



IBM PROJECT REPORT

GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

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1. INTRODUCTION

1.1 Project Overview:

This project helps the industries in monitoring the emission of harmful gases. In several areas, the integration of gas sensors helps in monitoring the gas leakage. If any gas leakage is detected the admins will be notified along with the location. In the web application, admins can view the sensor parameters.

1.2 Purpose:

Inhaling concentrated gas can lead to asphyxia and possible death. To overcome these disasters, we designed a system for monitoring and alerting the leakage of those harmful gases. This makes the industrialists get rid of the fear of any disasters caused by the gases.

2. LITERATURE SURVEY

2.1 Existing Problem:

The number of sensors is unpredictable and the positioning of equipment is improper and also the affordability of the system is high and the systems are sometimes causing heavy disasters.

2.2 References:

NAME: Wireless gas sensor network for detection and monitoring of harmful gases in utility areas and industries

AUTHOR: P. C. Jain, Rajesh Kushwaha

CONTENT: This work was carried out as a part of project "Development of low-cost real-time monitoring system for detection of harmful gases".

NAME: Gas Leakage Detection Based on IOT

AUTHOR: V Suma, Ramya R, Shekhar Kumar, A Akshay

CONTENT: This paper puts forth a new proposed system which is a microcontroller-based application of gas booking and gas detection systems using IOT. The main intention of this work is to ensure a safe and easier way of gas booking and leakage detection to avoid disasters that may occur due to negligence.

NAME: Smart Gas Leakage Detection with Monitoring and Automatic Safety System

AUTHOR: S.M. Zinnuraain Mahmudul Hasan, Md. Akramul Hakque,

Mir Mohammad Nazmul Arefin

CONTENT: The proposed system is mainly aimed for household purposes, where the user can be notified of the amount of LPG remaining in the cylinder so that necessary actions can be taken to pre-book a new cylinder without any hassle. Also, it notifies the user about any LPG leakage to take preventive action to avoid an explosion by sending data with the help of Wi-Fi communication system and with an automatic safety system.

NAME: IOT Device for Sewage Gas Monitoring and Alert System

AUTHOR: Nitin Asthana, Ridhima Bahl

CONTENT: This project aims at providing smart solutions to monitor poisonous sewage gases and works on a system of live sewage level detection and monitoring. Whenever a certain threshold is crossed, an alert is sent to the observer who is examining the conditions from a remote location. The information is then forwarded along with different gas ppm values indicating whether it is safe for the worker to clean or work in that environment or not.

NAME: Sleep Scheduling in Industrial Wireless Sensor Networks for Toxic Gas Monitoring

AUTHOR: Mithun Mukherjee, Lei Shu Likun Hu Gerhard P. Hancke Chunsheng Zhu

CONTENT: This article proposes a sleep scheduling scheme based on the hazardous classification of a gas leakage area in a petrochemical plant. The proposed scheme wakes up a minimum number of sleep nodes in a gas leakage area compared to the well-known CKN algorithm that considers the entire region to meet the threshold zone coverage degree.

NAME: Embedded System for Hazardous Gas Detection and Alerting

AUTHOR: V Ramya, B Palaniappan

CONTENT: It is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries etc. It is a designed microcontroller based toxic gas detecting and alerting system.

2.3 Problem statement definition:

Since the number of sensors is unpredictable, the industrialists feel insecure in handling the gases. Also, the cost price of the products and the complications in installing the systems are high. This makes the customers feel disappointed sometimes.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:

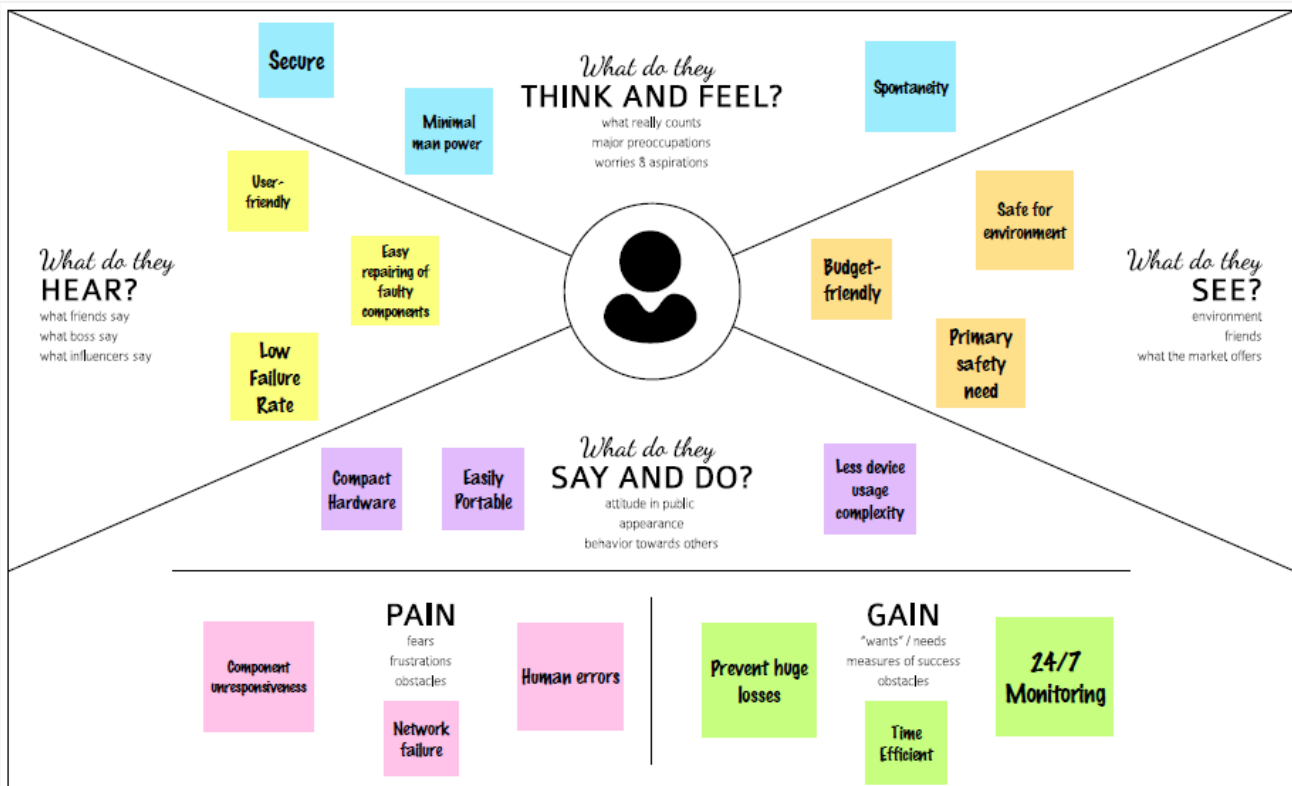
Edit this template
Right-click to unlock

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.



Share your feedback

3.2 Ideation & Brainstorming:

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

⌚ 10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!



Akshitha.B

Industries monitor the emission of harmful gases

If gas is detected, notification is sent to user

Sensor parameters can be tracked using a web application

Gas sensors detect the gas leakage

Location is notified for quick recovery

Notification is sent via a fast SMS

Aishwarya.R

Store a generated report

Measures the leaked gas level

Cut off power supply to the main switch

Give call to the fire station and ambulance

Turn on the night mode camera

Send GPS location to the fire station and ambulance

Elavarasan.V

It can save many people lives

To avoid unwanted leakage and consequences like poisoning or explosions

Supervise gas concentration levels

Cost effective installation

Data analytics for improved decisions

If any gas leakage is detected admins will be notified along with the location

Dural Ashwath.M

Gas-specific detection

Gas leakage detected at the earliest to prevent major uncertainties

Display emergency exit once alarm triggered

Creating a buzzer alarm

Enable ventilation and exhausts automatically after sensing

DC-operated alarming & exit mechanisms

3.3 Proposed Solution:

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Continuous industrial development gives rise to harmful gas releases. Often these emissions are controlled. Lapses in preventive maintenance led to faulty pipelines & equipment. Such operational negligence to detect gas leaks is damaging the environment. Apart from polluting the atmospheric air, such leaks create potential hazards for the workers in the industry. Consequently, breathing even with low concentration can lead to many diseases and increase fatality. This project presents a gas leakage alerting and monitoring system to detect leakage in industries and to alarm the people onboard.
2.	Idea / Solution description	<p>The key research objectives are as follows:</p> <ul style="list-style-type: none">• 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• In the web application, admins can view the sensor parameters.
3.	Novelty / Uniqueness	In the instance of a gas leak inside a secluded area, the workers must be evacuated immediately. Just in case there are people unable to get out, a night vision camera could be installed to monitor their presence and help them. Once gas is detected, the main power supply will be cut off to prevent fires. Also, DC - operated alarming and exit mechanisms will be installed since the power supply is cut off.
4.	Social Impact / Customer Satisfaction	From the public perception as worst impacts of present the uneconomical cost, the system failure, the employee's negligence, the structure mismanagement.
5.	Business Model (Revenue Model)	Gas leakage monitoring and Alerting System organises its operations into two reportable business segments:

		<p>The petroleum industry is just one of the numerous industries that make up a company's strategy. Other components include the detection of the gas kind and leaking quantity, the primary switching off mechanism, and the battery-operated night vision camera that records, and adding on to it a sensor can be installed to detect motion. The method to lead out while in dark and an alerting sound.</p>
6.	Scalability of the Solution	<p>It can be monitored, and preventive measures can be taken to avoid any disaster.</p> <p>The suggested system makes use of sensor and communication technologies, which enable quick detection of the gas type.</p> <p>Suppose corrective steps are taken promptly after it is reported over the IoT devices. In that case, that can help save the loss of lives, alleviate any mishaps from happening, and cut down on business expenses.</p> <p>The gas leakage detection system can be optimized for detecting toxic gasses along with upgrading them with smoke and fire detectors to identify the presence of smoke and fire. Ensuring worker safety is important but making using of the right technology is even more vital.</p>

3.3 Problem Solution Fit:

Define CS, fit into CL	1. CUSTOMER SEGMENT(S) CS Demographic, psychographic and geographic	6. CUSTOMER LIMITATIONS CL <small>EG. BUDGET, DEVICES</small> High budget in installing other products make them to move far from modern technologies.	5. AVAILABLE SOLUTIONS AS <small>PLUSES & MINUSES</small> The leakage could be monitored and controlled with enough labour. Despite the fact that human labour could lower electricity costs and monitor correctly, there may be a great risk to their lives. Manpower is another factor that contributes to some errors.	Explore AS, differentiate
	2. PROBLEMS / PAINS + ITS FREQUENCY PR <ul style="list-style-type: none">• Component unresponsiveness• Network related errors• Human inefficiency/ negligence• High installation cost• Time consuming process	9. PROBLEM ROOT / CAUSE RC Workers' irresponsible and lack of concentration on their work can lead to a high risk of their health and the industry itself.	7. BEHAVIOR + ITS INTENSITY BE <ul style="list-style-type: none">• High risks come from utilising human resources to monitor leaks.• If the gas being released is particularly harmful, there is also a danger that it will have an impact on future generations' health.	Focus on PR, tap into BE, understand RC
Focus on PR, tap into BE, understand RC	3. TRIGGERS TO ACT TR The havoc and hazards incurred due to the past occurrences of gas leakage/explosions and the huge expenses because of losing gas has alerted the industries to take a	10. YOUR SOLUTION SL Develop an application that can always monitor and alert the workers in order to establish an efficient safety system in the industry.	8. CHANNELS of BEHAVIOR CH Using social media to promote. Through the aid of influencers/entrepreneurs on social media.	Extract online & offline CH of BE
	4. EMOTIONS EM <small>BEFORE / AFTER</small> <u>Before</u> : A sense of fear bloomed among the public, government and industries. Human loss and gas wastage led to grief and took a toll on everyone's mental well-being. Adaptation and recovery <u>was</u> very difficult <u>After</u> : Awareness, confidence and security was built inside the minds of public, government and industries		<small>OFFLINE</small> Through newspaper advertisements and brochure	
Identify strong TR & EM				

4. REQUIREMENT ANALYSIS

4.1 Functional Requirement:

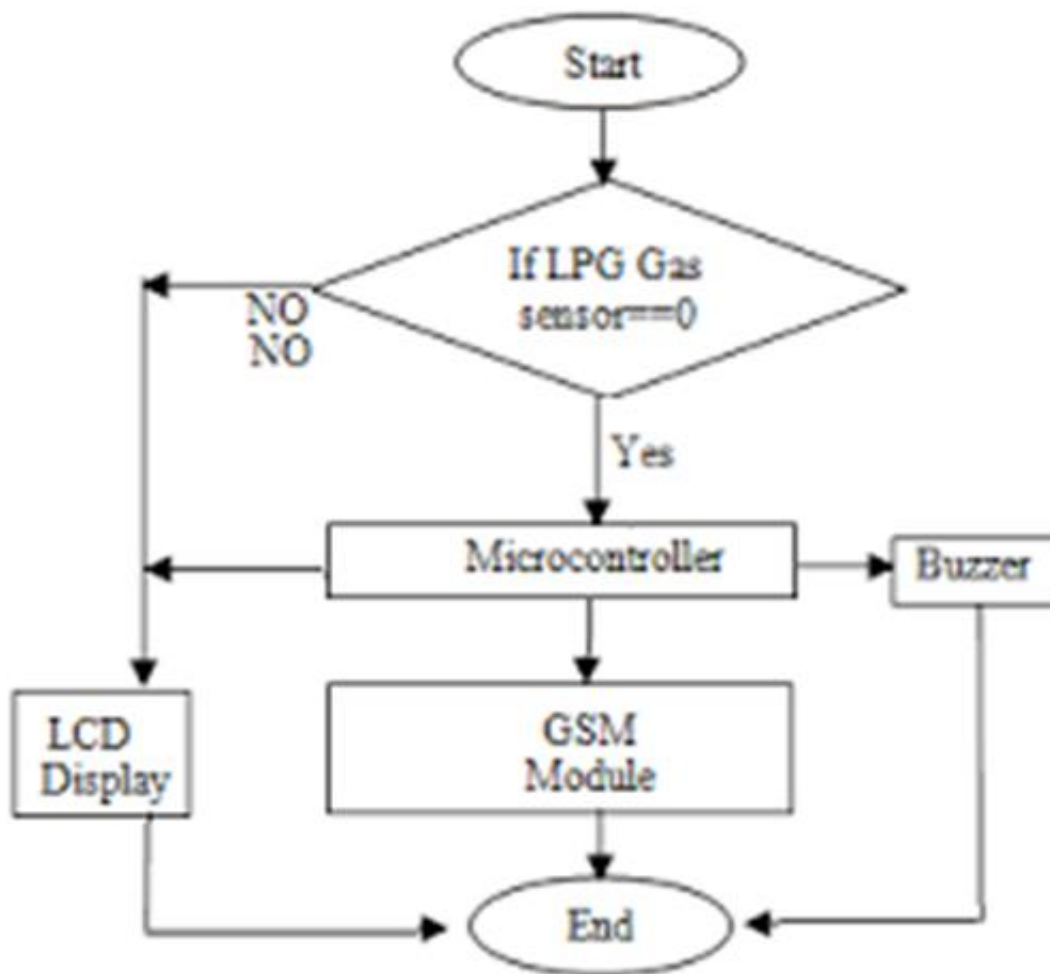
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	There must be a sound alarming system, to caution the people working in the plant.
FR-2	User Reception	The data like the level of gas should be sent through alerting messages.
FR-3	User Understanding	An emergency alert message must be passed on to the user through SMS or app. The message must notify the amount at gas leaked. The system should update the local database in real time.
FR-4	User Convenience	The system must provide an instantaneous sensor response as soon as the gas leaks. A night-mode camera must be used to capture footage of employees trapped in the environment. There must be a ventilation mechanism to let out the leaked gas. A battery-operated recovery system should be installed in case of power loss.
FR-5	User Performance	The system should make rapid intimating process. There must be an automatic hose to spray water to put out fire, if encountered.

