

P.S.V. COLLEGE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE ,New Delhi & Affiliated to Anna University, Chennai)

(AN ISO 9001:2015 certified Institution)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING

Gas leakage monitoring and alerting system

PROJECT MEMBERS:

V.PAVITHRA	(611819106035)
S.SWETHA	(611819106055)
S.KAVIYA	(611819106018)
J.DEVADHARASHINI	(611819106008)

Project Report Format

1. INTRODUCTION

1.1 Project Overview

1.2 Purpose

2. LITERATURE SURVEY

2.1 Existing problem

2.2 References

2.3 Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming

3.3 Proposed Solution

3.4 Problem Solution fit

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

4.2 Non-Functional requirements

5. PROJECT DESIGN

5.1 Data Flow Diagrams

5.2 Solution & Technical Architecture

5.3 User Stories

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

7. CODING & SOLUTIONING

7.1 Feature

7.3 Database Schema (if Applicable)

8. RESULTS

8.1 Performance Metrics

9. ADVANTAGES & DISADVANTAGE

10. CONCLUSION

11. FUTURE SCOPE

12. APPENDIX

Source Code

GitHub & Project Demo Link

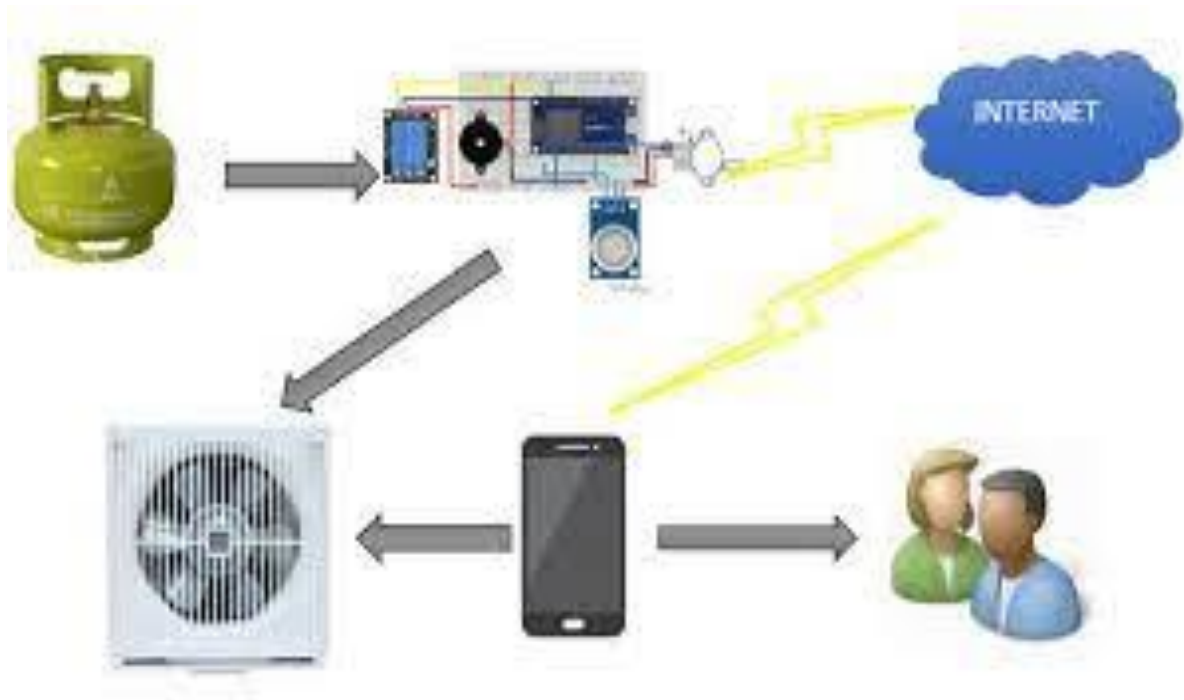
DECLARATION

We hereby declare that the project entitled” Gas leakage monitoring and alerting system” is an authentic record of S.PAVITHRA(611819106035), S.SWETHA (611819106055),S.KAVIYA (611819106018),J.DEVADHARSHANI (611819106006) who carried out work as requirements for the award of degree of B.E (Electronics and Communications) at P.S.V college of Engineering and Technology, Krishnagiri (Anna University, Chennai)

1.Introduction:-

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IoT on the Internet and economy are impressive, with some anticipating as many as 100 billion connected IoT devices and a global economic impact of more than \$11 trillion by 2025. The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities. The large-scale implementation of IoT devices promises to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, energy management devices are moving us toward a vision of the “smart home”, offering more security and energy efficiency. IoT systems like networked vehicles, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of “smart cities”, which help minimize congestion and energy consumption. IoT

1.1 Project Overview:-



1.2 Purpose :-

Harmful Gas Detection:

The sensing of toxic gases such as H₂S, Methane, and CO is of great importance in any industry to avoid unwanted leakage and consequences like poisoning or explosions. The presence of these gases can be easily detected in the industrial facilities and commercial buildings with the help of IoT-powered gas monitoring solution. Moreover, a gas detector or sensor device is a crucial part to carry out safe industrial operations. The sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises.

