PROJECT REPORT

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 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. 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 society members through the alarm and sending notifications.

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 produces an 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 for humans 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 monitoring system. In this system, the gas leakage is detected and controlled by means of the exhaust fan. The level of LPG in the cylinder is also continuously monitored.

Srinivasan, Leela, Jeya bharathi, Kirthik,Rajasree; in this research paper they told about gas leakage detection 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 safety measure.

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 framework sends 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 detection and 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.

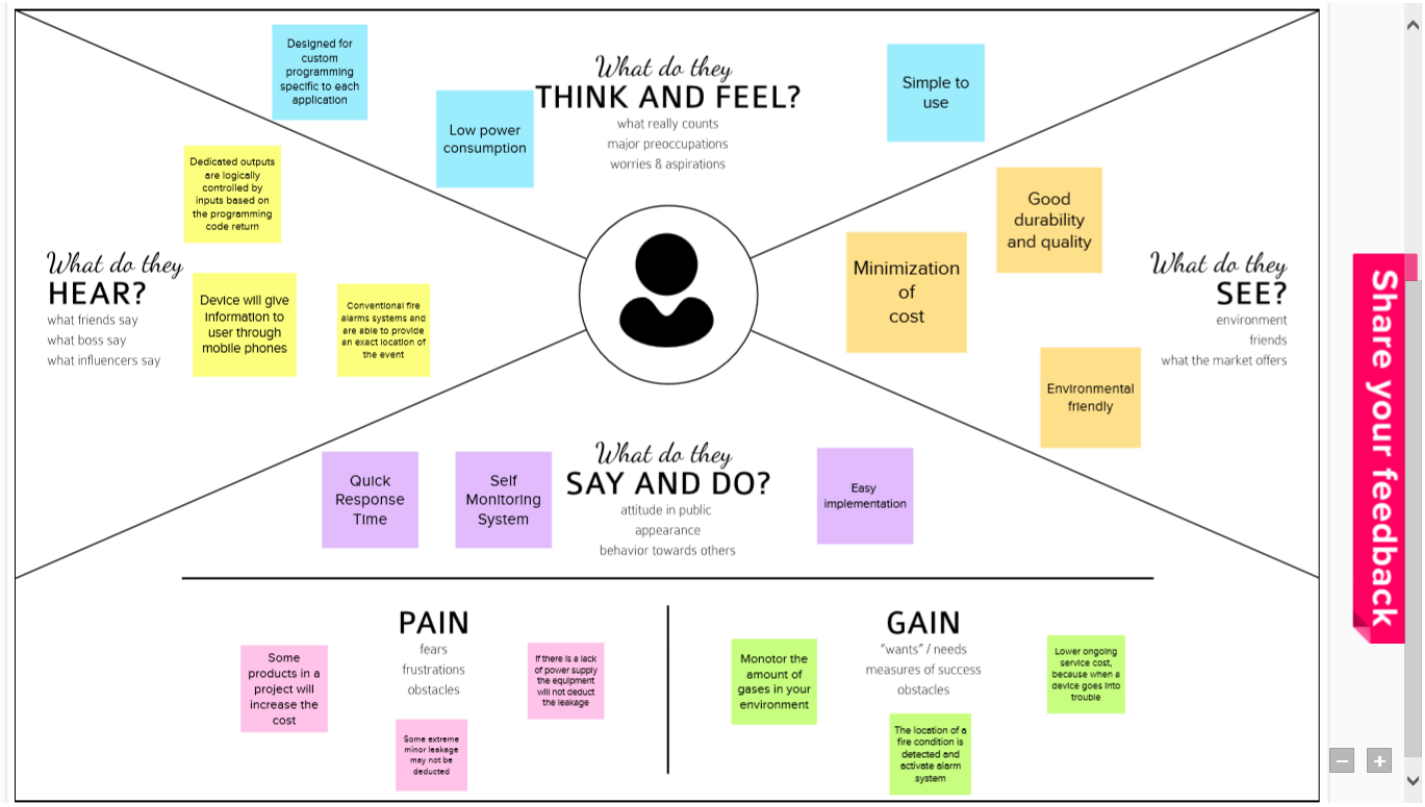
Pal-Stefan Murvaya, Ioan Sileaa, 2008, they told in their survey on gas leak detection and localization techniques various ways to detect gas leakage. They introduce some old or new techniques to detect the gas. The proposed techniques in this paper are nontechnical methods and hardware-based methods which include acoustic methods, optical methods, and active methods. In their survey 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 have no efficient system for monitoring	High cost and Complicated process of Installing	Disappointed
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	Frustrated

