

TEAM ID	PNT2022TMID06422
TOPIC	GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES
BATCH MEMBERS	Team Leader : Gowtham S (19106016) Team member : Gideon Durai P (19106012) Team member : Hari Krishnan S (19106017) Team member : Jayabal V (19106018)

ABSTRACT

Gas leakages resulting into fatal inferno has become a serious problem in household and other areas where household gas is handled and used. Gas leakage leads to various accidents resulting in financial loss as well as human injuries and loss. work aims at designing a system that detects gas leakage and alerts these describer through alarm and status display besides turning off the gas supply valve as a primary safety measure. The shutting off of the supply valve stops further gas flow to the cooker to prevent. The system more like a first Aid, automatically uses a normally closed solenoid valve for the shutting off of the gas valve before calling for help via visual display and audible alarm to those within the environment. **Team ID:**

Project Name:

BATCH MEMBERS:

The system is an intelligent system, as it does not create nuisance by continuously sounding alarm but the alarm stops beeping once the concentration of the gas in the atmosphere after leakage goes below the set point and opens the valve again for operations. This work will minimize losses occasioned by explosions due to gas leakages and improve safety of life. Gas leakage is a major problem with industrial sector, gas powered vehicles like CNG, LPG cars. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places.

LIST OF ABBREVIATIONS

ARM	Advanced RISC Machine
BSS	Base Station Subsystem
CNG	Compressed Natural Gas
FDN	Fixed Dailing Number
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
ISDN	Integrated Service Digital Network

IDE	I ntegrated D evelopment E nvironment
LCD	L iquid C rystal D isplay
LPG	L iquefied P etroleum G as
MS	T he M obile S tation
NSS	N etwork and S witching S ubsystem
RISC	R educed I nstruction S et N umber
SIM	S ubscriber I dentify M odule C ard
SMS	S hort M essage S ervice
TDMA	T he T ime D ivision M ultiple A ccess

1. INTRODUCTION

The use of liquefied petroleum gas (LPG) is rapidly increasing in developing countries like Nigeria, India, Bangladesh, Nepal, South Africa as It produces low smoke and less soot. The LPG is a flammable mixture of hydrocarbon gases like propane and but Gas pipelines are safe but they are prone to gas leakage due to mishandling, accidents and over filling of the gas cylinder. Explosions resulting from domestic cooking gas leakage can be fatal causing loss of property and injuries or even deaths.

A number of research papers have been published on gas to leakage security system in which gas sensors are used to detect gas leakage and a response circuit is caused to initiate an alert procedure and/or take action to avert an incident. One such method detects

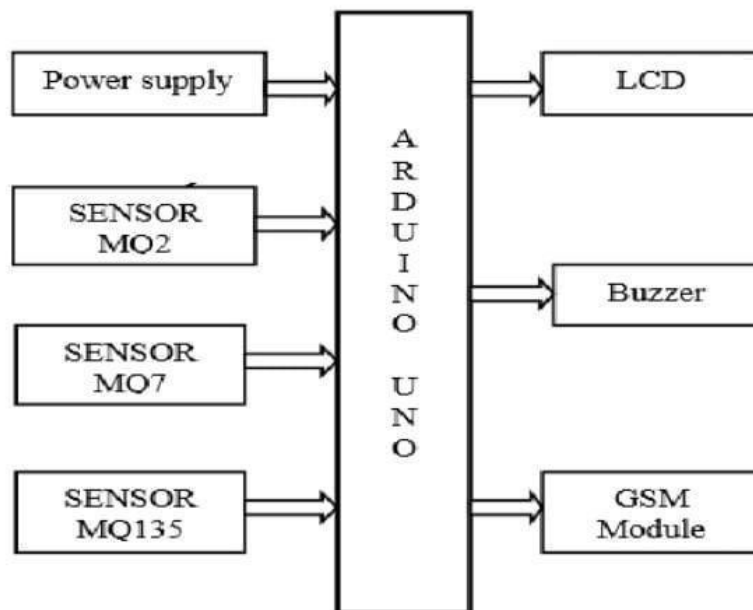
gas leakage and sends SMS to the householder. This does not make provision for halting further gas leakage. Another method not only detects gas leakage but also beep and turns off main power and gas supplies, and send an SMS. GSM module is used which alert the user by sending an SMS. This has broader focus beyond kitchen gas leakages. Another approach uses a smart security phone attached gas leakage sensor that senses leakage and sounds an alert alarm as well as sending a SMS to the home owner and emergency services.

1.1 PROPOSED METHOD

The gas leakage detection and alerting system. Arduino UNO (Atmega-328) the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. The detection results displayed on LCD. Indicates the people of danger in work place, factory, home. Buzzer activity with beep(siren) sound is made. Also send alert SMS to the in charge of the plant whose number is saved in SIM card by using GSM modem.

The SMS received depends upon the leak of gas in the detection area of the sensor.

1.2 PURPOSE



Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. A methodology does not set out to provide solutions—it is therefore, not the same as a method. Instead, a methodology offers the theoretical underpinning for understanding which method, set of methods, or best practices can be applied to a specific case. Through a methodology, we are achieving the knowledge about planning, design, and implementation and testing.

2. PROBLEM SLOVING

2.1 EXISTING PROBLEM

There are different classes of leakage detection which have been used to monitor the leakage, several criteria are classified into their classification, some of which are critical principles and abilities needed from humans. The detection is classified into three, which are automated detection, manual detection, and semi-automated detection. Automated Detection involves monitoring of detecting leakage without the help of the operator, once the detector device is installed and been connected to the display of the personnel in charge and can be automatically shut down from the display unit. (SCADA); Manual Detection - These are methods in which the device can only be operated by humans. Like thermal imager or light detection and ranging (Lidar)

devices; Semi- automated detection– solutions that necessitate a certain amount of input or assistance in carrying out certain tasks (e.g. statistical or digital signal processing methods). The technology used in leakages detection can be classified into two categories which are, Direct method and the Indirect method The direct method is making use of a handheld detector by the patrol team along the pipeline and in the aspect of the very long pipeline, the airplane mounted optical imaging device is used along the pipeline for measuring gas emanation for fast result

2.2 REFERENCE

- [1] Shrivastava, A., Prabhaker, R., Kumar, R., & Verma, R. GSM based gas leakage detection system. International Journal of Emerging Trends in Electrical and Electronics (IJETEE-ISSN: 2320-9569), 2013; 3(2):42-45.
- [2] Hema, L. K., Murugan, D., & Chitra, M. WSN based Smart system for detection of LPG and Combustible gases. In National Conf. on Architecture, Software systems and Green computing-2013.
- [3] Ramya, V., & Palaniappan, B. Embedded system for Hazardous Gas detection and Alerting. International Journal of Distributed and Parallel Systems (IJDPS), 2012; 3(3):287-300.
- [4] Priya, P. D., & Rao, C. T. Hazardous Gas Pipeline Leakage Detection Based on Wireless Technology. International Journal of Professional Engineering Studies, India, 2014; 2(1).
- [5] Jero, S. E., & Ganesh, A. B. 2011, March. PIC18LF4620 based customizable wireless sensor node to detect hazardous gas pipeline leakage. In 2011 International Conference on Emerging Trends in Electrical and Computer Technology (pp. 563-566). IEEE.
- [6] Anusha, O., & Rajendra prasad, C. H. Experimental investigation on road safety system at crossings. International Journal of Engineering and Advanced Technology, 2019; 8(2):214–218

2.3 PROBLEM STATEMENT DEFINITION

This technique has been tested by leak of gas almost about sensors, MQ2 gas sensor sends the signal to the Arduino UNO after detecting the gas Leakage. Arduino to other externally connected device such as LCD, buzzer and GSM send vigorous signals. SMS is sent by GSM module to the provided mobile number as a result. In practice, results for are noticed by the people surrounding by the area are displayed in the LCD and buzzer sound indicate the danger to the people by making beep sound.

