Gas Leakage Monitoring and Alerting System

Final Report

Team ID: PNT2022TMID17812

1. INTRODUCTION:

1.1 Project Overview:

Safety is of the biggest importance in today's environment, and certain precautions must be taken both at work and at home to assure it. Whether the topic is electricity or oil and gas, working or living in a hazardous environment requires certain safety measures. Liquified Petroleum Gas (LPG), a kind of natural gas, is highly compressed and stored in a metal cylinder. Leaving LPG exposed next to any fire source can cause catastrophic harm because it is highly flammable. LPG is more widely available than any other natural gas and is largely used for cooking. Sadly, due to its widespread use, gas leaks and even explosions are frequent occurrences. Therefore, a system for identifying and keeping track of gas leaks is necessary. The system will monitor the concentration of gas in the environment. When concentration is high, the user will be notified. Tests have demonstrated that the device can monitor gas leaks and wastage in an efficient manner. The resultant performance demonstrated that it was effective in lowering the amount of lost domestic gas.

1.2 Purpose:

These days, a home safety detection system is crucial to people's security. Since everyone in the household works every day, it is impossible to check on the home's appliances, particularly the LPG gas cylinder, wired circuits, etc. Liquefied petroleum gas (LPG) and natural gas demand has significantly increased during the past three years. LPG and natural gas are recommended to meet this high level of energy demand and to substitute oil or coal due to those fuels' negative environmental effects.

Large-scale industrial uses for these gases include heating, melting, motor fuel, etc... The system has a MQ6 gas detector to keep an eye on this gas leak. This sensor measures the quantity

of gas leakage that is present in the atmosphere around it. The effects of an explosion or gas leak can be prevented in this way.

2. LITERATURE SURVEY

2.1 Existing Problem:

The goal of the Internet of Things is to simplify our lives by automating all of the little tasks around us. The advantages of IoT can also be extended to improving the current safety standards in addition to helping us automate difficult jobs. IoT has not been immune to the fundamental worry of any project. Gas Leaks can be fatal and dangerous, whether they occur in open or closed spaces. Despite their high level of precision, conventional gas leak detection systems overlook a few important aspects of warning others of a leak. In order to create a Gas Leakage Detector for society that includes data analytics capabilities, Smart Alerting strategies that involve texting are to be incorporated. Our main goal is to provide a gas leak detection system for a society in which every apartment has gas leak detecting equipment. The dangerous gases in the environment will be detected, and members of society will be alerted via alarm and notification.

2.2 Reference:

1. **Suma V, Ramya R Shekar, Akshay Kumar," Gas** Leakage Detection Based on IOT**"** published on 2019.This paper detects leakage of gas in household and sends a warning message to the appropriate user. It can also automatically book a new cylinder when the gas is about to empty. Here load cells are used to monitor the weight of the gas cylinder.
2. **Luay Fraiwan, Khaldon Lweesy, Aya Bani-Salma, Nour Mani**," A Wireless Home Safety Gas Leakage Detection System" published on 2011. The device is intended for use in household safety where appliances and heaters that use natural gas and liquid petroleum gas (LPG) may be a source of risk. The system also can be used for other applications in the industry or plants that depend on LPG and natural gas in their operations.

3. **M Athish Subramanian, Naveen Selvam, Rajkumar S,RMahalakshmi, J Ramprabhakar**," Gas Leakage Detection System using IoT with integrated notifications using Pushbullet" published on 2020. . Gas leaked is converted from Parts Per Million (PPM) to volts through the arduino IDE and results in notifying the user when the threshold limit is crossed. The user is alerted via an application for quick notification through the internet and also through a buzzer /LED for physical notification.
4. **Mr. Arijit Banik, Mr. BodhayanAich, Mr. Suman Ghosh**," Microcontroller Based Low-Cost Gas Leakage Detector with SMS Alert" published on 2018. The system detects the leakage of the LPG using a gas sensor (MQ-5 Sensor) and uses the GSM to alert the person about the gas leakage via SMS. When the LPG concentration in the air exceeds a predetermined level, the gas sensor senses the gas leakage and the output of the sensor goes LOW. This is detected by the microcontroller and the LED and buzzer are turned ON simultaneously. The system then alerts the customer by sending an SMS to the specified mobile-phone.
5. **Ravi Kishore Kodali,Greeshma, R.N.V,Kusuma Priya Nimmanapalli,Yatish KrishnaYogi**, "IOT Based Industrial Plant Safety Gas Leakage Detection System"published on 2018. A leakage detector which sends the warning to the concerned people through SMS. This detector senses the presence of harmful gases particularly, LPG, Methane and Benzene. LPG and Methane gases catch fire easily resulting in blasts. Benzene is carcinogen effecting the health of workers, if inhaled in higher concentrations.

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:

Empathy map is used to map what a user SAYS after using our system, what DOES they do while using our system, what they THINK about our system and finally, how does they FEEL before, during and after using our system.

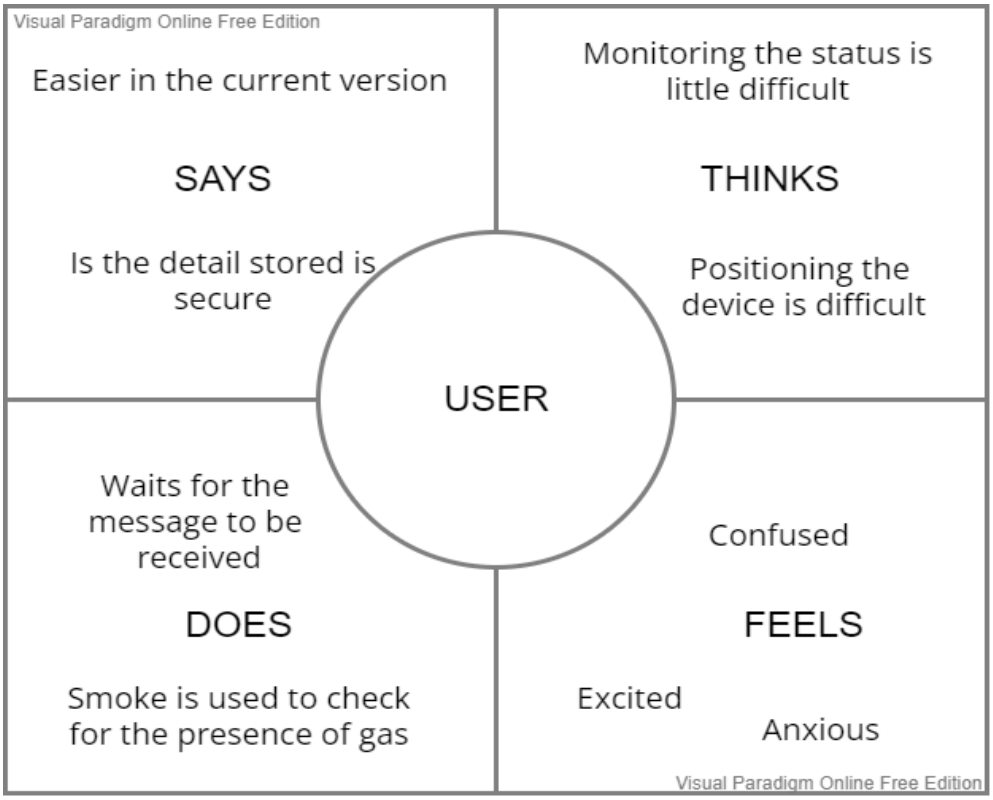


Figure 3.1: Empathy Map of Gas Leakage Monitoring and Alerting System

3.2 Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving.

During brainstorming we valued the volume of ideas rather than their values, welcomed out of box ideas and encouraged all the participants to participate. Due to the above-mentioned process, we have generated lot of ideas and prioritized them based on importance.

