

Project Report

Date	17 November 2022
Team ID	PNT2022TMID27080
Project Name	Gas leakage monitoring and alerting system for industries.
Team Members	Nandha Kumar S (Lead) Naveen Kumar K Sanjai Kumar V Vishnu raaj K

1. INTRODUCTION

1.1 Project Overview

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.

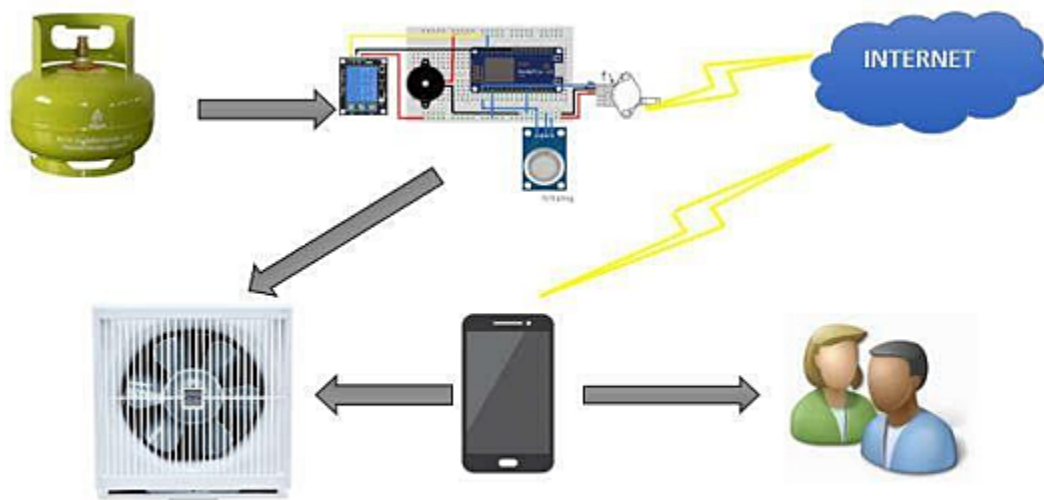
Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for enhancing the existing safety standards. Safety has always been an important criterion while designing home, buildings,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



1.2 purpose

The Internet of things (IoT) is a futuristic technology where interconnection of devices and the internet is proposed. As the safety keeps an important concern, the proposed gas detection system makes use of **IoT to detect the leakage and alert the user for preventing the leakage.**

The purpose of this project is to detect the presence of LPG leakage as a part of a safety system and save the workers in the gas industries and casualties in the houses.

2.LITERATURE SURVEY

2.1 Existing problem

The gas leaked by an LPG cylinder if inhaled can lead to suffocation, as well as cause difficulty in walking or speaking. Your nervous system can get affected, while you can experience heart attack and rise in your blood pressure. Hence, it is important to be careful if you detect a LPY cylinder leak.

It may lead to suffocation when inhaled and may lead to explosion. Due to the explosion of LPG, the number of deaths has been increased in recent years. To avoid this problem there is a need for a system to detect the leakage of LPG.

2.2 References

[1] Mohammad Reza Akhondi, Alex Talevski, Simon Carlsen, Stig Petersen. "Applications of Wireless

Sensor Networks In the Oil, Gas And Resources Industries." International Conference On Advanced

Information Networking And Applications, IEEE 2010

[2] Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar and Rahul Verma "Gsm Based Gas Leakage

Detection System." International Journal Of Technical Research And Applications EISSN: 2320-8163

[3] Tyler Kersnovski, Felipe Gonzalez, Kye Morton. "A UAV System For Autonomous Target Detection

And Gas Sensing." Yellowstone Conference Center, Big Sky, Montana, IEEE 2017

[4] Vana Jelacic, Michele Magno, Davide Brunelli, Giacomo Paci, Luca Benini, Fellow. "

Context Adaptive Multimodal Wireless Sensor Network For Energy-Efficient Gas Monitoring" IEEE

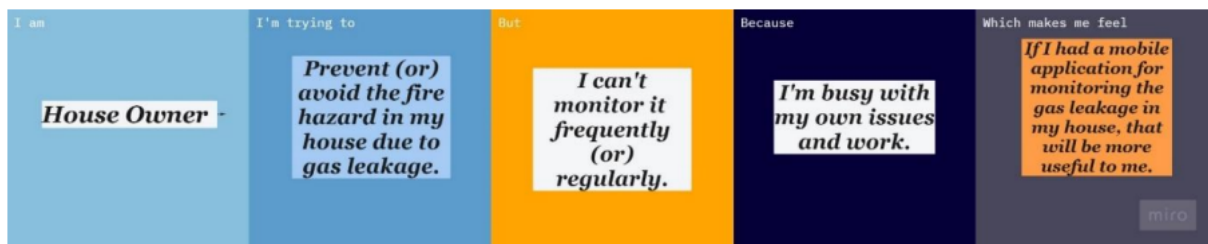
Sensors Journal · January 2013 DOI: 10.1109/JSEN.2012.2215733, IEEE 2013

2.3 Problem Statement Definition

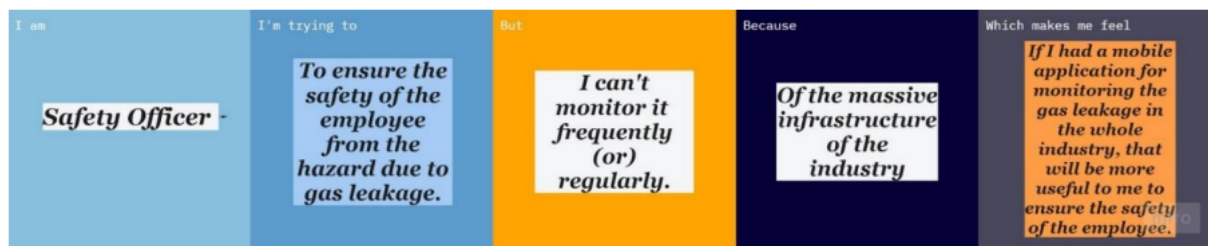
The Problem statement Comprises set of questions which the project seeks to address. It identifies the current state and future state and any gaps between the two.

