Gas Leakage Monitoring & Alerting system for Industries

PROJECT REPORT

PNTIBM39391

1.INTRODUCTION

1.1 PROJECT OVERVIEW

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles like Compressed Natural Gas (CNG), buses, cars, etc. It is noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, and vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and merger harm to the environment. Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The risks of explosion, fire, suffocation are based on their physical properties such toxicity, flammability, etc. The number of deaths due to the explosion of gas cylinders has been increasing in recent years. The Bhopal gas tragedy is an example of accidents due to gas leakage.

1.2 PURPOSE

The gas detectors can be used for the detection of combustible, flammable and poisonous gases and for loss of oxygen, and also to detected a gas leak or other pollutants. It makes the area where the leak occurs an warning sound and instructs operators to leave the area.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

LITERATURE 1: Latest Trends of Integration of Gas Leakage and Fire Detection Using IoT: A Survey

ABSTRACT:

The integration of gas leakage and fire detection using IoT applications offer in solving the transparency issue such as in communication and accountability. Due to existing of the advanced controller, the method is more effective than the classic system in terms of data collection from sensors which will be coded with python in a particular file, and for the ecology circumstances. A mechanical malfunction of the gas containing the equipment is the most frequent source of explosions and fires associated with gas leaks. When the malfunction happens, the gas may spill, causing fires which produce gases that burn. In addition to causing

headaches, people might also experience irregular breathing due to a natural gas leak. This project indicates a literature review of integration of gas leakage and fire detection using Internet-of-Things (IoT) systems. Commonly, the Raspberry Pi and Arduino Uno are used to establish this system. Next, different types of sensors will be compared and reviewed in terms of number of gases and chemicals that can be detected. This project expects that using MQ 2 sensor is better than MQ 5 in detecting the certain gases and for the activation of alarm. MQ 5 gas sensors can be replaced with a MQ2 sensor as it detects a much wider spectrum of gases and chemicals.

LITERATURE 2: Gas Leakage with Auto Ventilation and Smart Management system Using IoT

ABSTRACT:

In the evolving smart home, the issue of gas spillage and fire is still remaining as a significant hindrance for designing a comprehensive, safe and sustainable kitchen model. On the other hand, security has also been significant challenge in this digital era. In urban areas, most of the kitchens are very small and it doesn't contain proper ventilation system. In such case, Spillage of gas increases the risk of fire accident, suffocation or a blast. To eradicate this

challenge, smart management system viz. gas leakage detection and fire detection system should be developed. In this project, Arduino UNO microcontroller was utilized to build a smart gas detection system with many usable sensors (MQ2, IR Fire Sensor) and actuators (air fan, buzzer). When gas spillage is recognized, the client will be intimated through SMS and at the same time they will receive notification via blynk application. The proposed system can detect fire, gas leakage and it also has the ability to take further steps and decrease gas concentration via auto air ventilation and extinguish fire with water. This method will help to improve the safety and reduce the death toll and reduce the damages that occur to the surrounding environment.

LITERATURE 3: Gas level detection and automatic booking notification using IOT:

ABSTRACT:

Now a day's LPG is a major cooking fuel as it is cost effective also. So, it is the most preferred fuel source. LPG cylinder has to be pre-booked every time. This booking process is not much efficient nowadays, because users of LPG have increasing day by day. Due to large pool of requests every day the system cannot record every request and serve. This project cares about this issue and gives additional effectiveness to it. As this project monitor's the gas level in the cylinder and if the gas level is lesser than certain level then it automatically sends a notification to both user and the gas agency using mobile network. This project uses microcontroller-based system in which a weight sensor or load sensor are used to find the gas level in the cylinder. This reading is passed to LCD module to show the gas content in the cylinder. If the gas level is less than the fixed value then GSM module sends the notification to the mobile and also informs the gas agency to record the booking on confirmation with customer. This project also ensures safety near the cylinder by detecting if any gas leakage

and if any fire occurs. If any of these detected a buzzer will ring and also an exhaust fan will be turned on. The user will also be notified regarding this.

LITERATURE 4: A Smart Natural Gas Leakage Detection and Control System for Gas Distribution Companies of Bangladesh using IoT

ABSTRACT:

This project proposes a smart mobile based model of gas leakage detection and control for gas distribution system of Bangladesh using IoT, called as smart natural gas leakage

detection and control system (SNLDCS). The proposed SNLDCS has been implemented in both software and hardware modules. The existing researches are about Liquefied Petroleum Gas (LPG) leakage detection that are used for cylinder gas. Hence, these models are not suitable for gas distributions companies of Bangladesh where natural gas leakage is being controlled from remote places. But the proposed model can quickly detect natural gas leakage by continuous monitoring and can control gas leakage by a smart phone from anywhere. The experimental results confirm that, implementation of SNLDCS model in gas distribution system in Bangladesh can provide the quickest detection and rapid resolve of gas leakage. As a result, it will increase safety, decreases system loss and reduces Greenhouse Gas (GHG) emission in the air.