Manish T		Mohammad Umar M		Athinarayanan B		Anto Nidhish M		Arun Priyan	
Device must be capable of working in all environments.	Data should be made available only to the authenticated users.	Messaging service should be made available.	Network must be available at all times.	Small amount of gas should be enough to detect.	Wide range of gases should be detected.	Ease of Mobility.	The proposed system must be affordable.	Constant power source should be available.	Backup power should be readily available in case of emergency.
Log must be maintained for monitoring the users who have accessed the data.	Modifications on device configurations can only be done by an authenticated user.	Latency in delivering the message should be minimal.	Product should be made of high-quality materials.	Cost of sensor should be economical.	Ease of installation and maintainance.	Secure communication via Internet.	Rate of detection must be high.	Backup data should be made available.	Accuracy of detection must be high.

Figure 3.2: Ideas generated during Ideation

After generating ideas, we have clustered them together based on their categories such as Environment, Cost, Authentication, Quality, Data, Performance and Network.

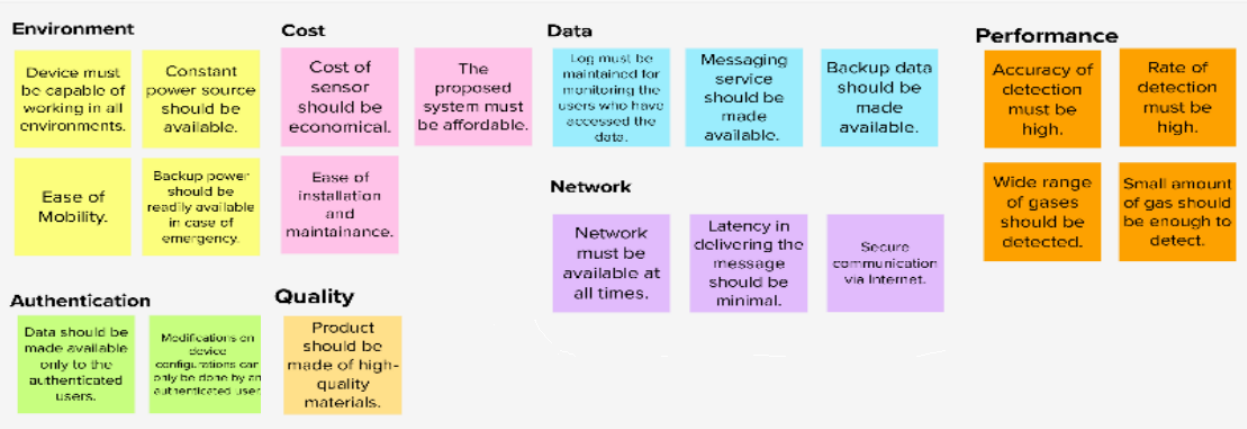


Figure 3.3: Clusters of generated Idea

As a final step we have prioritized based on the importance and feasibility of an idea.

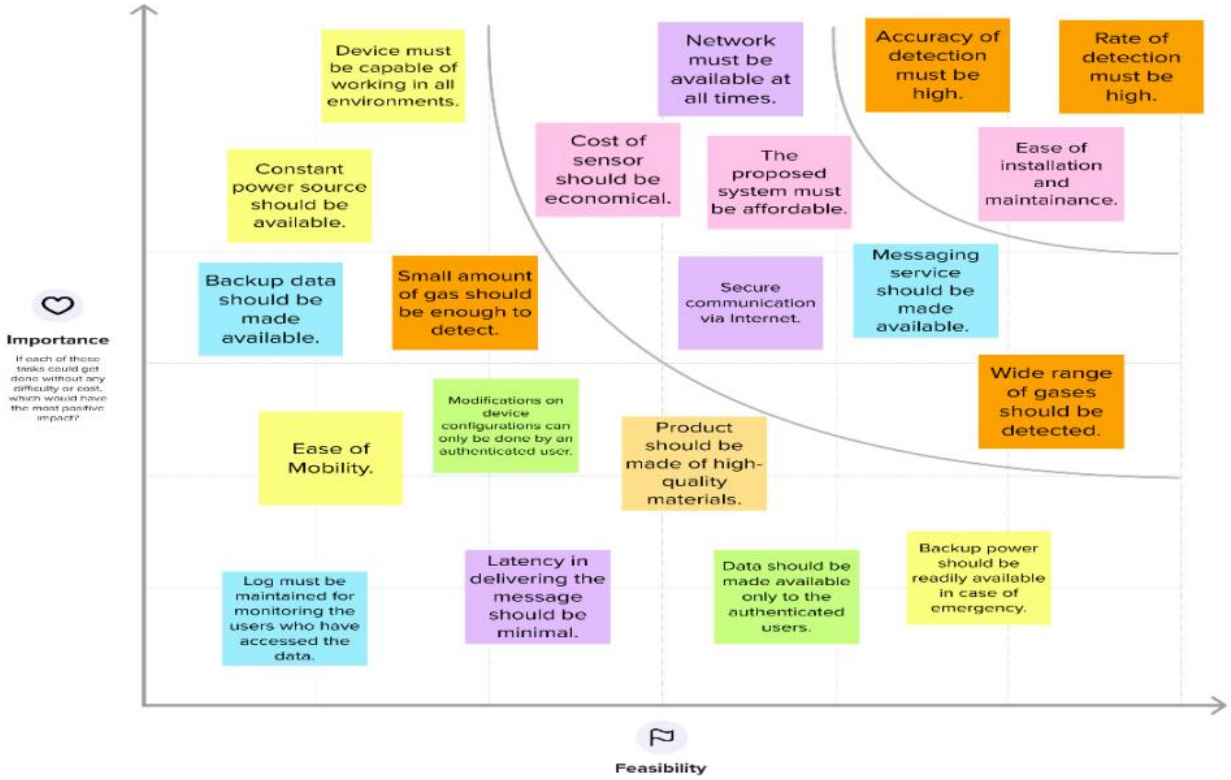


Figure 3.4: Idea prioritization graph

3.3 Proposed Solution:

Proposed solution consists of the systems problem statement, Solution description, Novelty in the system, Customer satisfaction, Business model and Scalability of the solution.

Table 3.1: Proposed Solution of Gas Leakage Monitoring and Alerting System

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	o Gas Leakage Monitoring and Alerting System.
2.	Idea / Solution description	o Using a variety of sensor, the environmental parameters such as concentration of the gas can be monitored in real time o If the concentration of gas reaches hazardous level an alert message can be sent to the user.
3.	Novelty / Uniqueness	o Device being developed can monitor a wide range of gases that are highly used in industries. o Apart from notifying the user, Safety personnel are also notified in case of emergencies. o User friendly in nature.
4.	Social Impact / Customer Satisfaction	o As the device is small, it is easy to install them in various locations based on necessity.
5.	Business Model (Revenue Model)	o Device can be obtained by paying for the subscription. o It can be yearly or monthly. o Based on the term of subscription 5 – 8% discount shall be made available.
6.	Scalability of the Solution	o In future more variety of gas can also be monitored, by adding the necessary sensor and monitoring the data obtained from it.

3.4 Problem Solution fit:

It is used to identify various concerns and constraints felt by a user. Based on this, developers will find the root cause and generate the feasible solutions to overcome the said problems. From a single problem, Business people analyze the behavior of customers, Trigger for customers and the Emotions felt by a customer.

From the analysis, Developers try to prevent future occurrence of a problem and they also learn the appropriate actions that can be taken to prevent the customer from getting upset in case of an issue.