3. PREREQUISITES

3.1 CLOUD SERVICES

IBM Watson IoT Platform connects devices, ingests device data and transforms that data into meaningful insights. Watson IoT Platform and its additional add on services enable Clients to capture data for devices, equipment, and machines, to explore this data, and to discover insights on this data that drive better decision making. Watson IoT Platform provides a pre graded foundation for industry solution and Client applications built on IoT data. IBM Watson IoT Platform is made up of three fundamental services: Connection Service, Analytics Service, and Block chain Service.

All three services have a nonproduction package for proofs of concept and pilot work, as well as a production package for full production deployment. IBM

Watson IoT Platform Connection Service capabilities include:

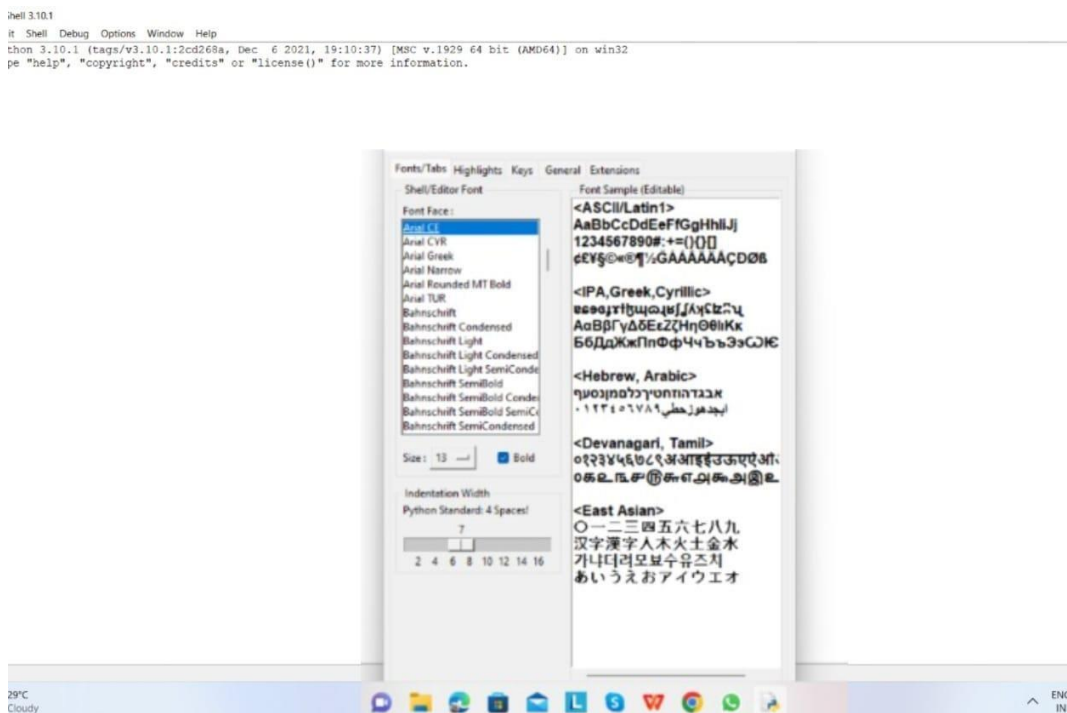
- Connection of a wide spectrum of IoT devices
- IoT device registration and management
- User Registration, setup, and authentication
- Ability to create alerts
- Security with TLS authentication support, access control group for devices & gateways
- Data Lifecycle Management
- Solution administration for deployment and device groupings

Additionally:

- Analytics Service enable to enrich, augment and interact with raw data
- Block chain Service enable to connect with Block chain enabled networks.

