PROJECT REPORT

TEAM ID	PNT2022TMID36331
COLLEGE NAME	JNN INSTITUTE OF ENGINEERING
TEAM MEMBERS	LOGHANANDHINI.K. SANTHOSH KUMAR.M. ABEL FRANCIS MOHAN.S.
BRANCH	ELECTRONICS AND COMMUNICATION ENGINEERING
PROJECT NAME	GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

CONTENTS

1.INTRODUCTION

1.1 Project Overview:

The internet of Things is a developing topic of technical, social, and economic significance. The usage of the gas brings great problems in the domestic as well as working places. The inflammable gas, which is excessively used in the work places (Industries). The leakage of the gas causes destructible impact to the lives and as well as to the heritage of the people. Most of the societies have fire safety mechanism. But it can use after the fire exists. As a result, a system for detecting and monitoring gas leaks is required. Through a flame sensor, the system will sense 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 gas that was wasted.

1.2 Purpose:

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 using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. 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:

Gas leakage is nothing but the leak of any gaseous molecule from a pipeline, or cylinder etc in the industries. Gas Leakages in open or closed areas can prove to be dangerous .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, industry and the environment. 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 REFERNCES

1. Rohan Chandra Pandey, Manish Verma, LumeshKumar Sahu 2017. Internet of Things (IOT) Based Gas LeakageMonitoring and Alerting System with MQ-2 Sensor. Thispaper choice of using a real time gas leakage monitoringandSensing the output levels of gas has been clearly observedbythe help of this system.

2. Asmita Varma, Prabhakar S, Kayalvizhi Jayavel 2017. GasLeakage Detection and Smart Alerting and PredictionUsingIoT. The proposed gas leakage detector is promisingintheField of safety.

3. Chaitali Bagwe, Vidya Ghadi, Vinayshri Naik, NehaKunte2018. IOT Based Gas Leakage Detection SystemwithDatabase Logging, Prediction and Smart Alerting. Thesystemprovides constant monitoring and detection of gasleakagealong with storage of data in database for predictionsandanalysis. The IOT components used helps in makingthesystem much more cost effective in comparisonwithtraditional Gas detector systems.

4. Rohan Chandra Pandey, Manish Verma, LumeshKumar Sahu, Saurabh Deshmukh 2018. Internet of Things(IoT) Based Gas Leakage Monitoring and Alerting SystemwithMq-6 Sensor. A discussion on how the aims and objectivesaremet is presented. An overall conclusion IOT basedtoxicgasdetector is it has become more efficient, more applicabletotoday's applications and smarter.

5. Shital Imade, Priyanka Rajmanes, Aishwarya Gavali 2018. Gas Leakage Detection and Smart Alerting SystemUsingIoT.In this paper we use IOT technology for enhancingtheexisting safety standards. While making this prototypehasbeen to bring a revolution in the field of safety against theleakage of harmful and toxic gases.

