PROJECT REPORT

ROJECT NAME

GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES

TEAM ID

PNT2022TMID28961

TEAM MEMBERS

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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 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.

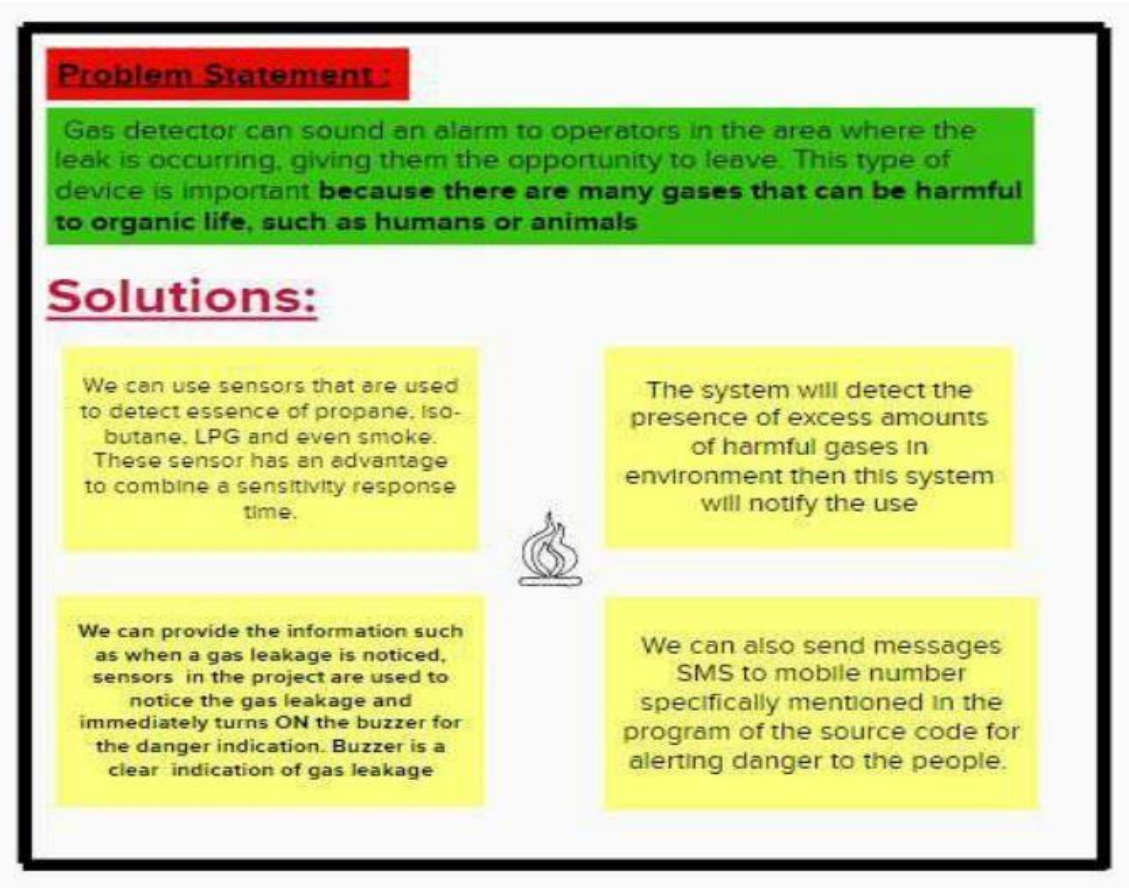
Srinivasan, Leela, Jeya bharathi, Kirthik,Rajasree; in this research paper they told about gas leakage detection and control. In this paper, the gas leakage resulting in fatal inferno has become a serious problem in households and other areas where household gas is handled and used. It alerts the subscriber 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.