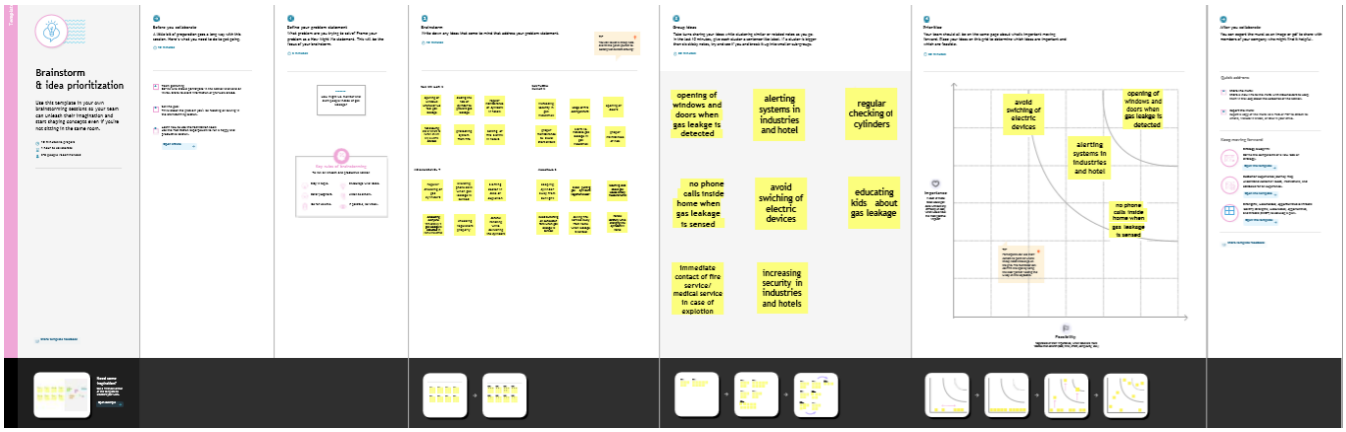
3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:

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 has always been an important criterion while designing a 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 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 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. The presence of excess amounts of harmful gases in the environment then this system can notify the user. The system can notify to society admin about the condition before a mishap takes place through a message. The system consists of gas detector sensors, an Arduino board, ESP8266, and a 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, and 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 the cloud server. The server can Check that the sensor values existed in the threshold value. If the sensor value can cross the limit the server can send the command to the hardware for buzzing the alarm. The server also sends the notification message to the user.