Non-Functional Requirement:

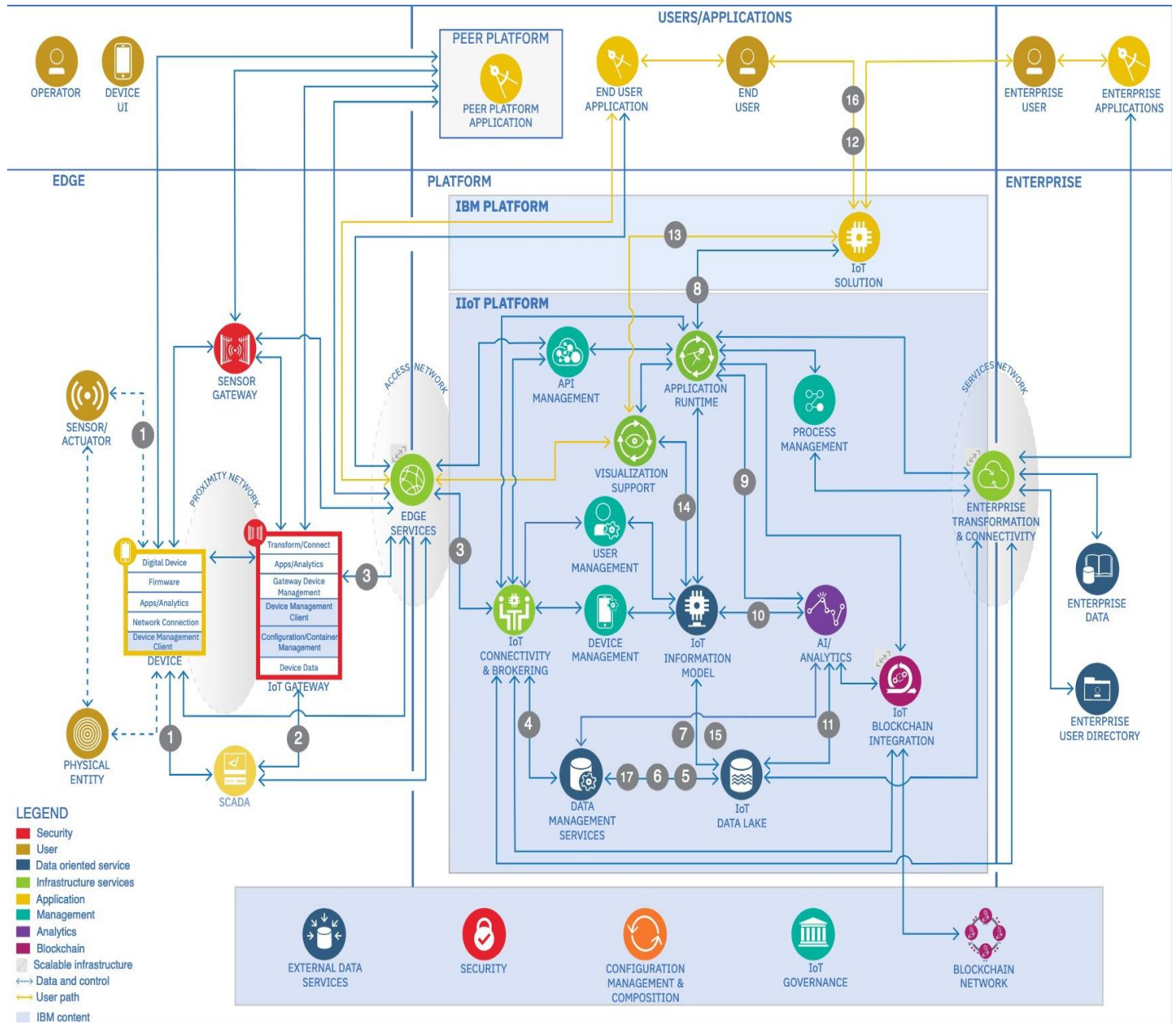
Business Requirements	User Requirements	Product Requirements
The said system can be deployed in homes, hotels, factory units, LPG cylinder storage areas, and so on. The main advantage of this IoT and Arduino-based application is that it can determine the leakage and send the data over to a site. It can be monitored, and preventive measures can be taken to avoid any disaster.	The gas leakage detection system can be optimized for detecting toxic gasses along with upgrading them with smoke and fire detectors to identify the presence of smoke and fire. Ensuring worker safety is important but making using of the right technology is even more vital.	Detecting gasses is necessary regardless of your business role or individual purpose. Certain technologies at play make such IoT devices what they are, and if you want to indulge in IoT application development, you must know what they are and what purpose they can fulfil.