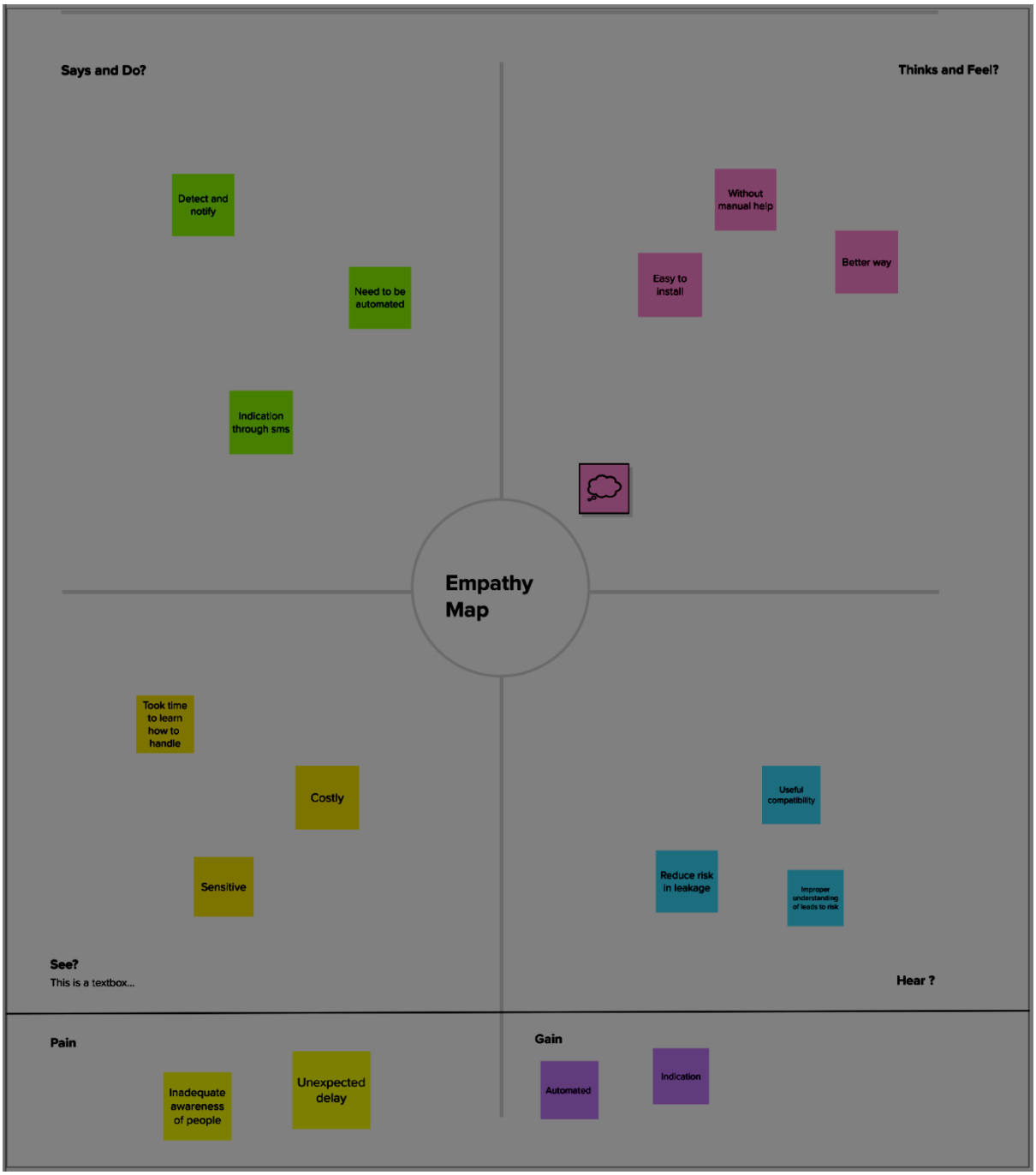
2.3 Problem Statement Definition:

In most industries, one of the key parts of any safety plan for reducing risks to personnel and plant is the use of early-warning devices such as gas detectors. These can help to provide more time in which to take remedial or protective action. They can also be used as part of a total, integrated monitoring and safety system for an industrial plant. Rapid expansion of oil and gas industry leads to gas leakage incidents which are very serious and dangerous.

Solutions need to be found out at least to minimize the effects of these incidents since gas leaks also produce a significant financial loss. The challenges are not only to design a prototype of the device that can only detect but also automatically respond to it whenever the leakage occurs. Customer Problem Statement:

3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING

1. LOGHANANDHINI.K

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

2. **SANTHOSH KUMAR.M**

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

3. **ABEL FRANCIS**

In the proposed system, the sensor which is used to sense many gases is MQ-2 sensor.

After the detection of leakage in the gas, the sensor sends the signal to the Arduino UNO for the further process where other hardware components are connected to each other.
Through Arduino UNO, it sends the signal to the LCD display for displaying the alert message as GAS Detected, accordingly, the buzzer be on so that the surrounding people will the alerted.