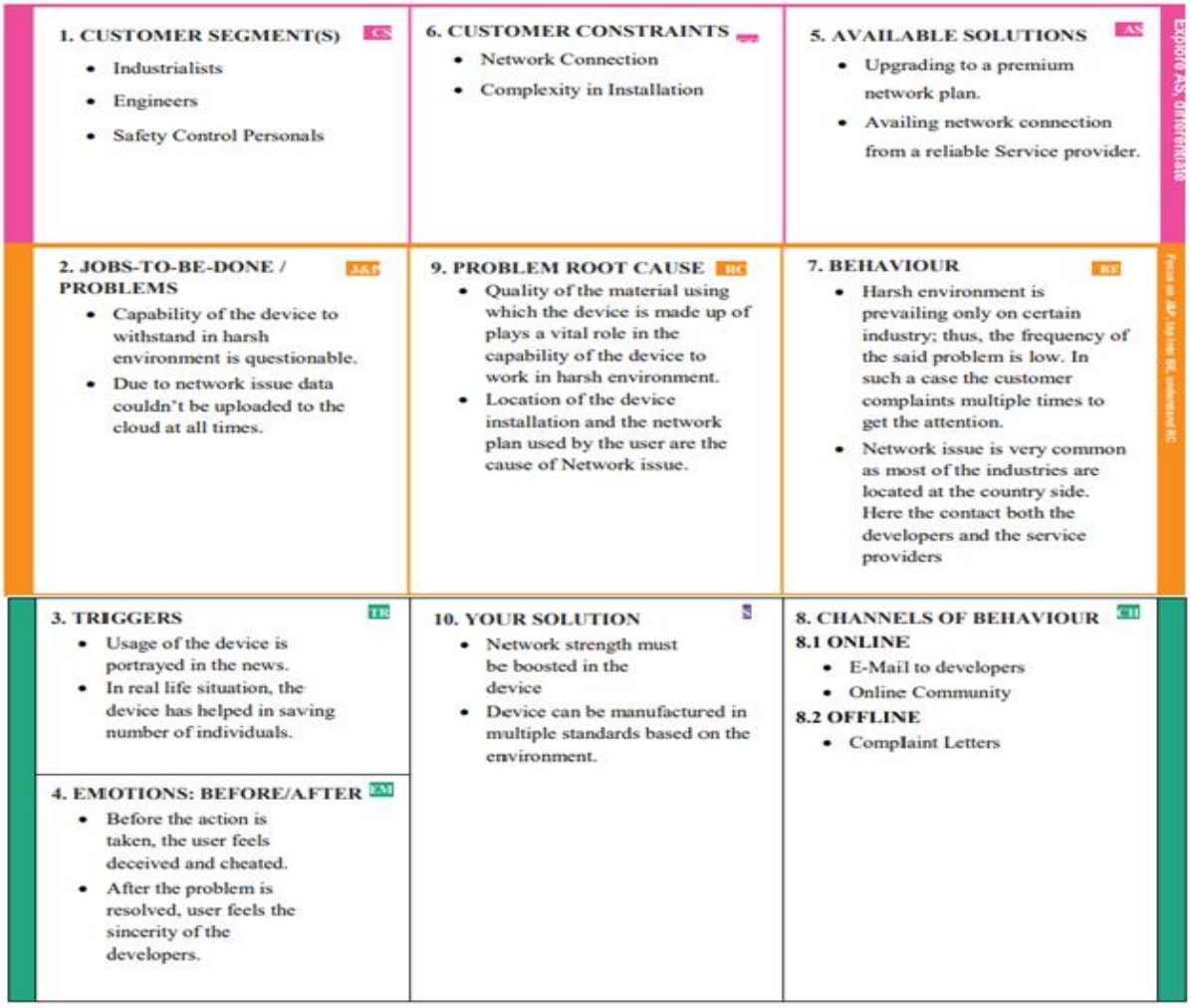


Figure 3.5: Problem Solution Fit of Gas Leakage Monitoring and Alerting System

4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

Functional requirements of the proposed solution are made up of Registration, Access and Alerting modules.

Table 4.1: Functional Requirement of Gas Leakage Monitoring and Alerting System

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Online Payment for the service
FR-2	User Access	Access the details using web browser Access the details using mobile application
FR-3	User alert	Gets alert as an SMS message Gets alert alarm in the working area.

4.2 Non-Functional requirement:

Non-Functional requirements of Gas Leakage Monitoring and Alerting System are Usability, Security, Reliability, Performance, Availability and Scalability.

Table 4.2: Non- Functional Requirement of Gas Leakage Monitoring and Alerting System

NFR No.	Non-Functional Requirement	Description
NFR – 1	Usability	The device must be usable by the customer anywhere
NFR – 2	Security	Data from the sensors are stored securely and away from other data

NFR – 3	Reliability	Data can be retrieved any time and no data is discarded without customer knowledge
NFR – 4	Performance	No performance delay in cases of large number of data or more parameters
NFR – 5	Availability	The device doesn't fail even under harsh conditions. Device continues to send data, even after an ALERT
NFR – 6	Scalability	Device must be capable of measuring conditions even in a larger industry

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. Using a neat and clear DFD we have depicted the right amount of system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

DFD Level 0 has 4 main modules namely Gas Detection, Customer Management, Payment Management and Booking Management.

Figure 5.1: DFD Level 0 of Gas Leakage Monitoring and Alerting System

DFD Level 1 shows the need for Check Payment Details, Generating Report and Customer report functional modules.

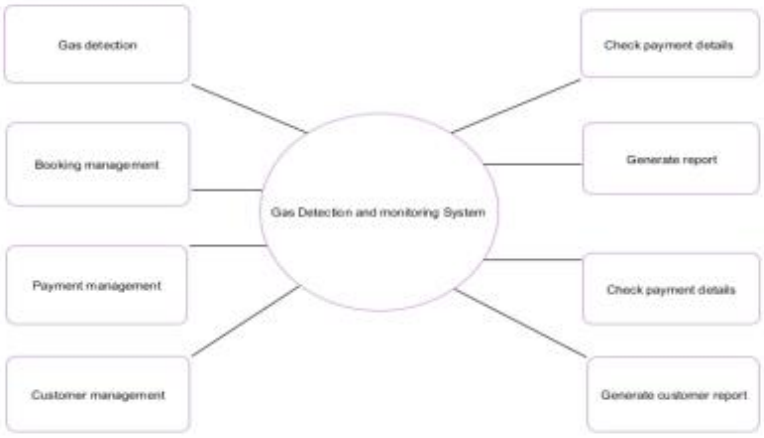


Figure 5.2: DFD Level 1 of Gas Leakage Monitoring and Alerting System

DFD Level 2 displays all the stubs that are to be developed for the successful completion of the Proposed System. Stubs include View Grievances, Get Alert, Login, Email Registration, Posting Query, Chatbot, Providing Feedback, etc.