The Problem arises here in this project is:

Problem 1:



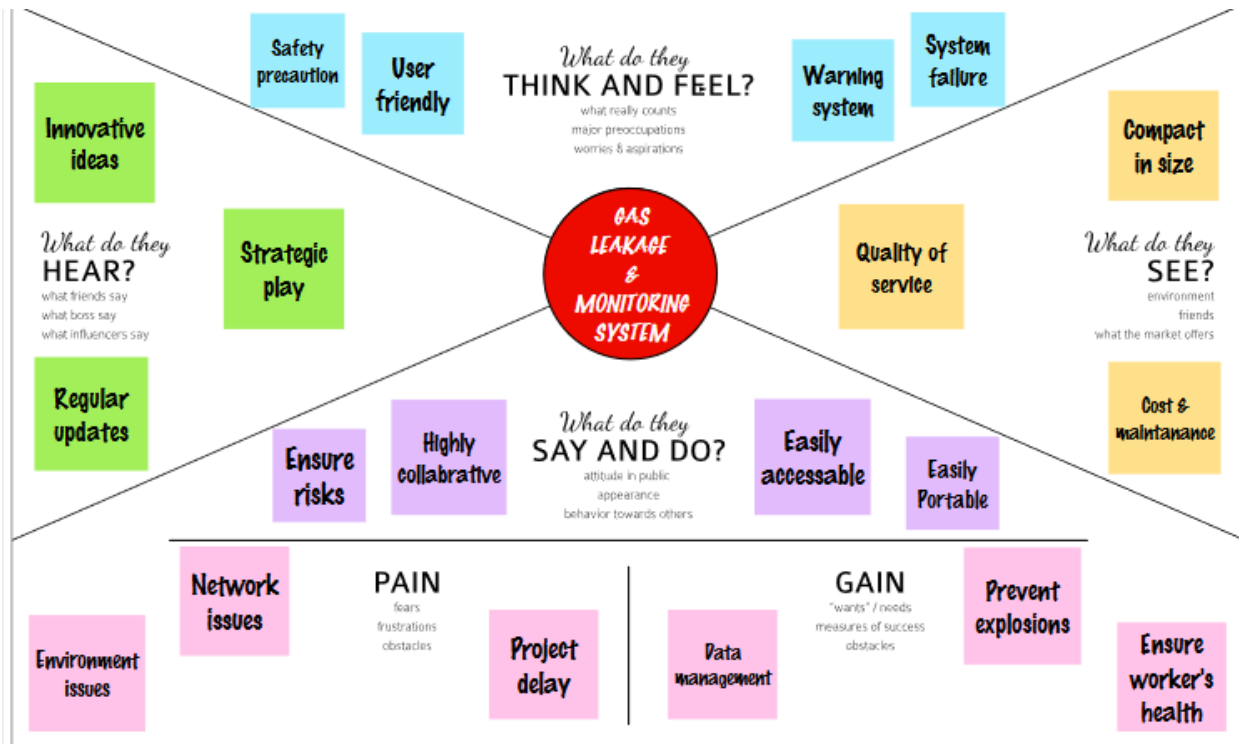
Problem2:



3: IDEATION & PROPOSED SOLUTION

3:1 Empathy Map Canvas

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers



3.2 Ideation & Brainstorming

Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas. A principal difference between ideation and brainstorming is that ideation is commonly more thought of as being an individual pursuit, while brainstorming is almost always a group activity.

Brainstorm & Idea Prioritization:

Step-1: Team Gathering, Collaboration and Select the Problem Statement:



Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕒 10 minutes



Team gathering

Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.



Set the goal

Think about the problem you'll be focusing on solving in the brainstorming session.



Learn how to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

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1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

PROBLEM

How might we upgrade the efficiency of Monitoring the Gas Leakage and the System get Alerted?



Key rules of brainstorming

To run a smooth and productive session



Stay in topic.



Encourage wild ideas.



Defer judgment.



Listen to others.



Go for volume.



If possible, be visual.

Step2: Brainstorm, Idea Listing and Grouping:

Person 1

The GSM module sends an message to user

The electric power supply is shutdown to prevent this accident

This automatic control action takes place

Its alerts us by alarm

When leakage occurs it leads to explosion

Exhaust fans are used to switch leaked gas out

Gas sensors are used to detect the dangerous gases

RF link is responsible for producing the alarm

LCD display are used to show the gases rate in air

Person 2

Gas Leakage Detection System Project Using Arduino

Gas Sensor Tool will be used

The Rf Link is Responsible for Producing the Alarm

Gas Based Gas Leakage Monitor&Alerting System

LCD Technology is used to Display the Image

Collect Input Data as Process and also Release Output Data

Liquid Crystal Display Module

To Monitor for Liquid Petroleum Gas (LPG)Leakage to Avoid Fire Accident

GSM Module will send an SMS Alert to the Mobile

Person 3

So keeping it in the concept of the project we have determined to develop correct time

We began the process walking around the area

The system provides information such as leakage in sensor off the project on the buzzer for the leakage detector

The detection of the hazardous gas the alerting message reached to the person

The area has been sent responsible person for the preparatory safety validation

Encourage wild and exaggerated

Go for large quantities of ideas lead to quality

Build on each other Idea's

Member having more ideas can share their ideas freely

Person 4

We can control any electronic equipments any home and industries

Number of sensors can be in different places they can be used in home, buildings and industries for detecting LPG, Propane, Methane or any other harmful gas.