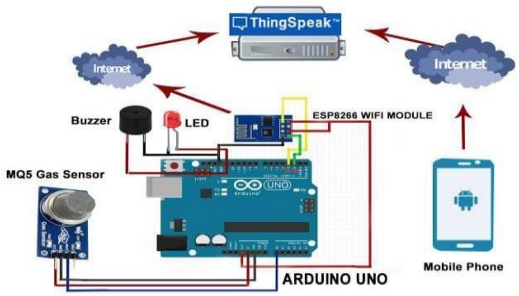
4.MOHAN.S

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

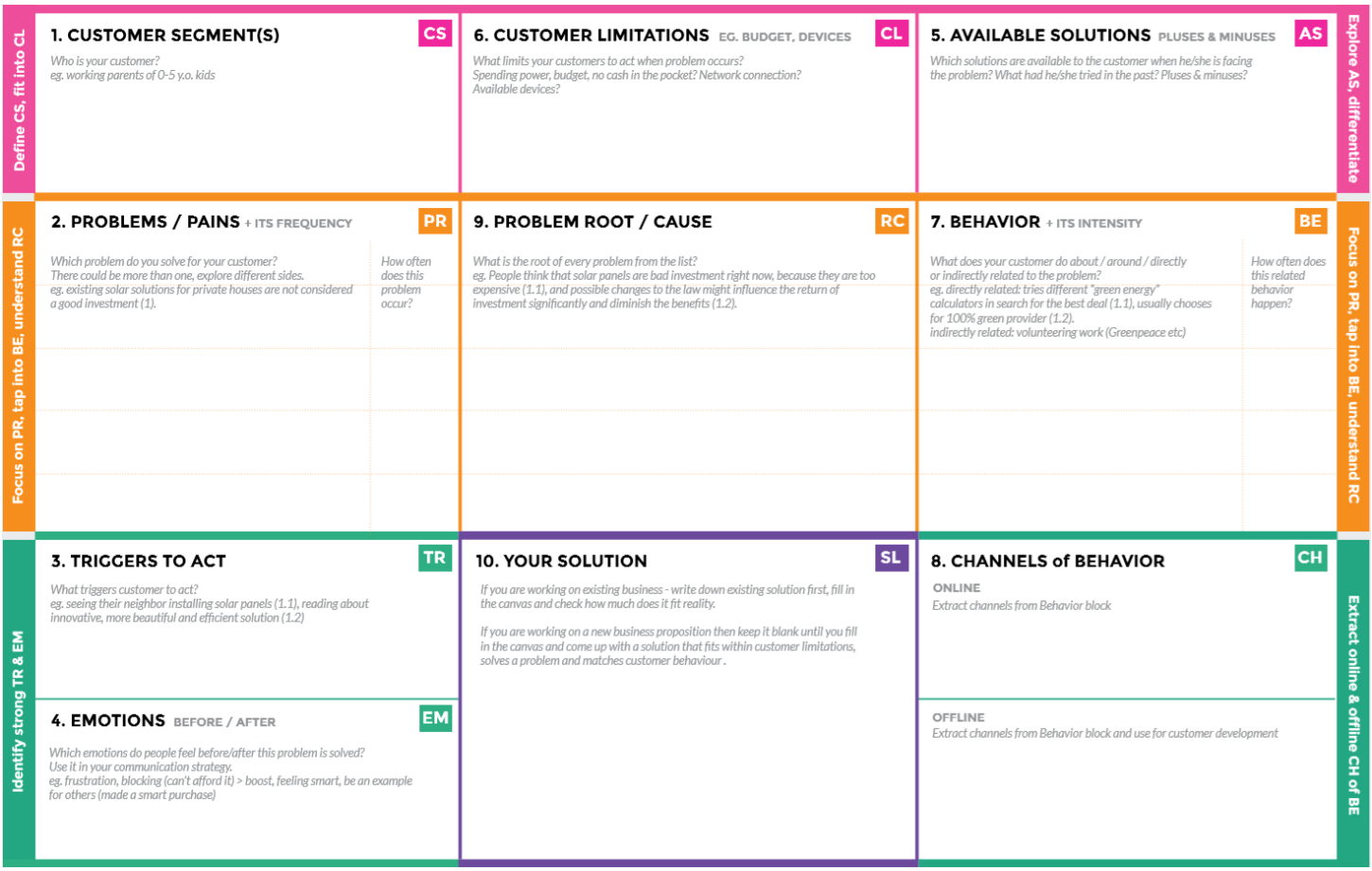
3.3 PROPOSED SOLUTION

S.NO	Parameter	Description
1.	Problem Statement (Problem to be solved)	To detect the gas leakage to alert the user through notification
2.	Idea / Solution description	In order to have a control over such conditions we proposed system that uses sensors which is capable of

		detecting the gases such as LPG, CO2, CO and CH4. This system will not only able to detect the leakage of gas but also alerting through audible alarms.
3.	Novelty / Uniqueness	• Ability to predict the hazardous situation • Low cost
4.	Social Impact / Customer Satisfaction	• This model is vital for the society as there are lot of people unable to detect the gas leakage prior the fire accident. • 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 readings.
5.	Business Model (Revenue Model)	
6.	Scalability of the Solution	Develop a proposed system which include some safety factors.