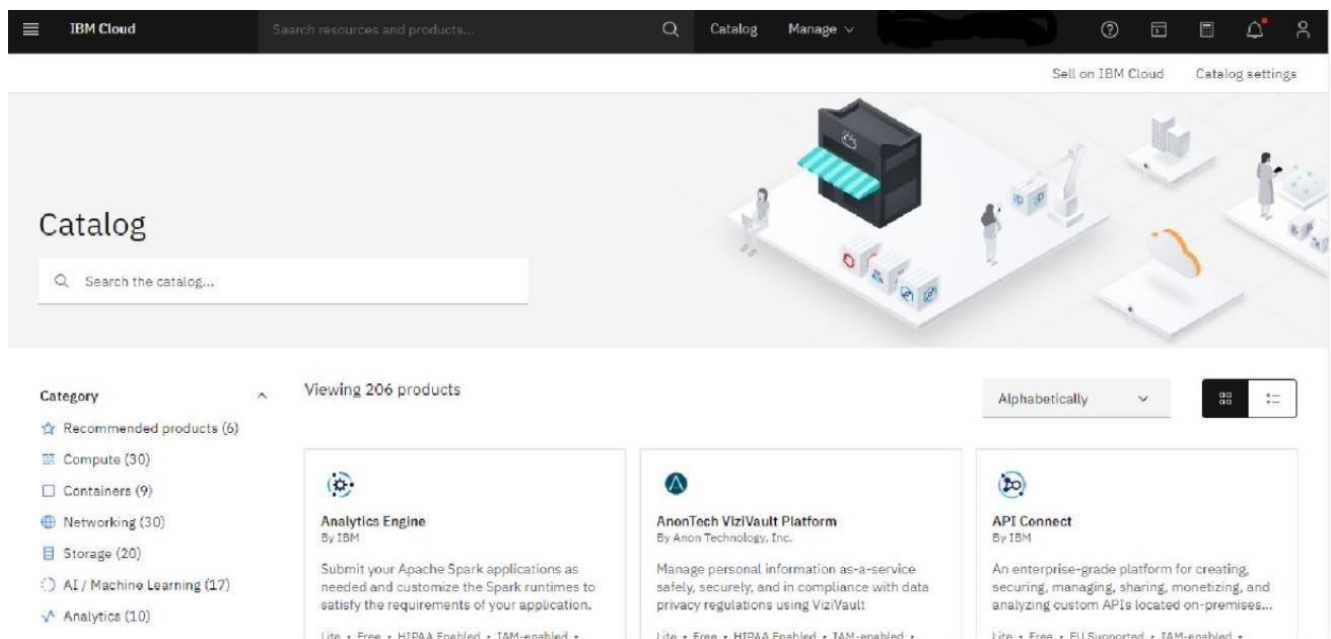
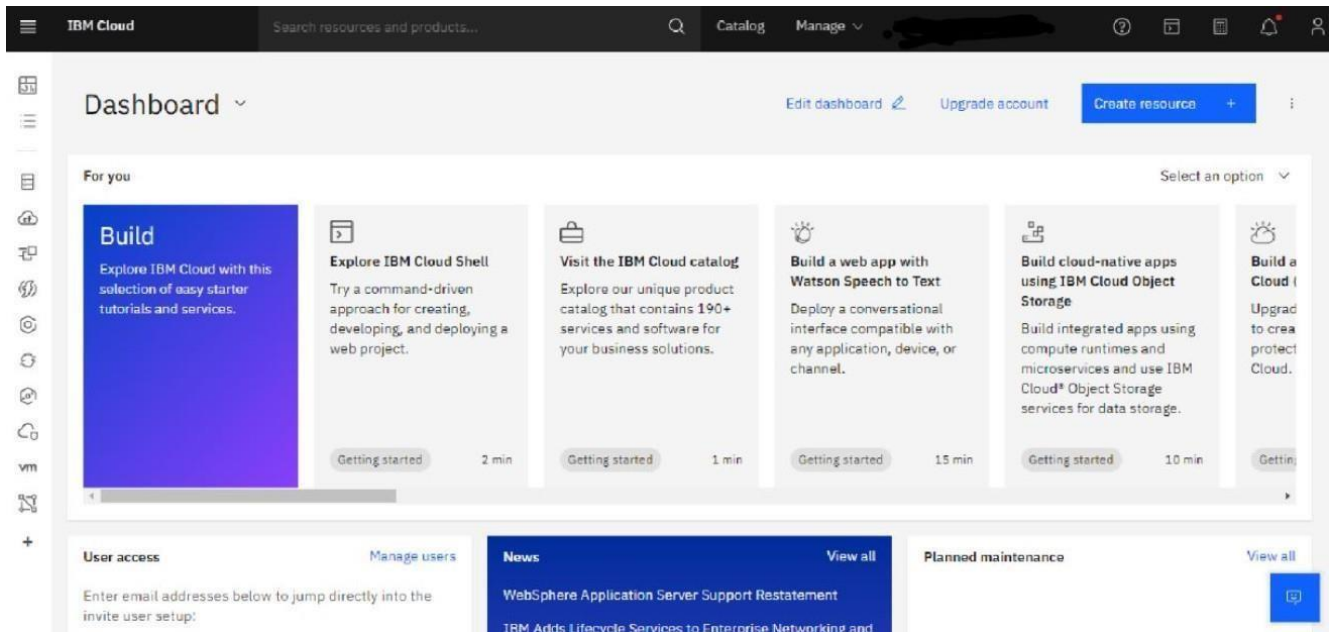
Node-RED Service: NodeRED is a flow base development tool for visual programming developed originally by IBM for wiring together hardware devices, APIs and online services as part of the Internet of Things. Node-RED provides web browser -based flow editor, which can be used to create JavaScript functions. Elements of applications can be saved or shared for re-use. The runtime is built on Node.js. The flows created in Node-RED are stored using JSON. Since version 0.14, MQTT nodes can make properly configured TLS connections.

3.2 SOFTWARE



4. CREATE AND CONFIGURE CLOUD SERVICE

4.1 CREATE IBM WATSONIOT PLATFORM AND DEVICE



Resource list /

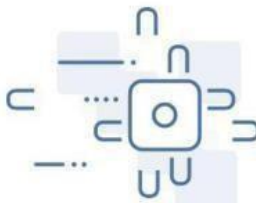
Internet of Things Platform-xl Active Add tags

Details Actions...

Manage

Plan

Connections



Let's get started with IBM Watson IoT Platform

Securely connect, control, and manage devices. Quickly build IoT applications that analyze data from the physical world.

Launch Docs

Ready for the next level?

IBM Watson IoT Platform Journey

✓

Lite

The Lite service plan provides a lightweight development environment to get you started

Non-Production

The Non-Production service plan is a full-featured, fully-integrated offering that enables

Production

The Production service is a fully managed SaaS offering that enables you to manage and analyze

Collect data from

Equipment

and make value from it

Learn More

Cookie Preferences

IBM Watson IoT Platform

130719106304@amartinternz.com
ID: 1hg25o

Your boards Public boards + Create New Board

Sort By

Recently changed

SMART HOME

No cards

Owned by you

USAGE OVERVIEW

3 Cards

Owned by you

RISK AND SECURITY OVERVIEW

4 Cards

Owned by you

Boards shared with you

0 Simulations running

← Back

Device Drilldown - 1234

Device Credentials

Connection Information

Recent Events

State

Device Information

Metadata

Diagnostics

Connection Logs

Device Actions

Device Credentials

You registered your device to the organization. Add these credentials to the device to connect it to the platform. After the device is connected, you can navigate to view connection and event details.

Organization ID	ea7xtp
Device Type	TestDeviceType
Device ID	1234
Authentication Method	use-token-auth
Authentication Token	a181+8uAqrHfNK0xbo4

⚠

Authentication tokens are non-recoverable. If you misplace this token, you will need to re-register the device to generate a new authentication token.

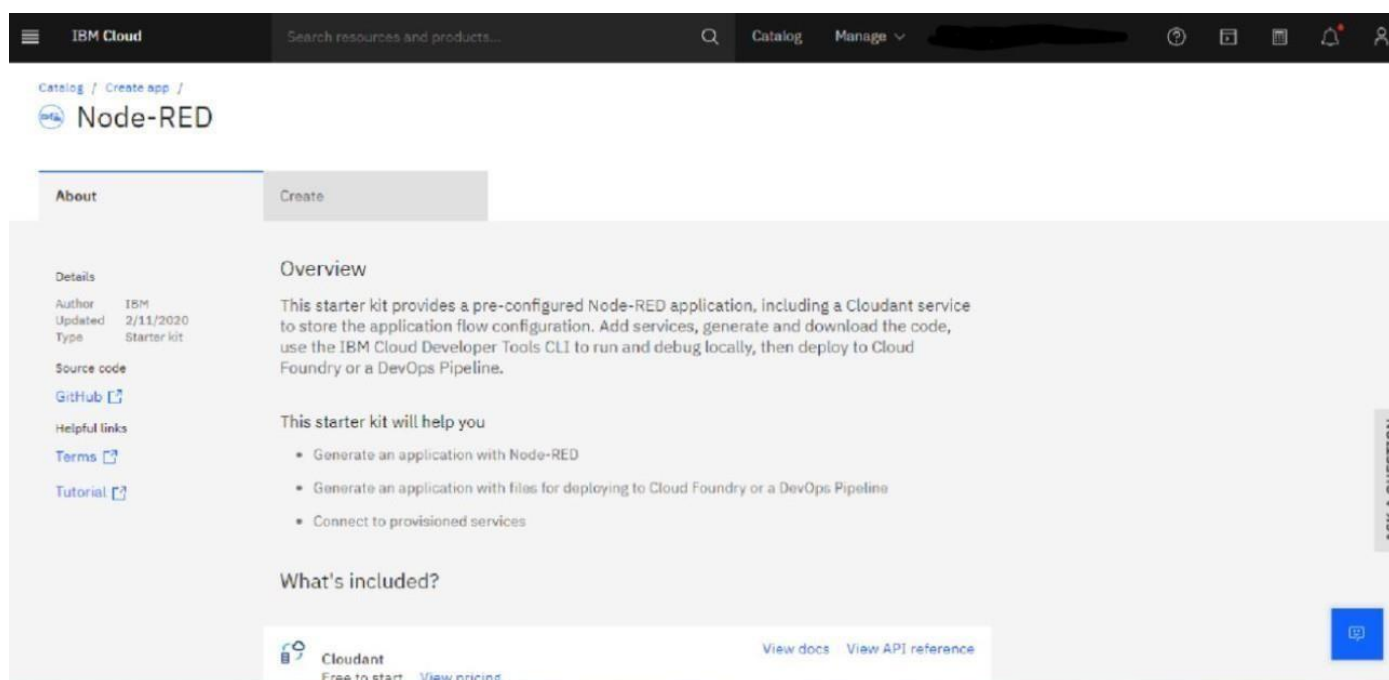
Find out how to add these credentials to your device ↗

