PROJECT REPORT

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Project Title	Gas Leakage Monitoring And Alerting System For Industries

GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

Abstract:

The Internet of Things aims to simplify life by automating all of the little tasks that we encounter. As much as IoT aids in task automation, its advantages can also be extended to improve current safety requirements. IoT has not been immune to the fundamental worry of any project, safety. Gas leaks can be fatal and harmful, whether they occur in open or closed spaces. Despite their high level of precision, conventional gas leak detection systems overlook a few important aspects in warning the public of a leak. In order to create a Gas Leakage Detector for society that has Smart Alerting Techniques that involve text messaging the appropriate authority, we used the Internet of Things (IoT) technology.

1. Introduction:

The Internet of Things aims to simplify life by automating all of the little tasks that we encounter. As much as IoT aids in task automation, its advantages can also be extended to improve current safety requirements. Safety has always been a top consideration when planning a home, a building, an industry, or a city.

It can be exceedingly dangerous for some gases to be present in the environment at higher concentrations. These gases may be hazardous after surpassing the stated concentration limits, combustible under specific temperature and humidity circumstances, or even contribute to local air pollution issues like smog and poor visibility, which can lead to serious accidents and have a negative impact on people's health.

The majority of civilizations have fire safety measures. But it can be used even after a fire has started. We developed a system using sensors that can detect gases like LPG, CO2, CO, and CH4 in order to have control over such situations. This device will be able to identify gas leaks and inform users via loud alarms as well.

This device can alert the user if there are excessive amounts of dangerous gases present in the surroundings. System can send a message to society administrators informing them of the situation before an accident occurs.

Gas detector sensors, an Arduino board, an ESP8266, and a cloud server make up the system. All flat member users can be registered on our system by a single society authority person. The administrator of the society can enter information on each flat's users, including their user name, phone number, and flat sensor information. Each sensor's threshold value can be set by society admin. Each flat can be equipped with system hardware.

The value per time can be sensed using sensors. Values can be sent from the system to a cloud server. The sensor values' existence at the threshold value can be checked by the server. The server can instruct the hardware to buzz the alert if the sensor value can exceed the limit. Additionally, the server notifies the user.

2. Literature Survey:

To detect and quantify methane gas in the vicinity of flammable gas stockpile locations, a technology was developed. The instrument measures the quality of the air and water, taking into account every parameter that could deviate due to a gas leak in the water or the air.

While the temperature, pH, and electrical conductivity of the water are being monitored, the sensors measure the amount of CH4 and CO2 gas in the air. An Arduino UNO microcontroller controls the apparatus and sends measurement results to the Raspberry Pi 3's database.There have been several improvements in pipeline leak detection proposed. This comprises infrared thermography, ground penetrating radar, optical fibre sensors, acoustic emission, and vapour sampling.

For data gathering, a system with sensors attached to an Arduino uses LabVIEW as the GUI (graphical user interface).

A thorough list of sensors for flammable, poisonous, and combustible gases has been compared, along with any potential benefits and drawbacks. One such illustration is the SB-95 sensor, which successively monitors variations in the concentrations of methane and carbon monoxide gas and changes its resistance as necessary. Variations in voltage on the load resistor are conveyed together with variations in filament resistivity.

Metal oxide sensors have a lengthy reaction time as well as an even longer recovery period. For the purpose of measuring the gas concentration, these sensors must remove the gas by drilling a hole in the pipe. Making holes could be risky because of leaks.

On the other hand, ultrasonic sensors don't have the aforementioned drawbacks and can measure gas concentration quickly with a low cost and small size.

A thorough investigation has been conducted on the potential health effects of gases such hydrogen sulphide, carbon monoxide, and methane. The operation of the sensor and how optical alarms and buzzers are activated when the sensed values of the SB-95 sensor rise above the threshold are described in detail. The table provides information on the sources and maximum flammable concentrations of hydrocarbons and hydrogen sulphide gas.

Although both forms of gas leaks have frequent sources, hydrocarbon leaks are more prone to explosions because of their shorter range of flammability than hydrogen sulphide. The toxicity of hydrogen sulphide is estimated to be 50 ppm, which can seriously affect people's health and potentially result in death from prolonged exposure.