Fire Hazard Prevention:

The gas sensors help detect the concentration of the gases present in the atmosphere to avoid hazardous consequences like fire breakouts. Also, it is an imperative solution to keep the plant workers and equipment safe from fire hazards. It effectively detects the presence of hazardous gases like propane and methane and alerts the plant authorities, preventing the premises from unexpected ignition. Moreover, a gas monitoring solution uses gas analyzers to generate alerts regarding the temperature increase. This allows the management to take immediate actions to curb harmful fire explosions.

Oxygen Level Measurement:

Sensing the presence of gases is a necessity to conduct industrial operations as several pitmen had lost their lives due to lack of oxygen in the process of mining explorations. A sudden decrease in the oxygen levels can result in dizziness, brain damage, or even death among the workers working in mines or close-packed industrial premises. A gas monitoring system significantly benefits the industries by maintaining proper oxygen levels that reflect the optimal performance of your workers. This system also creates alerts in real-time about the decreasing oxygen levels, which gives enough time to take necessary measures to evacuate the facilities much before the health gets affected.

2.Existing problem :-

Existing gas leakage detection system has fixed in the wall of the home. It gives only alarm and LED output. It can't Use the devices like servo motors to turn off the LPG Cylinder. Servo Motor to be Fixed in LPG Cylinder can Turn-Off the Cylinder when the leakage Occurs. It Cannot identify the Flammable or Inflammable gases

2.1 LITERATURE SURVEY :-

Sr. No	Paper Title	Author Name	Publication Year	Result
1.	Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor	Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu	2017	This paper choice of using a real time gas leakage monitoring and Sensing the output levels of gas has been clearly observed by the help of this system.
2.	Gas Leakage Detection and Smart Alerting and Prediction Using IoT	Asmita Varma, Prabhakar S, Kayalvizhi Jayavel	2017	The proposed gas leakage detector is promising in the Field of safety.
3.	IOT Based Gas Leakage Detection System with Database Logging, Prediction and Smart Alerting	Chaitali Bagwe, Vidya Ghadi, Vinayshri Naik, Neha Kunte	2018	The system provides constant monitoring and detection of gas leakage along with storage of data in database for predictions and analysis. The IOT components used helps in making the system much more cost effective in comparison with traditional Gas detector systems.
4.	"IoT Based Gas Monitoring System using ARDUINO	Mobasshir Mahbub	2019	Toxic and hazardous gas detection, measurement and monitoring system for safety assurance in home and industrial application of wireless sensor node.

2.2 References:-

[1] Anandhakrishnan S, Deepesh Nair, Rakesh K, Sampath K, Gayathri S Nair “ IOT Based Smart Gas Monitoring System ” IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) 2018.

[2] Ch.Manohar Raju, N. Sushma Rani. “An android based automatic gas detection and indication robot”. In International Journal of Computer Engineering and Applications. 2014; 8(1).

[3] Metta Santiputri, Muhammad Tio “IoT-based Gas Leak Detection Device” 978-1-5386-8066- 7/18/\$31.00 ©2018 IEEE.

[4] Pal-Stefan Murvaya, Ioan Sileaa. “A survey on gas leak detection and localization techniques.”

[5] Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu “Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor, © 2017 IJEDR | Volume 5, Issue 2 | ISSN: 2321-9939

2.3 Problem Statement Definition:

Gas leakage is nothing but the leak of any gaseous molecule from a stove, or pipeline, or cylinder etc. 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, home, workplace, industry and the environment.

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, home, workplace, industry and the environment.

Few of the major incidents that took place due to gas leakage include the Bhopal Disaster and the Vizag Gas leak. The Bhopal disaster is known to be the worst industrial accident ever. Approximately 45 tons of Methyl Isocyanate was leaked from this insecticide plant. Methyl Isocyanate is an organic compound and a chemical that could come from the carbamate pesticides. This colorless, poisonous and flammable liquid is something that human beings have to be away from.

Vizag Gas leak was a resultant of the escape of styrene that were unattended for a long period. This colorless oily liquid can spread in fumes. So, a detector must be made in such a way that could detect any kind of gas, fume, leak, smoke etc. However harmful and dangerous it can be, the detector could be attached with certain parameters that could help to prevent the issue.