3.4 PROBLEM SOLUTION FIT



4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Business Requirements	User Requirements	Product Requirements
They 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 gases 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

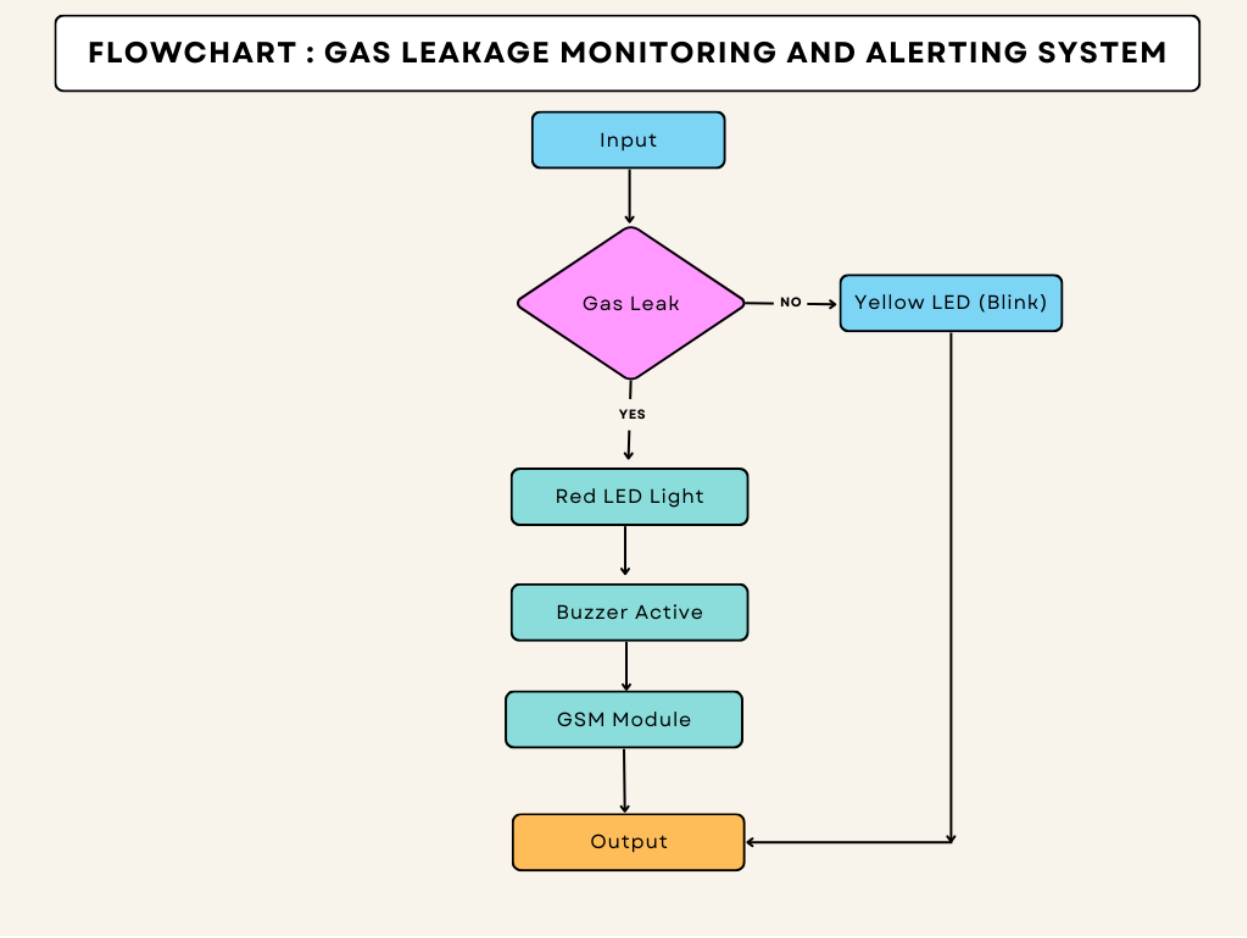
FR.NO	NON-FUNCTIONAL REQUIREMENTS	DESCRIPTION
NFR-1	USABILITY	Easy user interface with alerting notifications and locations of the defect gas cylinder
NFR-2	SECURITY	1. Secure Cloud database is used 2. Notify only the registered and verified users 3. Multiple deployment across the potential sources can help industries to avoid any industrial accident and protect work place safely
NFR-3	RELIABILITY	1. Gas exposure will measured with ± 25% of the true

		concentrationof the target analyte with 95% certainty. 2.Robust device that can withstand harsh industrial conditions andprovide real-time gas leakage detection.
NFR-4	PERFORMANCE	1. Accurate data monitoring system enables periodic analysis of the air quality. 2. Provides data on a real-time basis which enables safety managers to take timely corrective actions
NFR-5	AVAILABILITY	1.Through Suppliers 2.With online shopping platforms
NFR-6	SCALABILITY	1. Can be extended further from industrial application to domestic gas applications.