[illegible]

4.2 CREATE NODE-RED SERVICE

Steps to be followed

Step 1: Navigated to the App creation page.



Step 2: Entered project details and clicked on create



Accept the default name, or enter a value between 2 and 128 characters.

Resource group

Default



Tags



Examples: env:dev, version-1.

Platform



Node.js

Service details

Cloudant*

* = You have existing instances of this service available to use in this kit. If you wish to use the existing service, select it from the pricing plan menu.

Region

Sydney

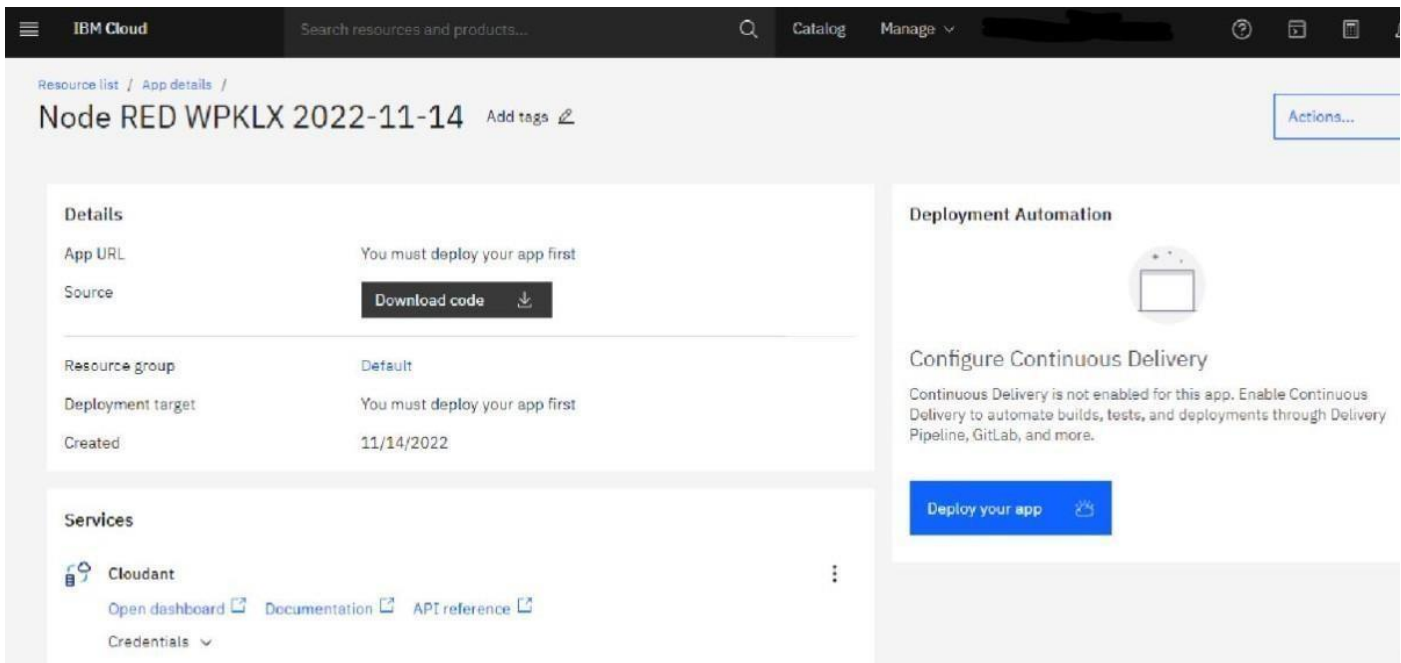


Resource group

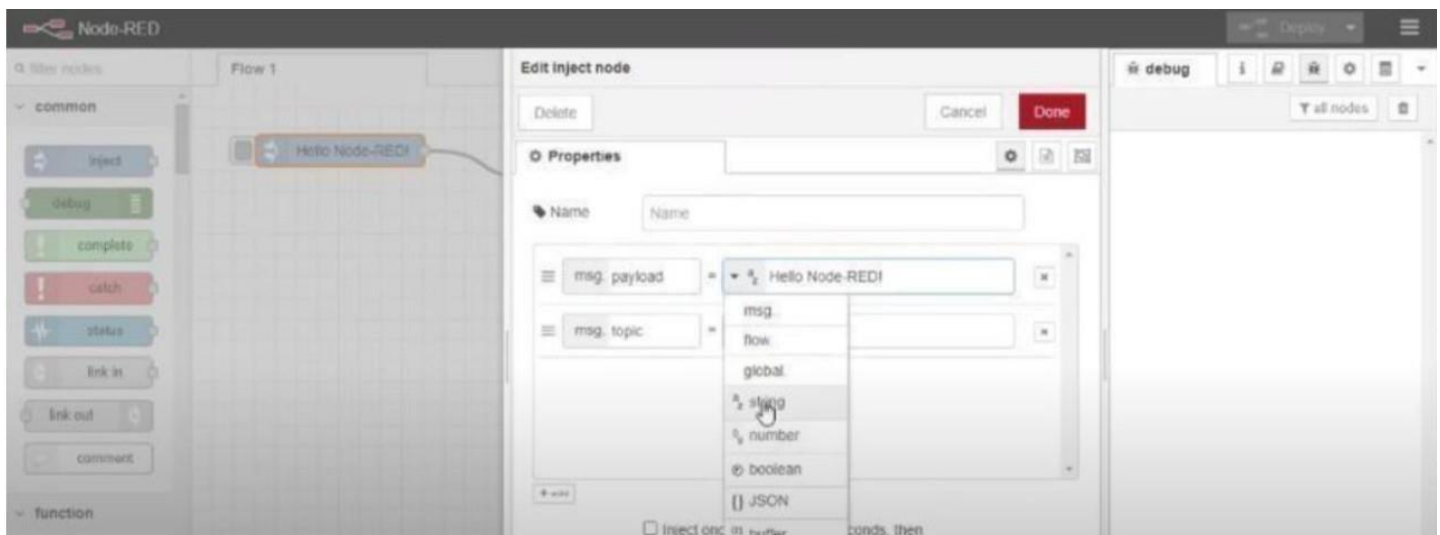
Default



Step 3: Clicking on the “Deploy your App” Button.