Conclusion of Literature Survey:

In this study, we employ IOT technologies to raise the bar for current safety regulations. The goal of creating this prototype was to revolutionise environmental safety by eliminating any major or minor hazards brought on by the release of hazardous and dangerous gases into the environment. We created a Gas Leakage Detector for society using IOT technology, and it has the ability to perform data analytics on sensors and Smart Alerting techniques that send text messages to the relevant authorities. Using gas sensors, this system will be able to identify any gases present in the surrounding area. This will shield us from the main detrimental issue.

3. IDEATION REPORT:

Abstract:

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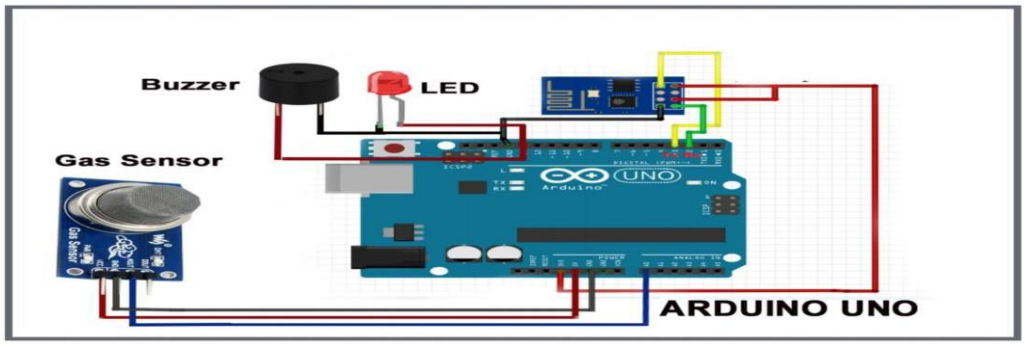

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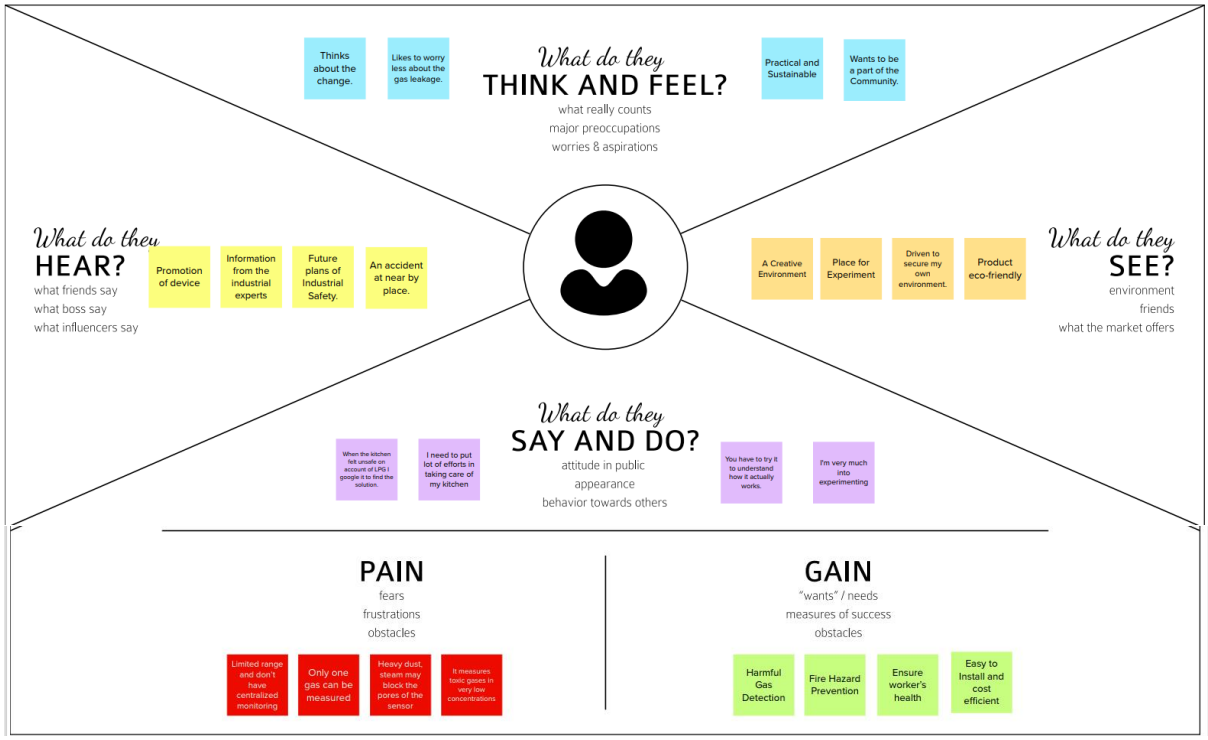
4. EMPATHY MAP:



5. PROPOSED SOLUTION:

1. **Problem Statement (Problem to be solved) :**

   Workers who are engaged with a busy industries packed with gas either harmful or harmless needs a way to monitor their gas pipelines continuously and detect early if there is any leakage of gas in their surroundings so that they can work efficiently on major crises rather than worrying about monitoring or leakage of gas, this will indeed reduce the manpower of that industry and create a peaceful environment.

2. **Idea / Solution description:**

   Real time gas monitors can overcome delayed response times to such gas leaks. Hence, multiple gas monitors can be placed strategically across any potential source for early gas leak detection. Also, mapping of such gas leaks in these industrial zones can help the safety in charge to take timely corrective actions. Hence, by setting appropriate thresholds, various data-driven environmental automation can be implemented for industrial safety.

3. **Novelty / Uniqueness:**

   Even though there are many existing solutions for this problem they failed to satisfy the needs of customer. Some of the solutions are only detecting some particular gases

where some others failed to alert the main department and other solutions are with some delays. Our solution not only notify the industry person but also notify the fire fighters so that can take control over the situation and our solution will alert the workers even there is a small leak of gases.

4. **Social Impact / Customer Satisfaction:**

Our solution will be very helpful for the workers and the society which is associated or located nearby the industries. Our solution will prevent great disasters like Bhopal Gas Tragedy so that so many lives can be saved. Through this project the workers mental pressure will be reduced so that they can concentrate on other works or by relaxing them.

5. **Business Model (Revenue Model):**

The main target of our solution is Industries so we have planned to visit industries and explain them about the benefits of our products. So that they can aware of the importance of this solution and use it.

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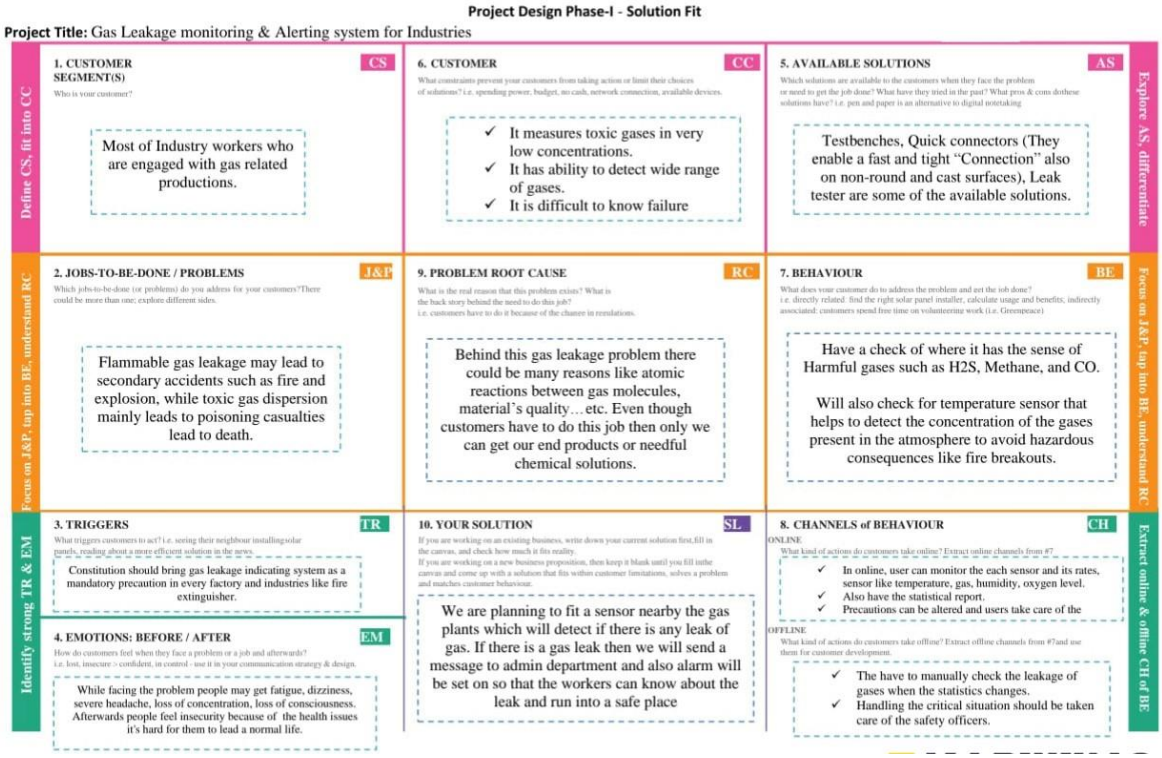
6. **Scalability of the Solution:**