Gas leakage is a major problem with industrial sector. Residential premises and gas powered vehicles like Car, Buses and CNG Compressed Natural Gas

Gas leakage detection is not only important but stopping leakage is equally essential.

System can notify to society admin about the condition before mishap takes place through a message

This project provides the design approach for both hardware and software.

The main objective of the work is designing microcontroller based toxic gas detecting and alerting system

We have used the IoT technology to make a gas leakage detector for safety which having smart alerting techniques

System hardware can be deployed on each flat.

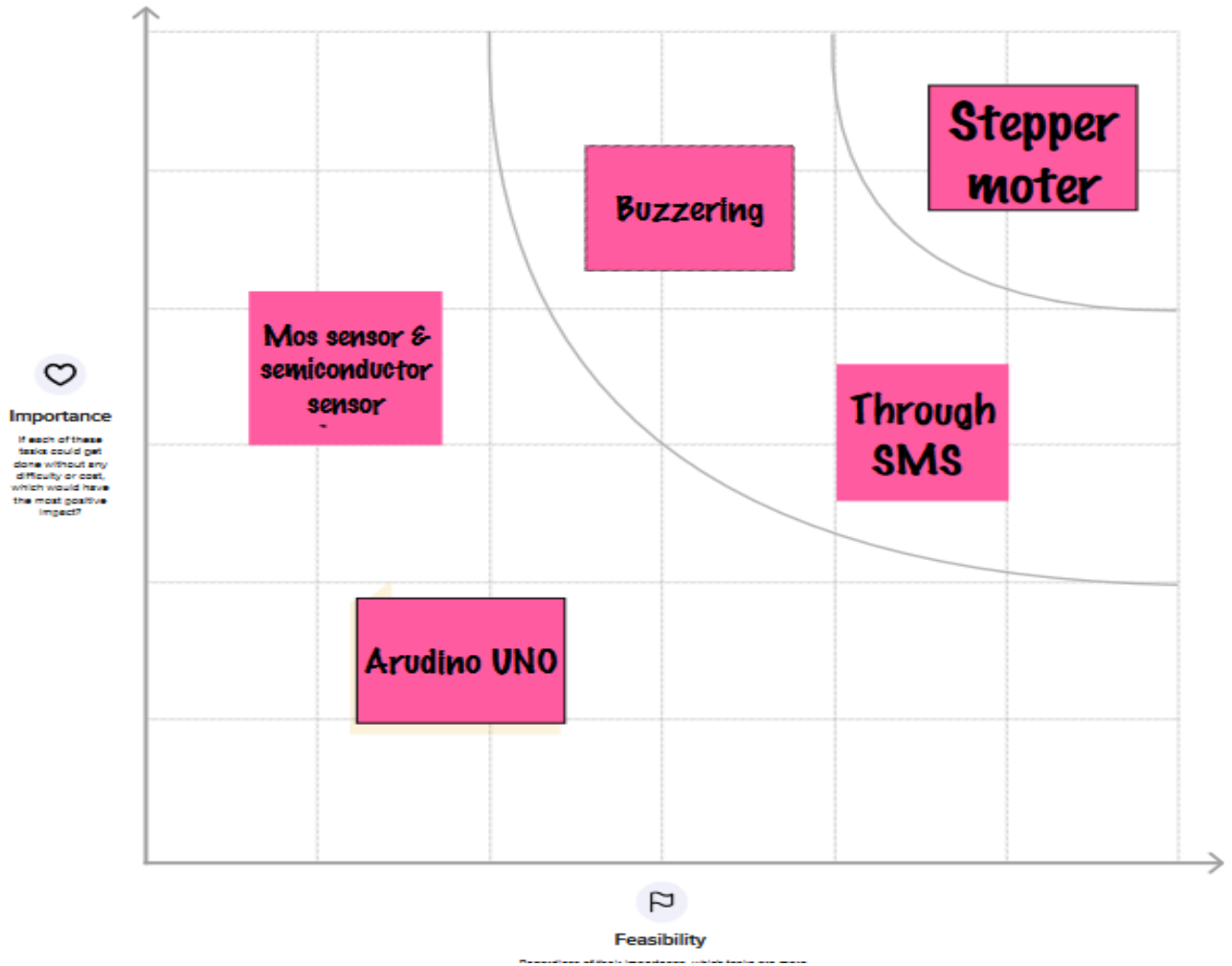
Step3: Idea Prioritization:

4

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.