Step 4: Setting up the environment and deploying the app.

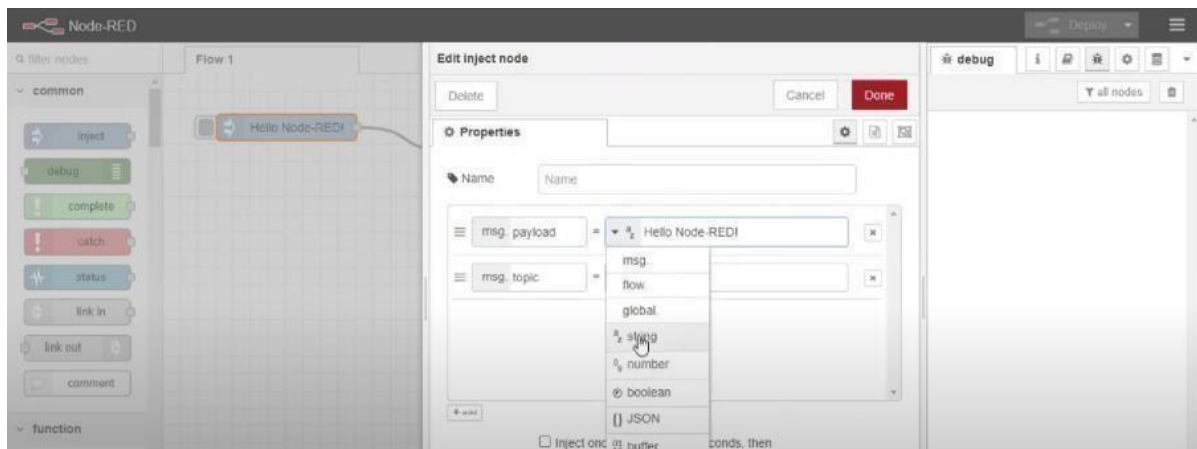


Step 5: Successfully deployed the app.

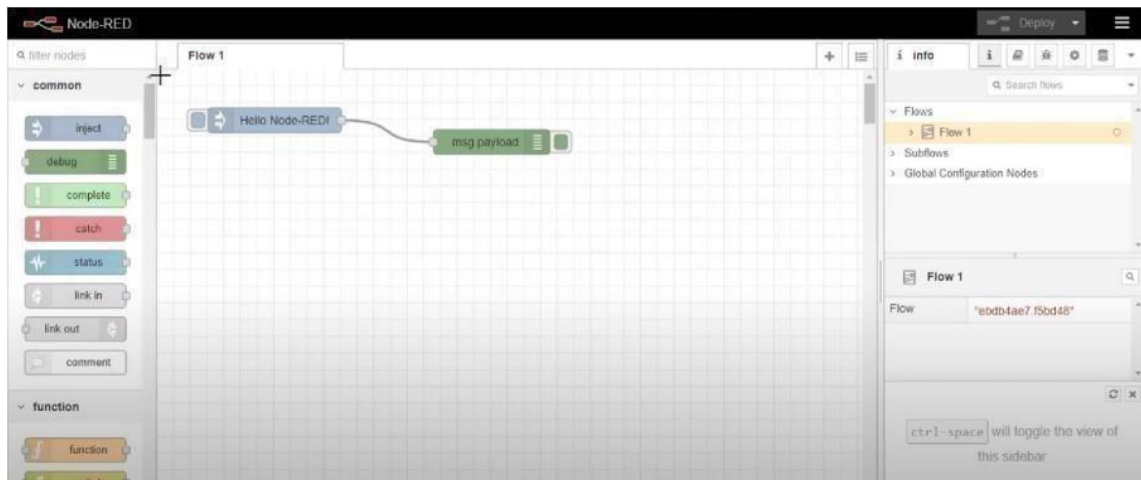
Delivery Pipelines

Name	ci-pipeline
Status	✓ Success
Last input	Last commit by IBM Cloud DevOps Services (7 minutes ago) Clone from zip

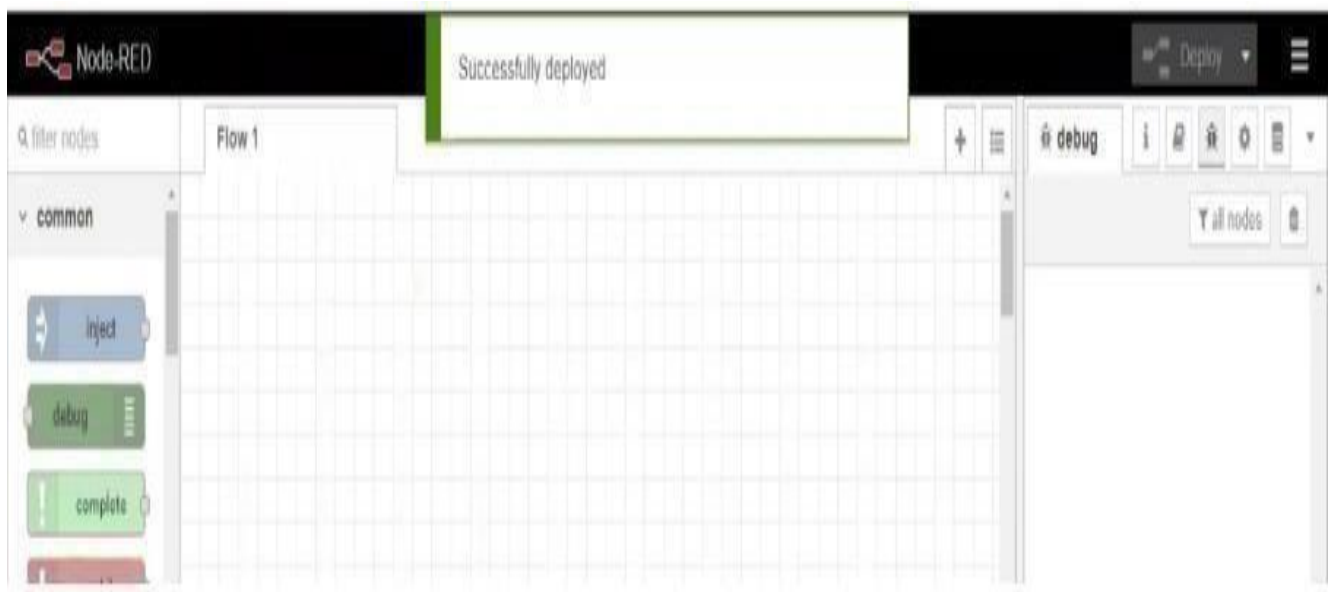
Step 6: Dragged and dropped components into the editor.



Step 7: Editing some values of the properties.



Step 8: Successfully deployed the app.