Our solution can be integrated for further future use because the solution we have provided will be lay on the basic or initial stage of any upgraded version.

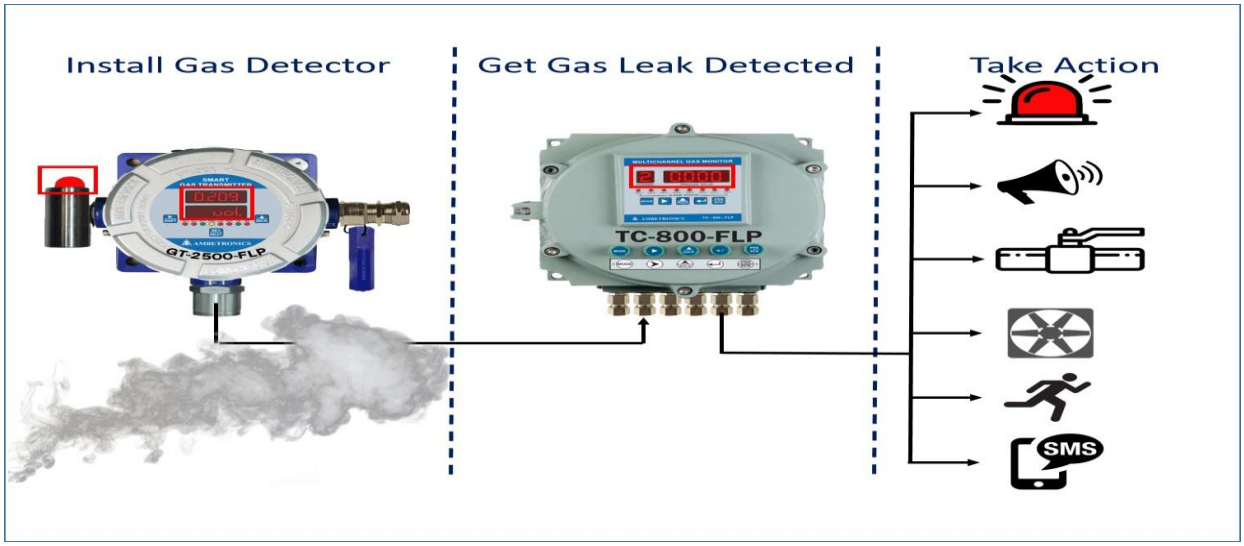
6. PROPOSED SOLUTION FIT:



7. SOLUTION ARCHITECTURE:

To be able to work effectively on major crises rather than worrying about monitoring or gas leaks, workers in busy industries that are packed with gas, whether harmful or harmless, need a way to continuously monitor their gas pipelines and detect early if there is any leakage of gas in their surroundings. This will reduce the manpower of that industry and foster peace.