🕒 20 minutes



3.3 Proposed Solution

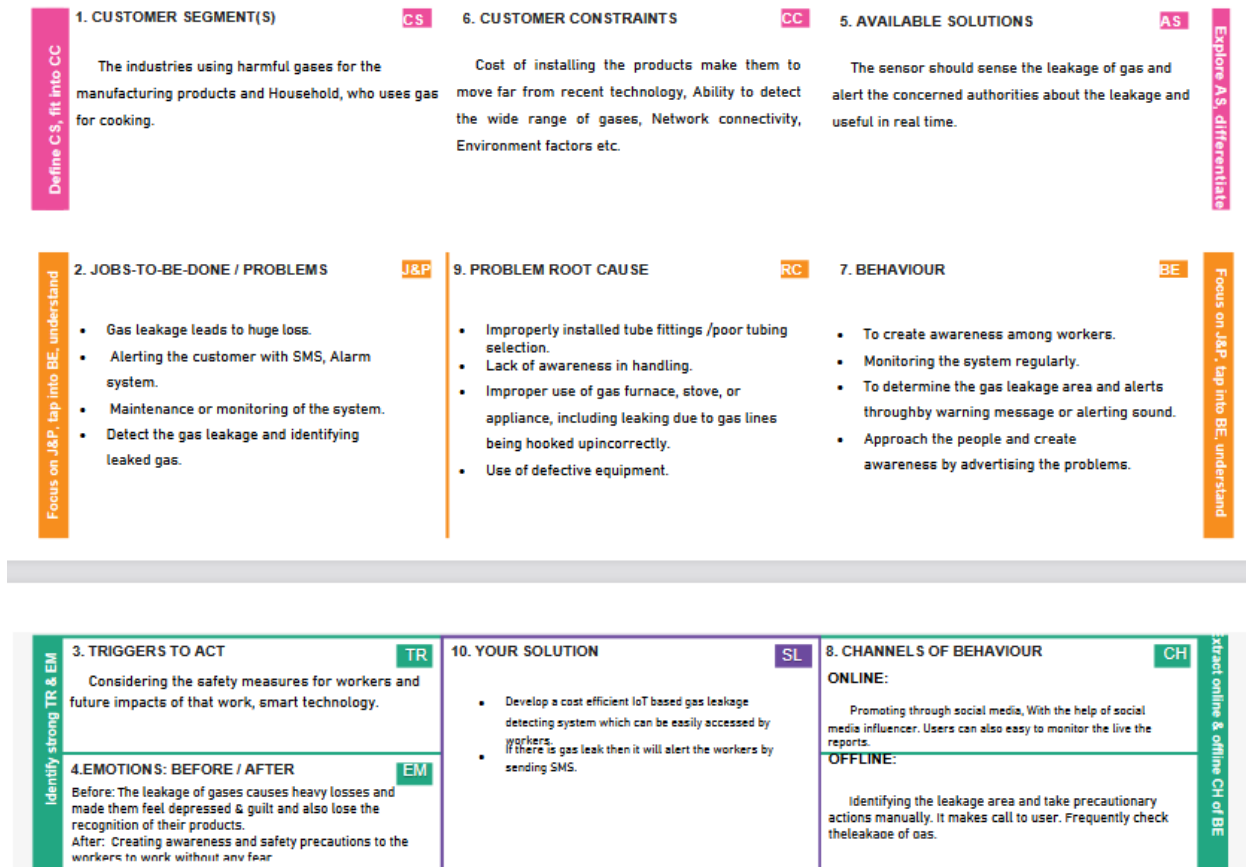
Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Gas leakage leads to various accidents resulting into both financial loss as well as human injuries. In human's daily life, environment gives the most significant impact to their health issues. The poisonous gas in the atmosphere will cause the human and I will be burnt.
2.	Idea / Solution description	IOT gas leakage detector, Such IOT as Arduino based gas leakage detectors can be installed in homes. This device will continuously monitor the level of gas present in air. So, when the level of LPG in air increases then the Smart Alerting System which makes alarm sound and send's alert to the user.

3.	Novelty / Uniqueness	Providing SMS to the authorized person and supervising the gas concentration levels and store data for improved decisions and helps us to find where the fault occurred, Send immediate gas leakage alerts and cost-effective installation.
4.	Social Impact / Customer Satisfaction	This will impact in saving the lives of humans and their property from danger and avoid huge loss. This makes people to feel safe
5.	Business Model (Revenue Model)	This will help in live tracking, If gas leaks there by send the alert message and displaying in LCD display. This leads to low-cost product and also more reliable.
6.	Scalability of the Solution	The continuous tracking of gas, safety and displaying the gas levels in LCD display continuously. This system has better scope at present and future

Problem Solution fit

Problem-Solution canvas is a tool for entrepreneurs, marketers and corporate innovators, which helps them identify solutions with higher chances for solution adoption, reduce time spent on solution testing and get a better overview of current situation.



4: REQUIREMENT ANALYSIS

4.1Functional requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Detection of Leakage of Gases	Detection of gases with the use of sensor. Detect which gas has been leaked and what is thepermissible level and has much has it crossed the level.

FR-2	Altering the user	Notification viaSMS Notification via Email
FR-3	Notification to the admin.	Notifying the exact location where the incident hasoccurred. Update the person with route to the location
FR-4	Creation of web application	Update the website with location of place whereleakage has happened. Update the level of leakage in the particular industry.

Non-Functional requirements

Following are the non-functional requirements of the proposed solution.