5. DEVELOP A PYTHON SCRIPT TO PUBLISH AND SUBSCRIBE TO IBM PLATFORM

5.1 PUBLISH DATA TO THE IBM CLOUD

```
#IBM Watson IOT
Platform #pip install
wiotp-sdk import
wiotp.sdk.device import time
import random
myConfig = {
"identity":
{
    "orgId": "yf0dyy ", "typeId":
    "Agassh ",
    "deviceId": "1234
    5"
},
"auth": {
"token": "VJTDPRX@f&4Vuox8ms "
}
}
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()

while
True: gas=random.randint(0,100)

temp=random.randint(0,100) hum=random.randint(0,100)
pre=random.randint(0,100) myData={ 'Hazardous Gas':gas,
'Temperature':temp, 'Humidity':hum,
'Pressure':pre } client.publishEvent(eventId="status", msgFormat="json",
data=myData, qos=0, onPublish=None) print("Published data Successfully:
%s", myData) client.commandCallback = myCommandCallback
time.sleep(2) client.disconnect()

```

5.2 DEVELOP THE PYTHON CODE

```

PYTHON CODE import random print('Random number
=,str(random.randint(0,100)))

print('Temperature=,str(random.randint(0,100)))
print('Humidity=,str(random.randint(0,100)))

```

OUTPUT:

6.2 USE DASHBOARD NODES FOR CREATING UI



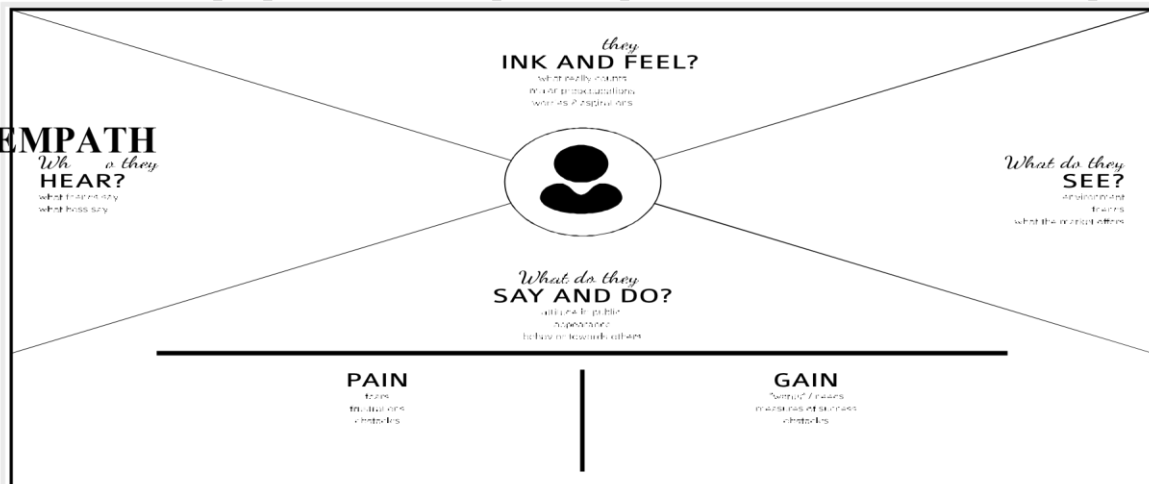
7. IDEATION PHASE

7.1. LITERATURE REVIEW

Microcontroller Based LPG Gas Leakage Detector Using GSM Module, in this system where used gas sensor, GSM module, microcontroller, if the gas concentration is increases the gas sensors will sense the leakage of the gas and then send to the microcontroller. Then the GSM module is connected to the microcontroller which will gives the command to stop the main supply. The system is highly reliable, tamper-proof and secure. In the long run the maintenance cost is efficient. It is highly accurate. (A.sood, B.Sonkar, A.Ranjan, Mr. A.Faisal, June2015)

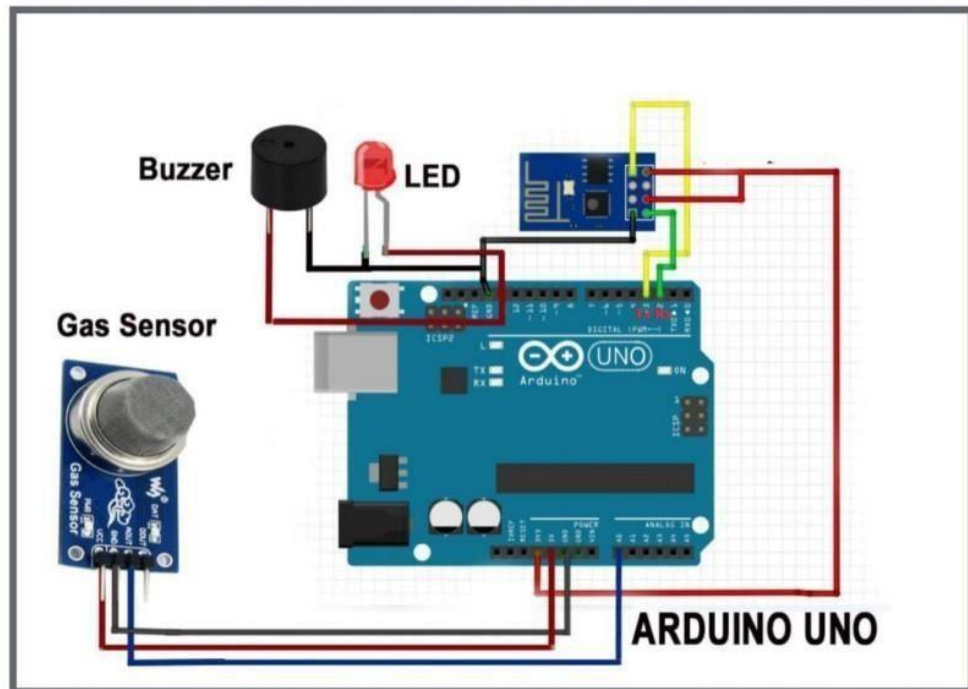
Liquefied Petroleum Gas commonly known as LPG consists of a mixture of Commercial Propane and Commercial Butane having saturated as well as unsaturated hydrocarbons. It is an odorless gas due to which Ethyl Mercaptan is added as powerful odorant so that leakage can easily be detected. LPG is commonly used in homes for heating and cooking. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. LPG was first produced in 1910 by Walter Snelling (Didpaye1, 2015) and is classified as a hazardous material because of its flammable properties and explosive potential when stored under pressure.

