

PROJECT REPORT

PROJECT NAME	GAS LEAKAGE MONITORING & ALTERING SYSTEM FOR INDUSTRIES
TEAM ID	PNT2022TMID03956
TEAM MEMBERS	NANDHITHA.S.T LAVANYA.N PRAKRITI.B RAJALAKSHMI.S
BRANCH	ELECTRONICS AND COMMUNICATION ENGINEERING

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 ensure it. Working or living in a dangerous environment necessitates specific safety measures. A type of natural gas known as "Liquefied Petroleum Gas"(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. As a result, a system for detecting and monitoring gas leakages 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

Gas leakage detection and alerting system using Arduino Uno

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The presence of hazardous LPG gas leakage in a domestic, work place, also, stored gases container gas which exhibits ideal characteristic is use. For that sake, an alarm unit is used to vibrate an alarm which is buzzer. Buzzer gives an audible sign of the presence of LPG volume. The sensors are widely used to detect essence of propane, iso-butane, LPG and even smoke. The sensor has an advantage to combine a sensitivity response time. If the LPG sensor senses gas leak from work place or home, sensor output goes to active low (logic-0) condition. Arduino UNO is used in the project; low signals are overlooked by the Arduino and gas leakage is been noticed by the Arduino. The Arduino UNO turns on the LCD and buzzer. It even turns on the GSM modem after that, it continues to send messages SMS to mobile number specifically mentioned in the program of the source code for alerting danger to the people.

Sensor-Based Gas Leakage Detector System

Department of Electrical and Computer Engineering, North South University,
Presented at the 7th Electronic Conference on Sensors and Applications, 15–30 November 2020;

Liquefied Petroleum Gas (LPG) is the main source of fuel, especially in urban areas because it is clean compared to firewood and charcoal. Gas leakage is a major problem in the industrial sector, residential premises, etc. Nowadays, home security has become a major issue because of increasing gas leakage. Gas leakage is a source of great anxiety with ateliers, residential areas and vehicles like Compressed Natural Gas (CNG), buses, cars etc. One of the preventive and useful methods to stop accidents associated with the gas leakage is to install a gas leakage detection kit at vulnerable places which includes an alerting system for the users. Design of a gas leakage detection system, that can automatically detect, alert and control gas leakage. The system is based on a sensor that easily detects a gas leakage.

LPG Leakage Detector using Arduino with SMS Alert and Sound Alarm

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Nowadays, LPG leakages is a mutual hindrance in household and manufacturing. “LPG Leakage Detector using Arduino with SMS Alert and Sound Alarm”, will be a great help in

terms of preventing any danger caused by gas leakage. This is used to detect the presence of LPG leakage as a part of a safety system. Apart from sound alarm, an SMS alert system will inform the authorized person about the leakage and the solenoid valve will be triggered to shut down the gas supply to prevent any harmful effects due to the leakage. Usage of gas sensor is to monitor the LPG if the gas leak reaches beyond the normal level and it will trigger the sound alarm. In addition, the authorized person will be informed about the leakage via SMS alert and the gas supply will be automatically shut down. The people can be saved from a potential explosion caused by gas leakage.

Hazardous Gas Detection and Alerting Using Sensors

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Home safety has been a major issue in our day-to-day life and it is everyone's duty to provide good safety system at home. The main objective is to eradicate hazardous gas from home using IoT. The Internet of Things (IoT) is a system of interrelated computing devices which has the feature of providing unique features without human-to-human or human-to-computer interaction. It aims at developing the home safety against the leakage of LPG gas. In case of any leakage it provides an SMS alert to the user using the GSM and switch off the gas knob or valve. In addition it also turnoff the power supply and inverter automatically in order provide a complete home safety. The sensors are used to monitor the leakage of the gas as sensor plays as important role in our day-to-day life. Sensors are of different kinds and are present in the different fields such as monitoring the health of old patients, sensing the environment, leakage of gas etc. Today every individual is living in a smart world and our entire house is based on automation system in order to prevent accidents and safeguard ourself.

Problem Statement Definition & Brainstorming:

Problem Statement :

Gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important **because there are many gases that can be harmful to organic life, such as humans or animals**

Solutions:

We can use sensors that are used to detect essence of propane, iso-butane, LPG and even smoke. These sensor has an advantage to combine a sensitivity response time.