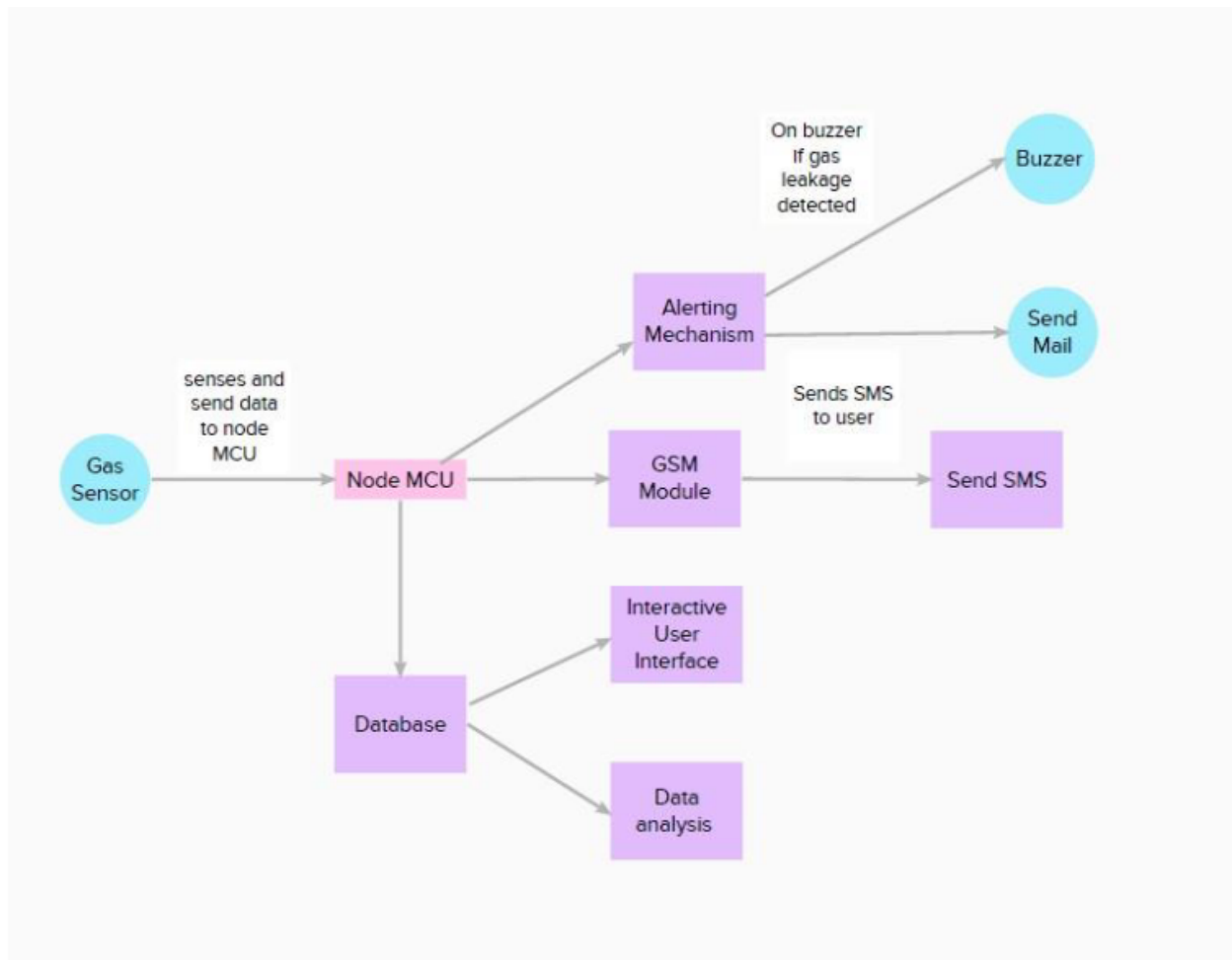
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	There must be basic knowledge to the users inoperating internet. The user should be aware about the harmfulness ofgases.
NFR-2	Security	Users and admins can only access the web application through protected login functions.
NFR-3	Reliability	The admin must notified about the exact locationalong the route. Notification must be sent to the user at correct timeso that we can prevent the damage.
NFR-4	Performance	Within few secondsthe user and admin must bealerted through notification to prevent damage

NFR-5	Availability	If the notification reaches the admin, he must check if some person is available so that he can be sent to place where leakage has occurred. If not, he must at least inform the user about how long it will take to reach them.
NFR-6	Scalability	Once the problem is notified there must be at least 20-30 people to address the problem immediately once notified

5:PROJECT DESIGN

5:1 Data Flow Diagrams

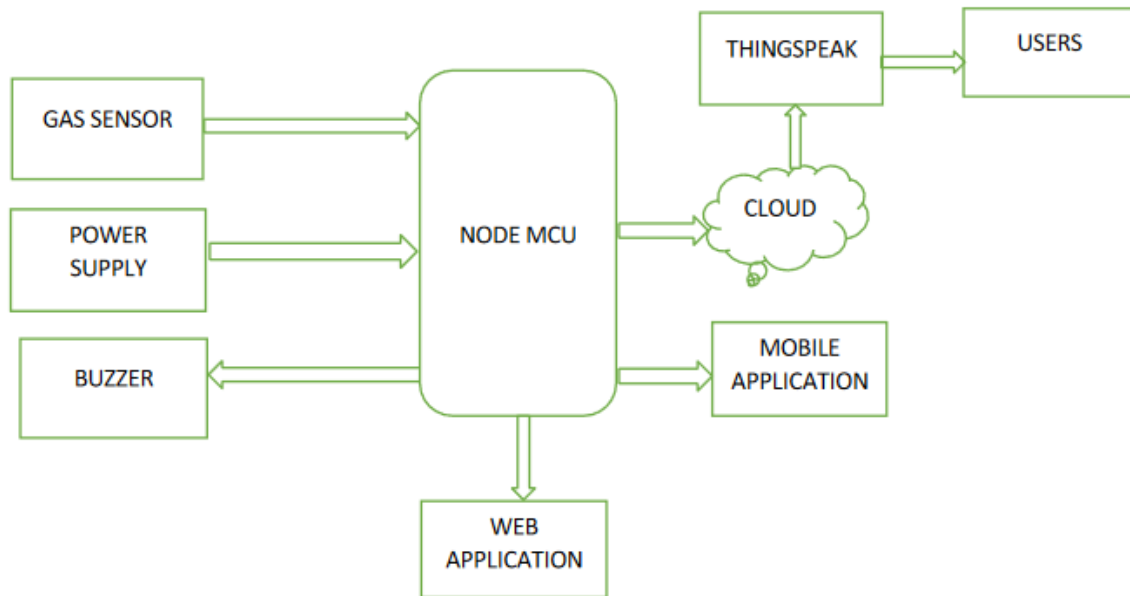
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