7.2 EMPATH



Before the development of electronic

7.3 IDEATION



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

8. PROJECT DESIGN PHASE-1

8.1 PROBLEM SOLUTION

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS <p>It targets industry owners and workers. The main aim is to ensure the safety of workers from gas leakages that may occur in an industry.</p>	6. CUSTOMER CC <p>To make sure that gas does not leak from anywhere, proper and regular maintenance must be done on the equipment. This might be expensive.</p>	5. AVAILABLE SOLUTIONS AS <p>Sensors can be used to detect gas leakage and a buzzer can indicate the same. If there is a gas leakage, GSM module helps us to get appropriate notifications. This might be easier to implement but can be more expensive.</p>	Explore AS, differentiate
Focus on J&P, tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS — <p>Due to certain network or connectivity issues, the reliability of data transfer in the real time system might be affected. The system might not withstand extremely harsh environmental conditions.</p>	9. PROBLEM ROOT CAUSE RC <p>Gas leakage might be caused due to usage of unreliable metal to metal seals or poor tubing during the construction of gas lines.</p>	7. BEHAVIOUR BE <p>Regular inspections can be done to find out areas in which there are gas leakages. Some detection systems can be hardwired to detect leaks. In the case of wireless systems, if there are network issues, the service provider or the helpline can be contacted.</p>	Focus on J&P, tap into BE, understand RC
	3. TRIGGERS TR <p>Reports in the news about the accidents due to gas leakage and concern for the safety of workers might encourage customers to take action.</p>	10. YOUR SOLUTION SL <p>To develop a cost effective IOT based system that can be easily accessed and manipulated by the customers so that gas leakages are detected at the earliest possible time.</p>	8.CHANNELS of BEHAVIOUR CH 8.1 ONLINE <p>The status of the sensor is continuously monitored and notification is received if there is any gas leakage.</p> 8.2 OFFLINE <p>Ensure that proper network and power is supplied to the system for it to work efficiently and prevent any physical damage that might occur to the sensor.</p>	
	4. EMOTIONS: BEFORE / AFTER EM <p>When a problem arises suddenly, the user might feel confused and scared and when the problem is resolved, the user might feel relief and a sense of success.</p>			

8.2 PROPOSED SOLUTION

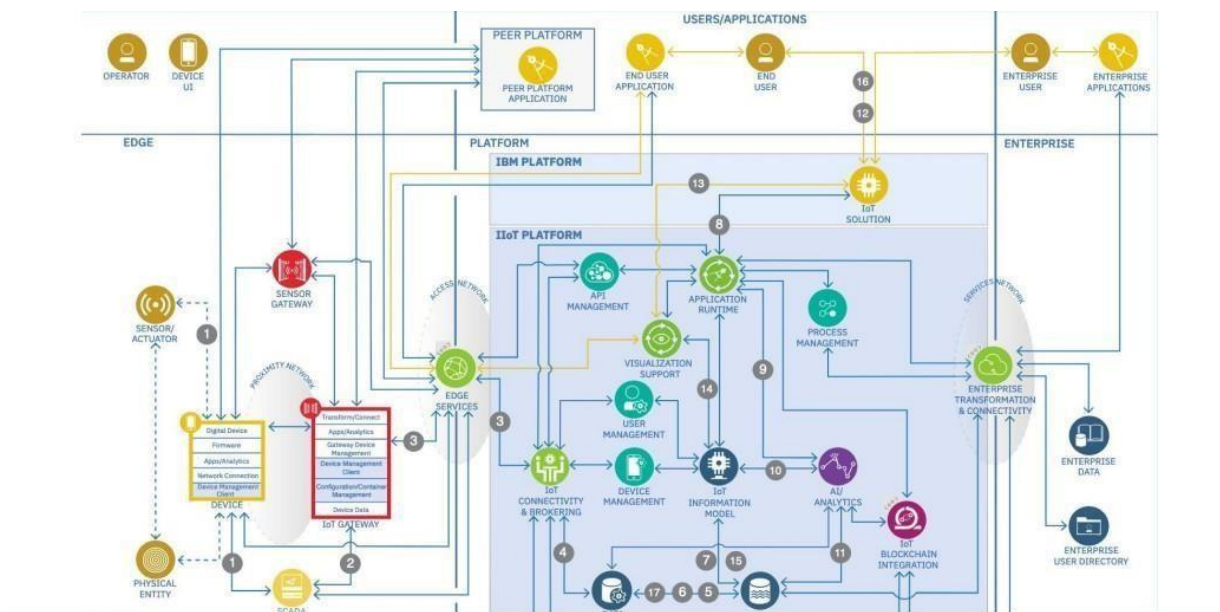
S.NO	Parameter	Description
1	Problem Statement (Problem to be solved)	Gas leakage in industries can be very dangerous as certain gases can be poisonous while others can be explosive. So, system can be designed to monitor, detect and alert the workers in the case of a gas leakage in a timely manner.
2	Idea / Solution description	Gas sensors can be placed at strategic locations in an industry that is prone to accidents due to gas leakage. These sensors can be interfaced with the cloud using a microcontroller. When the level of gas passes a threshold value, the sensor can send an alert via the cloud and also a buzzer can be made to give an alert sound to alert the workers on site. By using GSM module, SMS can also be sent to the required people or helpline. It enables us to monitor gas levels remotely and in real time
3	Novelty / Uniqueness	Here wireless communication system using either Wi-Fi or ZigBee can be used.
4	Social Impact / Customer Satisfaction	Easy to install, lesser cost and reduction in accidents due to gas leakage.
5	Business Model (Revenue Model)	Due to inflammatory or poisonous gases being used in many industries, the rate of accidents and deaths increased. The gas leakage detection model can help prevent accidents so as long as there are workers in industries, this model is a necessity and production will not be stopped.

6

Scalability of the Solution

Even if there is a large volume of gas leakage, the product will sense the accurate value and alert the users. In the case of accident or extreme leakage, the respective authorities or helplines can be notified almost immediately with the fast communication that is provided

8.3 SOLUTION ARCHITECTURE



9. PROJECT DESIGN PHASE 2

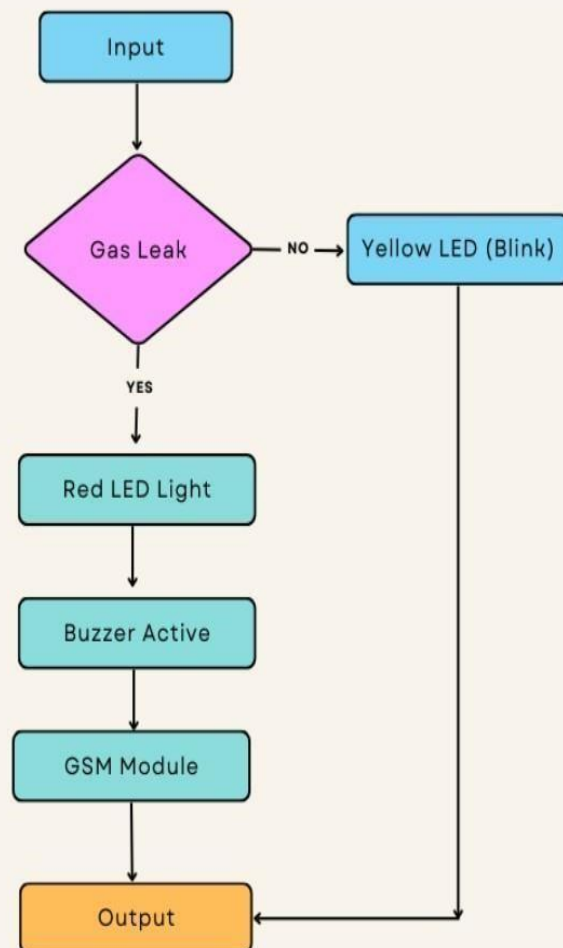
9.1 CUSTOMER JOURNEY

Customer Journey Map

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
OBJECTIVES	Write a goal or activity	Gas leakage detection systems protect personnel and the environment from potentially hazardous exposure to gases.	The system comprises of sensors for detecting gas leak interfaced to microcontroller that will give an alert to user whenever there is a gas leakage, display warning information by using Liquid.	Gas Leak Detection System Gas leak detection is the process of identifying potentially hazardous gas leaks by sensors. These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected.	An alarm management system represents the series of actions a system performs in an event of gas leakage.
NEEDS	Write a need you want to meet	Fire hazard prevention	Harmful gas detection	Oxygen level measurement	Prompt gas leak alerts
FEELINGS	Write an emotion you expect the customer to have	Happy about this solution	Embrassed on the solution and promoted the good wordes towards this project	Happy	Encouraging toeorads this project and giving good feedbacks.
BARRIERS	Write a potential challenge to your objective	Higher Officials	commercial companies	The gasses are toxic in nature, resulting in human unconsciousness and even death if consumed in larger quantities.	Moreover, gaseous blasts are another disaster that everyone - working in a factory or at home - would want to avoid at all costs!