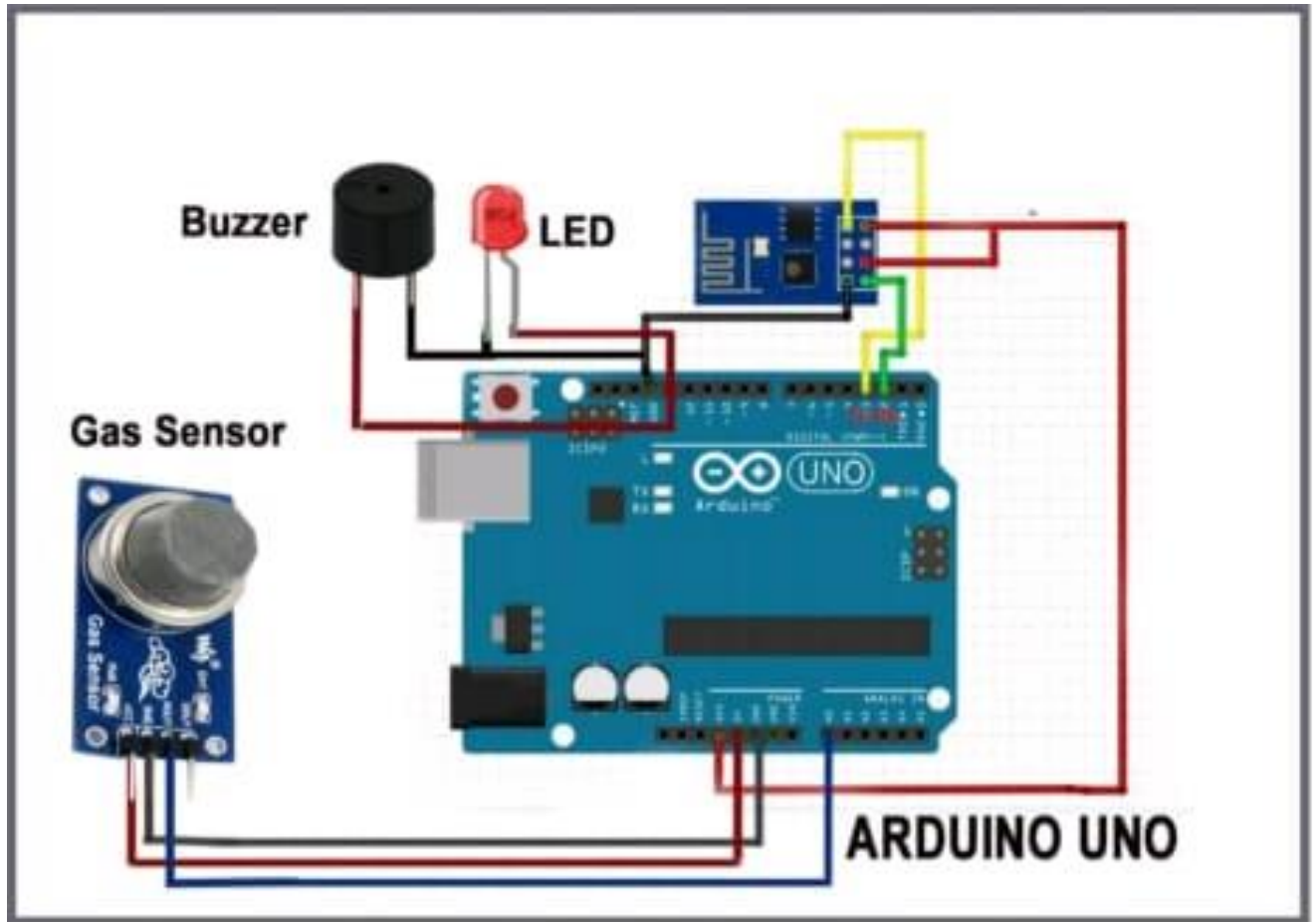
3. IDEATION & PROPOSED SOLUTION:-

Introduction:

Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for enhancing the existing safety standards. Safety has always been an important criterion while designing home, buildings, industries as well as cities.