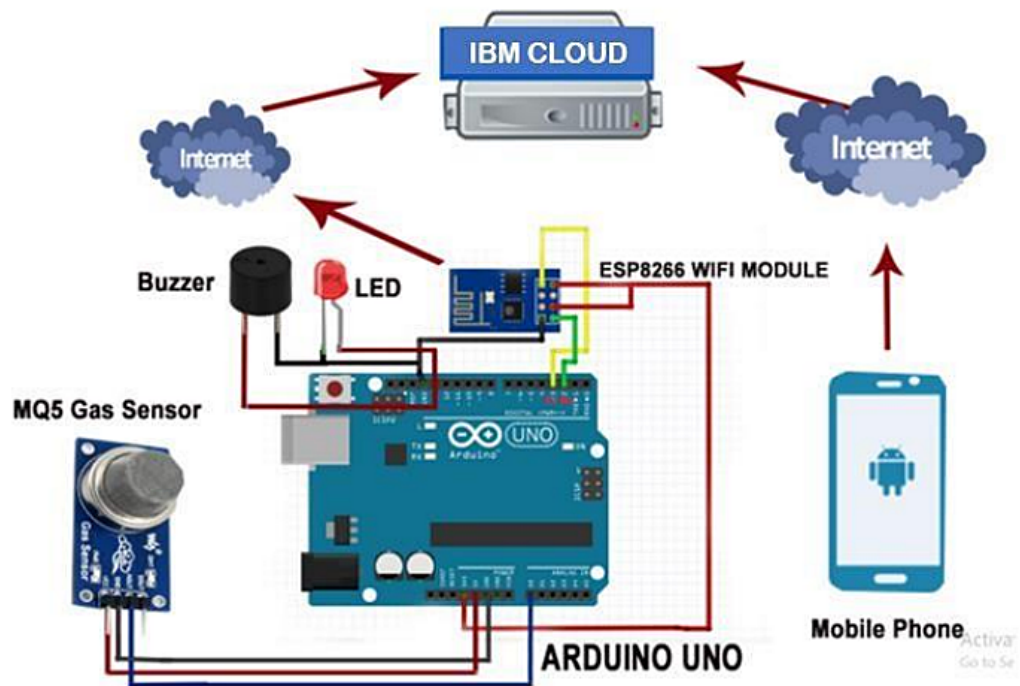


Solution & Technical Architecture:

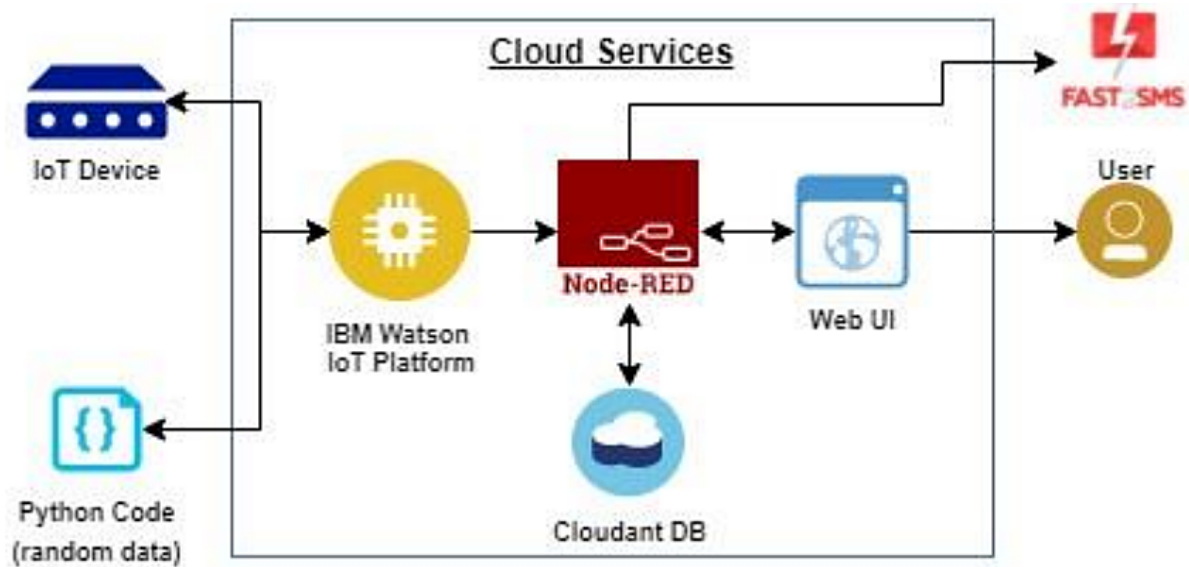
A solution architecture (SA) is architectural description idea of a specific solution. SA's combine guidance from different enterprise architecture viewpoints (business, information and technical), as well as from the enterprise solution architecture (ESA).

Solution Architecture Diagram:





Technical Architecture



User Stories

A user story is an informal, general explanation of a software feature written from the perspective of the end user or customer. The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer.