LITERATURE 5: Development of LPG Leakage Detection Alert and Auto Exhaust System using IoT:

ABSTRACT:

Security play a significant part in this day and age and it is fundamental that acceptable wellbeing frameworks are to be actualized in spots of schooling and work. Gas spillage is the significant issue in private premises, mechanical area, homes and so forth. To stay away from this mishap because o f spillage, a gas recognition unit will be introduced. The principle target of this examination work is to recognize gas spillage and control it consequently after the location of Liquefied Petroleum Gas (LPG) spillage. Utilize this work changes the current security model introduced in enterprises and this framework in homes and workplaces. The valve is naturally shut utilizing a solenoid valve and the gas spillage is forestalled. Simultaneously, the fumes fan is turned on naturally. Liquid Crystal Display (LCD) will show that there is LPG spillage and an alarm message will be shipped off the client by means of an application in their cell phone utilizing IoT.

2.2 REFERENCES

1. Mahalingam, A.; Naayagi, R.T.; Mastorakis, N.E. Design and implementation of an economic gas leakage detector. In Proceedings of 6th International Conference on Circuits, Systems and Signals, Athens, Greece, 7–9 March 2012; pp. 20–24.

2. Attia, H.A.; Halah, Y.A. Electronic Design of Liquefied Petroleum Gas Leakage Monitoring, Alarm, and Protection System Based on Discrete Components. Int. J. Appl. Eng. Res. 2016, 11, 9721–9726.

3. Apeh, S.T.; Erameh, K.B.; Iruansi, U. Design and Development of Kitchen Gas Leakage Detection and Automatic Gas Shut off System. J. Emerg. Trends Eng. Appl. Sci. 2014, 5, 222–228. Eng. Proc. 2020, 2, 28 6 of 6

4. Soundarya, T.; Anchitaalagammai, J.V.; Priya, G.D.; Karthickkumar, S.S. C-Leakage: Cylinder LPG Gas Leakage Detection for Home Safety. IOSR J. Electron. Commun. Eng. 2014, 9, 53–58.

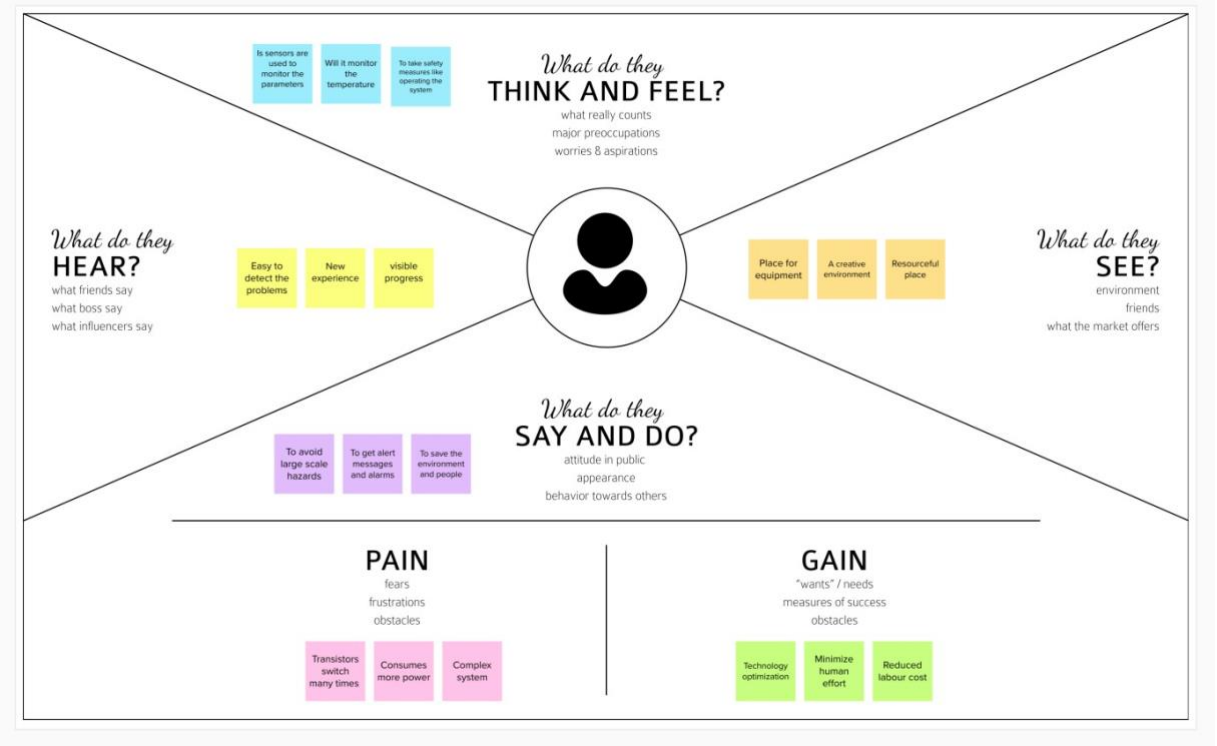
5. Shrivastava, A.; Prabhaker, R.; Kumar, R.; Verma, R. GSM based gas leakage detection system. Int. J. Emerg. Trends Electr. Electron. 2013, 3, 42–45.