Solution Statement:



The system might be viewed as a modest attempt to link up the principal gas detection techniques now in use with a mobile platform coupled with IoT platforms. One metre around the rover, the gases are detected, and the sensor output data is continually sent to the nearby server. Stray gases are also detected because MQ sensors' accuracy isn't up to par, which causes some mistake in the sensors' outputs, particularly in the case of methane. Additionally, the storage and availability of hazardous gases like hydrogen sulphide makes it difficult to test the integrated gear. The complexity of system maintenance and material selection for the system in the event of corrosive gases arises from the fact that the system functions outside the pipeline.

8. FUNCTIONAL REQUIREMENTS:

Business 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.

User Requirements:

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.

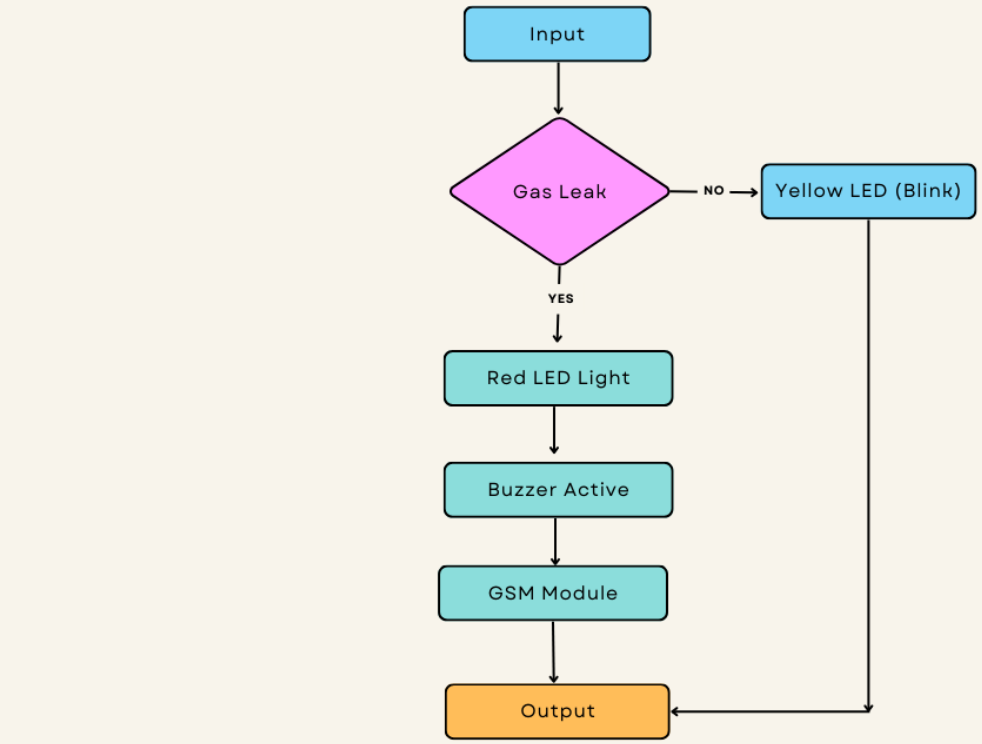
Product Requirements:

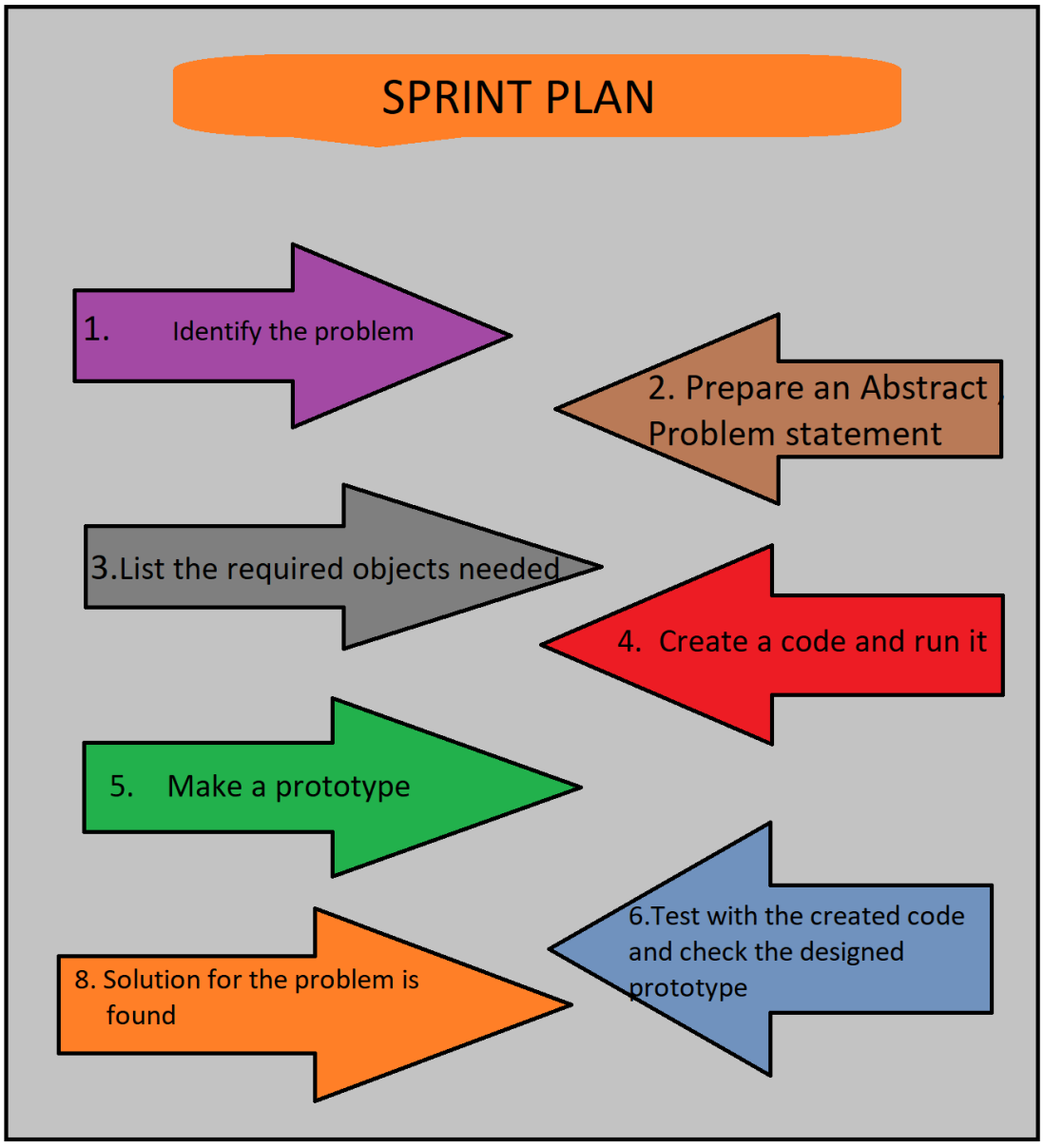
Detecting gases is necessary regardless of your business role or individual purpose. Certain technologies at play make such IoT devices what they are, and if you want to indulge in IoT application development, you must know what they are and what purpose they can fulfill.

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 towords this project	Happy	Encouraging toeords 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!

FLOWCHART : GAS LEAKAGE MONITORING AND ALERTING SYSTEM




SPRINT PLAN
1. Identify the problem
2. Prepare an Abstract Problem statement
3.List the required objects needed
4. Create a code and run it
5. Make a prototype
6.Test with the created code and check the designed prototype
8. Solution for the problem is found