5. PROJECT DESIGN

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:



5.3 User Stories:

<div> <div>CUSTOMER JOURNEY</div> <div>  People 2-5  Time 30 min  Difficulty Beginner </div> </div>									
Journey Steps Which step of the experience are you describing?	DISCOVERY Why do they even start the Journey?		REGISTRATION Why would they trust us?		ONBOARDING & FIRST USE How can they feel successful?			SHARING Why would they invite others?	
Actions What does the customer do? What information do they look for? What is their context?	Leakage of the gas is detected	Type of the gas leaked is detected	To share their contact details to reach them out!	To prioritise delivery	Check for well-functioning and faulty devices	Ensure all specifications are met	Testing the whole system before actual deployment	Check for authenticity	Test device before sharing
Needs and Pains What does the customer want to achieve or avoid?	Quick action after the gas detected	To prevent future disaster	To make them know how inevitable these machines are for the safety of their industries	To get to know completely about the device they're going to purchase	Expects seamless working experience	Achieve maintenance and long life of devices		Promote business	A way of helping the society
	Network Failure	Human Errors	Delivering uncertified product	Not being customer-friendly	Looks down on expensive and frequent reparations		Efforts going unrecognised		
Touchpoint What part of the service do they interact with?	Through their IOT-connected devices, such as mobile phones and systems	Website	Website	App	Expos	A guided manual	Relevant hardware and software	Database management	Warnings and buzzers
Customer Feeling What is the customer feeling on this product?	Secured feeling		Happy about this discovery		Non-complex			Easy Process	
	Trustable		Confident equipment handling		Save people's lives.			Generate good revenue	

6. PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Analyzing the gas leakage	USN-1	The owner who wants to save his employees or a person who wants to save their family from explosion takes necessary actions	2	High	Aishwarya. R Akshitha. B Elavarasan. V Durai Ashwath.M
Sprint-1	Prevent from explosion	USN-2	The fire officers worry about any explosions due to gas leakage which may cause many death	1	High	Aishwarya. R Akshitha. B Elavarasan. V Durai Ashwath.M
Sprint-2	To detect the gas leakage	USN-3	The owner can take necessary steps by deploying gas detectors in their surroundings	2	Low	Aishwarya. R Akshitha. B Elavarasan. V Durai Ashwath. M
Sprint-3	Testing and training of the model device	USN-4	The programmer can design a gas leakage detection model by training the dataset	2	Medium	Aishwarya. R Akshitha. B Elavarasan. V Durai Ashwath. M
Sprint-4	Notification	USN-5	The gas leakage detected by the model can be notified using SMS or alarming system	1	High	Aishwarya. R Akshitha. B Elavarasan. V Durai Ashwath. M

6.2 Sprint Delivery Schedule:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	17 Nov 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	17 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	18 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports From JIRA:

BACKLOG & ROADMAP

The screenshot displays the Jira Software interface for the 'Gas Leakage Monitoring and Alerting System' project. The left sidebar shows navigation options under 'PLANNING' (Roadmap, Backlog, Board, Reports) and 'DEVELOPMENT' (Code, Project pages, Add shortcut, Project settings). The main area shows the 'Backlog' for the project, with two sprints listed: 'GLMAS Sprint 3' (7 Nov - 12 Nov) and 'GLMAS Sprint 4' (14 Nov - 19 Nov). Each sprint contains a list of issues, with the first issue in each sprint being 'GLMAS-6' and 'GLMAS-9' respectively. A 'Quickstart' panel is visible on the right side of the interface, providing guidance on creating a project, delivering more often with scrum, creating an issue, inviting teammates, and connecting tools. The bottom of the screen shows a Windows taskbar with various application icons and system information.