2.3 PROBLEM STATEMENT DEFINITION

	I am customer	I am trying to	But	Because	Which makes me feel
PS-1	Industrialist	Monitor gas leakage in the industry	I don't have a system for monitoring	The affordable of the system is high and the systems are sometim making disasters	Unsafe

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

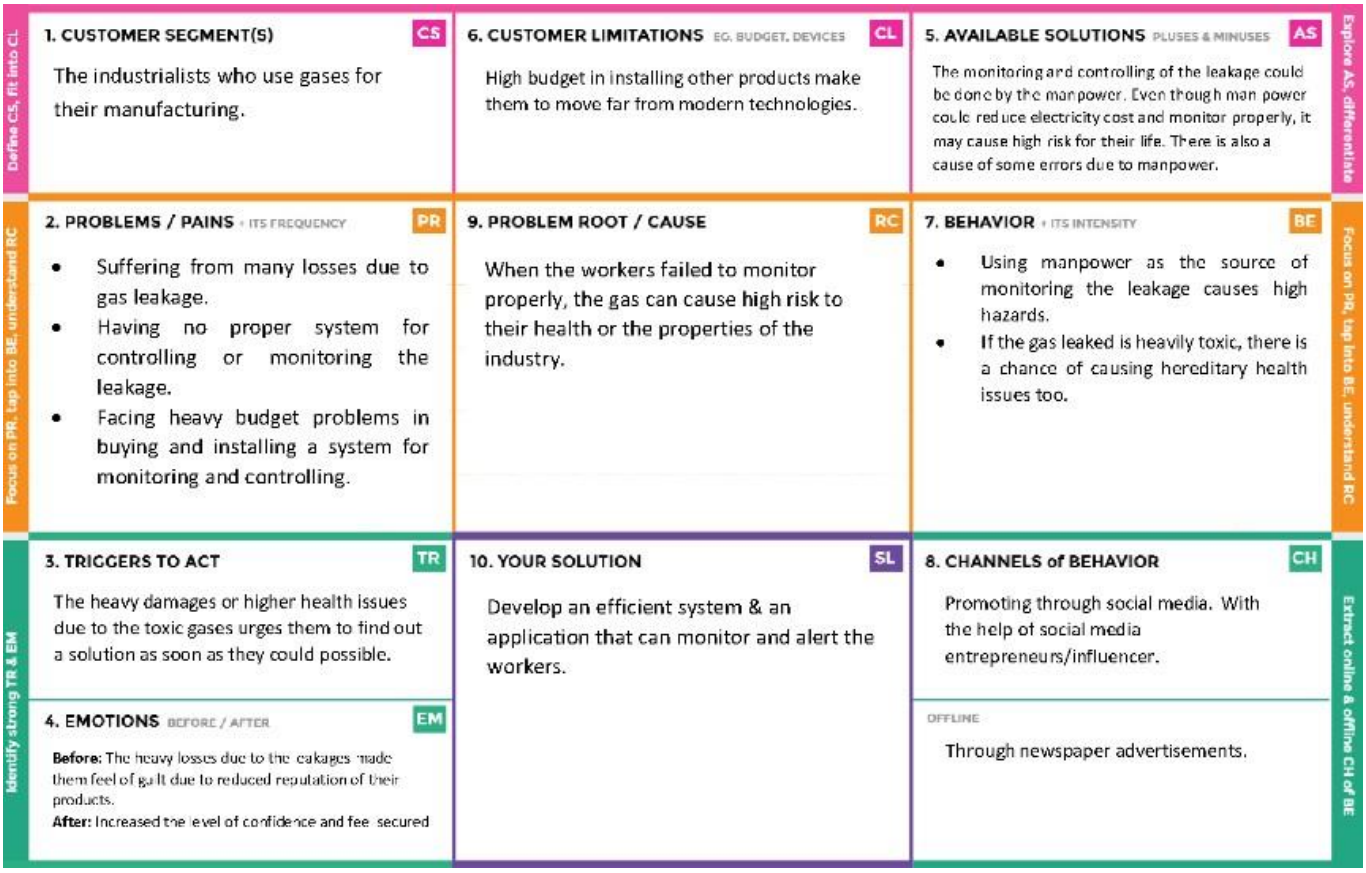


3.2 IDEATION & BRAINSTROMING

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	➢ Develop an efficient system & an application that can monitor and alert the users(workers)
2.	Idea / Solution description	➢ This product helps the industries in monitoring the emission of harmful gases ➢ In several areas, the gas sensors will be integrated to monitor the gas leakage ➢ If in any area gas leakage is detected the admins will be notified along with the location ➢ In the web application, admins can view the sensor parameters.
3.	Novelty / Uniqueness	➢ Fastest alerts to the workers ➢ User friendly
4.	Social Impact / Customer Satisfaction	➢ Cost efficient ➢ Easy installation and provide efficient results Can work with irrespective of fear
5.	Business Model (Revenue Model)	➢ The product is advertised all over the platforms. Since it is economical, even helps small scale industries from disasters. ➢ As the product usage can be understood by everyone, it is easy for them to use it properly for their safest organization
6.	Scalability of the Solution	➢ Since the product is cost efficient, it can be placed in many places in the industries. ➢ Even when the gas leakage is more, the product sense the accurate values and alerts the workers effectively

3. 4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Business Requirements	User Requirements	Product requirements
The said sysytem can deployed homes,hotels,factory units LPG cylinder storage area,and so on. The main advantagee of this IOT and arduino based application is that can determine the leagage and send the data over t a site.It can be monitored, and preventive measures can be taken avoid any disaster.	The ga leakage detection system can be optimized For detecting toxic gasses Along with smoke and fire detecter to identify the presence of smoke and fire. Ensuring worker safety is Impotant but making use o The right technology even more visual.	Detection gasses necessary regardless of Your business role or Individual purpose Certain technolgy 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.

