GAS LEAKAGE MONITORING AND ALERTING SYSTEM

SNS COLLEGE OF TECHNOLOGY, COIMBATORE

PROJECT REPORT

TEAM ID: PNT2022TMID17768

Project Report Format

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GAS LEAKAGE MONITORING AND ALERTING SYSTEM

INTRODUCTION:

Nowadays, home safety detection systems play a significant part in people's security. Since everyone in the household works every day, it is impossible to check on the household 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 applications for these gases include industry, heating, home appliances, and motor fuel. The system has a MQ6 gas sensor to monitor this leakage gas. This sensor detects how much leak gas is there in the environment around it. Explosions or being harmed by gas leaks could be avoided in this way.

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. The system is managed by an Arduino UNO microcontroller, which sends measured data to the Raspberry Pi 3 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 put you in danger by allowing hazardous gas to seep or explode.

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.

PROPOSED SOLUTION:

IDEATION PROPOSED SOLUTION:

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 societies 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 system will be able to identify gas leaks and alert users via audible alarms as well. This system can alert the user if there are excessive amounts of harmful gases present in the environment. System can send a message to society administrators informing them of the situation before an accident occurs.

PROPOSED METHOD:

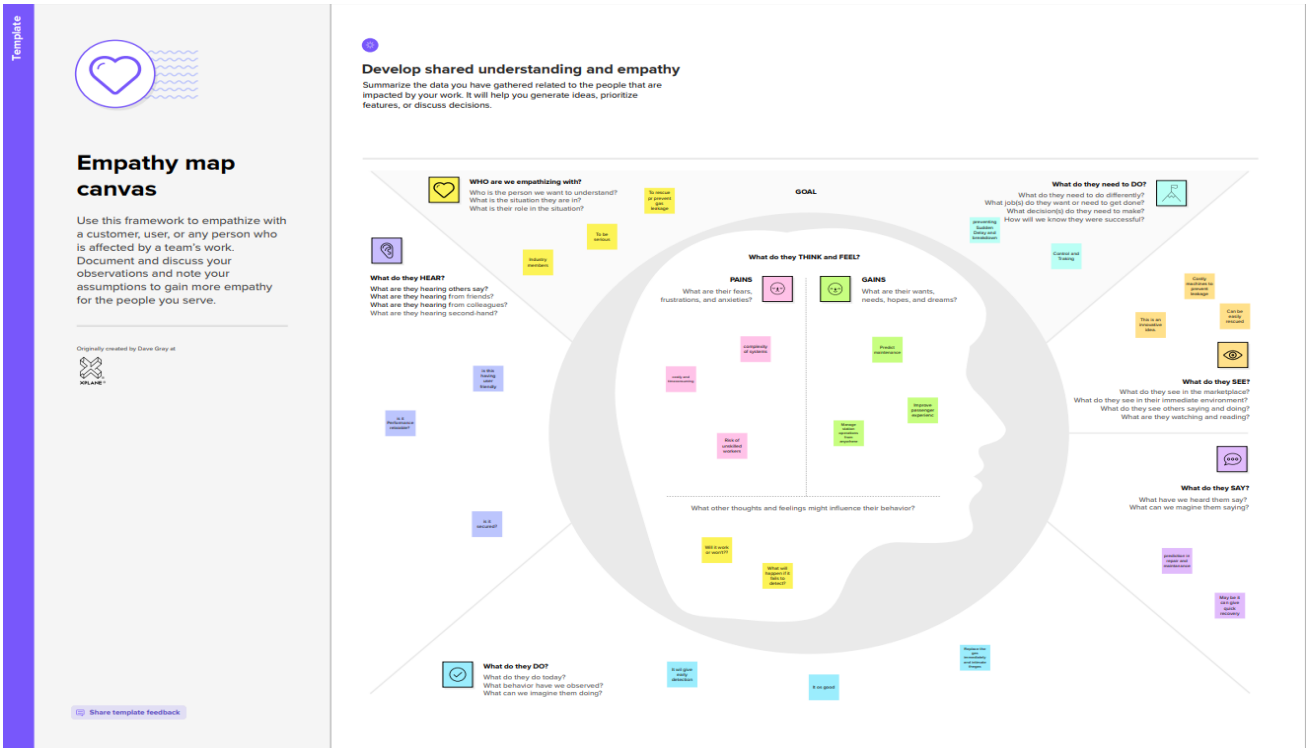
The core component of the system, the Arduino UNO (Atmega-328), carries out the following functions. The output signal of the sensor, which serves as input to Arduino, performs signal conditioning. Results of the detection were shown on LCD. warns individuals of risk at work, in factories, and at home. There is buzzer activity and a beep (siren) sound. Additionally, using a GSM modem, send an alarm SMS to the plant manager whose phone number is saved on the SIM card. The SMS you receive is based on whether there is a gas leak in the sensor's field of detection.