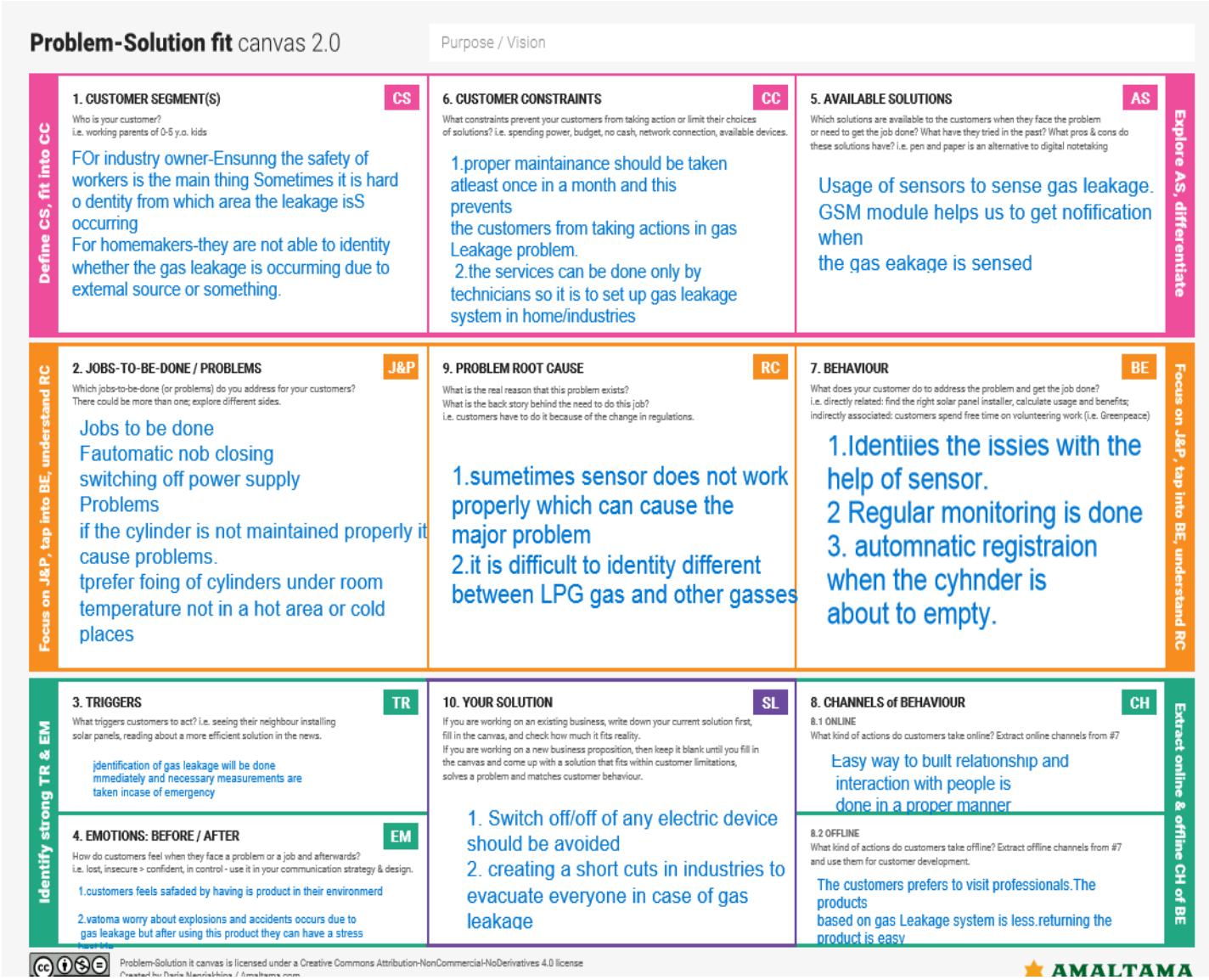


In this paper, we use IOT technology for enhancing the existing safety standards. While making this prototype has been to bring a revolution in the field of safety against the leakage of harmful and toxic gases in the environment and hence nullify any major or minor hazard being caused due to them.

3.3 Proposed Solution:

S.No	Parameters	Description
1.	Problem Statement (Problem to be solved)	Gas Leakage Monitoring and alerting System for Industries
2.	Idea / Solution description	By using Arduino UNO with MQ Gas sensors it detects the Gas leakage and alert the admin.
3.	Novelty / Uniqueness	We use location tagging and alert service so that the admin and fire department team will be notified the exact location as soon as the leakage is detected.
4.	Social Impact / Customer Satisfaction	Saves labour life and resources from fire accident.
5.	Business Model (Revenue Model)	By using : Safe from fire accidents, strong financial By without using :Fire accident, loss of lives, loss of resources.
6.	Scalability of the Solution	It is well advanced in the saving the lives of peoples of the industries.

Problem Solution fit:



4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

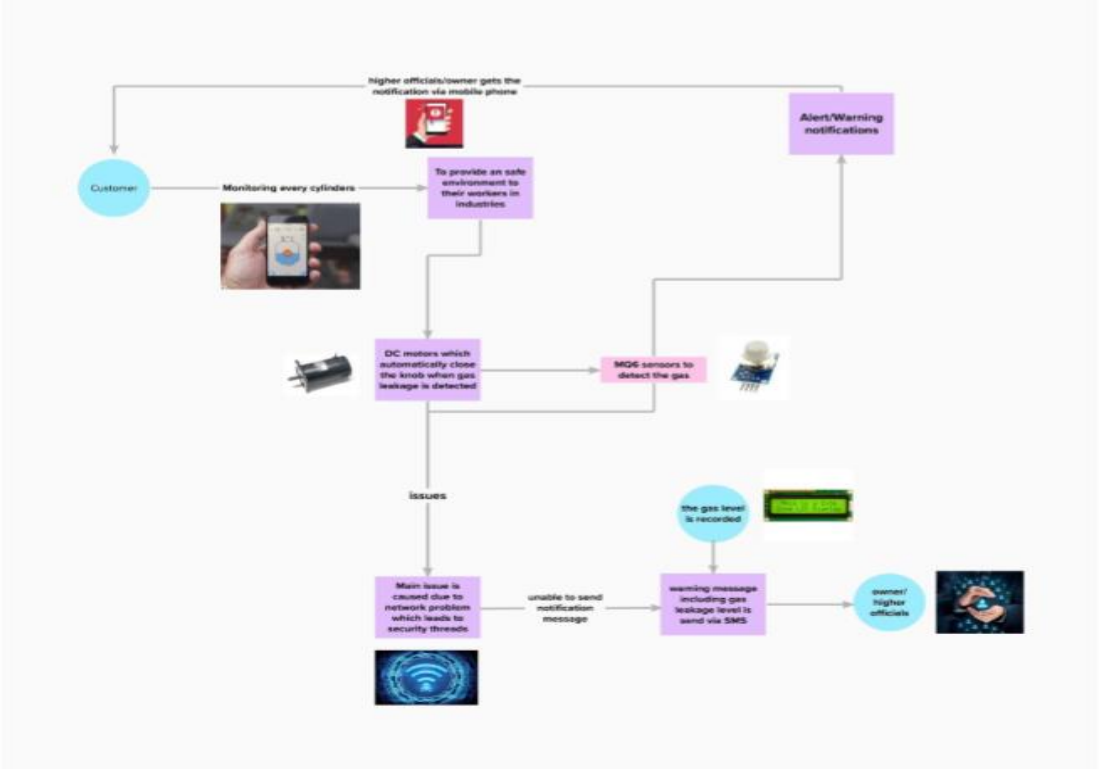
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	DC Motor	*With the help of DC motor we can automatically close the knob of the cylinder whenever gas leakage is detected.
FR-2	Sensor	*MQ6 Sensor helps us to sense/detect gas leakage level. This sensor can detect gas concentrations from 200 to 10000ppm.
FR-3	LCD Display	*LCD Display continuously shows the reading of gas level in the environment.
FR-4	Raspberry pi	*Raspberry pi receives the input light on the sensor and without any delay it starts activating the DC motor and sends notification messages to the owner.
FR-5	GSM Module	*By using GSM module we can able to alert the user by sending warning messages.
FR-6	Buzzer	*By fixing buzzers in industries we can able to alert the workers when there is a gas leakage is detected in their surroundings.

4.2 Non-Functional requirements:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	*DC motor is to close the knob of cylinder in case of leakage. *Sensors to sense gas leakage and the gas level is simultaneously shown in an LCD board.
NFR-2	**Security**	* GSM module is installed to send alert notifications message to the owner of the house/industry. *Buzzer are used in industries to indicate and alert workers.
NFR-3	**Reliability**	*It helps to monitor the gas level regularly by which we can able to avoid explosions.
		*Buzzers are used to notify the workers in industries which helps to save many life before any accidents occurs.
NFR-4	**Performance**	*Actions are taken immediately after detection. *Alert notifications are send to the owner without any delay. *Helps to reduce accidents occurs by gas explosions in home/industries.
NFR-5	**Availability**	*This device has MQ6 sensor that is highly sensitive to gas leakage and it helps us to know about the leakage without any delay.
NFR-6	**Scalability**	*instead of using DC motor we can use stepper motor which gives a better performance and it does not require human help.