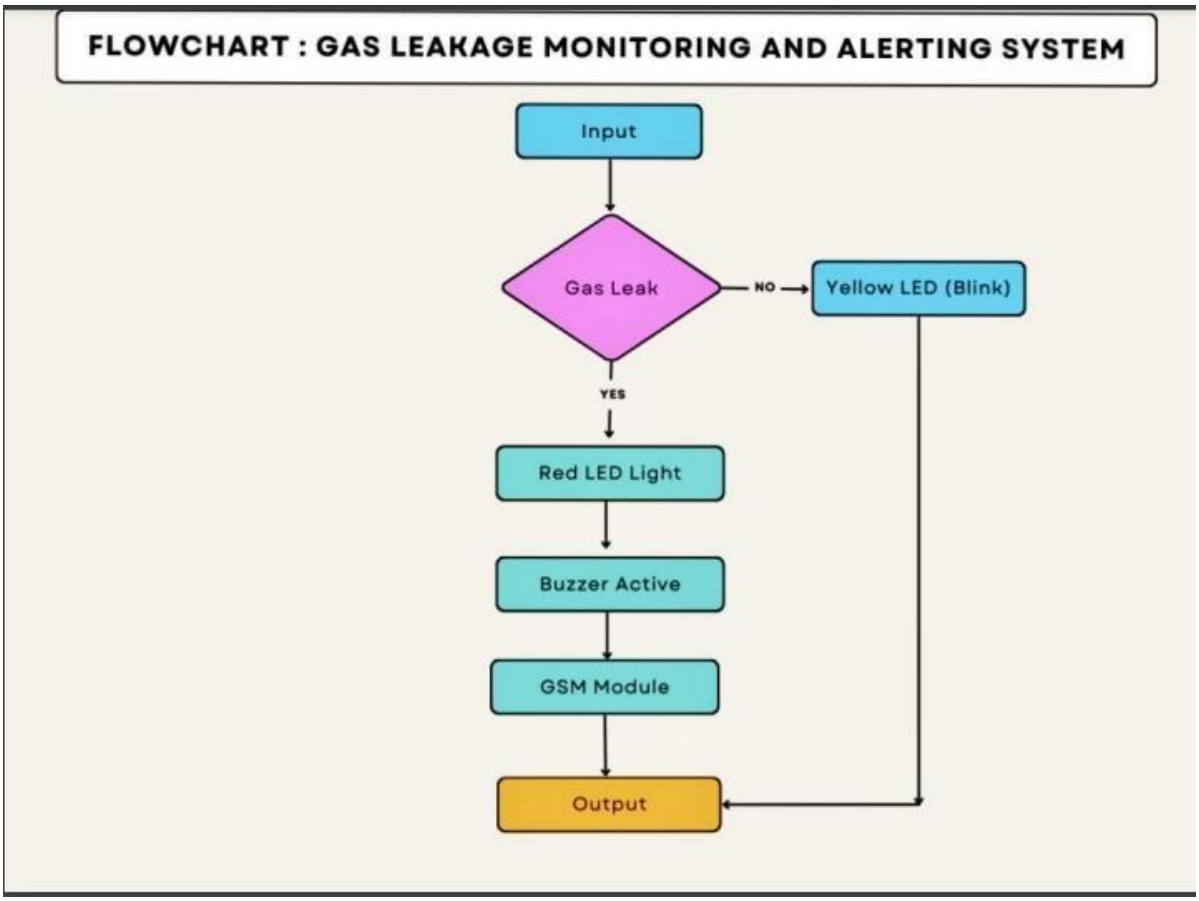
4.2 NON FUNCTIONAL REQUIREMENT

Business Requirements	User Requirements	Product requirements
The said sysytem can deployed homes,hotels,factory units LPG cylinder storage area,and so on. The main advantagee of this IOT and arduino based application is that can determine the leagage and send the data over t a site.It can be monitored, and preventive measures can be taken avoid any disaster.	The ga leakage detection system can be optimized For detecting toxic gasses Along with smoke and fire detecter to identify the presence of smoke and fire. Ensuring worker safety is Impotant but making use o The right technology even more visual.	Detection gasses necessary regardless of Your business role or Individual purpose Certain technolgy 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.