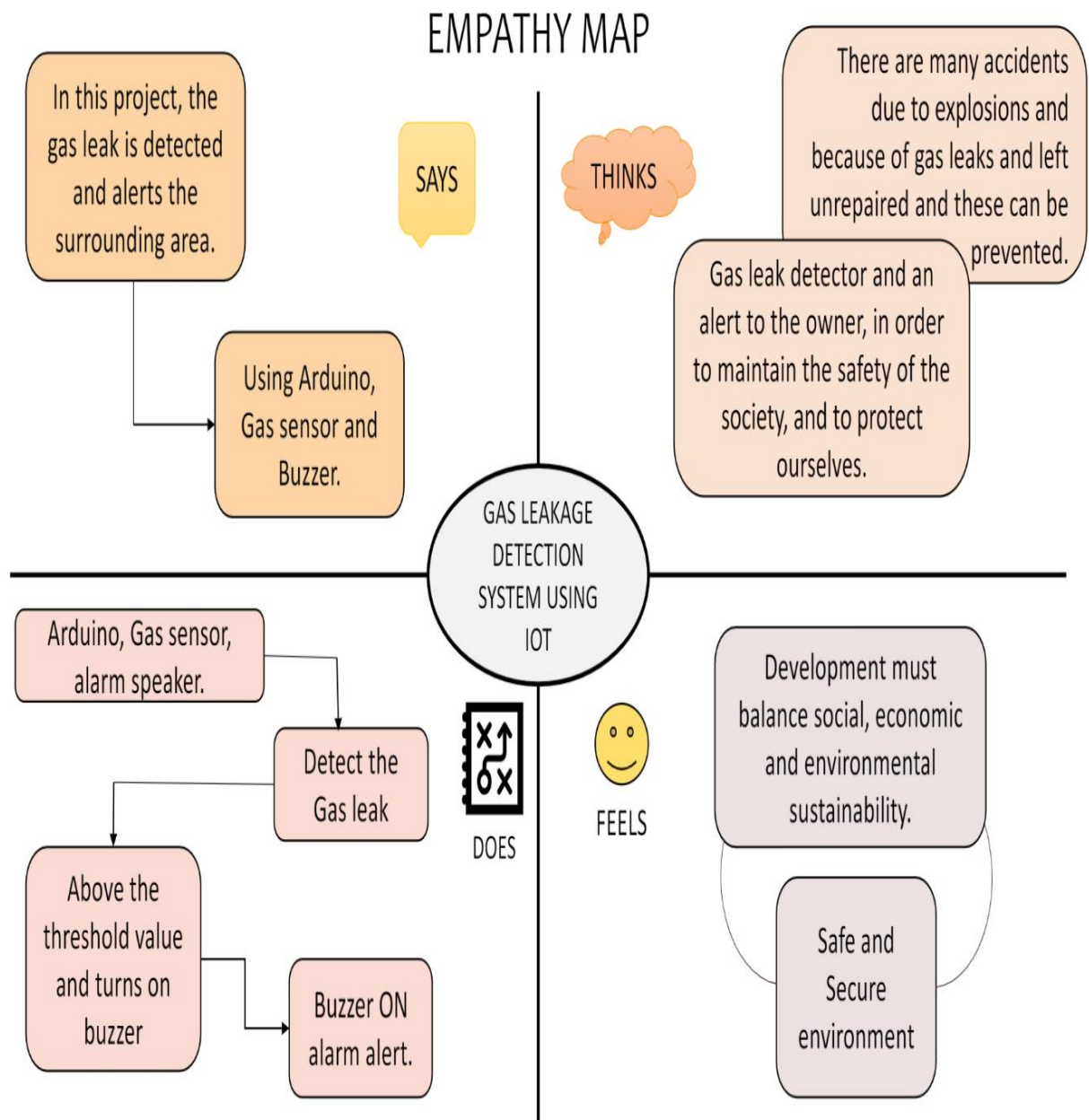
The increased concentration of certain gases in the atmosphere can prove to be extremely dangerous. These gases might be flammable at certain temperature and humidity conditions, toxic after exceeding the specified concentrations limits or even a contributing factor in the air pollution of an area leading to problems such as smog and reduced visibility which can in turn cause severe accidents and also have adverse effect on the health of people. Most of the societies have fire safety mechanism. But it can use after the fire exists. 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. Presence of excess amounts of harmful gases in environment then this system can notify the user. System can notify to society admin about the condition before mishap takes place through a message.

System consists of gas detector sensors, Arduino board, ESP8266 and 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, per user flat sensor details information. Society admin can configure that threshold value of each sensor. System hardware can be deployed on each flat. Sensors can sense the value per time. System can send the values to cloud server. Server can Check that the sensor values was existed the threshold value. If sensor value can cross the limit the server can send the command to hardware for buzzing the alarm. Server also sends the notification message to 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 environment and hence nullify any major or minor hazard being caused due to them. 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. This system will be able to detect the gas in environment using the gas sensors. This will prevent form the major harmful problem.

3.1 Empathy Map Canvas:-



3.2 Ideation & Brainstorming:-



3.3 Proposed Solution:-

This paper aims to provide a solution to this problem by building a device that utilizing sensors connected to Node MCU. The device performs area monitoring continuously. The gas sensor provides data to Node MCU, and then the results are displayed as a warning to the user via an Android-based smart-phone device. Other than LPG gas, Air conditioner and refrigerator leaked gases also harmful in home. Using this device, users will be able to prevent accidents that occur due to harmful gas leaks so that accidents can be avoided.

3.4 Problem Solution fit:-

Problem-Solution fit canvas 2.0

Purpose / Vision

Define CS, fit into	1. CUSTOMER SEGMENT(S) CS Industries are the end customers because the Gas Leakage monitoring and Alerting systems are used to detect the leakage of gas in industries and to prevent the industrial injury.	6. CUSTOMER CC In order to monitor and indicate the leakage of gases which cause gas explosion such as Bhopal tragedy various health issue for human beings by breathing of the leakage toxic gases and also causes atmospheric pollution.	5. AVAILABLE SOLUTIONS AS gas leakage in the machinery is possible when their a fault in the machinery ,to avoid this before the process is carried out through machines a high pressure should be passed through the machines if any leak is present the pressure gas will come out through that leakage part.	Explore AS.
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Non- availability of actions to ensure the service of machineries as per the given period of time and the reverse osmosis process is carried out. Once before the gas is released it should be undergone several methods to remove the toxic present in the gas	9. PROBLEM ROOT CAUSE RC Gas leakage leads to various accidents resulting in both material loss and human injuries. The Risk of explosion, firing, suffocation are based on their physical properties such toxicity, flammability etc. The reason of such Explosion is due to substandard cylinders, old valves, worn out regulators and lack of awareness in handling	7. BEHAVIOUR BE Customers will address the problems to the government and they will assign a project to product developing companies, those companies will develop a project and finish as a product. The end product will sell to the customers by the Government.	
Focus on J&P, tap into BE, understand	3. TRIGGERS TR The gas detector can sound an alarm to operators in the area where the leak is occurring giving them the opportunity to leave. This kind of device is very important because their may many gases that are harmful to organic life	10. YOUR SOLUTION SL This system will not only able to detect the leakage of gas but also alerting through audible alarms. Presence of excess amounts of harmful gases in environment then this system can notify the user. System consists of gas detector sensors, Arduino board, ESP8266 and Cloud server	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE Through the company official website they can share the queries in their customer satisfaction section and can also individually express through their personal rating options which in turns convey as feedback to the end user . 8.2 OFFLINE If they buy the product by in person then they can convey directly to the product directing manager through who they have contract and can convey their problem even in a more efficient way.	Extract online & offline CH of BE
	4. EMOTIONS: BEFORE / AFTER EM BEFORE : When they face a problem, they feel insecure,Discomfort, confused and lose their confident. They don't know what to do next and how to overcome this problem. AFTER : Afterwards they address the problem to the government and get the product for their problem from the government. This end product will regain their confidence, gives comfortness , happiness and feels gratitude towards it			