9. PROJECT MILESTONES:

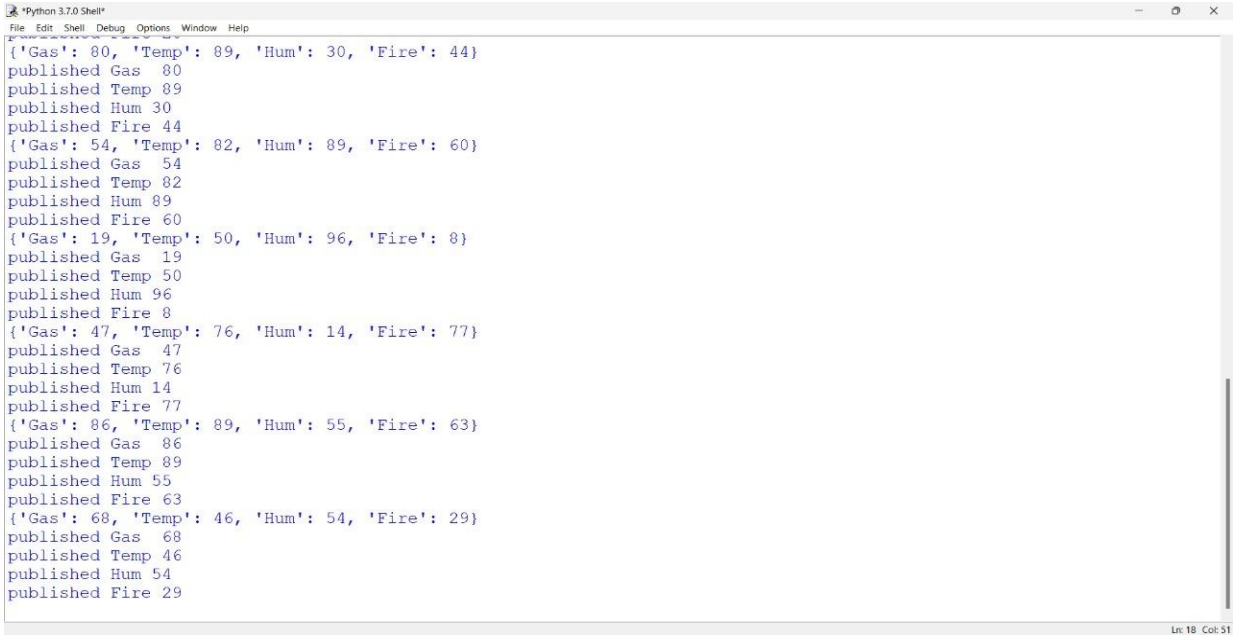
- Prerequisites
  - IBM Cloud Services
  - Software
- Project Objectives
- Create And Configure IBM Cloud Services
  - Create The IBM Watson IoT Platform And A Device
  - Create Node-RED Service
- Develop A Python Script To Publish And Subscribe To IBM IoT Platform
  - Develop The Python Code
  - Publish Data To The IBM Cloud
    - Publish Data To The IBM Cloud
    - Python Code
- Develop A Web Application Using Node-RED Service.
  - Develop The Web Application Using Node-RED
    - Create Node Red Flow To Get Data From Device
  - Use Dashboard Nodes For Creating UI(Web App)
    - UI Nodes Installation
- Ideation Phase
  - Literature Survey On The Selected Project & Information Gathering
  - Prepare Empathy Map
  - Ideation
- Project Design Phase – I
  - Proposed Solution
  - Problem Solution Fit
  - Solution Architecture
- Project Design Phase-II
  - Customer Journey
  - Functional Requirement
  - Data Flow Diagrams
  - Technology Architecture
- Project Planning Phase
  - Prepare Milestone & Activity List
  - Sprint Delivery Plan
- Project Development Phase
  - Project Development - Delivery Of Sprint-1
  - Project Development - Delivery Of Sprint-2
  - Project Development - Delivery Of Sprint-3
  - Project Development - Delivery Of Sprint-4