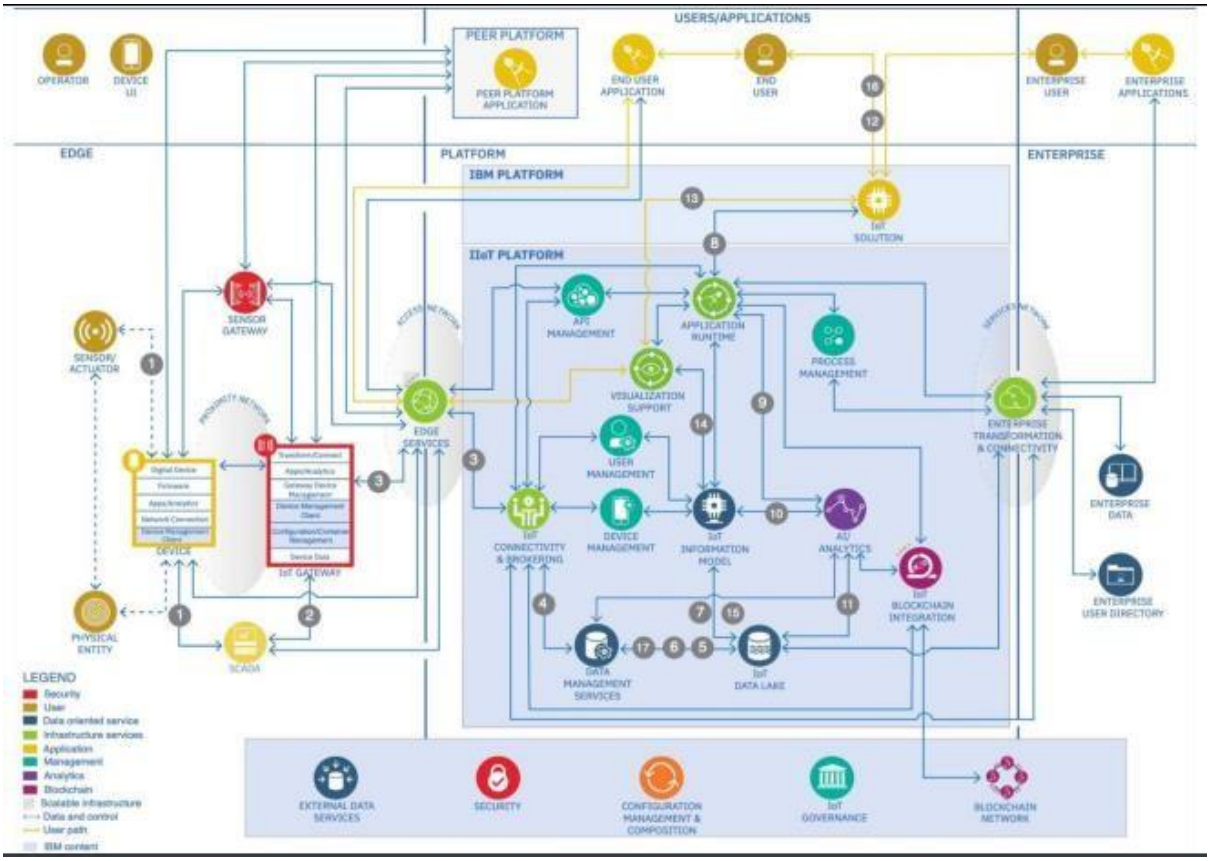
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 SOLUTION & TECHNICAL ARCHITECTURE



S No	Characteristics	Description	Technology
1.	Open-Source Frameworks	The Node-RED open source frameworks are used build the web application as well as to communicate with the mobile application and to handle alert sms	Node-RED framework
2.	Scalable Architecture	The 3 – tier architecture used with a separate user interface, application tier and data tier makes it easily scalabl	IBM Watson Studio
3.	Availability	The web application is high available as it is deployed cloud	IBM Cloud
4.	Performance	The performance of the websi is improved with caching and security.	IBM Cloud Internet Services

5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, i can register for the application by entering my email, password, and confirming my password.	I can access my accou / dashboard.	High	Sprint-1
Customer	Registration	USN-2	As a user, I will receive confirmation message once I have registered for the application.	I can receive confirmation message click confirm.	High	Sprint-1
Administrato	Login page	USN-3	As a user entering the username and password which is already existing.	Redirecting to user account.	Medium	Sprint-1
Weather station	Forecasting the curre weather	USN-4	As a user, we can monitor the weather fundamentals like (humidity, wind speed, wind direction and rainfall).	Notified about weather conditions.	High	Sprint-1
Controlling the Mot Pump	Controlling	USN-5	It is used to control motors and field sprinkler	Switching on and off the motor pumps manually via mobile application	High	Sprint-2
Fencing	Detecting the motion certain range	USN-6	Fencing system are helpf in providing Security against unauthorized access of human and animal.	Ica Receive notification preventi has been taken.	High	Sprint-3
Warehouse management	Collecting database crops	USN-7	Here famer need to update about expire date fertilizer and seeds.	Generate the popup message about expire date and stocks and offers	High	Sprint-4

6. PROJECT DELIVERY AND PLANING

6.1 SPRINT DELIVERY AND PLANING

Sprint	Functional Requirement (Epic)	User Story	User Story / Task	Story Point	Priority	Team Members
Sprint-1	Create	US-1	Create the IBM Cloud services which are being used in this project.	5	High	Leelavathy. A Kaviyasri.G
Sprint-1	Configure	US-2	Configure the IBM Cloud services which are beingused in completing this project.	1	Medium	Ilakiyaselvi.M Lawanya.C
Sprint-1	Create	US-3	IBM Watson IoT platform acts as the mediator to connect the web applicationto IoT devices, so create theIBM Watson IoT platform.	1	Medium	Leelavathy.A Lawanya.C
Sprint-1	Configure	US-4	Configure the IBM Watson IoT which are being used to display the output.	13	High	Ilakiyaselvi.M Kaviyasri.G
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 getthe device credentials.	13	High	Leelavathy.A Kaviyasri.G
Sprint-2	Configure	US-2	Configure a device in the IBM Watson IoT platformand get the device credentials.	3	Medium	Ilakiyaselvi.M Lawanya.C