4. REQUIREMENT ANALYSIS:-

4.1 Functional requirement:

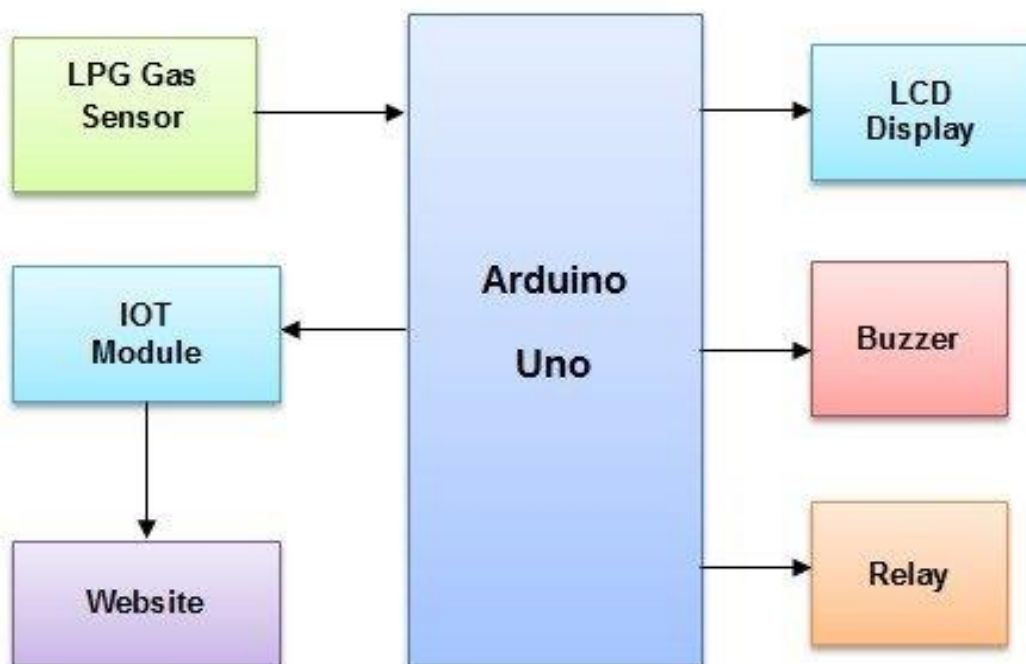
Business Requirements	User Requirements	Product Requirements
This system may be used in residences, hotels, industrial buildings, LPG cylinder storage sites, and other locations. This IoT and Arduino-based application's key benefit is its ability to identify leaks and transmit the information to a site. It can be tracked and disasters can be avoided by taking precautions.	The gas leakage detection system may be upgraded to include smoke and fire detectors in order to better detect dangerous gases and identify the presence of fire and smoke. Although ensuring worker safety is critical, adopting the appropriate technology is even more crucial.	Regardless of your career or personal circumstances, gas detection is required. In order to participate in IoT application development, you must be aware of the technologies at work that give rise to such IoT devices as well as the functions they may carry out.

4.2 Non-Functional requirements:-

Non-Functional Requirement	Description
Usability	The device must be usable by the customer anywhere
Security	Data from the sensors are stored securely and away from other data
Reliability	Data can be retrieved anytime and no data is discarded without customer knowledge
Performance	No performance delay in case of large number of data or more parameters
Availability	The device doesn't fail even under harsh conditions. Device continues to send parameters, even after an alert situation.
Scalability	Device must be capable of measuring conditions even in a larger industry

5.PROJECT DESIGN:-

5.1Data Flow Diagrams:



5.2Block diagram discription:

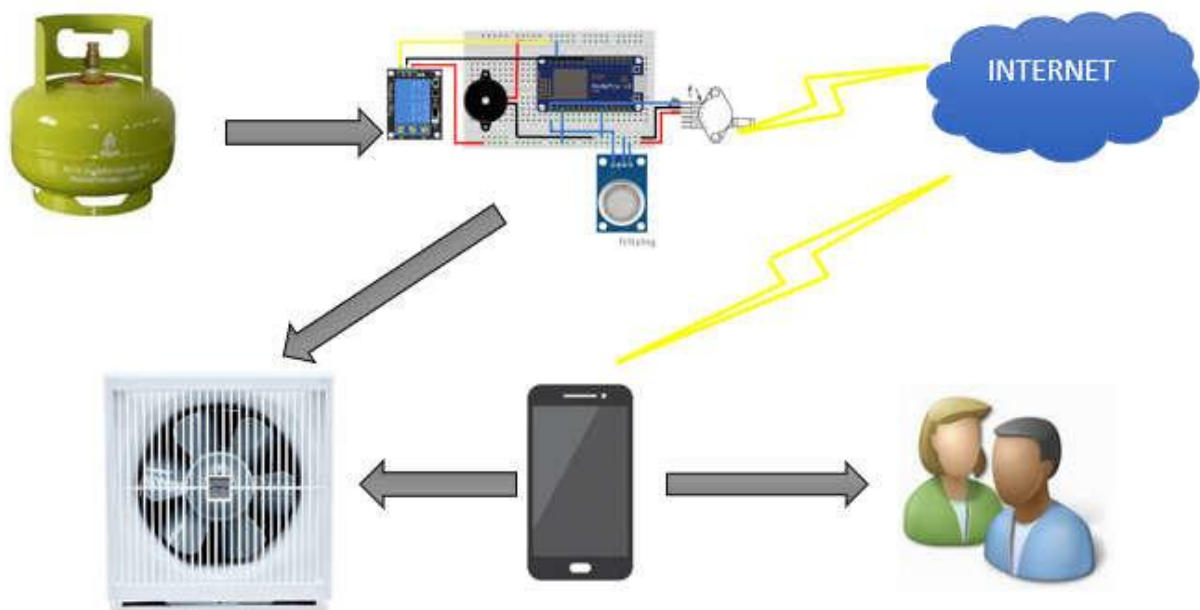
The device is ready to read gas concentration level from the environment through the Gas Sensor Module when the power supply circuit is ON. After that microcontroller reads analog environmental data through the MQ-5 gas sensor module, processes it and provides output to the LCD monitor and controller computer. If the concentration level exceeds the first critical level then the microcontroller starts Exhaust Fan, LED “ON”, Monitoring data and sends data to computer as well as LCD. Using exhaust fan the device will try to minimize the concentration level of the gas in the operational area. Yet, the level of gas concentration still increasing and exceeds the second critical level, then it will Power OFF the Gas Supply, starts alarm, monitoring data and sends data to computer. The first critical level and the second critical level is user defined. Users can change the critical level simply replacing by new one using MATLAB by simply inputting the critical value without any hardware modification of the device. The observed data taken from MATLAB is stored into the “Test & Measurement Tool” window of MATLAB and one can easily analyses the previous level of gas concentration of that area using the surveying statistics.

5.2 Solution & Technical Architecture:-

Gas Leakage Monitoring & Alerting System for Industries has all the features as explained below

- This project 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.
- The admins can view the sensor parameters that is sent to them through the Wi-Fi module.
- The system also provides indication through an LCD display, buzzer and turns on the exhaust fan on detecting gas leakage.