10. PYTHON CODE:

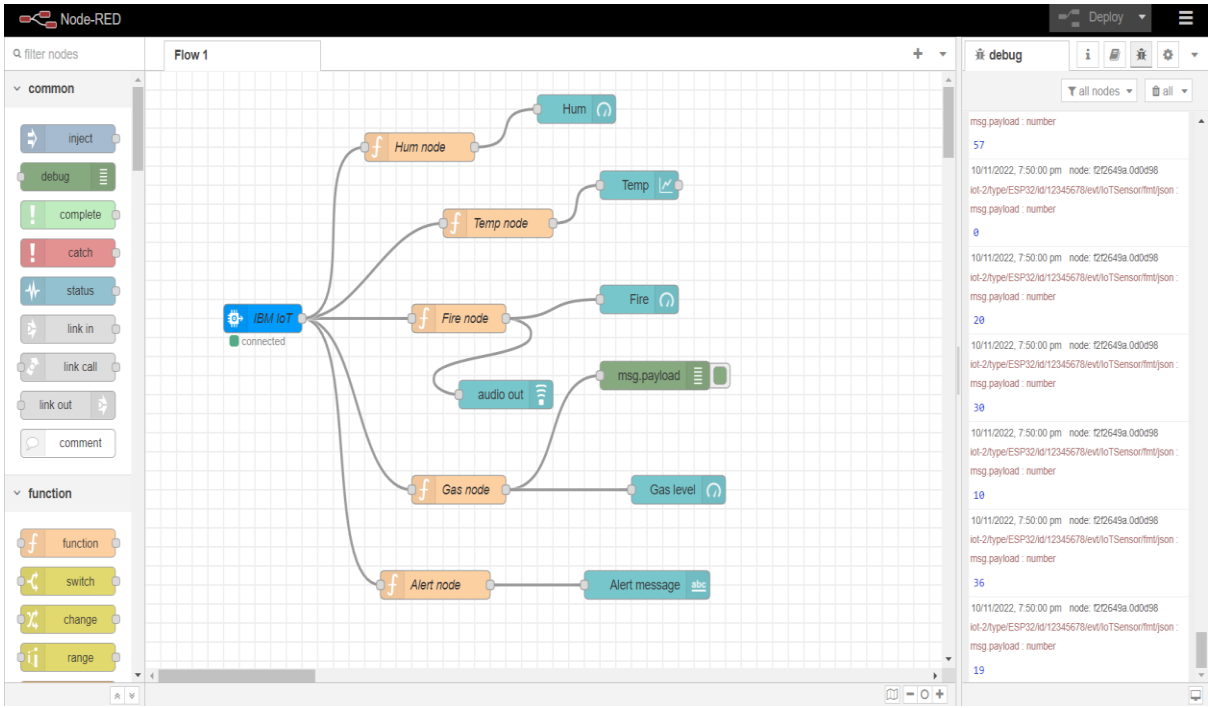
```
import ibmiotf.application

import ibmiotf.device

import time

import random

import sys


#ibm watson device credentials


organization="griwxv"

deviceType="ESP32"

deviceid="12345678"

authMethod="token"

authToken="12345678"


#generate random values for gas leakage



def myCommandCallback(cmd):

   print ("command received: %s" %cmd.data['command'])

   print (cmd)

try:

      deviceOptions={"org": organization,"type": deviceType,"id": deviceid,"auth-
method":authMethod, "auth-token":authToken}

      deviceCli = ibmiotf.device.Client(deviceOptions)


except Exception as e:

      print ("caught exception connecting device %s" %str(e))

      sys.exit()



#connect and sending data for gas leakage
```

```
deviceCli.connect()

while True:
    Gas=random.randint(0,100)
    Temp=random.randint(0,100)
    Hum=random.randint(0,100)
    Fire=random.randint(0,100)
    data={'Gas':Gas,'Temp':Temp,'Hum':Hum,'Fire':Fire}
    print(data)
    def myOnPublishCallBack():
        print("published Gas  %s " %Gas)
        print("published Temp %s " %Temp)
        print("published Hum %s " %Hum)
        print("published Fire %s " %Fire)
    success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,on_publish=myOnPublishCallBack)
    if not success:
        print ("Not connected to IoTF")
    time.sleep(1)

    deviceCli.commandCallback=myCommandCallback


#disconnect the device from the cloud

deviceCli.connect()
```

OUTPUT:



11. DASHBOARD NODES FOR CREATING UI:



12. CONCLUSION:

The goal of creating this prototype was to revolutionize environmental safety by eliminating any major or minor hazards brought on by the release of hazardous and dangerous gases into the environment. We created a Gas Leakage Detector for society using IOT technology, and it has the ability to perform data analytics on sensors and Smart Alerting techniques that send text messages to the relevant authorities. Using gas sensors, this system will be able to identify any gases present in the surrounding area. This will shield us from the main detrimental issue.

The data has been published to the IBM cloud. Thus in the python script, the values for the gas, temperature, humidity and fire have been generated and published to IBM cloud platform. This is achieved by importing the required libraries in the python script and also specifying the organization, deviceType, deviceid, authMethod and authToken to integrate with the specific cloud account, so that the data will be published to IBM cloud platform. A threshold value has been fixed for each module and if any value exceeds this threshold value, then an alert message has been generated.