Sprint-2	Create	US-3	Create a Node-RED service.	3	High	Ilakiyaselvi. Lawanya.C
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	Leelavathy.A Kaviyasri.G
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 IoT platform	13	High	Ilakiyaselvi.M Kaviyasri.G
Sprint-3	Configure	US-2	After developing python code and commands just run the code	1	Medium	Leelavathy. A Ilakiyaselvi.M
Sprint-3	Print	US-3	Print the statements which represent the control of the devices.	1	Low	Ilakiyaselvi. Kaviyasri.G
Sprint-3	Publish	US-4	Publish Data to The IBM Cloud	5	High	Leelavathi. Kaviyasri.G
Sprint-4	Create	US-1	Create Web UI in Node- Red	5	High	Kaviyasri.G Lawanya.C
Sprint-4	Configure	US-2	Configure the Node-RED flow to receive data from theIBM IoT platform	5	High	Kaviyasri.G Ilakiyaselvi.M
Sprint-4	Configure	US-3	Use cloudant DB nodes to store the received sensor data in the cloudant DB	5	High	Leelavathy.A Kaviyasri.G
Sprint-4	Publish	US-4	Publish the received data in web application	5	High	Leelavathy. A Lawanya.C

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	SprintStartDate	SprintEndDate(Planned)	SprintReleaseDate(Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	29Oct2022
Sprint-2	20	6Days	31Oct2022	05Nov2022	05Nov2022
Sprint-3	20	6Days	07Nov2022	12Nov2022	12Nov2022
Sprint-4	20	6Days	14Nov2022	19Nov2022	19Nov2022