The system will detect the presence of excess amounts of harmful gases in environment then this system will notify the use

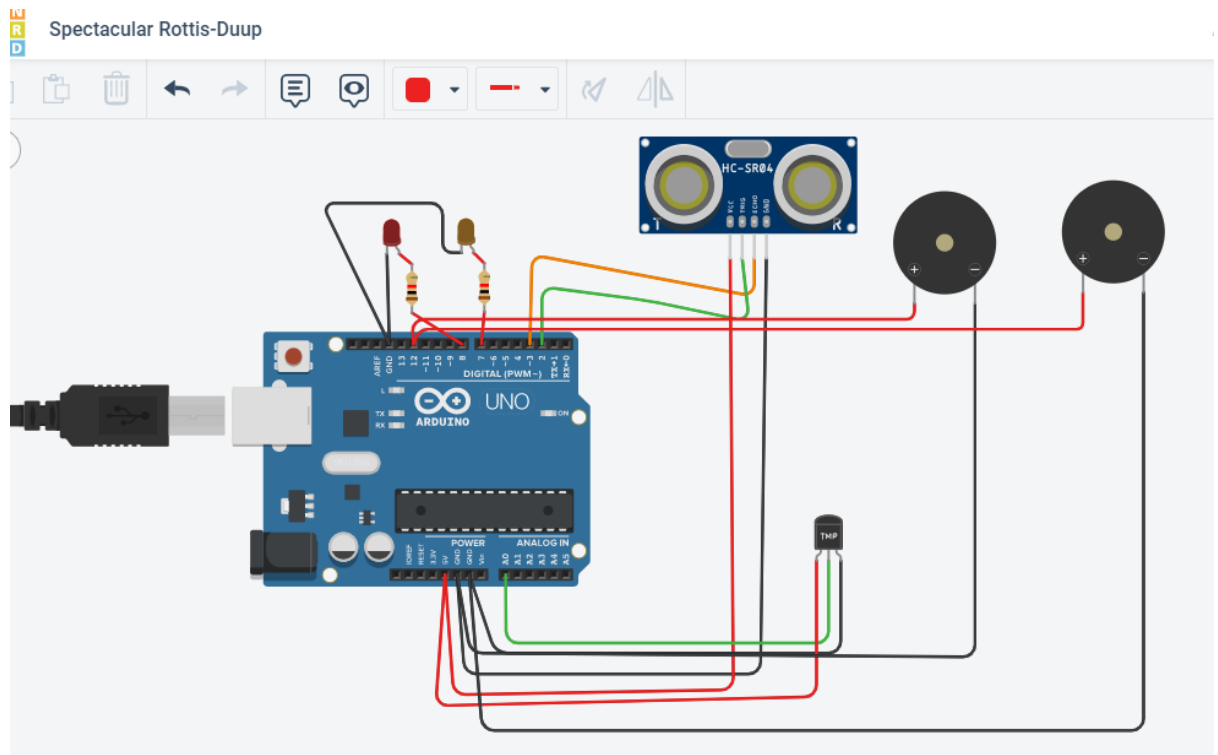
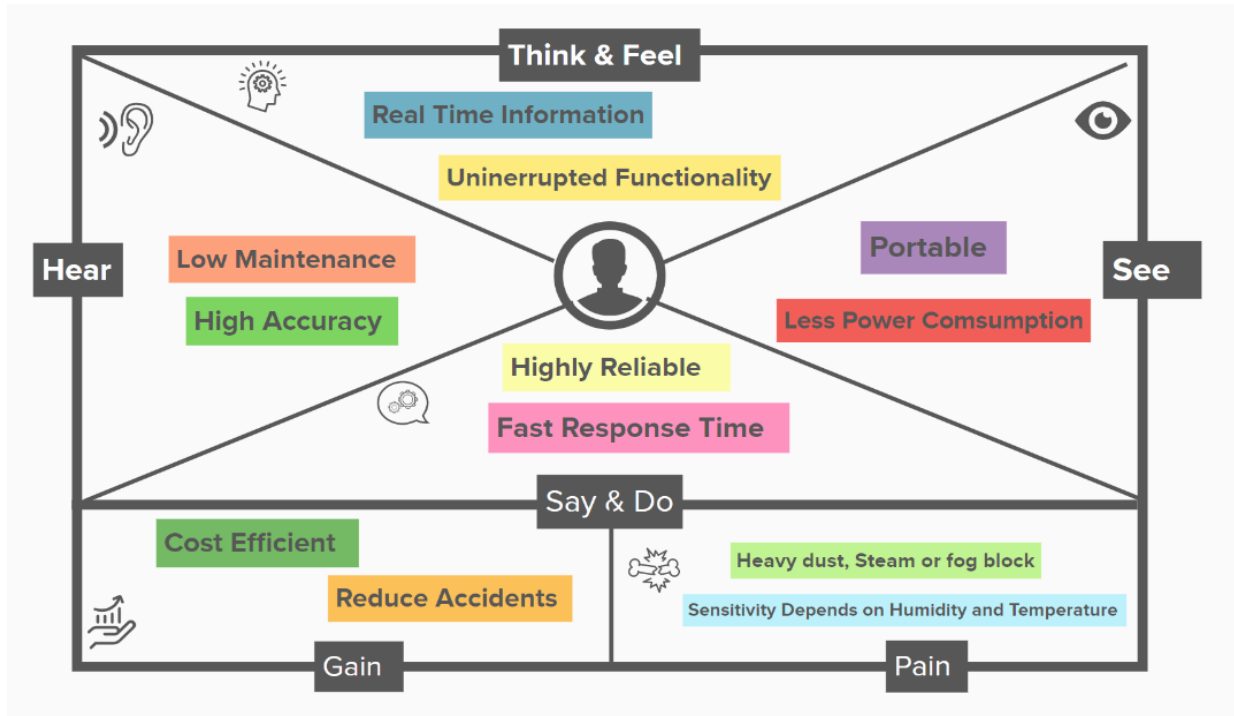