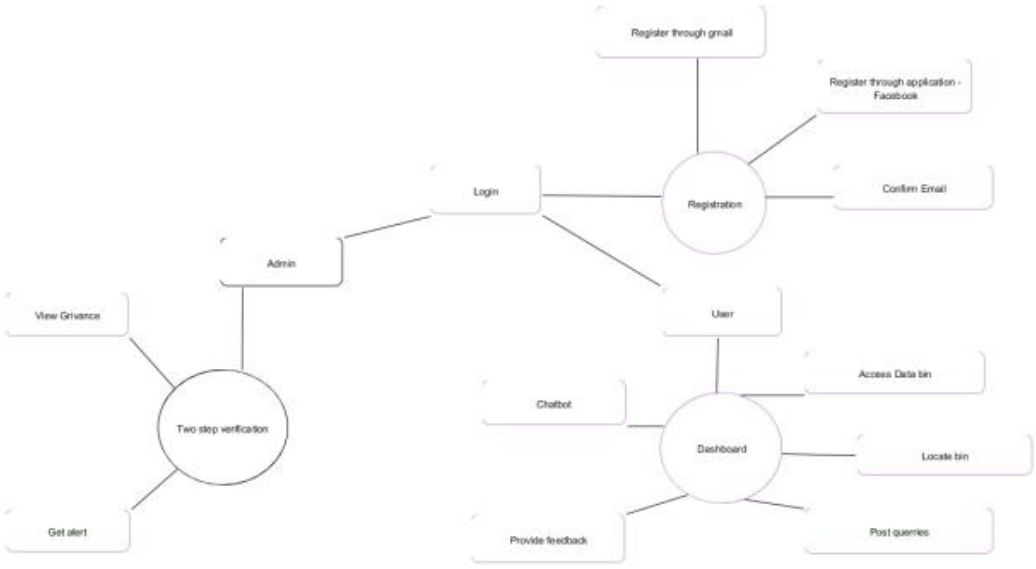


Figure 5.3: DFD Level 2 of Gas Leakage Monitoring and Alerting System

5.2 Solution & Technical Architecture:

Solution architecture is used to visually understand the working model of our system. From the figure 5.4 we can understand that data generated by sensor is sent to IBM Cloud via a gateway. Analysis of data gets started once the data reaches the IBM Cloud. This data is displayed in various portable device such as Mobiles and Laptops after proper authentication. If the data found is to be is above a certain threshold (Alert Level) Alert message will be generated and sent to the user.

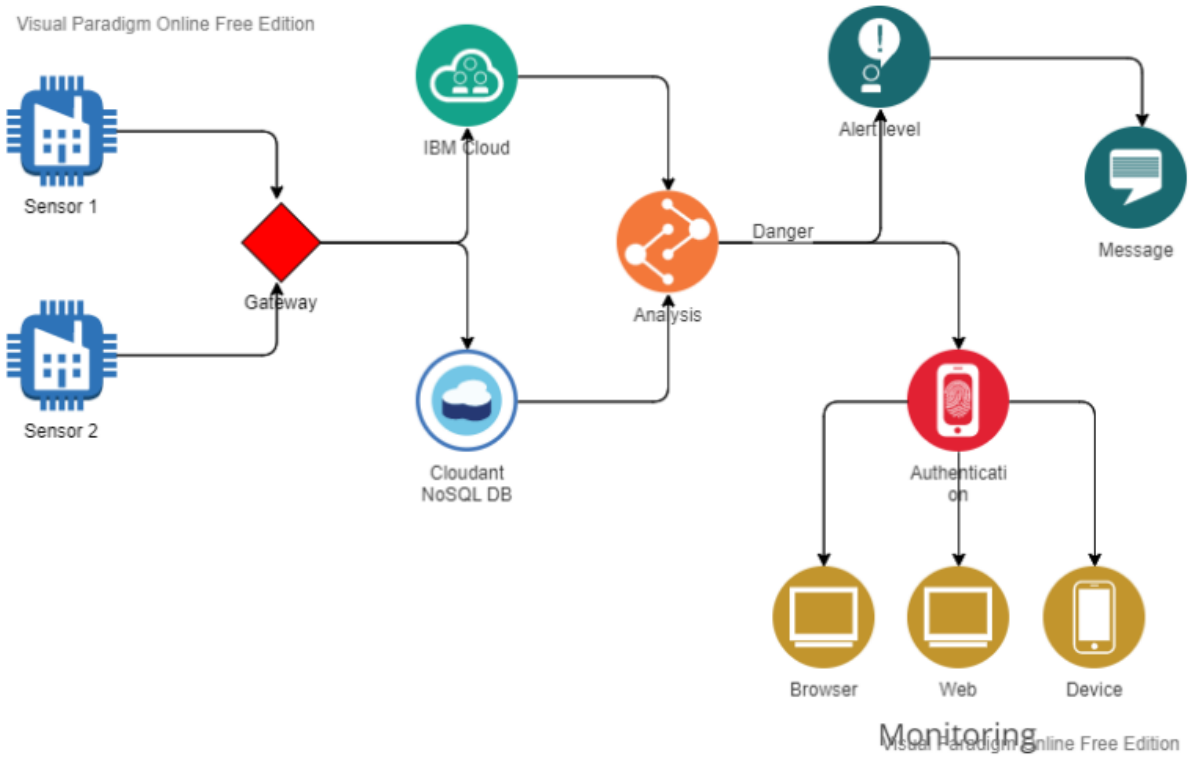


Figure 5.4: Solution & Technical Architecture of Gas Leakage Monitoring and Alerting System

5.3 User Stories:

The user stories describe about the tasks that can be performed by a user and the output that they might accept for such a task. The user might be a customer or admin. Priority of each task is decided using User Stories. Based on the priority Sprint plan has been developed.

Table 5.1: User Stories of Gas Leakage Monitoring and Alerting System

User Type	Functional Requirements	User Story No.	User Story/Task	Acceptance Criteria	Priority	Release
Customer (Mobile user)	Registration	USN - 1	As a user, I can register for the application by entering my email, password, and confirming my password	As a user, I can register for the application by entering my email, password, and confirming my password.	High	Sprint - 1
		USN - 2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint - 1
		USN - 3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint -2
		USN - 4	As a user, I can register for the application through Gmail	I can create new account & access it	Medium	Sprint – 1
	Login	USN - 5	As a user, I can log into the application by entering email & password	I can access my account/dashboard	High	Sprint – 1
	Dashboard	USN - 6	As a user, I can identify the location of the bin	I can view the location of the bin	High	Sprint – 1
		USN - 7	I can view the location of the bin	I can search a bin and view all details present in it	High	Sprint - 1
		USN - 8	As a user, I can post queries	I can post the difficulties faced by the user	Medium	Sprint -2
		USN - 9	As a user, I can provide feedback	I can provide the pros & cons present in the app	Medium	Sprint -2
		USN - 10	As a user, I can interact with chatbot	I can get assistance using the chatbot	Low	Sprint -2

Admin	Dashboard	USN - 11	As a user, I can view the grievances	Grievances posted by the users can be viewed and resolved	High	Sprint - 1
		USN - 12	As a user, I get alert	I get an alert, If the alarm senses noxious gas	High	Sprint - 1

6. PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning & Estimation:

The below table displays the sprint plan for developing Gas Leakage Monitoring and Alerting System. Each story is assigned to a team of 2 members. Priority and Story points are decided before the start of sprint.

Table 6.1: Sprint Planning for Gas Leakage Monitoring and Alerting System

Sprint	Functional Requirements	User Story No.	User Story/Task	Story Points	Priority	Team Members
1	Objective	USN - 1	The sensor must detect the gas	7	High	Manish, Athinarayanan
1	Feature	USN - 2	The value must be displayed	2	Low	Mohamad Umar, Anto Nidhish
1	Features	USN - 3	Based on threshold, Danger light must be turned ON	5	High	Arun, Priyan, Anto Nidhish
1	Features	USN - 4	Based on threshold, Buzzer and other alerting system must be turned ON	5	High	Mohamad Umar, Athinarayanan
2	Focus	USN - 5	Location of gas leakage must be found and attached in the alert message being generated	8	High	Anto Nidhish, Manish