5. PROJECT DESIGN

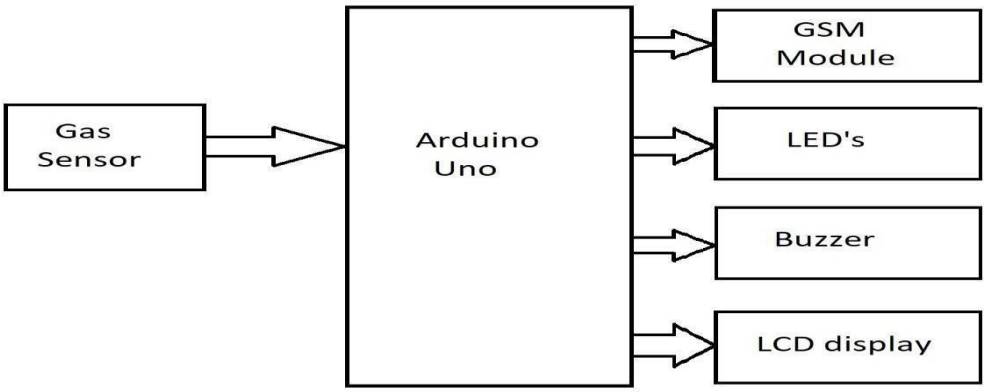
5.1 Data Flow Diagrams:



User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer(family member/industry owner)	Registration	USN-1	As a user ,I can register for the device in the owners mobile application by entering my email and password	I can access my account / dashboard	High	Sprint-1
Customer(higher authority)	confirmation	USN-2	As a user I will receive confirmation message via email and once I received I can install the device in the owners place	I can receive confirmation email & click confirm	High	Sprint-1
Customer (fire service 101)	Safety measure register	USN-3	As a register I can register the application in owner/family members mobile phone	I can register & access the dashboard with Facebook Login	Low	Sprint-2
Customer (mobile user)	Mobile application	USN-4	As a user I can register by mobile application	I can register for gas detection device with owners mobile number and the alert message will be send by SMS	Medium	Sprint-1
Customer (credential)	Login	USN-5	As a user I can log into the device by entering email & password in the owner's mobile application	Mail address and passwords are default	High	Sprint-1
Customer (Web user)	Notification	USN-7	As a user when there is a critical situation regarding gas explosion the alert notification will be received through GSM module	Alert message is sent to owners mobile as an SMS	High	Sprint-1
Customer care Executive	Network Connectivity	USN-8	When there is a gas leakage is detected in the surrounding	Sensor detect the leakage and notifies the owner via message	High	Sprint-1