SCRUM BOARD

The screenshot displays the Jira Software interface for a Scrum Board. The browser address bar shows the URL: `aisha195.atlassian.net/jira/software/projects/GLMAS/boards/1`. The page title is "Gas Leakage Monitoring and Alerting System".

Left Sidebar:

- PLANNING:** Roadmap, Backlog, **Board** (selected).
- DEVELOPMENT:** Code, Project pages, Add shortcut, Project settings.
- Bottom note: "You're in a team-managed project. Learn more."

Main Content Area:

- Header: "Set project and issue permissions. Try it in a 14-day trial of Jira Software Standard."
- Breadcrumbs: "Projects / Gas Leakage Monitoring and Alerting System".
- Section: "All sprints" with a "Complete sprint" button.
- Search bar and "GROUP BY" dropdown (set to "None").
- Columns:**
 - IN PROGRESS 1 ISSUE:** Contains issue GLMAS-9 with description "The gas leakage detected by the model can be notified using SMS or alarming system." and label "NOTIFICATION".
 - DONE 1 ISSUE:** Contains issue GLMAS-8 with description "The programmer can design an gas leakage detection model by training the dataset." and label "TESTING AND TRAINING".
 - IN REVIEW 3 ISSUES:** Contains issues GLMAS-1 and GLMAS-2. GLMAS-1 description: "The owner who wants to save his employees or a person who wants to save their family from explosion takes necessary actions." GLMAS-2 description: "The fire officers worries about any explosions due to gas leakage which may cause many death." Both have label "REGISTRATION".

Right Sidebar: Quickstart

- Buttons: "Create a project", "Customize your board", "Create an issue".
- Text: "Issues are individual pieces of work that you assign to teammates. Issues can be tasks or stories." with "Show me" and "View issue tutorial" links.
- Buttons: "Invite your teammates", "Connect your tools", "Get the mobile app".
- Bottom: "Dismiss Quickstart".

Windows Taskbar: Shows system tray with temperature (26°C), search bar, and date/time (20:22 17-11-2022).

7. CODING AND SOLUTIONING

7.1 Feature 1:

Cut-off power supply and turn on fans – When there is any gas detected by the sensors, the complete power supply of the building is cut off and there is a ventilation mechanism to automatically turn on the exhaust fans. It is done using battery-operated mode in order to prevent catching of fires. Just in case fire emerges unfortunately, there is also a method to put off fire, where the water hose sprays/sprinkles water on the burning fire.

7.1 Feature 2:

Night mode cameras – Night vision cameras are placed at specified places to monitor the safety of working staff and ensure they are evacuated safely out of the building. A display board for caution that says “EXIT” is also displayed at exit ways to guide the workers to get out of the location. The location of the gas leakage is also clearly specified such that the gas leakage can be detected and rectified easily within a short duration of time.