2	Focus	USN - 6	Alert SMS must be sent to the registered phone number	2	Low	Arun, Priyan, Mohamad Umar
2	Features	USN – 7	Pipe segment where the leakage is found must close automatically	5	Medium	Mohamad Umar, Manish
2	Features	USN – 8	Whether the pipe is closed successfully or not must be intimated to the user via message	5	Medium	Mohamad Umar, Anto Nidhish
3	Data Transfer	USN - 9	API key must be retrieved to transfer the data to IBM Cloud	2	Low	Mohamad Umar, Anto Nidhish
3	Data Transfer	USN - 10	Data of sensor along with its latitude and longitude must be sent to IBM Cloud	5	Medium	Arun Priyan, Anto Nidhish
3	Data Transfer	USN - 11	BM Cloud should send data to Node Red	2	Medium	Athinarayanan, Manish
3	Data Transfer	USN - 12	Data obtained in Node Red must be forwarded to MIT App	3	Medium	Athinarayanan, Anto Nidhish
3	Data Transfer	USN - 13	Data must be displayed in the application developed using MIT	8	High	Athinarayanan, Mohamad Umar
4	Registration	USN - 14	User must register an account using Email and Mobile Number in the website	2	High	Athinarayanan, Manish
4	Registration	USN - 15	Confirmation mail must be received to the registered Mail-ID	2	Medium	Manish, Arun Priyan
4	Login	USN - 16	User can login into web application through email	3	High	Anto Nidhish,

			and password			Arun Priyan
4	Dashboard	USN - 17	User can access the dashboard and make use of available resources	2	Medium	Mohamad Umar, Manish
4	Focus	USN - 18	User must receive an SMS once the leakage is detected	5	High	Mohamad Umar, Manish
4	Allocation	USN - 19	Admin must receive information about the leakage along with location and share exact location and route to the person	3	High	Manish, Arun Priyan
4	Allocation	USN - 20	Admin must allot particular person to look after the leakage in a particular location	3	High	Athinarayanan, Anto Nidhish

6.2 Sprint Delivery Schedule:

It shows the allotment of total story points for a sprint, Duration to complete the sprint and The Start & End date of a sprint. At the end of each sprint, we can calculate the story points that are actually completed as per schedule.

Table 6.2: Sprint Delivery Schedule for Gas Leakage Monitoring and Alerting System

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA:

7. CODING & SOLUTIONING

7.1 Feature 1:

Sensing data from the sensor. Here sensor data is generated using a python source code using random.randint(). One another way to generate data is to use Events in IBM Watson IoT Platform. In an event random() is used. For both the random functions (i.e., Python & Event) input random function includes start and end value as seed

Python Data Generation Code: (Method 1)

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
# Provide IBM Watson Device Credentials
organization = "u7bs6g"
deviceType = "GasSensor"
deviceId = "121"
authMethod = "token"
authToken = "987654321"
try:
 deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "authmethod": authMethod, "auth-token": authToken}deviceCli =
ibmiotf.device.Client(deviceOptions)
 deviceCli.connect()

# .....
```

```
except ibmiotf.ConnectionException as e:
 print("Caught exception connecting device: %s" % str(e))
 sys.exit()
while True:      #Data generation
 temp = random.randint(0, 100)
 hum = random.randint(0, 100)
 gas = random.randint(0, 100)
 mydata = {'temp': temp, 'hum': hum, 'gas': gas}
def on_publish():
 print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % hum, "Gas
Concentration = %s" % gas, "to IBM Watson")
success = deviceCli.publishEvent("IOTGasSensor", "json", mydata, qos=0,
on_publish=on_publish)
 if not success:
 print ("Not connected to IoTF")
 time.sleep(2)


# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

Event Data Generation: (Method 2)

```
{
 "gas": random(0, 100),
 "Temp": random(0, 100),
 "Hum": random(0, 100)
}
```

7.2 Feature 2:

Here the data is brought to Node-RED and the sensed environmental parameters is displayed in dashboard. In Node-RED, IBM IoT node is used to gather the sensed data from IBM Watson using API Key. Then functions are written to gather each data separately and Finally dashboard nodes are used to display the data in the users Dashboard.

Source Code:

Temperature Function: msg.payload = msg.payload.Temp;
return msg;

Humidity Function: msg.payload = msg.payload.Hum;
return msg;

Gas Function: msg.payload = msg.payload.gas;
return msg;

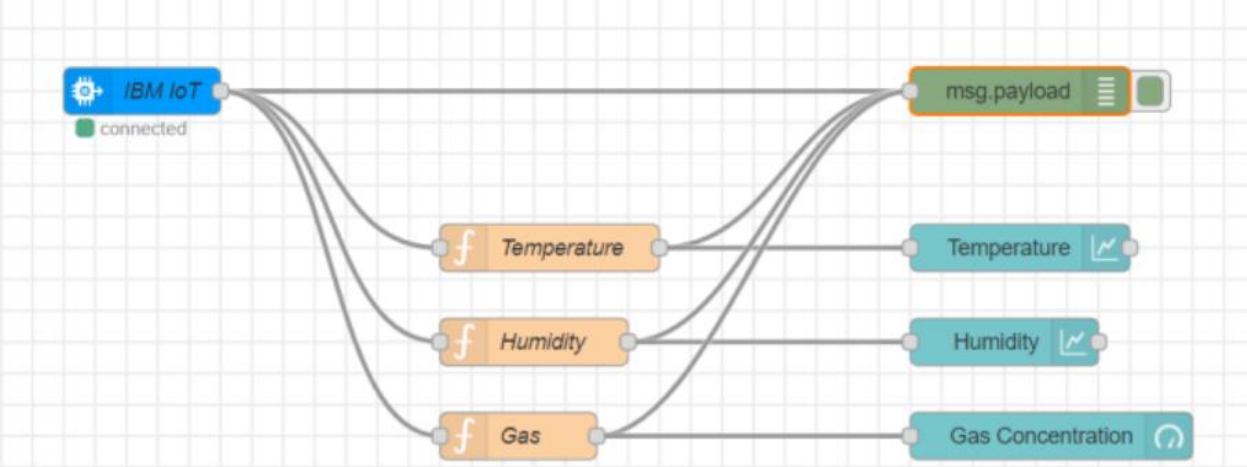


Figure 7.1: Node-RED of Gas Leakage Monitoring and Alerting System

7.3 Feature 3:

Developing a Mobile Application for Monitoring the Environmental parameters around the region of sensor using a Mobile Device. In order to develop Mobile Application, MIT App Inventor has been used It is made up of Designer & Blocks section. Designer is the front end whereas Blocks deals with the backend programming. Three screens have been developed to monitor the data. Blocks are accessible only to developers. So end user can't view or modify data present in block section.

Screens Information:

1. Screen – 1: It is the entry screen of the mobile application which will be displayed only for 3 seconds.

2. Screen – 2: It is the login page of the application. Each user has their own user id and password, which is known only to them. After validating the credential, User can access the data produced by their devices.

3. Screen – 3: Environmental parameters such as Temperature, Humidity & Gas Concentration are displayed in this page.

Designer:

Screen 1:

Figure 7.2: Designer of Screen 1 in Mobile Application

Screen 2:

Figure 7.3: Designer of Screen 2 in Mobile Application

Screen 3:

Figure 7.4: Designer of Screen 3 in Mobile Application

Blocks:

Screen 1:

As shown timer function is used in the Block of screen to move to the next screen in 3 Seconds of app starting.