We can provide the information such as when a gas leakage is noticed, sensors in the project are used to notice the gas leakage and immediately turns ON the buzzer for the danger indication. Buzzer is a clear indication of gas leakage

We can also send messages SMS to mobile number specifically mentioned in the program of the source code for alerting danger to the people.

3 .IDEATION & PROPOSED SOLUTION

Empathy Map Canvas:



4. Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Gas detector can sound an alarm to operators in the area where the leak is occurring , giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life , such as humans or animals.
2.	Idea / Solution description	We can use sensors that are used to detect essence of propane , Iso-butane , LPG and even smoke. These sensors have an advantage to combine a sensitivity response time. The system will detect the presence of excess amount of harmful gases in environment and immediately turns ON the buzzer for danger indication . Buzzer is a clear indication of gas leakage.
3.	Novelty / Uniqueness	Although, there are many solutions for this problem but they have some disadvantages . Some of the solutions only detect some particular gases and some others only detect those gases and alert small distance only we can rectify these issues by alerting large area and detect more gases. We can notify fire and rescue service department by sending the alert message to them.
4.	Social Impact / Customer Satisfaction	The solution given by us will be more helpful for the workers and the society. Our solution will prevent great losses like Bhopal Gas Tragedy in the world. We can also save more lives of people. Our project helps the people and those workers who works in industries which uses harmful gases .Our projects gives them mental relief and safer environment.
5.	Business Model (Revenue Model)	The main objective of our project is to save lives. So we can establish this project as a product and we can visit some industries and make them aware of this project so we can establish our project in their industries.
6.	Scalability of the Solution	We can use our project as a basic model and we can develop our project in a large scale and establish some new ideas in the future .We can upgrade our project in the future.

Problem Solution fit:

Define CS, PR into CL	1. CUSTOMER SEGMENT(S) CS Most of the Industrial workers are engaged In gas related work	6. CUSTOMER LIMITATIONS CL <small>EG. BUDGET, DEVICES</small> The current available solution are high In budget and installation cost is also high. Small Industries cannot afford.	5. AVAILABLE SOLUTIONS AS <small>PLUSES & MINUSES</small> Testbenches, quick connectors are some of the available solution in market	Explore AS, differentiate
	2. PROBLEMS / PAINS + ITS FREQUENCY PR The gasleakage can only be detected by humans. sometlmes It cannot be detected due to less sense of smell which may lead to accidents	9. PROBLEM ROOT / CAUSE RC Any type of gas leakage can cause fire breakout in the industries which lead to damages to costly machines or sometimes it leads to death of workers orking in the industries	7. BEHAVIOR + ITS INTENSITY BE This project will help us to detect the leakage of hamful gases and alert us by giving a buzzer sound.Accidents due to gas leakage can be reduced	
Focus on PR, Tap into BE, understand RC				Focus on PR, Tap into BE, understand RC
Identify strong TR & EM	3. TRIGGERS TO ACT TR All the industries must have gas detecting and alerting system as mandatory	10. YOUR SOLUTION SL We can use sensors that are used to detect essence of propane , Iso-butane , LPG and even smoke. These sensors have an advantage to combine a sensitivity response time. The system will detect the presence of excess amount of harmful gases in environment and immediately turns ON the buzzer for danger indication . Buzzer is a clear indication of gas leakage.	8. CHANNELS of BEHAVIOR CH ONLINE <ul style="list-style-type: none"> The reports are generated periodically The user can check the functionality of sensors used in this system via online OFFLINE <ul style="list-style-type: none"> When there Is an alert for danger we have to check manually The safety officer should check the system manually once In a week or month. 	Extract online & offline CH of BE
	4. EMOTIONS EM <small>BEFORE / AFTER</small> Most of the gases cannot be detected by humans. Human detecting thegas Is harmful to their health which may lead to comma or death. So, installing the gas leakage and alerting system will be useful to detect the gas leakage at early stage.			

Functional requirement:

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 in environment 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 to avoid accidents.

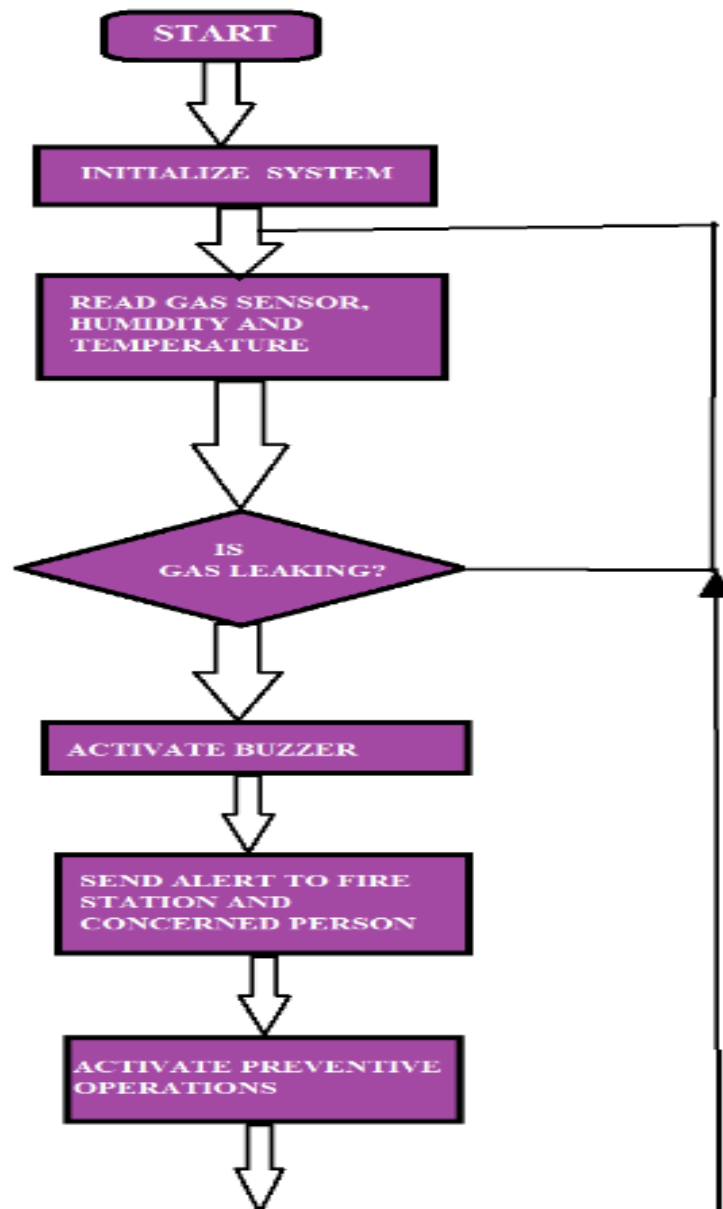
Non-Functional requirements:

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

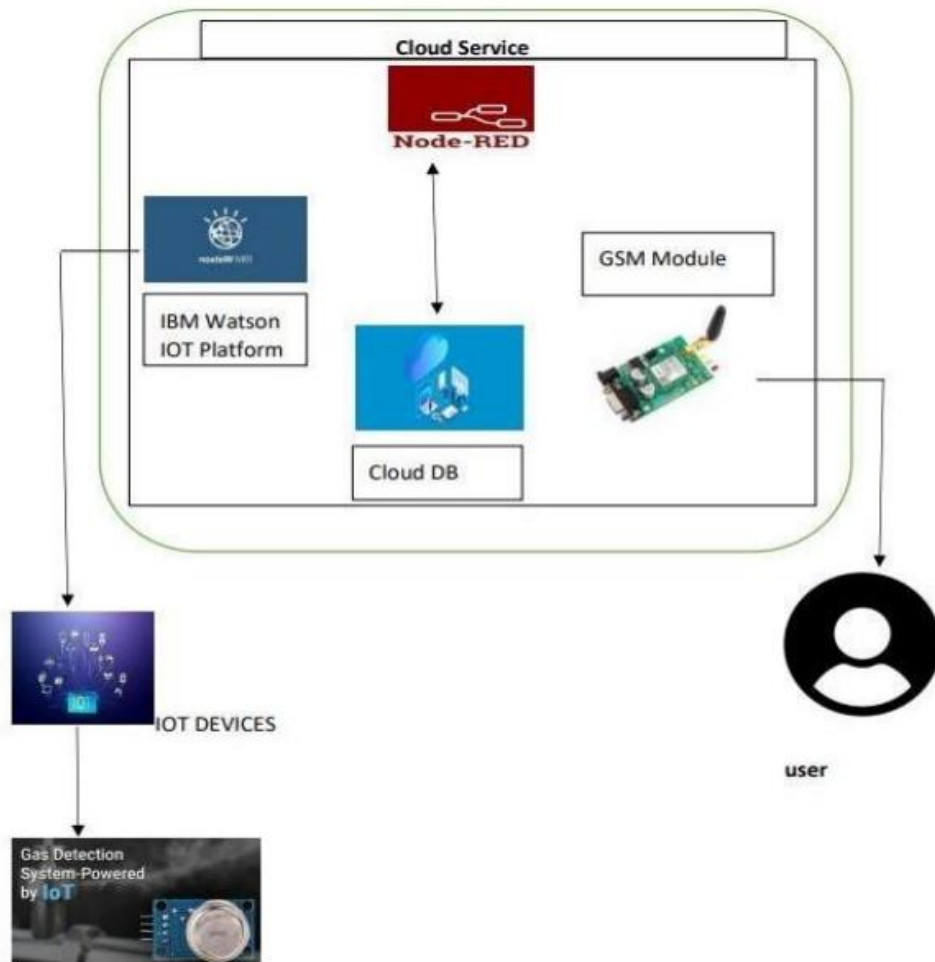
5. PROJECT DESIGN

Data Flow Diagrams:

GAS LEAKAGE DETECTION AND ALTERING SYSTEM



Solution & Technical Architecture:



Customer Journey:

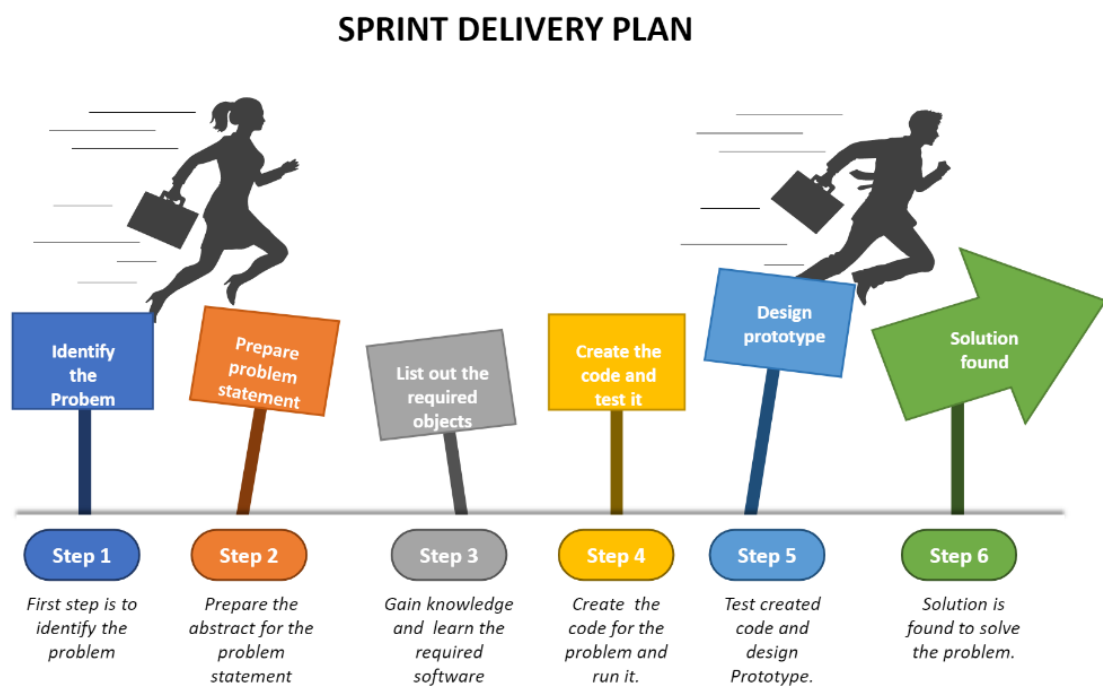
	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
OBJECTIVES	Write a goal or activity	Gas leakage detection systems protect the workers working in factory from accidents that occurs due to gas leakage	This system consist of sensors which are used to detect the gas leakage and these sensors are interfaced to microcontroller. When the gas leakage occurs this system will alert the user.	Gas leakage detection system is the process of identifying harmful gas leakage by using sensors. These sensor usually attached with an alarm to alert people when dangerous gas leakage has been detected.	An alarm management system represents the series of actions a system performs in an event of gas leakage.
NEEDS	Write a need you want to meet	Fire hazard prevention	Harmful gas detection	Oxygen level measurement	Prompt gas leak alerts
FEELINGS	Write a emotion you expect the customer to have	Happy about this solution	Happy about the solution. They give good reviews on the proposed solution.	Happy	Encouraging towards this project and giving good feedbacks.
BARRIERS	Write a potential challenge to your objective	Higher officials	Commercial companies	Some gasses are toxic in nature, resulting in human unconsciousness and even death if consumed in large quantities.	Moreover, blasts due to gas leakage are another disaster that everyone-working in a factory or at home –would want to avoid at any costs
AWARENESS	Write how to create awareness	Online advertisement and social media	Television ads	newspaper	Direct communication with customers
SERVICE	Write what at all services are provided	Provide warranty	Help desk/chat	Free installation	Free service for atleast 1 year

6. PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

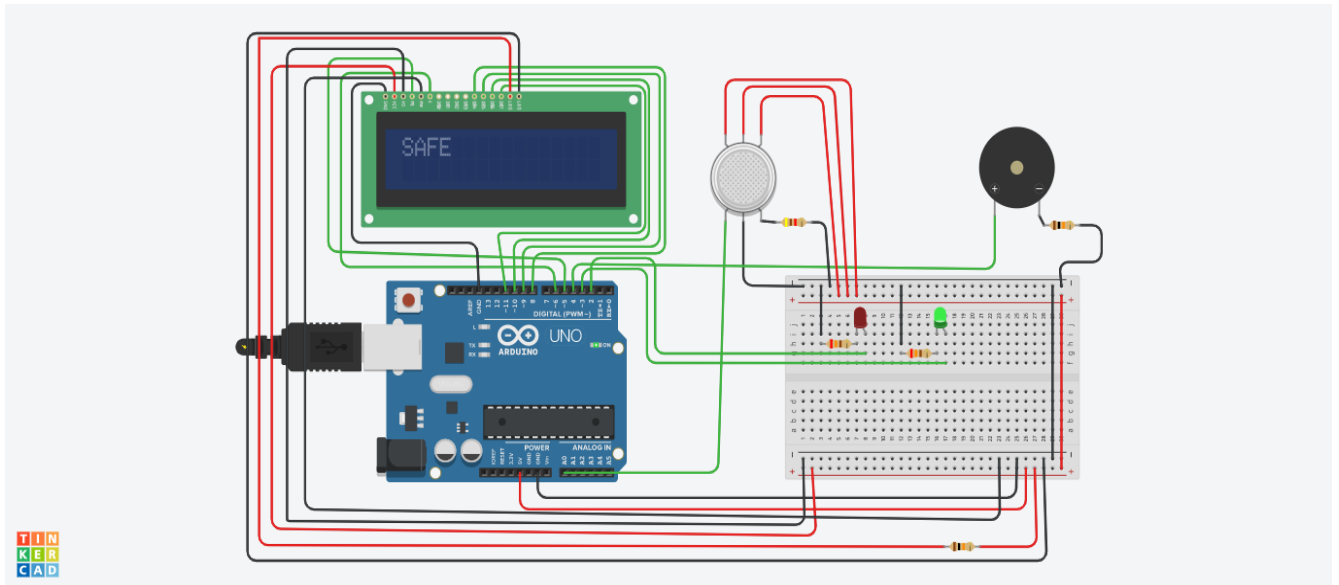
- ☐ *SPRINT PLAN*
- ☐ *ANALYZE THE PROBLEM*
- ☐ *PREPARE An ABSTRACT, PROBLEM STATEMENT*
- ☐ *LIST A REQUIRED OBJECT NEEDED*
- ☐ *CREATE A PROGRAM CODE AND RUN IT*
- ☐ *MAKE A PROTOTYPE TO IMPLEMENT*
- ☐ *TEST WITH THE CREATED CODE AND CHECK THE DESIGNED PROTOTYPE*