6.3 Reports From JIRA

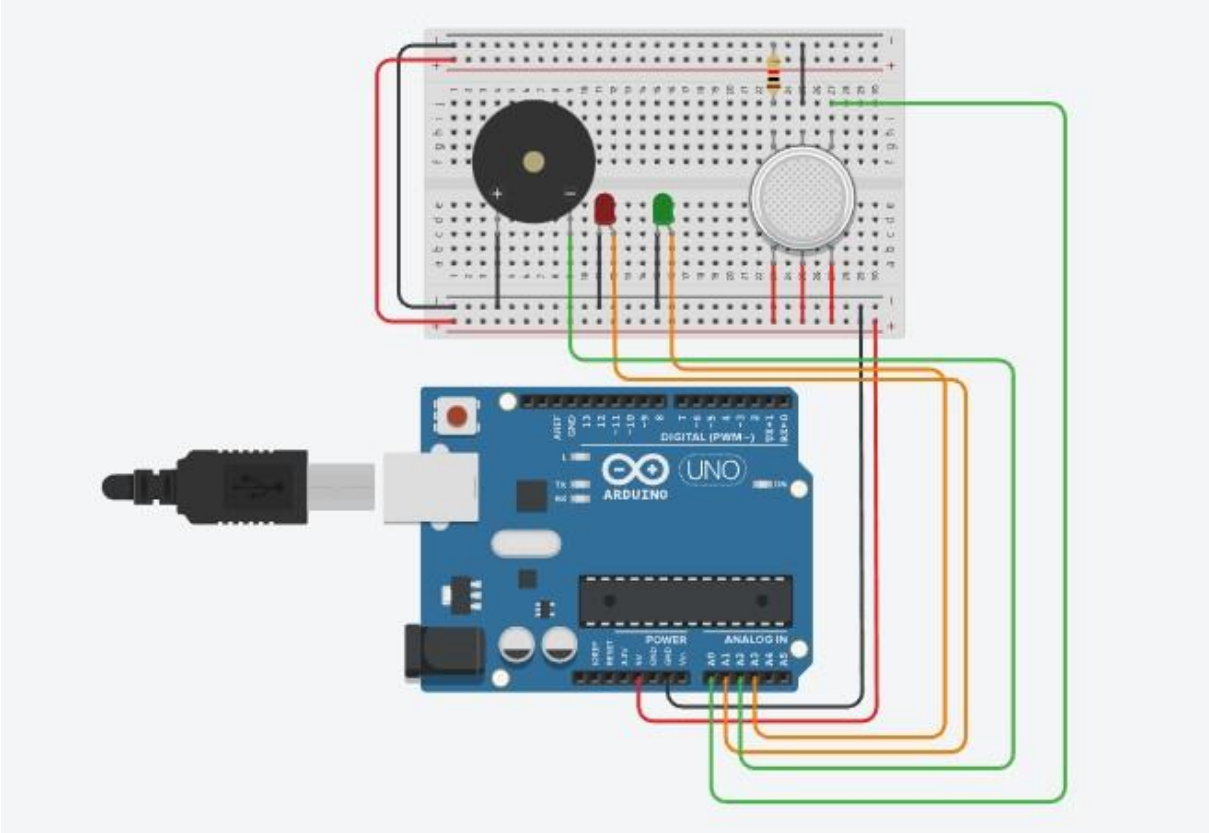
7. CODING& SOLUTIONING

7.1 Feature 1

```
int LED = A1;          //Red LED
int LED1 = A3;         //Green LED
int gas_pin = A0;      // For Gas Sensor
int buzzer_pin = A2;   // For Buzzer
void setup()
{
  Serial.begin(9600);
  pinMode (buzzer_pin, OUTPUT);
```

```
pinMode (gas_pin, INPUT);
}
void loop() {
        float sensorValue,gas_pin;
        sensorValue = analogRead(gas_pin); // read analog input pin 0


  if(sensorValue >= 300)
  {
    digitalWrite(LED,HIGH);
    digitalWrite(LED1,LOW);

    digitalWrite (buzzer_pin, HIGH);
    //Serial.println();
    Serial.print(sensorValue);
    Serial.println(" |SMOKE DETECTED|");
  }

  else
  {
        digitalWrite(LED,LOW);
    digitalWrite(LED1,HIGH);

    digitalWrite (buzzer_pin, LOW);
    Serial.println();
    Serial.println("Sensor Value: ");
    Serial.print(sensorValue);
```

```
  //Serial.print(" |Safe Mode|");
 }

 delay(1000);

}
```



7.3 DATABASE SCHEME

Today, India has around 16.64 crore active consumers of Liquefied Petroleum Gas (LPG). Around 21 million tonnes of LPG is required for consumption per annum. This deimportRPi.GPIO as GPIO

Listed below are the schemes provided for the benefit of LPG consumers.As per this scheme, BPL families can receive a new LPG connection without having to pay the security deposit for a cylinder and a pressure regulator. However, they are required to bear the following expenses,

- Installation or demonstration charges for the new connection.

- Administrative charges and cost of DGCC.
- Cost of gas stove and LPG rubber tube at the time of release of new LPG connection.
- If the stove is not procured from the LPG distributer, it needs to be inspected. These inspection charges will be borne by the customer.
- Price of LPG in the new cylinder.

All these charges should be paid to the concerned distributor.Every cylinder that is used by a consumer carries a subsidy of around Rs. 200. This amounts to a huge subsidy burden that deters the government from utilising these resources in other developmental activities. In an attempt to focus the LPG subsidy towards the needy, the government has launched the 'Opt out of subsidy' scheme. As per this scheme, the government motivates LPG consumers who can afford to pay the market price for LPG to surrender their subsidy.

Customers can opt-out from LPG subsidy through the website, www.mylpg.in or by submitting Form-5 to their distributors.

This scheme is targeted at streamlining the possession and transfer of LPG connections.

- For connection transfers, a written consent is needed from the registered customer for transfer to the person holding the equipment and SV.
- The distributor verifies the submitted documents and settles the security deposit amount between the registered customer and holder of the equipment.
- A fresh SV will be issued to the holder of the equipment.
- For people holding equipment without any connecting documents, a security deposit at the prevailing rate is charged.
- In case of death of the SV holder, the beneficiary shall be transferred the connection on submitting Death Certificate and Legal Heir Certificate/NOC.
- Transfer of LPG connection within the family is possible if the registered member provides a written consent for the same.

PSU Oil Marketing Companies act as Principals and take Insurance policies for LPG accidents including Third Party Insurance Cover. These are Public Liability Policies and are not in the name of an individual customer.

- The distributor does not collect any premium for the insurance policies from the customer.
- The claim amount is remitted through the Oil Company to the beneficiary.
- There are limits on the liability for compensation.

Under this provision, a customer can shift to an alternate distributor if he/she is dissatisfied with service. This is useful in keeping distributors competent and in providing improved service to customers.

- Customers can transfer the connection through the website, www.mylpg.in.
- The approval of the parent distributor is not needed to initiate transfer. The customer can complete required documentation at the new distributorship within the specified time.
- There shall be no transfer fee or additional security deposit for transfer of LPG connection under this scheme.
- There is a commendable electronic tracking mechanism to ensure smooth processing of the transfer request. The initial phase of the PAHAL scheme required the consumer to have to avail LPG subsidy. This has been reviewed comprehensively and a modified scheme has been launched recently. Once a customer joins the scheme and is ready to receive subsidy in his bank account, he is said to be Cash Transfer Compliant (CTC).

- As per the modified approach, there are two methods by which LPG customers can receive subsidy.
  - Primary option - Aadhaar will remain the medium of cash transfer. The Aadhaar number is linked to the bank account and the LPG consumer number.
  - Secondary option - If the LPG consumer does not have an Aadhaar number, he can receive subsidy in his bank account irrespective of this. In this case, the consumer is required to produce his bank account information to the LPG distributor for updating the LPG database. He should also present his LPG consumer ID to his bank.
- If LPG consumers were already CTC prior to the update in PAHAL, they need not take fresh action to receive subsidy.

- As per this scheme, LPG cylinders will be sold to customers at Market Determined Price.
- Customers who join PAHAL will be provided a one-time advance, and it will remain with the customer till termination of connection. At termination, the amount will be adjusted by the distributor.