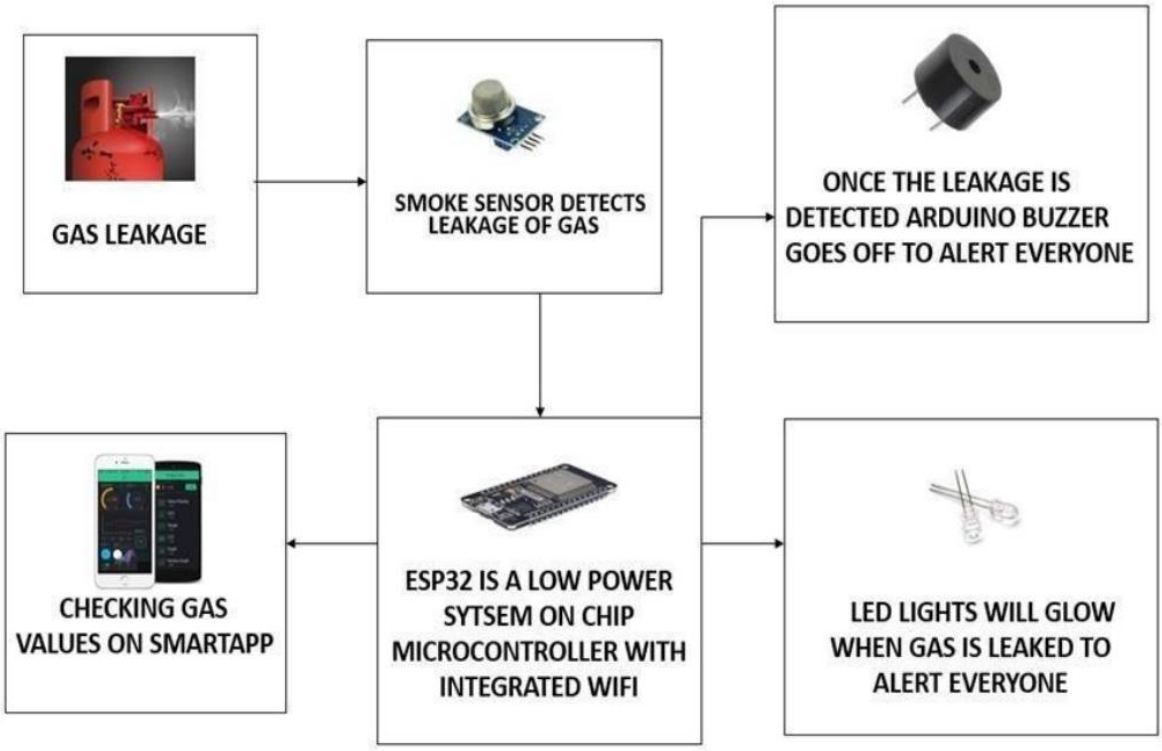
		2. Deployment in petrol banks and vehicle fuel plants for gas leakage detection application.