8. TESTING

8.1 User Acceptance Test: -

<div>Date19-Nov-22</div> <div>Team IDPNT2022TMD27861</div> <div>Project - Gas Leakage Monitoring And Alerting System For Industries</div> <div>Maximum Marks4 marks</div>												
Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result Status	Comments	TC for Automation(Y/N)	Executed By	
TC_001	Functional	IBM cloud	Create the IBM Cloud services which are being used in this project.	IBM Cloud login ID & Password	1.Go to IBM Cloud signup page 2.Enter e-mail id and other credentials 3.Enter a password	https://cloud.ibm.com/login	User should sign up IBM cloud and details should be verified	Working as expected	Pass Results verified	No	AISHWARYA & AKSHITHA.B	
TC_002	Functional	IBM Cloud	Configure the IBM Cloud services which are being used in completing this project.	IBM Cloud login ID & Password	1.Go to Cloud login 2.Enter user ID & Password 3.Verify login by the popup display	https://cloud.ibm.com/login	User login to IBM Cloud and should be navigated to IBM Cloud dashboard page	Working as expected	Pass Results verified	No	AISHWARYA.R	
TC_003	Functional	IBM Watson IoT Platform	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	IBM Watson IoT Platform login ID & Password	1.Login to IBM Cloud 2.Click Catalog 3.Search IoT and click create 4.Go to resource list and search Internet of Things platform 5.Press Launch and click Sign in IBM Watson Platform	https://wdevsly.internetofthings.ibmcloud.com/dashboard/	User should be navigated to IBM IoT Watson Platform	Working as expected	Pass Results verified	No	AISHWARYA.R	
TC_004	Functional	IBM Watson	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.		1.Login to IBM Watson Platform 2. Click Add Device 3.Enter the details and click Finish. Create Device ID & Device type 4.Turn on Device Simulator and click simulation running. Enter the values of gas, temperature & humidity level 5.Click Send & Save. Verify the displayed result of the levels	Temperature, Humidity and Gas sensor values are generated randomly in simulation	Temperature, Humidity and Gas sensor values should be randomly generated	Working as expected	Pass Results verified	No	AKSHITHA.B	
TC_005	Functional	IBM Cloud(Node Red)	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	Node Red Installation	1.Install node red and open node red in command prompt 2.Select IBM input in IoT	https://cloud.ibm.com/docs/developer/appservice/create-api-key?start=1#59c6b6b-4d31-3611-897a-89ee80c926defaultan	User should be able to see the Node Red page	Working as expected	Pass Results verified	No	AKSHITHA.B	
TC_006	Functional	Node Red	Create a Node-RED service.	Node Red Installation	1.Select IBM IoT input in Node. In IBM IoT Watson Platform, go to apps and click on generate API keys. 2.Copy & paste generated API key and token in the IBM IoT input. After entering all details, click the done button. 3.Add debug to the IBM IoT and rename as Mag payload and click on done. Click gauge from the dashboard and fill the details & add functions to the gauge. Check the generated values from the debug message. 4.Edit function node, connect them, add another gauge and functions, name them as "Temperature", "Gas" & "Humidity" 5.Finally add alarm ON/OFF and Sprinkler ON/OFF buttons to the IBM.	Values of sensors and button for Alarm & Sprinkler ON/OFF should be displayed	Values of sensors and button for Alarm & Sprinkler ON/OFF should be displayed	Working as expected	Pass Results verified	No	AKSHITHA.B	

TC_007	Functional	Python 3.7.0	Develop a python script to publish random sensor data such as temperature, humidity level and Gas level to the IBM IoT platform	Python 3.7.0(64 bit) installation	1.Download and install Python 3.7.0 2.Develop python code	https://www.python.org/downloads/release/python-370/	User should be able to develop a python code	Working as expected	Pass	Results verified	No	DURGA ASHWATHAM
TC_008	Functional	Python 3.7.0	After developing python code, commands are received just print the statements which represent the control of the devices.	Python 3.7.0(64 bit) installation	1.Download Python 3.7.0 2.After python code	Get the output from the code	User should be able to get the results from the developed code	Working as expected	Pass	Results verified	No	ELAHARASAN V
TC_009	Functional	IBM Cloudant DB	Publish Data to The IBM Cloud	IBM Cloud Login ID & Password	1.Run the python code 2.Verify the displayed output	Publishment of python code	User should be able to publish the code	Working as expected	Pass	Results verified	No	ASHWATHA R
TC_010	Web UI	Node Red & MIT Inventor	Create Web UI in Node-Red	MIT Inventor Login ID & password	1.Go to Node-Red. Select http in & http response. Add functions and select another http in and http response. Connect them to IBM IoT output and function. Print the command statements such as Sprinkler ON/OFF, Alarm ON/OFF and sensor 2.Go to MIT app inventor and create frontend using buttons horizontal arrangement, text bar etc. Add blocks and so on to create back end. Verify the output	Sensors values and command values can be seen in the mobile application	Sensors values and command values should be seen in the mobile application	Working as expected	Pass	Results verified	No	AKSHITHA B & ASHWATHA R
TC_011	Functional	IBM Cloudant DB	Configure the Node-RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the	IBM Cloud Login ID & Password	1.Go to IBM cloud, search Cloudant in Catalog. Add new dashboard, go to Node-Red 2.Connect to cloudant and verify the results	Cloudant is connected by NODE-RED	User should be able to connect the Cloudant and Node-Red	Working as expected	Pass	Results verified	No	AKSHITHA B