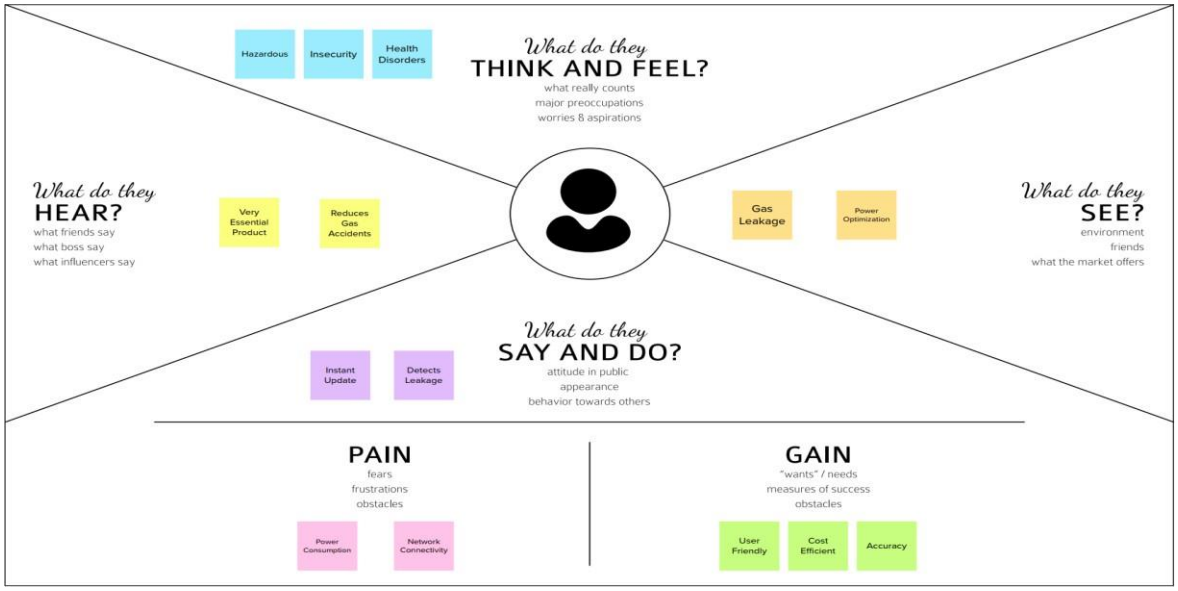
Pal-Stefan Murvaya, Ioan Sileaa, 2008, they told in their survey on gas leak detection and localization techniques various ways to detect gas leakage. They introduce some old or new techniques to detect the gas. The proposed techniques in this paper are nontechnical methods and hardware-based methods 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:

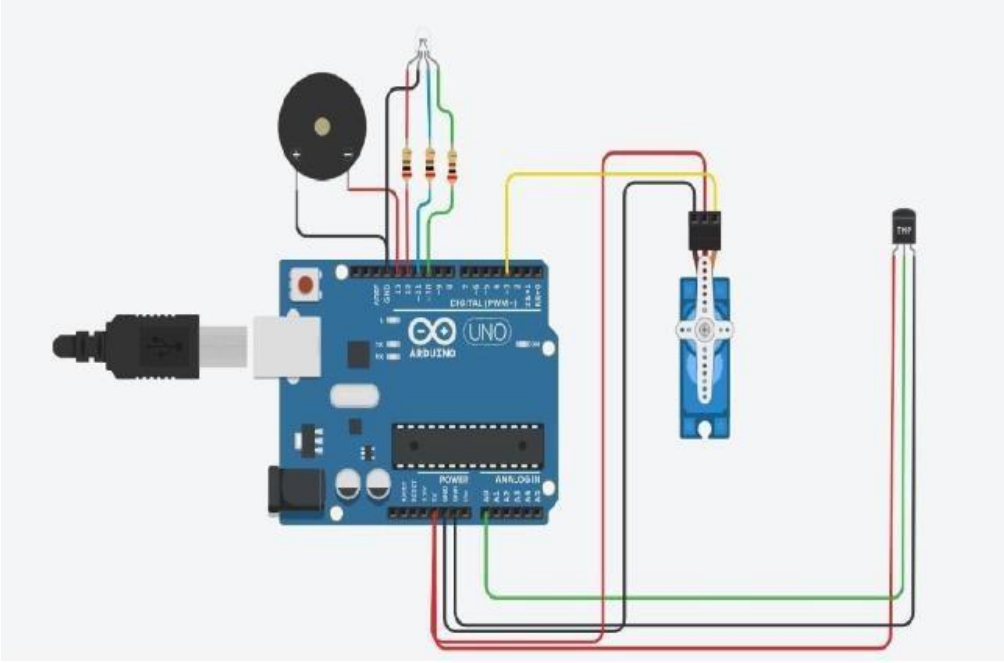


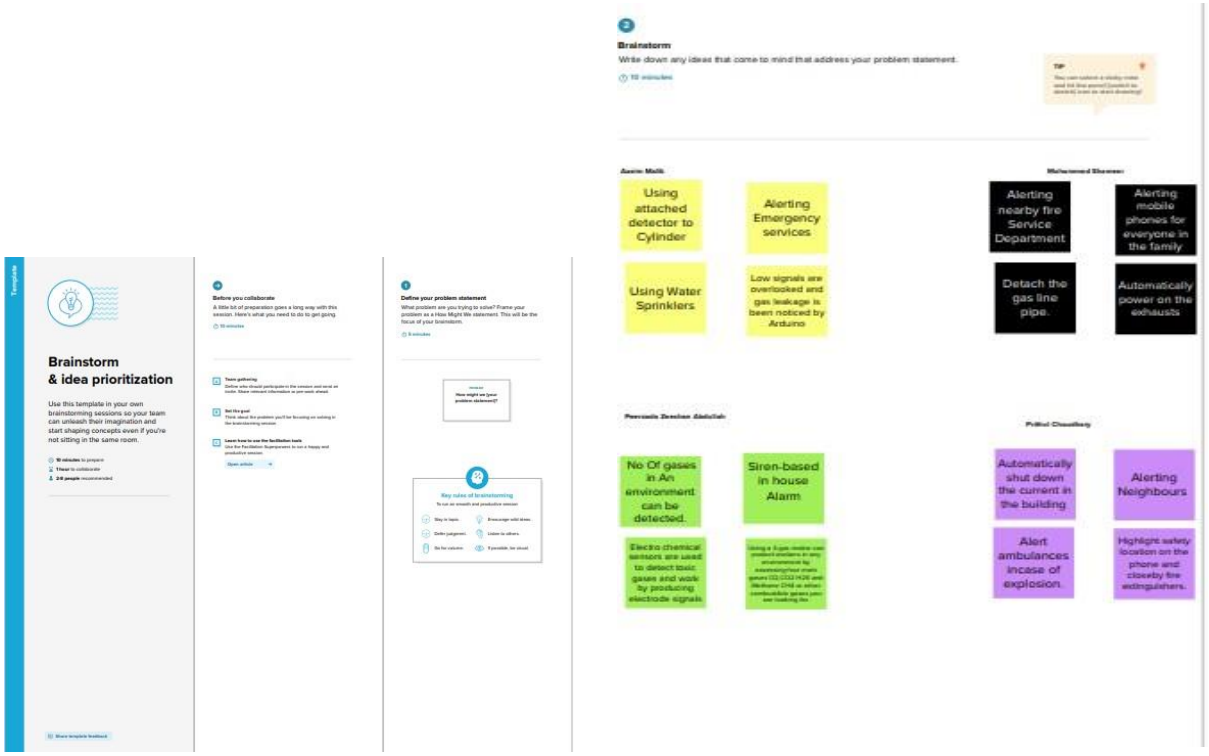
3. IDEATION & PROPOSED SOLUTION:

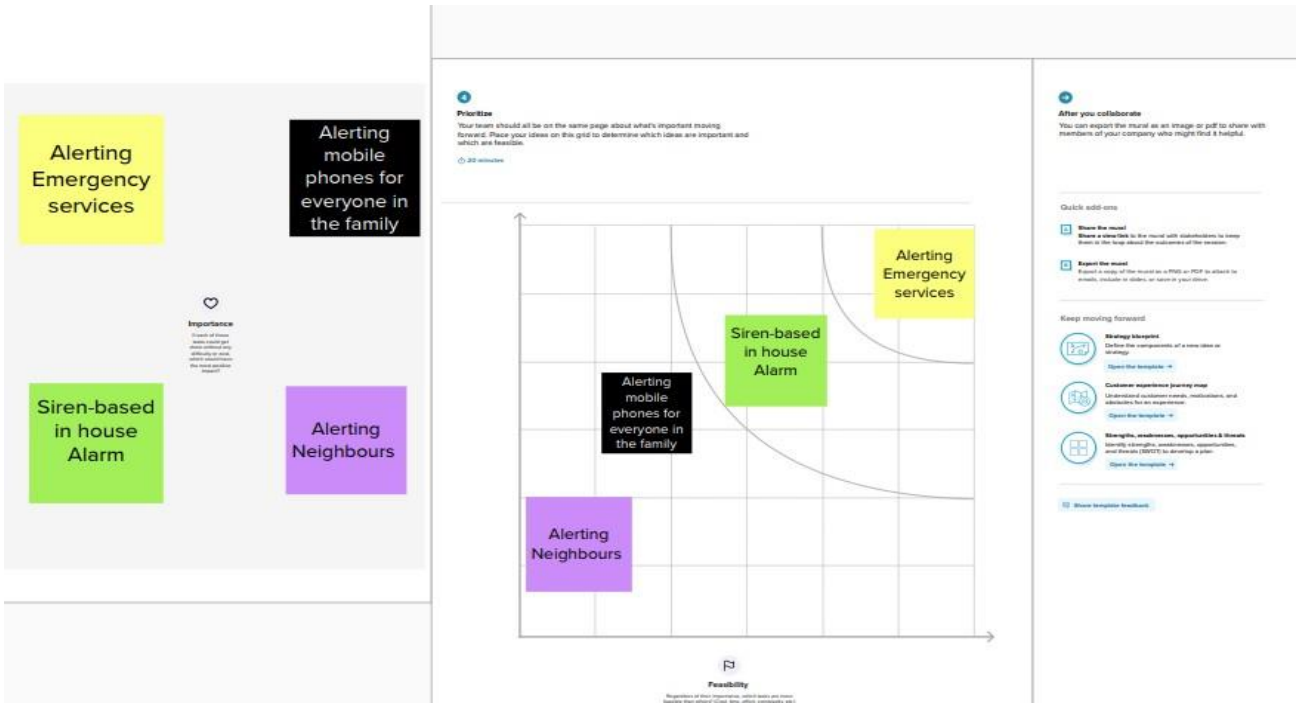
3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:



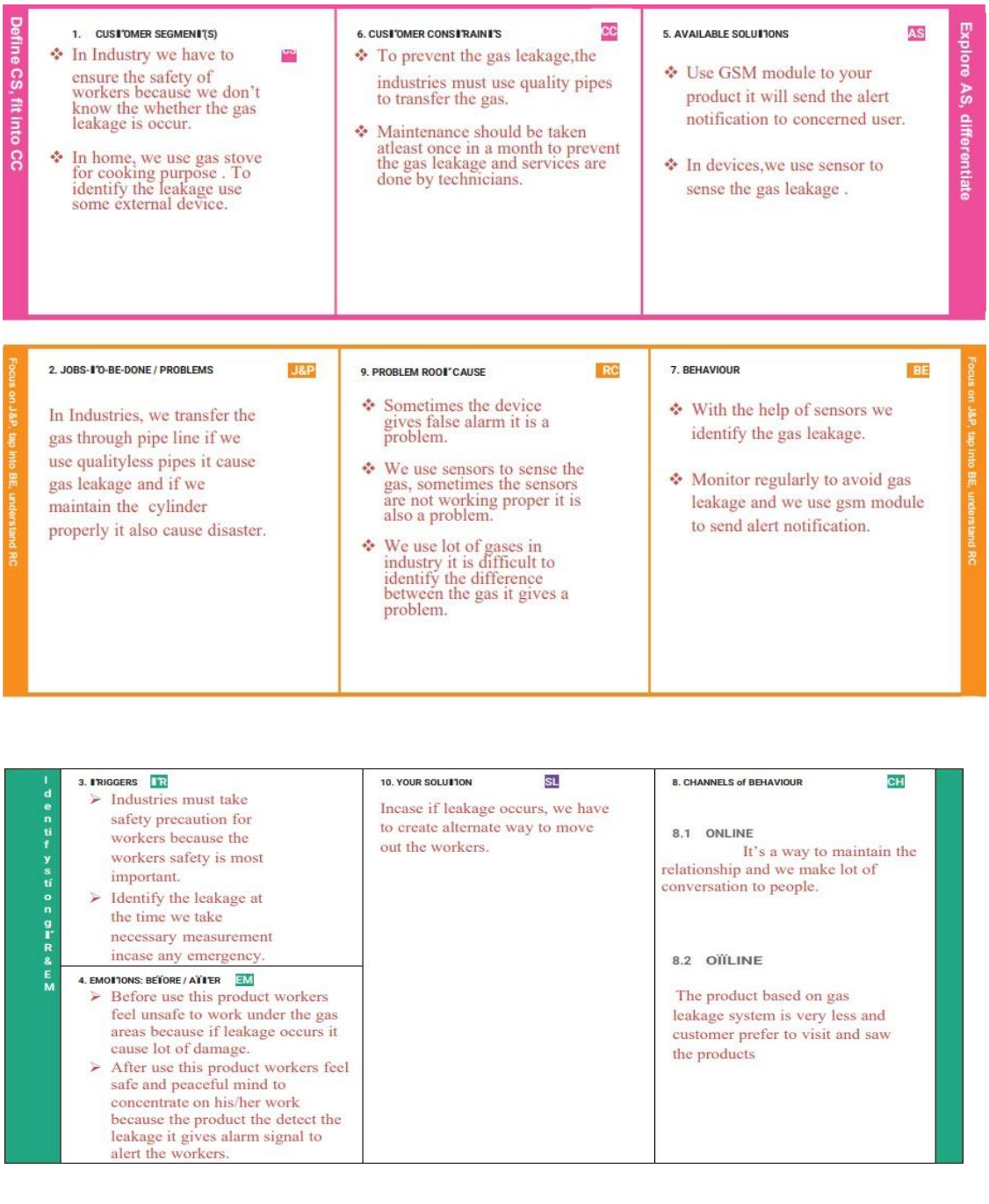

Brainstorm
& idea prioritization
Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.
Before you collaborate
Define your problem statement
Brainstorm
Write down any ideas that come to mind that address your problem statement.
Using attached detector to Cylinder
Alerting Emergency services
Using Water Sprinklers
Low signals are overlooked and gas leakage is been noticed by Arduino
Alerting nearby fire Service Department
Alerting mobile phones for everyone in the family
Detach the gas line pipe.
Automatically power on the exhausts
No Of gases in An environment can be detected.
Siren-based in house Alarm
Electro chemical sensors are used to detect toxic gases and work by producing electrode signals
Automatically shut down the current in the building
Alerting Neighbours
Alert ambulances incase of explosion
Highlight safety location on the phone and closeby fire extinguishers.


Alerting Emergency services
Alerting mobile phones for everyone in the family
Importance
Siren-based in house Alarm
Alerting Neighbours
Prioritize
Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.
Alerting Emergency services
Siren-based in house Alarm
Alerting mobile phones for everyone in the family
Alerting Neighbours
Feasibility
After you collaborate
You can export the mural as an image or pdf to share with members of your company who might find it helpful.
Quick add-ons
Keep moving forward

3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	➢ It helps for monitoring the emission of harmful gases. ➢ If in any area gas leakage is detected thead mins will be notified along with the Location and sent alert message to all workers. ➢ Admins can view the sensor Parameters.
2.	Idea / Solution description	➢ Smart bands are used to alert workers of gas leaks in factories. ➢ GSM technique is used to send alert messages to the respective persons and workers, if there is no response it sends the message to fire department. ➢ Using offline messaging alert facility alerting people without internet in range of up to 100 meters.
3.	Novelty / Uniqueness	➢ Visual and Audible alarms are triggered. ➢ It is power consumption and it is effective.
4.	Social Impact / Customer Satisfaction	➢ Get real-time alerts about the gaseous presence in the atmosphere ➢ Prevent fire hazards and explosions ➢ Supervise gas concentration levels ➢ Ensure worker's health using alert fit band. ➢ Cost-effective

3.4 Problem Solution fit:



4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

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. 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 safety is important but making using of the right technology is even more vital.*	*Detecting gasses is necessary regardless of your business role or individual purpose. Certain technologies at play make such IoT devices what they are, and if you want to indulge in IoT application development, you must know what they are and what purpose they can fulfill.*

4.2 Non-Functional requirements:

Data Gathering:

Using multiple sensors, we are going to gather the necessary data.