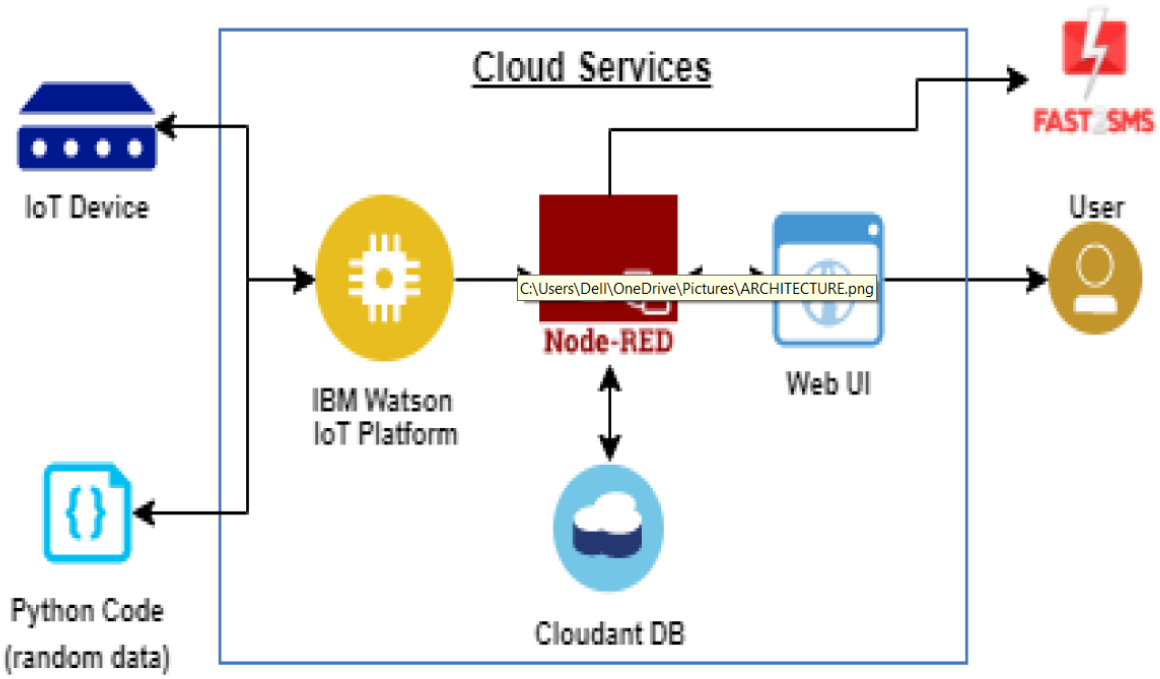
5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS



5.2 SOLUTION AND TECHNICAL ARCHITECTURE





5.3 USER STORIES

The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of a 1m radius of the 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 AND SCHEDULING

6.1 SPRINT PLANNING AND 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	Functional Requirement (Epic)	User Story	User Story / Task	Story Point	Priority
Sprint-1	Create	US-1	Create the IBM Cloud services which are being used in this project.	5	High
Sprint-1	Configure	US-2	Configure the IBM Cloud services which are	1	Medium

			being used in completing this project.		
Sprint-1	Create	US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	1	Medium
Sprint-1	Configure	US-4	Configure the IBM Watson IoT which are being used to	13	High

			display the output.		
Sprint-2	Create	US-1	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	13	High
Sprint-2	Configure	US-2	Configure a device in the IBM Watson IoT platform and get the device credentials.	3	Medium
Sprint-2	Create	US-3	Create a Node-RED service.	3	High

Sprint-2	Configure	US-4	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	1	Medium

Sprint-3	Develop	US-1	Develop a python script to publish random sensor data such as temperature, Flame level and Gas level to the IBM IoTplatform	1 3	High
Sprint-3	Configure	US-2	After developing python code and commands just run the code	1	Medium
Sprint-3	Print	US-3	Print the statements which represent	1	Low

			the control of the devices.		
Sprint-3	Publish	US-4	Publish Data to The IBM Cloud	5	High
Sprint-4	Create	US-1	Create Web UI in Node-Red	5	High
Sprint-4	Configure	US-2	Configure the Node-RED flow to receive data from the IBMIoT platform	5	High
Sprint-4	Configure	US-3	Use cloudant DB nodes to store the received sensor data in the	5	High

			cloudant DB		
Sprint-4	Publish	US-4	Publish the received data in webapplication	5	High