9. RESULTS

9.1 Performance Testing Report:

Date : 19-11-2022

Team ID : PNT2022TMID27861

Project Name : Gas Leakage Monitoring and Alerting System

NFT - Risk Assessment								
S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Load/Volume Changes	Risk Score	Justification
1	Light ON/OFF	Existing	Low	No Changes	Low	>5 to 10%	GREEN	Changes occurs less
2	Fast SMS	New	No changes	No Changes	Low	>5 to 10%	GREEN	Changes occurs hardly
3	Fan ON/OFF	Existing	Low	No Changes	Low	>5 to 10%	GREEN	No changes occurs
4	Sensor values	Existing	Moderate	No Changes	Moderate	>10 to 30%	ORANGE	Some changes occurs
5	automatic ON/OFF	New	No changes	Adding component	Low	>10 to 30%	GREEN	Some changes occurs
NFT - Detailed Test Plan								
S.No	Project Overview	NFT Test approach	Approvals/SignOff	Assumptions/Dependencies/Risks				
1	Python script	Python coding	https://www.python.org/pip/#sponsors@heroku	Depend on the delivered code				
2	Node Red	Sensor & command values	https://node-red-bv1oz-2022-11-10.eu-gb.mybluemix.net/#/flows	Sensor values				
3	MIT Inventor	Light/Sprinkler/Sensors notification	http://a2-appinventor.mit.edu/#5253021333053632	Notifications				
End Of Test Report								
S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Identified Defects (Detected/Closed/Open)	Recommendations	Approvals/SignOff
1	Python Code	Python coding	Met	Pass	GO	Closed	Efficient code	https://www.python.org/pip/#sponsors@heroku
2	Node Red	Sensors&command values	Met	Pass	GO	Closed	Sensing the values perfectly	https://node-red-bv1oz-2022-11-10.eu-gb.mybluemix.net/#/flows
3	MIT APP Inventor	Light/Sprinkler/Sensors notification	Met	Pass	GO	Closed	Notifies the users at correct time	http://a2-appinventor.mit.edu/#5253021333053632

10. ADVANTAGES AND DISADVANTAGES

Advantages:

- Detect the concentration of the gases
- The sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises.
- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Supervise gas concentration levels
- Ensure worker's health
- Real-time updates about leakages
- Cost-effective installation
- Data analytics for improved decisions
- Measure oxygen level accuracy
- Get immediate gas leak alert

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.

11. CONCLUSION

Gas leakage leads to severe accidents resulting in material losses and human injuries. Gas leakage occurs due to poor maintenance of equipment and inadequate awareness of the people. Hence, gas leakage detection is essential to prevent accidents and to save human lives. This paper presented LPG leakage detection and alert system. This system triggers buzzer and notification to alert people when gas leakage is detected.

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. This system can be implemented in Industries, Hotels and wherever the gas 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 naive 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. Several medical equipment requires gas cylinders.

12. APPENDIX

Source Code:

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(6, 7, 8, 9, 10, 11);
float gasPin = A0;
float gasLevel;
int ledPin = 2;
int buttonPin = 3;
int buzzPin = 4;
int buttonState;
int fan = 5;

void setup(){
  pinMode(ledPin, OUTPUT);
  pinMode(buttonPin, INPUT);
  pinMode(gasPin, INPUT);
  pinMode(fan, OUTPUT);
  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.setCursor(0,0);
```

```

    lcd.print(" Welcome");
    lcd.setCursor(0,2);
    lcd.print("PNT2022TMID51246");
    delay(500);
    lcd.clear();
}

void loop(){
    // Read the value from gas sensor and button
    gasLevel = analogRead(gasPin);
    buttonState = digitalRead(buttonPin);

    // call the function for gas detection and button work
    gasDetected(gasLevel);
    buzzer(gasLevel);
    exhaustFanOn(buttonState);
}

// Gas Leakage Detection & Automatic Alarm and Fan ON
void gasDetected(float gasLevel){
    if(gasLevel >= 200){
        digitalWrite(buzzPin,HIGH);
        digitalWrite(ledPin,HIGH);
        digitalWrite(fan,HIGH);
        lcd.setCursor(0,0);
        lcd.print("GAS:");
        lcd.print(gasLevel);
        lcd.setCursor(0,2);
        lcd.print("FAN ON");
        delay(1000);
        lcd.clear();
    }else{
        digitalWrite(ledPin,LOW);
        digitalWrite(buzzPin,LOW);
        digitalWrite(fan,LOW);
        lcd.setCursor(0,0);
        lcd.print("GAS:");
        lcd.print(gasLevel);
        lcd.setCursor(0,2);
        lcd.print("FAN OFF");
        delay(100);
    }
}

```

```

    lcd.clear();
  }
}
//BUZZER
void buzzer(float gasLevel){
if(gasLevel>=200)
{
  for(int i=0; i<=30; i=i+10)
  {
    tone(4,i);
    delay(400);
    noTone(4);
    delay(400);
  }
}
}
// Manually Exhaust FAN ON
void exhaustFanOn(int buttonState){
  if(buttonState == HIGH){
    digitalWrite(fan,HIGH);
    lcd.setCursor(0,0);
    lcd.print("Button State:");
    lcd.print(buttonState);
    lcd.setCursor(0,2);
    lcd.print("FAN ON");
    delay(10000);
    lcd.clear();
  }
}
}

```

GitHub and Project Demo Link:

Github Link -

<https://github.com/IBM-EPBL/IBM-Project-21805-1659791852>

Project Demo Link -

https://drive.google.com/file/d/18hoo_3UpG2tG258dYIs9WV4BMwS9JF6s/view?usp=drivesdk