9.2 DATA FLOW DIAGRAM

FLOWCHART : GAS LEAKAGE MONITORING AND ALERTING SYSTEM



9.3 FUNCTIONAL REQUIREMENTS

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 fulfill

9.4 TECNOLOGY ARCHITECTURE



DATA



PROCESSED
DATA



Table-1 : Components & Technologies:

S. N O	Components	Description	Technology
1	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2	Application Logic-1	Logic for a process in the application	Java / Python
3	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
6	Infrastructure (Server / Cloud)	Application Deployment on Cloud	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S. N O	Charateristics	Description	Technology
1	Scalable Architecture	We can implement in Industries, Hotels, Public places	IOT (Internet of Things)

2	Availability	To Detect leakage 24/7 for interrupted services we have implemented in distributed servers (cloud)	IBM cloud
3	Performance	If we implemented in industries, it needs many gas sensors to detect	

10. PROJECT PLANNING PHASE

10.1 MILESTONE AND ACTIVITY LIST

September 2022

- Project Design and Planning (Ideation Phase)
- Project Design and Planning (Project Design Phase 1) ○ Project Design and Planning (Project Design Phase 2)
- Project Design and Planning (Project Planning Phase)

October 2022

- Project Development Phase (Sprint 1)
- Project Development Phase (Sprint 1)
- Project Development Phase (Sprint 1)
- Project Development Phase (Sprint 1)

10.2 SPRINT DELIVERY POINT

1. Identify the Problem
2. Prepare an abstract and Problem Statement
3. List a required Objects needed
4. Create a code and run it
5. Test with a created code and check the designed Prototype
6. Solution for the problem is found

11. PROJECT DEVELOPMENT PHASE

11.1 DELIVERY OF SPRINT 1

```
#include <LiquidCrystal.h> LiquidCrystal lcd(5,6,8,9,10,11);
```

```
Int redled =2;
```

```
Intgreenled=3
```

```
Int buzzer =4;
```

```
Int sensor = A0;
```

```
Int sensorThresh = 400;
```

```
Void setup()
```

```
{
```

```
pinMode(redled, OUTPUT);
```

```
pinMode(greenled,OUTPUT);
```

```
pinMode(buzzer,OUTPUT);
```

```
pinMode(sensor,INPUT);
```

```
Serial.begin(9600); Lcd.begin(16,2);
```

```
}
```

```
Void loop()
```

```
{
```

```
Int analogValue = analogRead(sensor);
```

```
Serial.print(analogValue);
```

```
If(analogValue>sensorThresh)
{
  digitalWrite(redled,HIGH);
  digitalWrite(greenled,LOW);
  tone(buzzer,1000,10000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALERT"); delay(1000);
  lcd.clear(); lcd.setCursor(0,1);
  lcd.print("EVACUATE");
  delay(1000);
}
Else
{
  digitalWrite(greenled,HIGH)
; digitalWrite(redled,LOW);
  noTone(buzzer); lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("SAFE");
  delay(1000); lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALL CLEAR");
  delay(1000);
}
}
```

11.2 DELIVERY OF SPRINT 2 #include <LiquidCrystal.h> LiquidCrystal

```
lcd(5,6,8,9,10,11); Int redled = 2;
```

```
Int greenled = 3;
```

```
Int buzzer = 4; Int
```

```
sensor = A0;
```

```
Int sensorThresh = 400;
```

```
delay(1000); lcd.clear();
```

```
lcd.setCursor(0,1);
```

```
lcd.print("EVACUE");
```

```
delay(1000);
```

```
}
```

```
Else
```

```
{
```

```
digitalWrite(greenled,HIGH)
```

```
; digitalWrite(redled,);
```

```
noTone(buzzer); lcd.clear();
```

```
lcd.setCursor(0,0);
```

```
lcd.print("SAFE");
```

```
delay(1000); lcd.clear();
```

```
lcd.setCursor(0,1);
```

```
lcd.print("ALL
```

```
CLEAR");
```

```
delay(1000);
```

```
}
```

```
}
```

11.3 DELIVERY OF SPRINT 3

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup()
{
  pinMode(redled, OUTPUT);
  pinMode(greenled, OUTPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(sensor, INPUT);
  Serial.begin(9600); lcd.begin(16, 2);
}

void loop()
{
  int analogValue = analogRead(sensor);
  Serial.print(analogValue);

  if (analogValue > sensorThresh)

  { digitalWrite(redled, HIGH);
    digitalWrite(greenled, LOW);
    ; tone(buzzer, 1000, 100);
```



```

lcd.setCursor(0,1);
lcd.print("ALERT");
delay(1000); lcd.clear();
lcd.setCursor(0,1);
lcd.print("EVACUE");
delay(1000);

}
Else
{
  digitalWrite(greenled,HIGH)
  ; digitalWrite(redled,);
  noTone(buzzer); lcd.clear();
  lcd.setCursor(0,0)
  ;
  lcd.print("SAFE")
  ; delay(1000);
  lcd.clear();
  lcd.setCursor(0,1)
  ; lcd.print("ALL
  CLEAR");
  delay(1000);

}

```

```
}
```

11.4 DELIVERY OF SPRINT 4

```
#include <LiquidCrystal.h> LiquidCrystal
```

```
lcd(5,6,8,9,10,11); Int redled = 2;
```

```
Int greenled = 3;
```

```
Int buzzer =
```

```
4; Int sensor
```

```
= A0;
```

```
Int sensorThresh = 400;
```

```
delay(1000); lcd.clear();
```

```
lcd.setCursor(0,1);
```

```
lcd.print("EVACUE");
```

```
delay(1000);
```

```
}
```

```
Else
```

```
{
```

```
digitalWrite(greenled,HIGH);
```

```
digitalWrite(redled,);
```

```
    noTone(buzzer);  
    lcd.clear();  
    lcd.setCursor(0,0)  
    ;  
    lcd.print("SAFE")  
    ; delay(1000);  
    lcd.clear();  
    lcd.setCursor(0,1)  
    ; lcd.print("ALL  
    CLEAR");  
    delay(1000);  
    }  
}
```