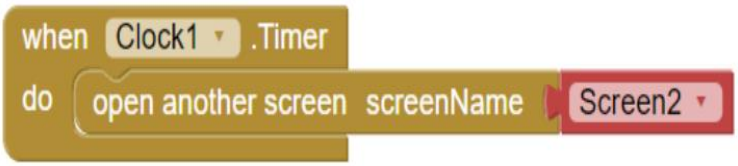


Figure 7.5: Block of Screen 1 in Mobile Application

Screen 2:

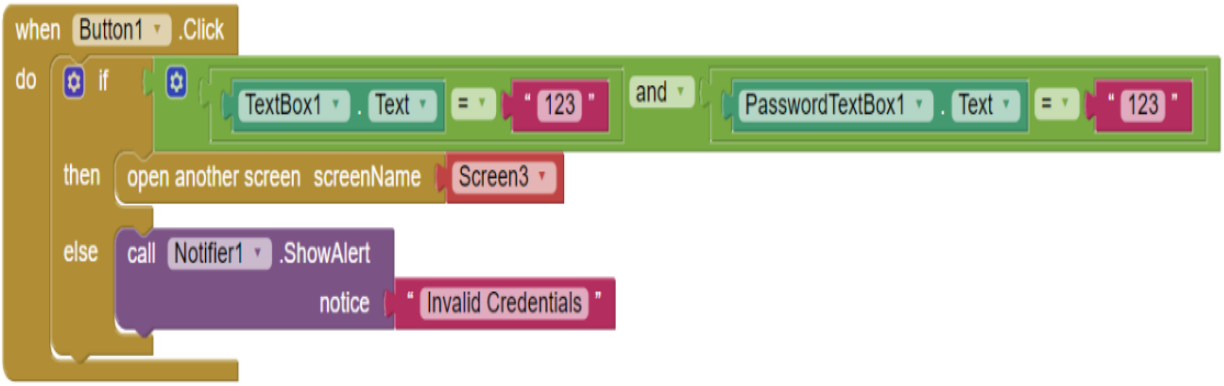


Figure 7.6: Block of Screen 2 in Mobile Application

7.4 Feature 4:

As the data is rendered in Mobile Application, when an abnormal condition is observed ALERT message is to be generated. MIT App is used to generate a notification along with an alarm whenever the data observed is above the safety threshold.

Here we generate an alarm and notification when temperature is above 40℃, Humidity is above 30% and Concentration of gas is greater than 50%.

Screen 3 of the Mobile Application is used to implement the following feature.

Screen 3:

Designer:

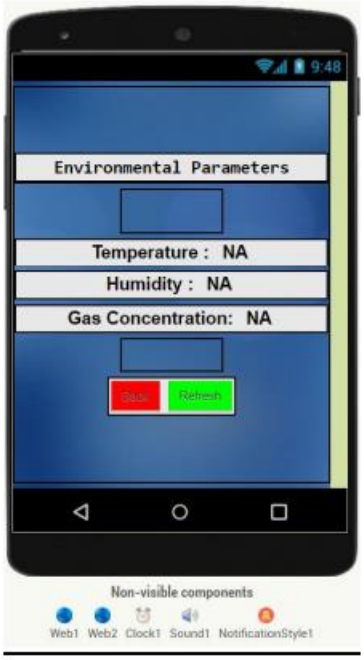
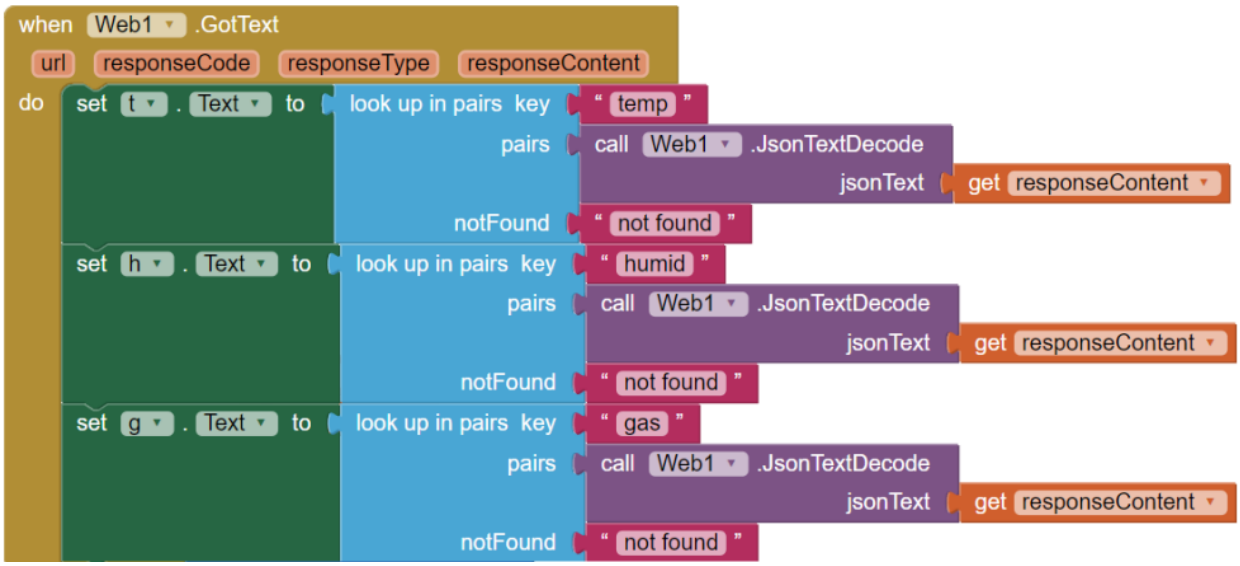


Figure 7.7: Designer of Screen 3 in Mobile Application

Block:



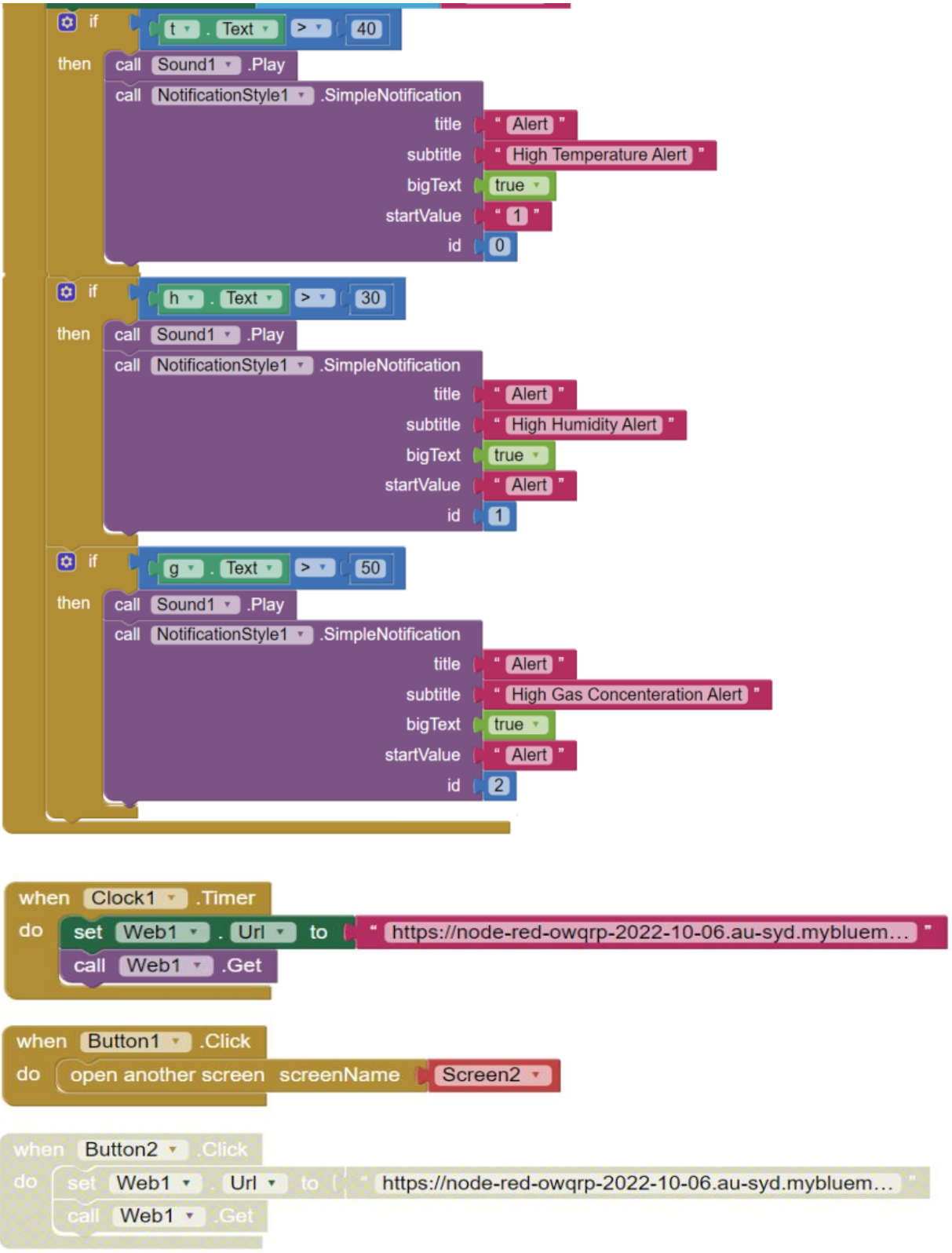


Figure 7.8: Block of Screen 3 in Mobile Application

8.TESTING

8.1 Test Cases:

This report shows the number of test cases that have passed, failed and untested for each section.

Table 8.1: Test Case Report of Gas Leakage Monitoring and Alerting System

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

8.2 User Acceptance Testing:

The purpose of User Acceptance Testing is to briefly explain the test coverage and open issues of the Gas Leakage Monitoring and Alerting System at the time of the release.

Table 8.2: User Acceptance Testing Report of Gas Leakage Monitoring and Alerting System

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

9. RESULTS:

9.1 Performance Metrics:

The conclusion from this project's performance is that the project system's detection of LPG gas leakage is remarkable. Useful for both domestic and industrial needs. We can use this technology to save lives in risky situations. The GSM module indicates an alert. Gases as CO2, oxygen, and propane are detected by a sensor node. Power usage and transmission range estimates are made. The sensor was constructed using straightforward techniques and an Arduino UNO Micro controller.

10. ADVANTAGES & DISADVANTAGES:

Advantages:

1. There is no interference from other gases because the laser emission has a very narrow 0.3 nm line width.
2. Response times are in the order of one second.

Disadvantages:

1. Each instrument can measure only one gas.
2. The system will not be able to take measurements if heavy dust, steam, or fog obscures the laser beam.

11. CONCLUSION:

In dangerous situations, we must use this system to save lives. The GSM module indicates an alert. A sensor node detects gases such as CO2, oxygen, and propane. The estimated transmission range and power consumption are obtained. To construct, simple procedures and an Arduino UNO Microcontroller were used.

12. FUTURE SCOPE:

We propose that the system be built with a MQ6 gas detection sensor and interfaced with an Aurdino Uno microcontroller and an LCD display. The gas sensor in our system detects any gas leaks. When it detects a gas leak, the gas sensor sends a signal to the microcontroller. This signal is processed by the microcontroller, and a message is displayed on the LCD to alert the user.

13. APPENDIX:

Source Code:

Python Data Generation Code:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
# Provide IBM Watson Device Credentials
organization = "u7bs6g"
deviceType = "GasSensor"
deviceId = "121"
authMethod = "token"
authToken = "987654321"
try:
 deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "authmethod": authMethod, "auth-token": authToken}deviceCli =
ibmiotf.device.Client(deviceOptions)
 deviceCli.connect()
```

```
# ..............................................
except ibmiotf.ConnectionException as e:
 print("Caught exception connecting device: %s" % str(e))
 sys.exit()
while True:      #Data generation
 temp = random.randint(0, 100)
 hum = random.randint(0, 100)
 gas = random.randint(0, 100)
 mydata = {'temp': temp, 'hum': hum, 'gas': gas}
def on_publish():
 print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % hum, "Gas
Concentration = %s" % gas, "to IBM Watson")
success = deviceCli.publishEvent("IOTGasSensor", "json", mydata, qos=0,
on_publish=on_publish)
 if not success:
 print ("Not connected to IoTF")
 time.sleep(2)


# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

Event Data Generation:

```
{
 "gas": random(0, 100),
 "Temp": random(0, 100),
 "Hum": random(0, 100)
}
```

Node-RED Code:

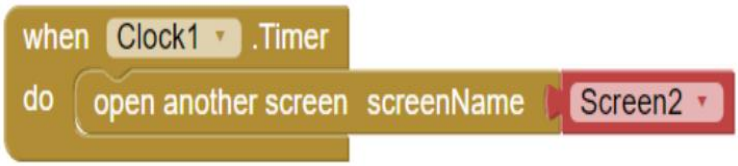
Temperature Function:
```
msg.payload = msg.payload.Temp;
return msg;
```

Humidity Function:
```
msg.payload = msg.payload.Hum;
return msg;
```

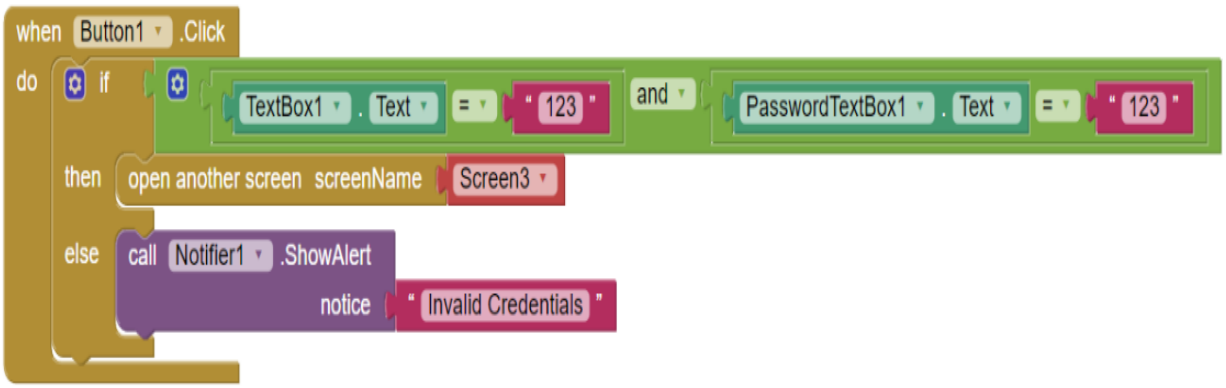
Gas Function:
```
msg.payload = msg.payload.gas;
return msg;
```

MIT Blocks:

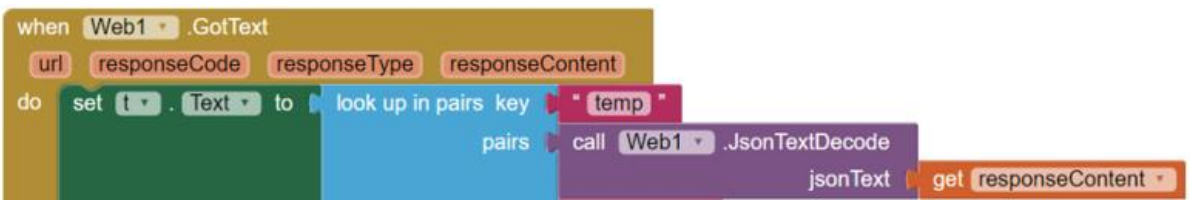
Screen 1:

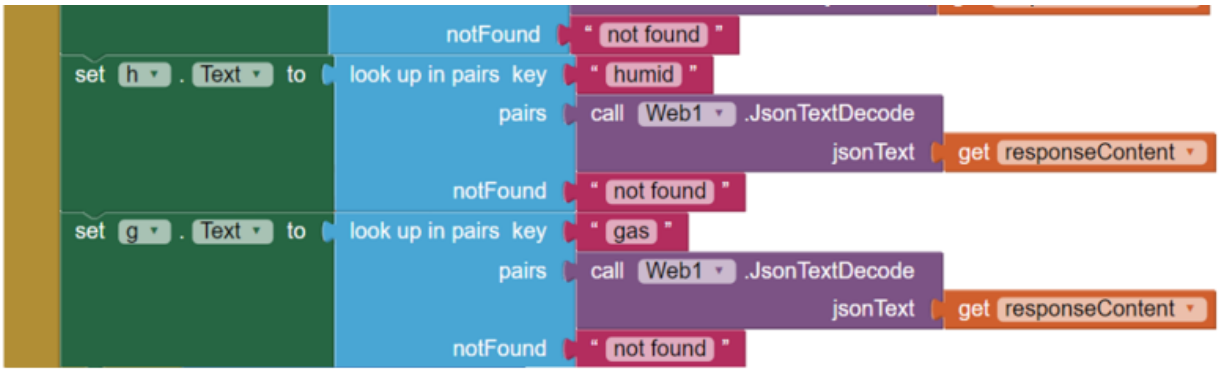


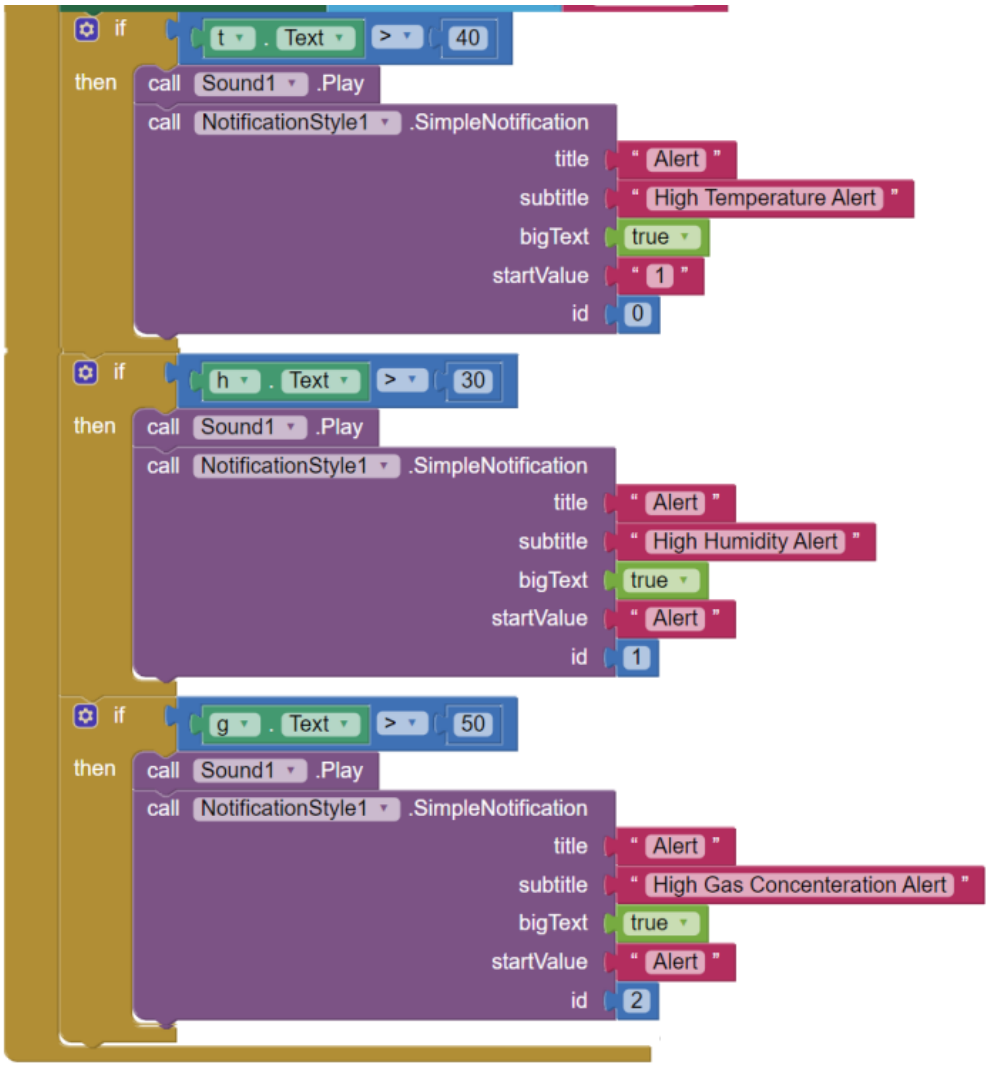
Screen 2:

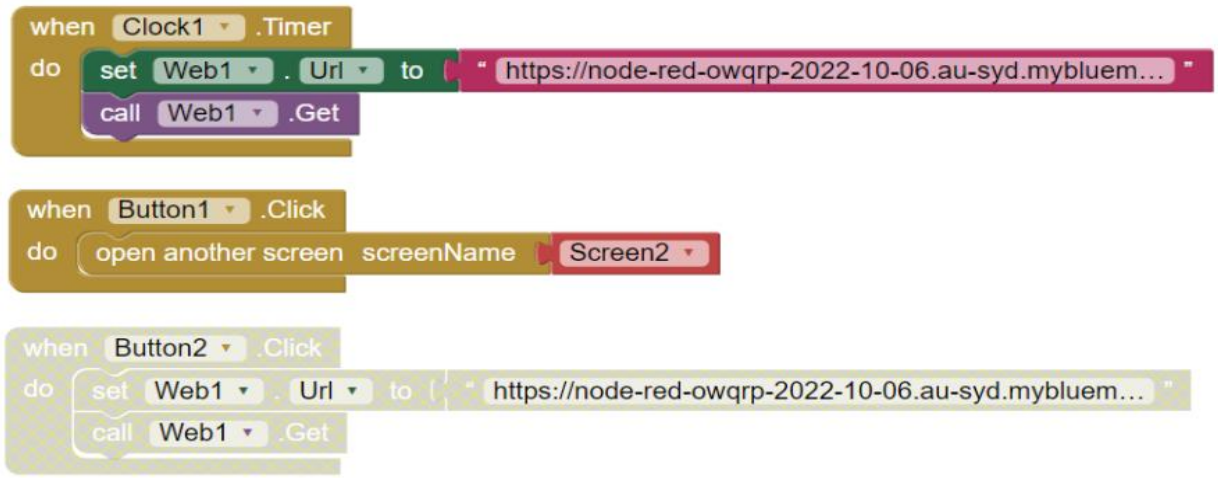


Screen 3:




notFound
not found
set h . Text to
look up in pairs key
humid
pairs
call Web1 .JsonTextDecode
jsonText
get responseContent
notFound
not found
set g . Text to
look up in pairs key
gas
pairs
call Web1 .JsonTextDecode
jsonText
get responseContent
notFound
not found


if
t . Text > 40
then
call Sound1 .Play
call NotificationStyle1 .SimpleNotification
title
Alert
subtitle
High Temperature Alert
bigText
true
startValue
1
id
0
if
h . Text > 30
then
call Sound1 .Play
call NotificationStyle1 .SimpleNotification
title
Alert
subtitle
High Humidity Alert
bigText
true
startValue
Alert
id
1
if
g . Text > 50
then
call Sound1 .Play
call NotificationStyle1 .SimpleNotification
title
Alert
subtitle
High Gas Concenteration Alert
bigText
true
startValue
Alert
id
2



Github Link: https://github.com/IBM-EPBL/IBM-Project-229-1658224925