8 TESTING:

8.1 TEST CASES:

- The higher the LPG gas is detected, the higher the voltage released. When the sensor output is moved The presence of gas, then Arduino will activate, and activate the buzzer and display the writing on the LCD stating the gas is high (high), which means there has been a gas leak, then the GSM SIM800L module will send a notification message to the handphone number specified in the program. However, if the sensor does not detect a leak, the sensor will not remove the output, and the sensor will continue to work until it is proven that there is an LPG gas leak. The system design in this study is described in the form of a flowchart to facilitate the reading and understanding of the system that will be made in this study. When the program is run the system will immediately detect LPG gas detected by the sensor. Then the Arduino microcontroller will read LPG gas through an LPG gas sensor. If it detects a gas leak, the red LED will light up, the buzzer will activate, then the system will send a notification message stating that there has been an LPG gas leak. If no LPG gas leak is detected, the system will continue to detect the gas level through the LPG gas sensor until it detects an LPG gas leak. System flow. The way the system works and this tool is, first when the system is turned on and this tool will immediately detect the gas content, using a sensor that is designed to be able to detect LPG gas, namely the MQ-2 gas sensor. Then each LPG gas level detected by the sensor is directly processed or converted into an analog signal. Then the analog signal will be sent directly by the MQ-2 sensor to Arduino. Because the analog signal to be sent is a number of LPG gas levels detected by the MQ-2 sensor. Then this analog signal will later become the Arduino working parameter. Does the gas level exceed the limit or not. If the level of LPG received by Arduino exceeds the predetermined limit of 5000ppm (part per million), then the Arduino will

directly control the other connected ones, namely relay, buzzer, and SIM800L, by sending commands to the relay to turn on the LED (Light Emitting Diode) red which indicates danger. Then Arduino sends commands to control the buzzer to be active, to give an alarm signal as a marker in the form of sirens that there has been a leak of LPG gas that has exceeded a predetermined limit. Finally, Arduino will instruct the SIM800L module to send an SMS message to the owner, to provide information about leaked LPG gas. However, if the gas content in the form of an analog signal received by the Arduino from the MQ-2 gas sensor does not exceed the limit of 5000ppm, then Arduino will not control other components. Or in other words, the system and this tool will work normally as when the initial system was turned on, which is detecting the existing level of LPG gas. Why in this case did the author make the gas parameter limit leak at the level of 5000 ppm? Because based on the MQ-2 gas sensor technical data, the range that can be measured by the MQ-2 gas sensor against LPG type gas ranges from 200ppm to 5000ppm. Therefore, in this case, the authors set a maximum limit of the level of LPG gas leakage at 5000ppm.

8.2 USER ACCEPTANCE TESTING:

- Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

9.RESULTS:

9.1 PERFORMANCE METRICS:

- The result of this project is determined by using a lighter to collect leaked gas around the gas sensor,after sensing procedure if sensor value is greater than the threshold value then ESP 8266(NODE MCU) will perform its programmed tasks : Immediately turn off the regulator knob to stop further leakage. After detecting the gas leakage, the relay will be on the

Enhanst fan to prevent any further accidents. Buzzer starts beeping to alert the nearby people. The exhaust fan will fan out all enclosed gas from the environment. The wi-fi module updates the information to the cloud. The user can get to know the gas values and status of the system through the app and also control of the power supply can be done manually by the user through the app

10. ADVANTAGES

• Because of the very narrow 0.3 nm line width of the laser emission, there is no interference from other gases.

• Response times are in the order 1 second. This allow for fine resolution/control when making process measurements.

• The intense laser light concentrated at the absorption wavelength enables path lengths up to 1 km to be measured.

• An average measurement is taken over the total path so that a narrow plume of gas has less chance of escaping detection.

• The range of measurement can be up to 4 orders of magnitude, enabling concentrations of 0.1 ppm to 1000 ppm to be measured.

• Because of the internal reference cell, the system is self calibrating.

• There is no ‘poisoning’ or degradation of the instrument with long term exposure to a gas.

• Can easily be conformed to be ‘Intrinsically Safe’.

• Low maintenance and low operating costs.

• Reliable technology.

DISADVANTAGES

• Only one gas can be measured with each instrument.

• When heavy dust, steam or fog blocks the laser beam, the system will not be able to take measurements. This is also the case when a person or vehicle blocks the path.

11. CONCLUSION:

It is always better to have preventive measure, rather than taking actions after a disaster. Having a system to monitor the changes in the surroundings should help the owners of the industry to keep their industries safe and also keep their workers safe. Though the initial cost of installation of the device is higher, it is always better to spend on precaution, than spending on fixing any harmful situation.

12. FUTURE SCOPE:

Another major future scope could be including a Automatic Shut-off device which will turn off the gas supply whenever it will detect any gas leakage. This system can be implemented in Industries, Hotels and wherever the LPG cylinders are used.

1) Fast Speed of response.

2) Immune to catalytic poisons.

3) High Reliability & Repeatability.

4) Heated optics eliminates condensation.

5) Ability to operate in the absence of oxygen or in enriched oxygen

As detectors measure a specified gas concentration, the sensor response serves as the reference point or scale. When the sensors response surpasses a certain pre-set level, an alarm will activate to warn the user. There are various types of detectors available and the majority serves the same function: to monitor and warn of a dangerous gas level. However, when considering what type of detector to install, it is helpful to consider the different sensor technologies.

Gas Detector Technologies :- Gas detectors are categorized by the type of gas they detect: combustible or toxic. Within this broad categorization, they are further defined by the technology they use: catalytic and infrared sensors detect

combustible gases and electrochemical and metal oxide semiconductor technologies generally detect toxic gases.

13 APPENDIX:

Project demo link:
https://drive.google.com/file/d/1_luxXs9VYbw90CVELs7dw67fmtH77cJw/view?usp=sharing

GitHublink:
https://drive.google.com/file/d/1_luxXs9VYbw90CVELs7dw67fmtH77cJw/view?usp=sharing