Diagram:-



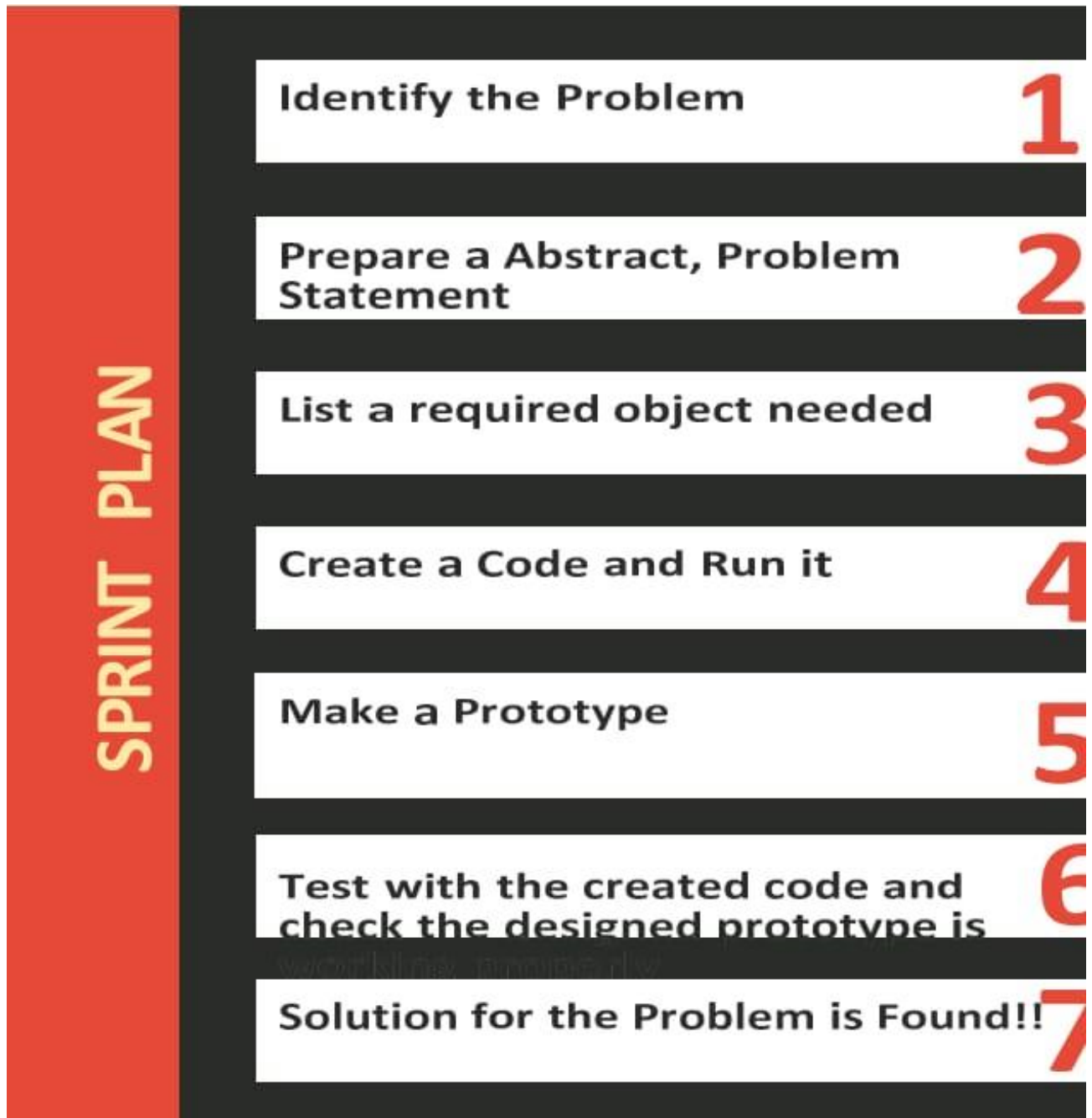
5.3 User Stories:-

LPG gas is one of the household things in daily life. But LPG gas is highly flammable. There have been many accidents due to leakage of LPG gas. The trigger varies from the incorrect installation to the use of defective gas cylinders. This paper aims to provide a solution to this problem by building a device that utilizing sensors connected to Node MCU. The device performs area monitoring continuously. The gas sensor provides data to Node MCU, and then the results are displayed as a warning to the user via an Androidbased smart-phone device. Other than LPG gas, Air conditioner and refrigerator leaked gases also harmful in home. Using this device, users will be able to prevent accidents that occur due to harmful gas leaks so that accidents can be avoided.

6. PROJECT PLANNING & SCHEDULING:-



6.1 Sprint Planning & Estimation:-



7. CODING & SOLUTIONING:-

7.1 FEATURE:-

- **In the automotive industries like oil and gas,hotels,and places where flammable gas are used in abundance,a gas detection system is a basic Requirement for safty.**
- **An IOT powered gas detection solution uses gas sensors to identify the presence of toxic gases such as CO₂,CO,NO_x in the industrial facilities.**
- **Especially, in the oil and gas industry where many gaseous products like propane ,butane,and hydrogen are manufactured at a greater level.**
- **Hence,the chances of gas explosion are higher as these gases are easily combustible in the oxygen -rich environment.**
- **Apart from these, toxic gases like hydrogen sulfide (H₂S) is produced during refining processes that might harm the workers' health.**