7. CODING AND SOLUTION

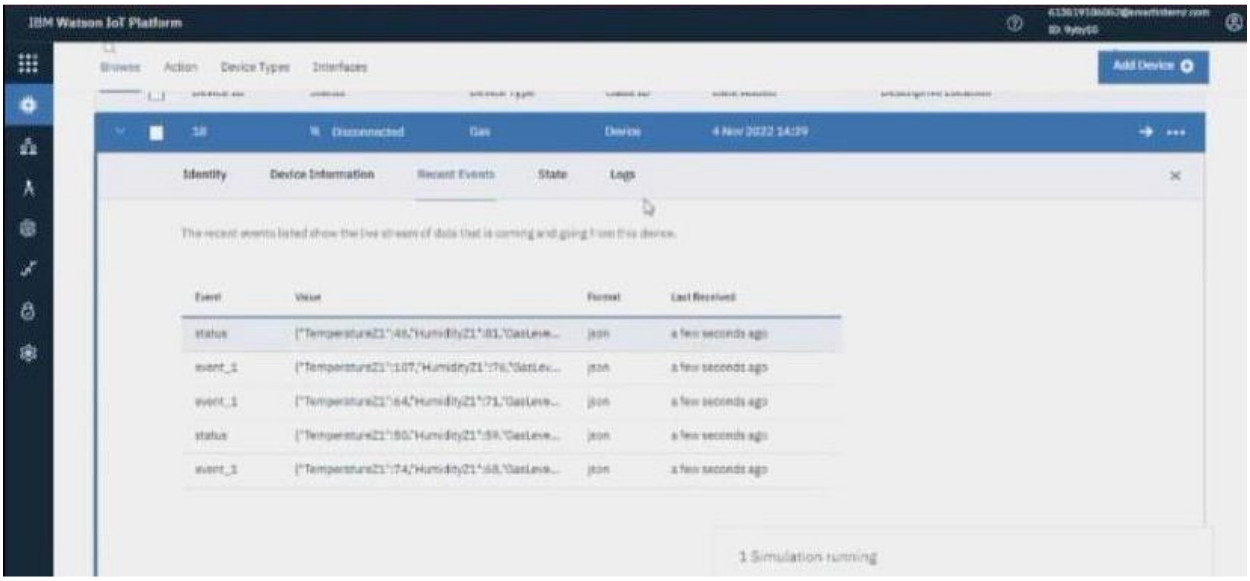
CODE

```
#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("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);
```

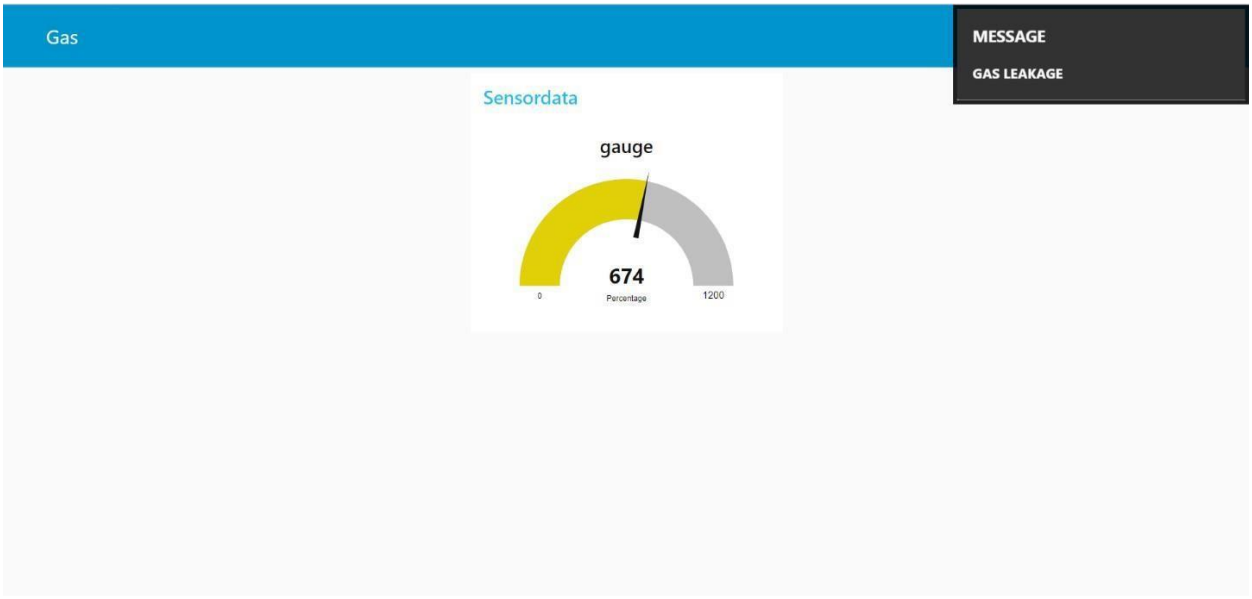
```
    lcd.print("ALL CLEAR");
    delay(1000);
   }

}
Cursor(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);
   }
```