6: PROJECT PLANNING & SCHEDULING

6:1 Sprint Planning & Estimation

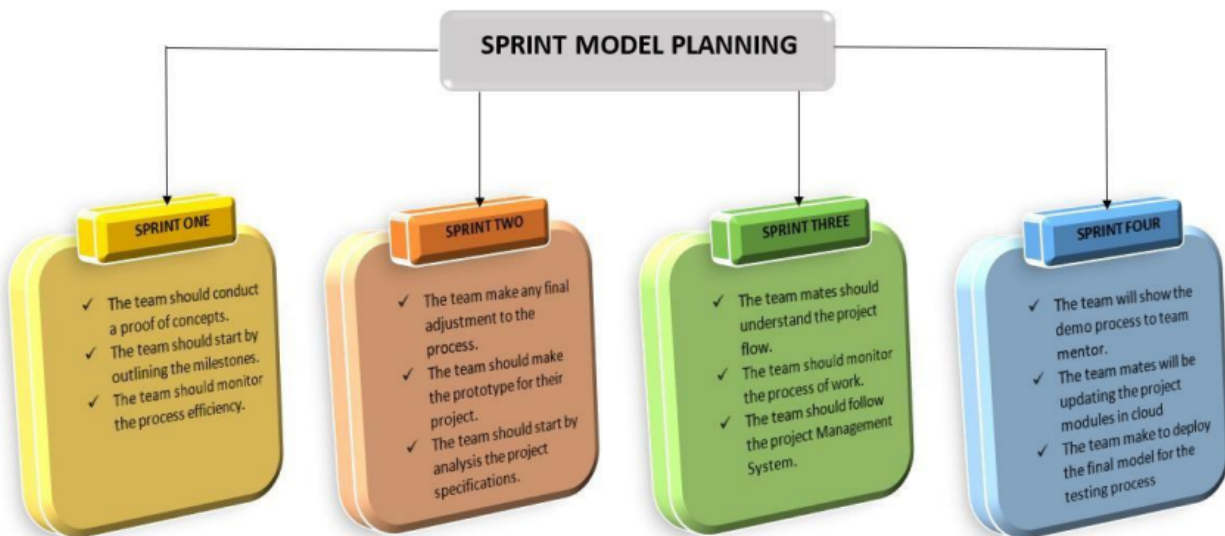
The objective of the Estimation would be to consider the User Stories for the Sprint by Priority and by the Ability of the team to deliver during the Time Box of the Sprint.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Preventing from explosion	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Nandha kumar S
Sprint-1	Analysing the gas leakage	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Naveen kumar K
Sprint-2	To detect the gas leakage	USN-3	As a user, I can register for the application through Facebook	2	Low	Sanjai kumar V

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Testing and training of the model device	USN-4	As a user, I can register for the application through Gmail	2	Medium	Vishnu raaj K
Sprint-4	Notification	USN-5	As a user, I can log into the application by entering email & password	1	High	Nandha kumar S

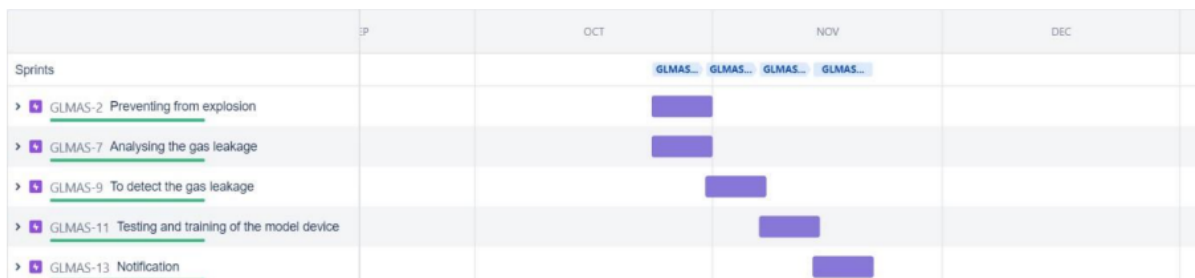
6:2 Sprint Delivery Schedule

Delivery Plan



6:3 Reports from JIRA

Jira Software is part of a family of products designed to help teams of all types manage work. Originally, Jira was designed as a bug and issue tracker. But today, Jira has evolved into a powerful work management tool for all kinds of use cases, from requirements and test case management to agile software development.



7: CODING & SOLUTIONING

7:1Python Code

#IBM Watson IOT Platform

#pip install wiotp-sdk import

wiotp.sdk.device import time

import random

#Provide your IBM Watson Device Credentials myConfig =

{

"identity": {

"orgId": "q26y5w",

```

        "typeId": "TestDeviceType",
        "deviceId": "2022"
    },
    "auth": {
        "token": "uu(rZQw9292EfSFGDX"
    }
}

```

```

def myCommandCallback(cmd):    print("Message received from IBM IoT Platform:
%s" % cmd.data['command'])    m=cmd.data['command']

```

```

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None) client.connect()

```

[#Conditions](#) while

True:

```

    temp=random.randint(0,125)
hum=random.randint(0,100)    pre=random.randint(0,100)
haz=random.randint(0,100)

```

```

myData={'Temperature':temp,
        'Humidity':hum,
        'Pressure':pre,
        'HazardousGas':haz
    }

client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)

print("Published data Successfully: %s", myData)    if(haz>90):
    print("Exhaust Fan is ON")    else:

```

```
print("Exhaust Fan is OFF")
```

```
client.commandCallback = myCommandCallback
```

```
time.sleep(2) client.disconnect()
```

8:TESTING

8:1Test Cases:

FileHomeInsertDrawPage LayoutFormulasDataReviewViewHelpTell me what you want to do

ClipboardFontAlignmentNumberStylesCellsEditing

Calibri11A⁺A⁻

</

8:2 User Acceptance Testing

The purpose of this document is to briefly explain the test coverage and open issues of the [Gas Leakage Monitoring and Alerting System] project at the time of the release to User Acceptance Testing (UAT).