8. RESULTS:-

8.1 Performance Metrics:

```
import random

i=1

while(True):

a=random.randint(10,100)

b=random.randint(10,100)

if(a>35 and b<65):

    print("HIGH TEMPERATURE AND HUMIDItY
OF:",a,b,"%","ALARM IS ON")

elif(a<35 and b>65):

    print("NORMAL TEMPERATURE AND HUMIDITY
OF:",a,b,"%","ALARM IS OFF")

if(i<10):

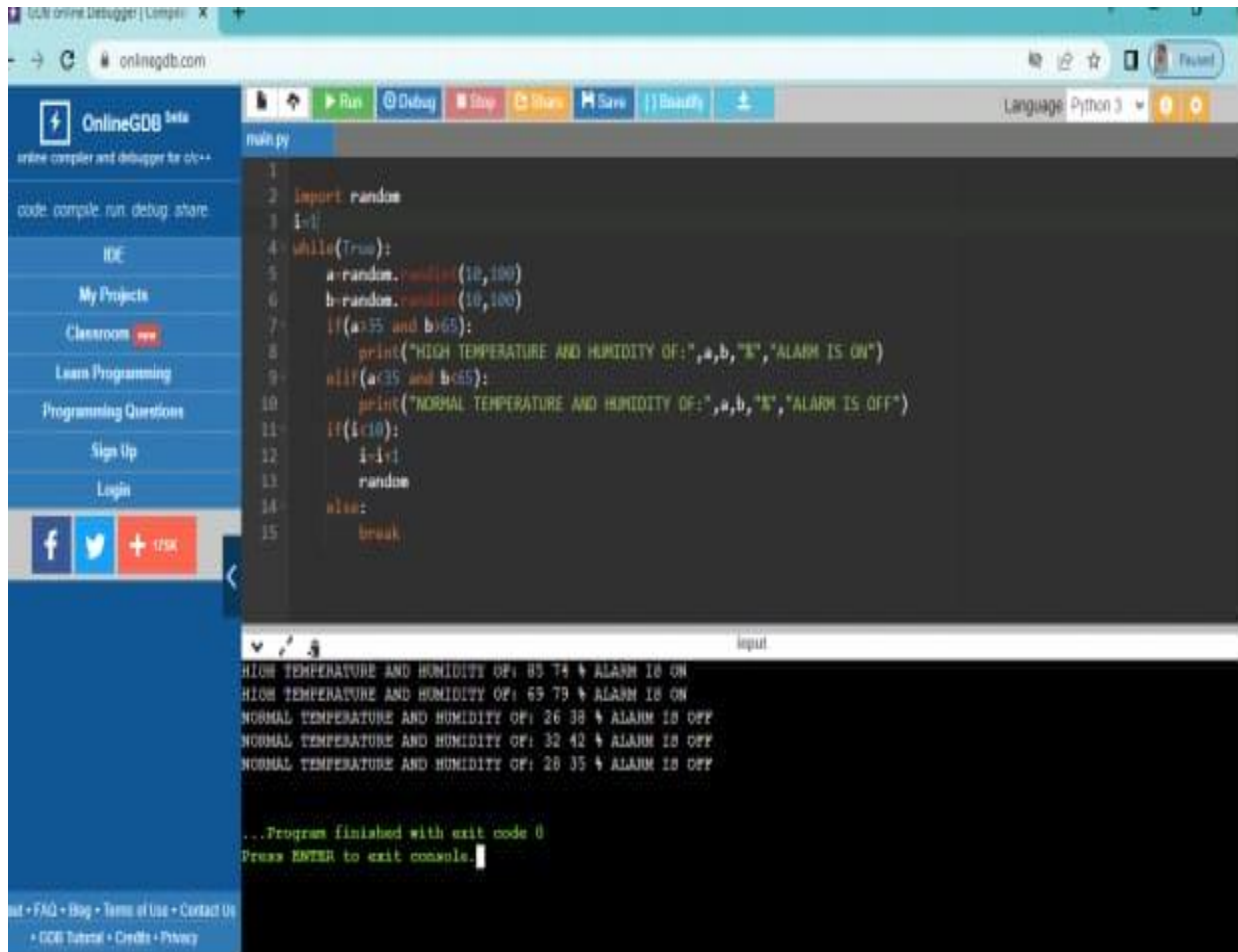
    i=i+1

    random

else:

    break
```

Output:



The screenshot displays the OnlineGDB web interface. The top navigation bar includes links for 'Run', 'Debug', 'Stop', 'Share', 'Save', 'Beautify', and 'Download'. The left sidebar contains a menu with 'OnlineGDB Beta', 'code: compile run debug share', 'IDE', 'My Projects', 'Classroom', 'Learn Programming', 'Programming Questions', 'Sign Up', and 'Login'. The main editor area shows a Python script named 'main.py' with the following code:

```
1
2 import random
3 i=1
4 while(True):
5     a=random.randint(10,100)
6     b=random.randint(10,100)
7     if(a>55 and b>65):
8         print("HIGH TEMPERATURE AND HUMIDITY OF: ",a,b,"°", "ALARM IS ON")
9     elif(a<35 and b<65):
10        print("NORMAL TEMPERATURE AND HUMIDITY OF: ",a,b,"°", "ALARM IS OFF")
11    if(i<10):
12        i=i+1
13        random
14    else:
15        break
```

Below the code editor, the 'input' tab shows the program's output:

```
HIGH TEMPERATURE AND HUMIDITY OF: 85 74 ° ALARM IS ON
HIGH TEMPERATURE AND HUMIDITY OF: 69 79 ° ALARM IS ON
NORMAL TEMPERATURE AND HUMIDITY OF: 26 38 ° ALARM IS OFF
NORMAL TEMPERATURE AND HUMIDITY OF: 32 42 ° ALARM IS OFF
NORMAL TEMPERATURE AND HUMIDITY OF: 28 35 ° ALARM IS OFF

...Program finished with exit code 0
Press ENTER to exit console.
```

The bottom of the page features a footer with links for 'FAQ', 'Blog', 'Terms of Use', 'Contact Us', 'GDB Tutorial', 'Credits', and 'Privacy'.

9. ADVANTAGES & DISADVANTAGES:-

Advantage:

- 1. Get real-time alerts about the gaseous presence in the atmosphere**
- 2. Prevent fire hazards and explosions.**
- 3. Ensure worker's health.**
- 4. Real-time updates about leakages.**
- 5. Cost-effective installation.**
- 6. Data analytics for improved decisions.**
- 7. Measure oxygen level accuracy.**

Disadvantage:

- 1.Only one gas can be measured with each instrument.**
- 2. 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.**

10.Conculsion:-

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas like CO₂, oxygen, 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.

11.FUTURE SCOPE:-

- The present gas spillage recognition framework can be additionally improved.
- For modern purposes, versatile robot can be produced for recognizing numerous has fixations
- Expansion of load cell can likewise be utilised as weight sensor which identifies the measure of gas in the chamber and furthermore recognises high weight gas in barrel pipe, showing the alarm message by mean of SMS and LCD display.

Gitup link:

<https://github.com/IBM-EPBL/IBM-Project-45393-1660729793>

Project demo link:

https://drive.google.com/file/d/1ktj9UnA1IYIkeT0Fp5OsQDtC_zMS_jZh/view?usp=share_link