Data Store:

Collected data is stored in Cloud and Necessary databases.

Data Analysis:

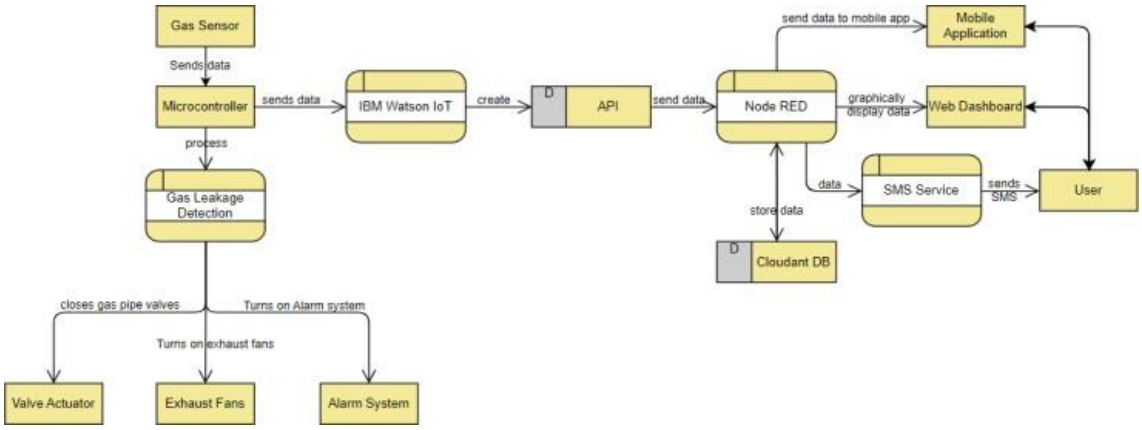
Data from the store must be analyzed for raising alerts in case of necessity.

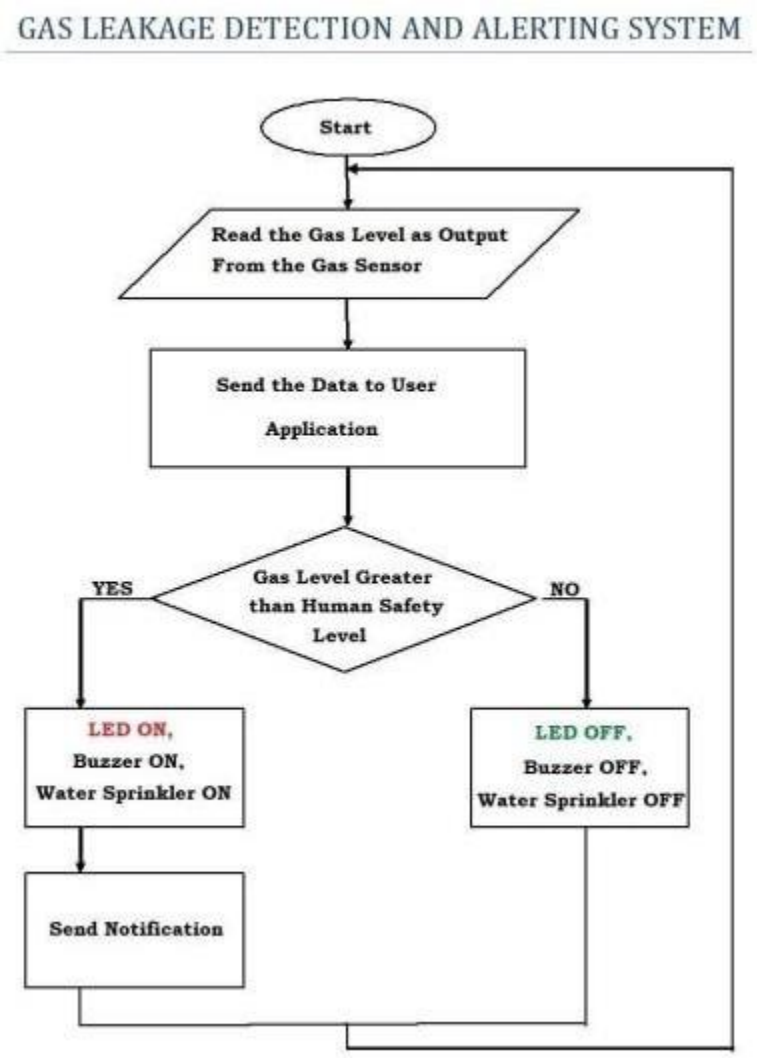
Data Monitoring:

Gathered data must be displayed to the user for monitoring.

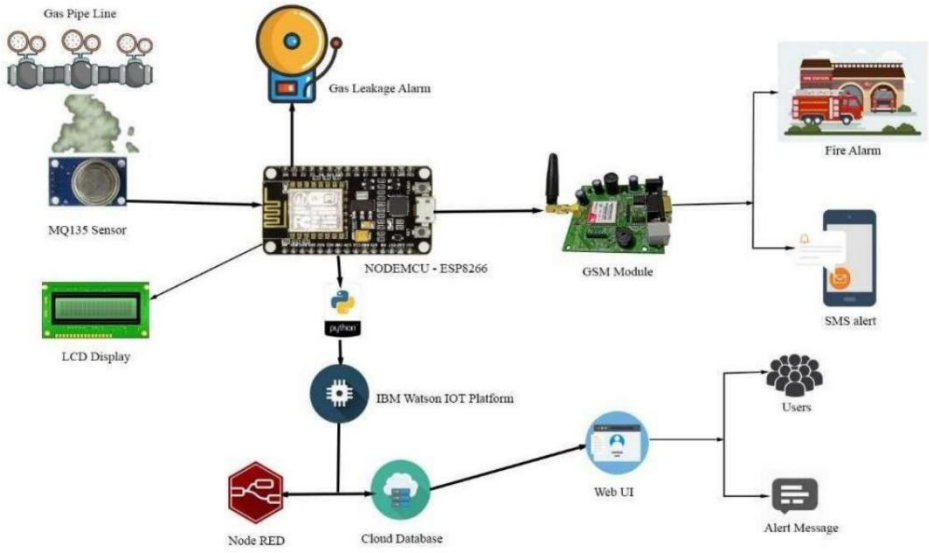
5. PROJECT DESIGN

5.1 Data Flow Diagrams:





5.2 Solution & Technical Architecture:



5.3 User Stories:

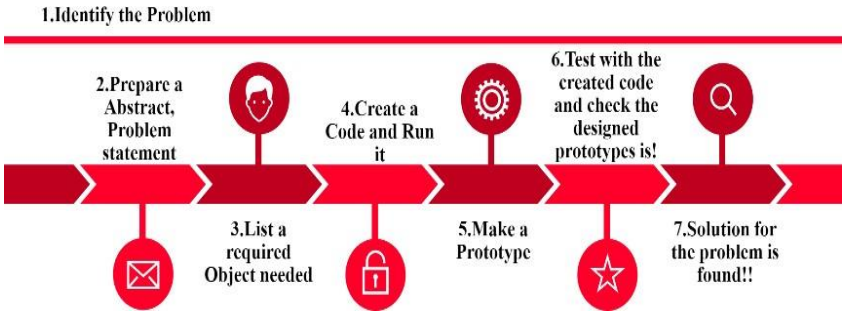
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Industry owner)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	Register to the application by email and password with password confirmation.	High	Sprint-1
Customer (Industry Owner)	Confirmation	USN-2	I will receive confirmation email once Ihave registered for the application	Receive confirmation email & click confirm	High	Sprint-1
Customer (Industry Owner)	Authorize	USN-3	As a user, I will enable the supervisor to monitor the gas leakage system status.	Provide access to supervisor.	High	Sprint-1
Customer (Supervisor)	Login	USN-4	As a user, I can log into the application by entering email & password.	Get access to dashboard.	High	Sprint-1
Customer (Supervisor)	Monitor	USN-5	As a user, I can monitor the status of the gas leakage system.	Status of gas leakage system.	High	Sprint-1
Customer (Line Workers)	Notification	USN-6	As a user, I can get (alarm system) alert about gas leakage.	Get alert about gas leak.	Medium	Sprint-2
Customer (Supervisor)	Notification	USN-7	As a user, I can get SMS notification & alarming alert about gas leakage.	Get alert about gas leakage.	Medium	Sprint-2
Customer (Industry Owner)	Sign-Up	USN-9	As a user, I can sign-up using Facebook login.	I can sign-up with the application using Facebook.	Low	Sprint-3
Customer (Supervisor)	Sign-Up	USN-10	As a user, I can sign-up using Google login.	I can sign-up with the application Google using.	Low	Sprint-3
Administrator	Service Request	USN-11	As a user, I can request for service in case of any issue with gas leakage monitoring system	Get service from provider	Low	Sprint-3
Administrator	Increase dservice	USN-12	As a user, I can request for scaling up the gas leakage monitoring system.	Get service from the provider.	Low	Sprint-4
Customer (Industry Supervisor)	Leakage detection	USN-13	Look for gas leakage in any other container	Access the monitor Display	High	Sprint-1