Sprint Delivery Plan



7. Schematic Diagram of project & Components:

Circuit Diagram



COMPONENTS:

The design of a sensor-based automatic gas leakage detector with an alert and control system. The components are

S.NO	NAME OF THE COMPONENTS	QUANTITY
1.	<u>Arduino</u> UNO R3	1
2.	Breadboard	1
3.	LED	5
4.	Resistor	2
5.	Gas Sensor	1
6.	LCD(16x2)	1

ARDUINO UNO R3:

The Arduino Uno is a microcontroller board based on the ATmega328. Arduino is an open-source, prototyping platform and its simplicity makes it ideal for hobbyists to use as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

BREADBOARD:

A breadboard, solderless breadboard, or protoboard is a construction base used to build semi-permanent prototypes of electronic circuits. Unlike a perfboard or stripboard, breadboards do not require soldering or destruction of tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education.

LED:

A light-emitting diode (LED) is a semiconductor device that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.

RESISTOR:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators.

GAS SENSOR:

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability. They are often part of a larger embedded system, such as hazmat and security systems, and they are normally connected to an audible alarm or interface. Because gas sensors are constantly interacting with air and other gasses, they have to be calibrated more often than many other types of sensors.

LCD(16X2):

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

8. CONCLUSION:

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 like CO₂, 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 build the sensor.

9. 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.

10. APPENDIX:

```

#include
<LiquidCrystal.h>
LiquidCrystal
l(5,6,8,9,10,11);

int rled = 2;
int gled = 3;
int buzzer = 4;
int ss = A0;
int st = 400;
void setup()
{
  pinMode(rled, OUTPUT);
  pinMode(gled,OUTPUT);
  pinMode(buzzer,OUTPUT);
  pinMode(ss,INPUT);
  Serial.begin(9600);
  l.begin(16,2);
}
void loop()
{
  int anV =
  analogRead(ss);
  Serial.print(anV);
  if(anV>st)
  {

    digitalWrite(rled,HIGH);

    digitalWrite(gled,LOW);

    tone(buzzer,1000,10000);
    l.clear();
    l.setCursor(0,1);
    l.print("ALERT");
    delay(2000);
    l.clear();
    l.setCursor(0,1);
    l.print("EVACUATE");
    delay(2000);
  }
  else
  {

    digitalWrite(gled,HIGH);

```

```
digitalWrite(rled,LOW);
  noTone(buzzer);
  l.clear();
  l.setCursor(0,0);
  l.print("SAFE");
  delay(2000);
  l.clear();
  l.setCursor(0,1);
  l.print("ALL
CLEAR");
  delay(2000);
}
```

GitHub Link: <https://github.com/IBM-EPBL/IBM-Project-24465-1659943191.git>

ProjectLink:<https://www.tinkercad.com/things/6Od4Zgousd7-grand-snicket-fyyran/editel?sharecode=HLMgyzs3wYybxdyn4HPS03R2ryF737ogtWFiOcyWA-4>