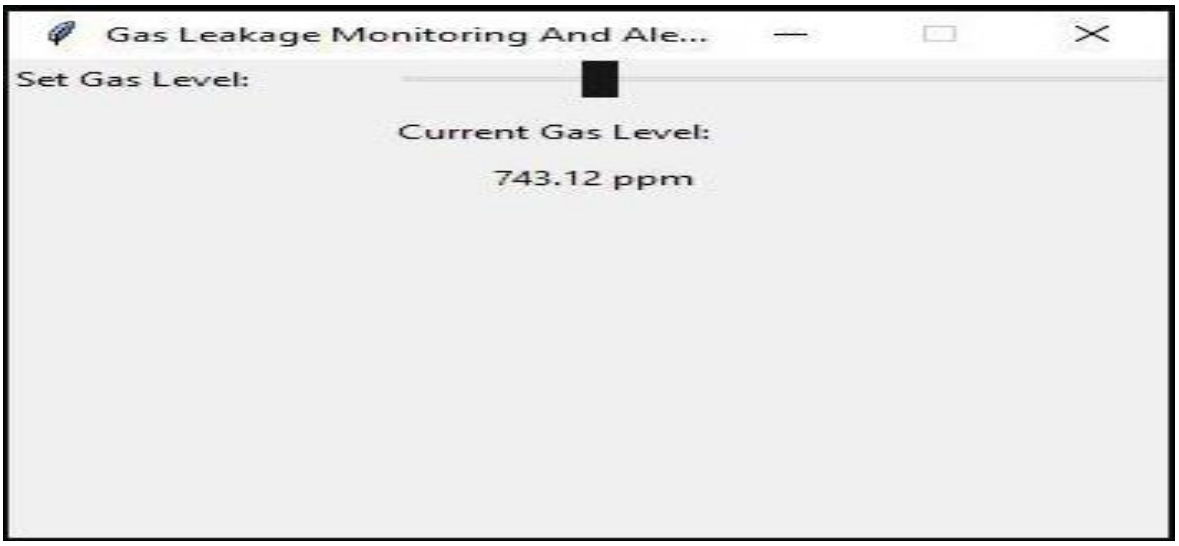
8. TESTING


IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Add Device
Disconnected
Gas
Device
4 Nov 2022 14:39
Identity
Device Information
Recent Events
State
Logs
Event
Value
Format
Last Received
status
event_1
event_1
status
event_1
json
a few seconds ago
1 Simulation running


Zone 1
Zone 1
Humidity
GasLevel
Pressure


Gas Leakage Monitoring And Ale...
Set Gas Level:
Current Gas Level:
467.89 ppm


Gas
MESSAGE
GAS LEAKAGE
Sensordata
gauge
674
Percentage
0
1200



8.1 TEST CASES

Exception Reporting	9	0	0	9
Final Report	4	0	0	4
Output Version Control	2	0	0	2

9. RESULT

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 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 and storage 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 use data primary indicator of leakage inside a plant.

10. ADVANTAGES / DISADVANTAGES

ADVANTAGES

1. Get real-time alerts about the gaseous presence in the atmosphere.
2. Prevent fire hazards and explosions.
3. Supervise gas concentration levels.
4. Ensure worker’s health

DISADVANTAGES

1. It requires air or oxygen to work.
2. It gets reacted due to heating of wire.
3. It can be poisoned by lead, chlorine and silicon

11.APPLICATIONS

1. Real-time updates about leakages.
2. Cost-effective installation.
3. Data analytics for improved decisions.
4. Measure oxygen level accuracy.
5. Get immediate gas leak alerts

12.CONCLUSION

This gas leak detector system contains two features, this includes the SMS Gateway feature for only sending warning information regarding the gas leak to user, and the alarm for the warning alert. There is some improvement which can be applied for the future work, such as regarding the SMS Gateway, it need to enhance with feature such as notifying the user whenever the remaining credit balance is insufficient. Another thing

which can be enhanced is regarding the sensor, the sensors in this module do not include somewhat notification for notifying the user whenever the sensor not working properly or not connected to the micro-controller for some cases, therefore, it is recommended to add this kind of features in the future work for better refinement.

13. 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. This 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.

14. GIT HUB AND DEMO LINK

GIT HUB LINK :
https://github.com/IBM-EPBL/IBM-Project-53766-1661494068.git

DEMO LINK:
https://drive.google.com/file/d/1Ts3N-icaQvjuegMwOs2cqQUctiFxpy98/view?usp=sharing