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	3	2	0	10
Duplicate	0	0	0	1	1
External	2	0	0	1	3
Fixed	6	2	0	0	8
Not Reproduced	0	1	1	0	2
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	13	6	3	2	24

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

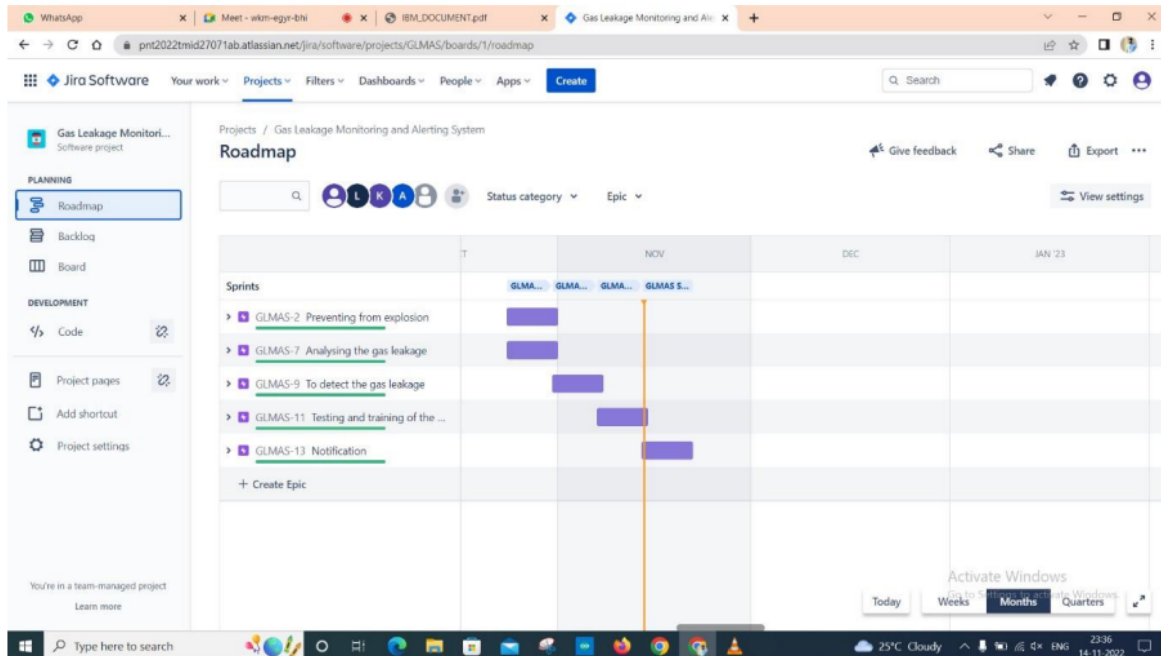
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	1	0	0	1
Client Application	2	0	0	2
Security	1	0	0	1
Outsource Shipping	1	0	0	1
Exception Reporting	1	0	0	1
Final Report Output	2	0	0	2
Version Control	2	0	0	2

9:RESULTS

9:1 Performance Metrics

Performance metrics are defined as figures and data representative of an organization's actions, abilities, and overall quality.

The screenshot displays the Jira Software interface for a project named 'Gas Leakage Monitoring and Alerting System'. The main view is the 'All sprints' board, which is organized into four columns: 'TO DO', 'IN PROGRESS', 'IN REVIEW', and 'DONE 5 ISSUES'. The 'DONE 5 ISSUES' column contains five issues, including GLMAS-10, GLMAS-12, and GLMAS-14. The interface includes a sidebar with navigation options like 'Roadmap', 'Backlog', 'Board', 'Code', 'Project pages', 'Add shortcut', and 'Project settings'. A top navigation bar shows 'Your work', 'Projects', 'Filters', 'Dashboards', 'People', and 'Apps'. A bottom status bar displays system information like temperature, cloud status, and time.



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.
5. Real-time updates about leakage.
6. Cost-effective installation.
7. Data analytics for improved decisions.
8. Measure oxygen level accuracy.

Disadvantages

1. Only one gas can be measured with each instrument.
2. Poor stability leads to greater environmental impact.
3. When heavy dust, steam or fog blocks the input of the sensor.

11:CONCLUSION

In this project 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

We focus on designing a prototype for IoT based LPG cylinder monitoring system. The proposed system is cost-effective and it is real-time. It monitors gas leakage on continuous basis and displayed the Temperature, Pressure, Humidity, and Gas level on mobile. The customer will get the information about the leakage of LPG and if someone is present near his/her house at that particular time, they will be notified accordingly. IoT based system will send an alert message to users on their phones so that they will be more aware about the gas level & leakage of LPG.

12: FUTURE SCOPE

Major cities of India are pushing Smart Home application, gas monitoring system is a part of Smart Home application. Enhancing Industrial Safety using IoT. IoT turns drone into gas detection sensor. 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. This system can be used in industries involving applications such as Furnace, Boilers, Gas welding, Gas cutting, Steel Plants, Metallurgical industries, Food processing Industries, Glass Industries, Plastic industries, Pharmaceuticals, Aerosol manufacturing. As hospitals require to provide maximum possible safety to patients, this system can be used to keep track of all the cylinders used in it. Some of the cylinders used are Oxygen cylinder, Carbon dioxide cylinder, Nitrous oxide cylinder.

As many students are naïve the risk of causing accidents is high. Hence, our system can also be used in schools, colleges. Many colleges have well established labs including chemistry lab and pharmaceutical labs where gas burners are used. Plenty of medical equipment requires gas cylinders.

13: APPENDIX

The Project deliverables are uploaded in Git repository and in the IBM dashboard.

- ✓ **GitHub Link:** <https://github.com/IBM-EPBL/IBM-Project-1567-1658398417>
- ✓ **Demo Link:** <https://drive.google.com/file/d/1RU9UKenIQzGA83Zg9Gzlf-Cd8lsQEJyV/view?usp=drivesdk>