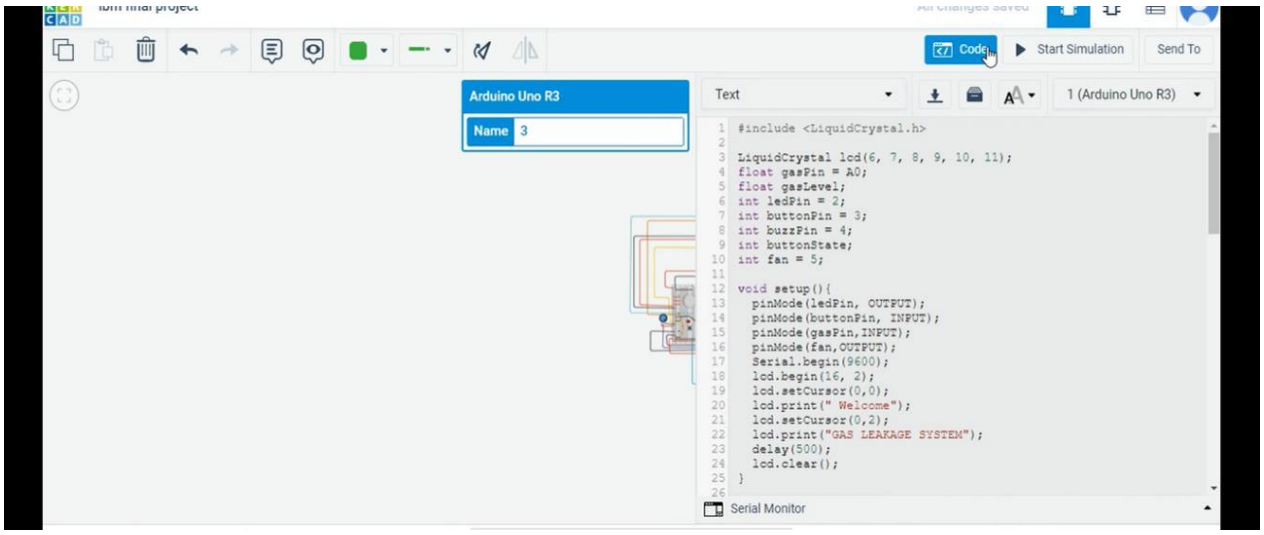
7.2. Feature 2



7.3. Database Schema







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

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 the Document

The purpose of this document is to briefly explain the test coverage and open issues of the[ProductName] project at the time of the release to User Acceptance Testing (UAT).

Defect Analysis

This report shows the numberof resolved or closed bugs at each severity level,and how theywere 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 anddomestic 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 Microcontroller are used to build the sensor.]

10. ADVANTAGES AND DISADVANTAGES

Advantages

1) Cost Effective- this Particular model can be purchased for a low cost or one can able to build it on their own.
2) Response time is in order of 1 to 2 seconds.
3) Easy to assemble and maintain- Connections and programming are not much difficult and much maintenance is required.
4) High accuracy- The level of the gas in the air, and the amount of gas leaked can be recorded and intimated.
5) The Sensor has excellent sensitivity.

Disadvantages

1) The kit cannot prevent fire.
2) Automatic cutoff of gas supply is not provided when there is a gas leak.
3) Applicable only as Alerting system while providing sound and message text to the monitor.
4) Little sensitivity to smoke
5) Loses its effectiveness when it is subjected to the chemicals sprinkled when there is an explosion of a chemical container along with the gas leak.
6) When there is heavy smoke, dust or fog, it disturbs the detection of the gas sensor and the system will fail to measure.

11. CONCLUSION

Using this monitoring and alerting system, we can be able to save lives in dangerous situations. Gases like Carbon dioxide, Oxygen, and Propane will be sensed using the gas sensor node. Arduino UNO microcontroller and a simple procedure in connecting the components and a bit of coding are used to build this monitoring and alerting system. This is a cost-effective operating IoT system that can be used in factories, industries, or for household purposes, to detect any gas leak from the cylinder.

12. FUTURE SCOPE

The present model is just for detecting gas leakage and alerting the user about the incident. But this monitoring system should be installed at all critical points of gas pipelines where there may be a chance for gas leaking. Therefore, multiple devices needed to be installed to make this work. In order to make this simple and much more effective, modifying the present model to advance where a single monitoring system is enough to monitor the gas flow throughout the gas line of the whole industry. This modification may include a few other sensors that can measure the pressure of the gas that is flowing in the pipes. When there is a gas leak, the pressure in pipes will decrease, and the pipe which is responsible for the leakage will also be detected. Also, with further research and work, a model can be developed where it can possess the capability to shut the valve automatically and to put off the fire, in case any fire emergence.

13. SOURCE 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,HIG
   H);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();
  }
}
```

14. GITHUB AND PROJECT DEMO LINK

GitHub- https://github.com/IBM-EPBL/IBM-Project-30540-1660148298

Project Demo link- https://www.tinkercad.com/things/fGvVek7Ol3p-ibm-final-project/editel?sharecode=iGapHQfMmO_xV402duIgs56cyEezHI88xpORIGxviqc

Video Link-

https://drive.google.com/file/d/1h9EaT61Vnx-YXpsS2zG2OSUNjnaQTgnw/view?usp=drivesdk