5.2 Solution & Technical Architecture:

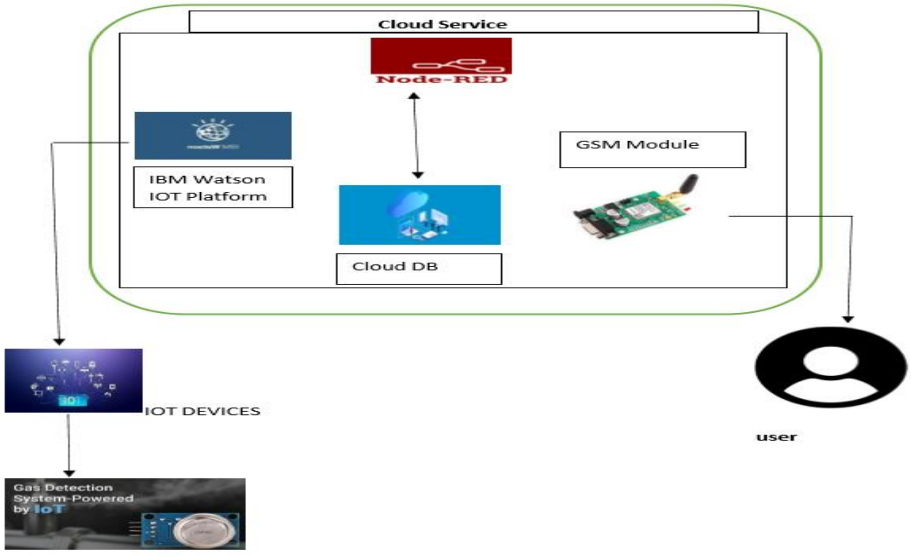


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	User has to register and we can able to view the other device. ex: using web UI, mobile app etc.,	HTML, CSS, JavaScript
2.	IOT Application Logic-1	Owner's device should be connected to the system	Python
3.	IOT Application Logic-2	Owner's device should be in on condition	IBM Watson STT service
4.	IOT Application Logic-3	If gas leakage is detected the notification message is send to the owner	IBM Watson Assistant
5.	Database	Data type can be any form such as text, User defined blob of data sent from cloud IOT core device etc.,	SQ lite, In Flux DB
6.	File Storage	File with be labelled with what they contain and how long they should be kept	IBM Block Storage or Local File system
7.	External API-1	Purpose of External API used in the device is to use the internet for communicating and conducting allotted operations efficiency.	Aadhar API, etc.
8.	Machine Learning Model	IOT and machine learning delivers insights otherwise hidden in data for rapid automated response and improved decision making	Object Recognition Model, Danger prediction Model etc.

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

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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 rover and 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 detected which creates an amount of error in the outputs of the sensors, especially in the case of methane. Further, the availability and storage of toxic gases like hydrogen sulfide also create 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.

6. PROJECT PLANNING & SCHEDULING

6.1 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 IS

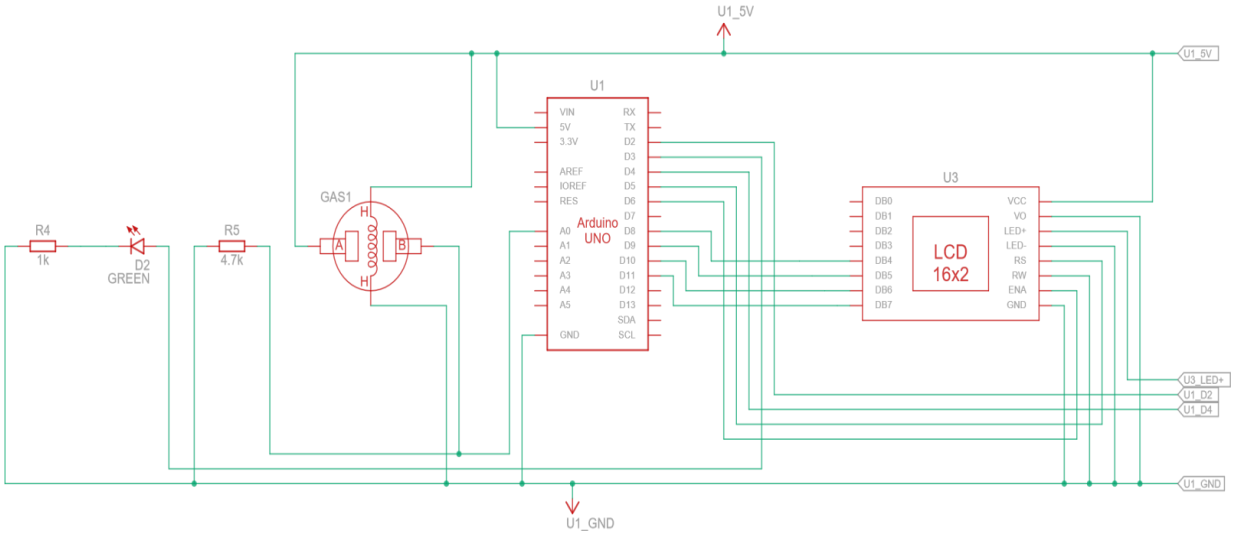
6.2 Sprint Delivery Schedule

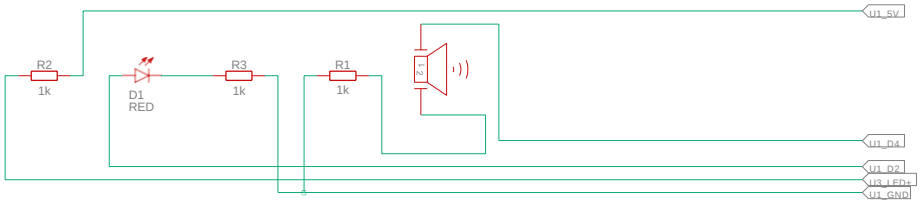
- Sprint 1
- Sprint 2
- Sprint 3
- Sprint 4