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

6.2 Sprint Delivery Schedule

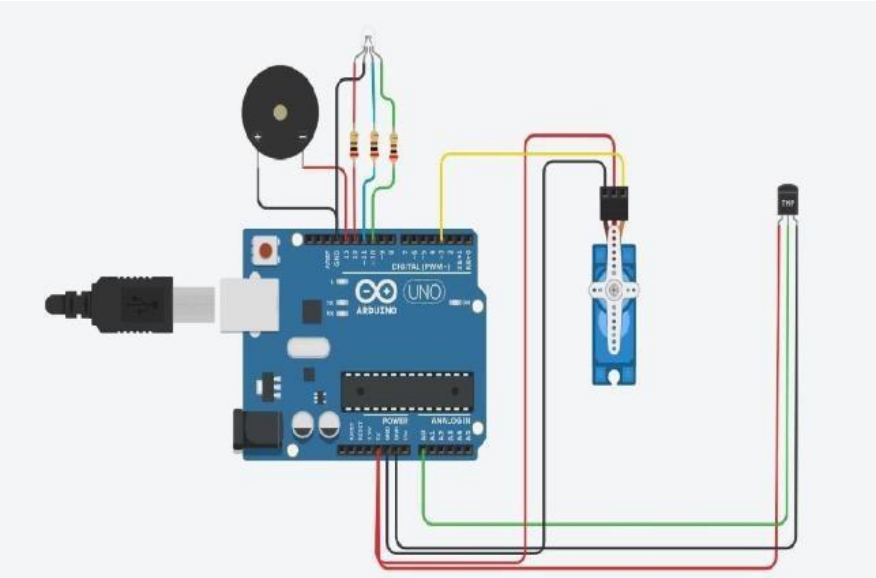


- Sprint 1
- Sprint 2
- Sprint 3
- Sprint 4

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:

```
#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("PNT2022TMID04007");
  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 >= 200){
   digitalWrite(buzzPin,HIGH);
   digitalWrite(ledPin,HIGH);
   digitalWrite(fan,HIGH);
   lcd.setCursor(0,0);
   lcd.print("GAS:");
   lcd.print(gasLevel);
   lcd.setCursor(0,2);
   lcd.print("FAN ON");
   delay(1000);
   lcd.clear();
  }else{
   digitalWrite(ledPin,LOW);
   digitalWrite(buzzPin,LOW);
   digitalWrite(fan,LOW);
   lcd.setCursor(0,0);
   lcd.print("GAS:");
   lcd.print(gasLevel);
   lcd.setCursor(0,2);
   lcd.print("FAN OFF");
```

```
   delay(100);
   lcd.clear();
  }
}
//BUZZER
void buzzer(float gasLevel){
if(gasLevel>=200)
  {
  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();
  }
}
```

GitHub & Project Demo Link: https://github.com/IBM-EPBL/IBM-Project-11597-1659335658.git