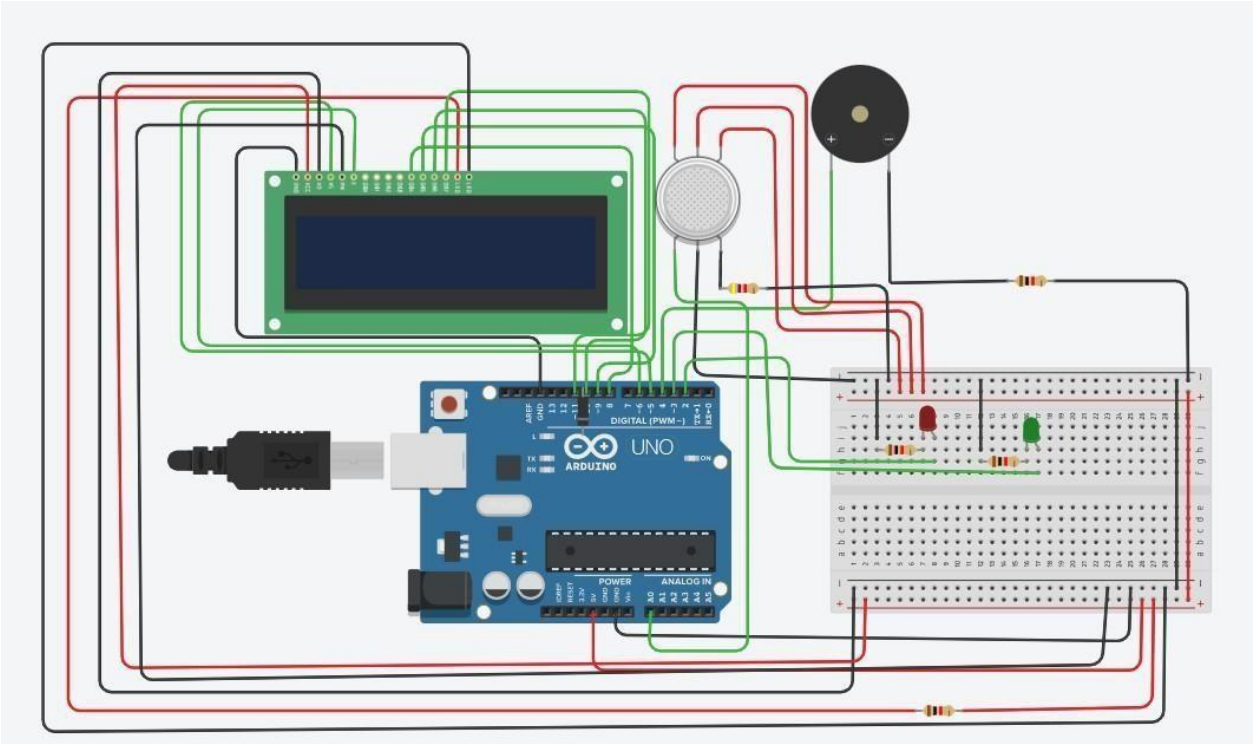
We are Developing the code in this Schedule.

7. Schematic Diagram of project & Components:

7.1 Circuit Diagram:







7.2 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 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 (16x2)	1

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

Source Code:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(5,6,8,9,10,11);
int redled = 2;
int greenled = 3;
int buzzer = 4;
int sensor = A0;
int sensorThresh = 400;
void setup()
{
pinMode(redled, OUTPUT);
pinMode(greenled,OUTPUT);
pinMode(buzzer,OUTPUT);
pinMode(sensor,INPUT);
Serial.begin(9600);
lcd.begin(16,2);
 }
void loop()
{
 int analogValue = analogRead(sensor);
 Serial.print(analogValue);
```

```
if(analogValue>sensorThresh) {
digitalWrite(redled,HIGH);
digitalWrite(greenled,LOW);
tone(buzzer,1000,10000);
lcd.clear();
 lcd.setCursor(0,1);
 lcd.print("ALERT");
 delay(1000);
 lcd.clear();
 lcd.setCursor(0,1);
 lcd.print("EVACUATE");
 delay(1000);
   }
 else
 {
  digitalWrite(greenled,HIGH);
  digitalWrite(redled,LOW);
  noTone(buzzer);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("SAFE");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALL CLEAR");
   delay(1000); }
  }
```

GitHub & Project Demo Link:

https://github.com/IBM-EPBL/IBM-Project-11489-1659331093