EMPATHY MAP CANVAS:

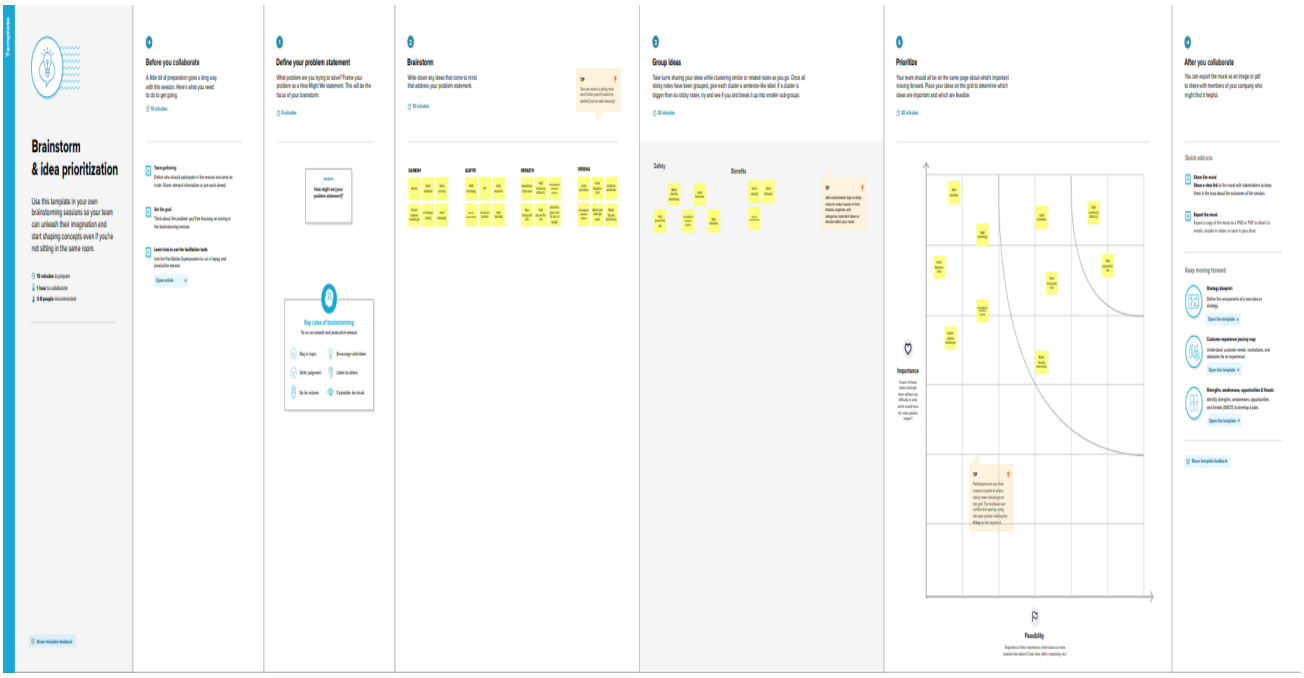
An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

● It is a useful tool to helps teams better understand their users.Creating an effective solution requires understanding the true problem and the person who is experiencing it.

● The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



IDEATION AND BRAINSTORMING:



PROPOSED SOLUTION FIT:

Project Title: Gas Leakage Monitoring & Alerting System For Industries

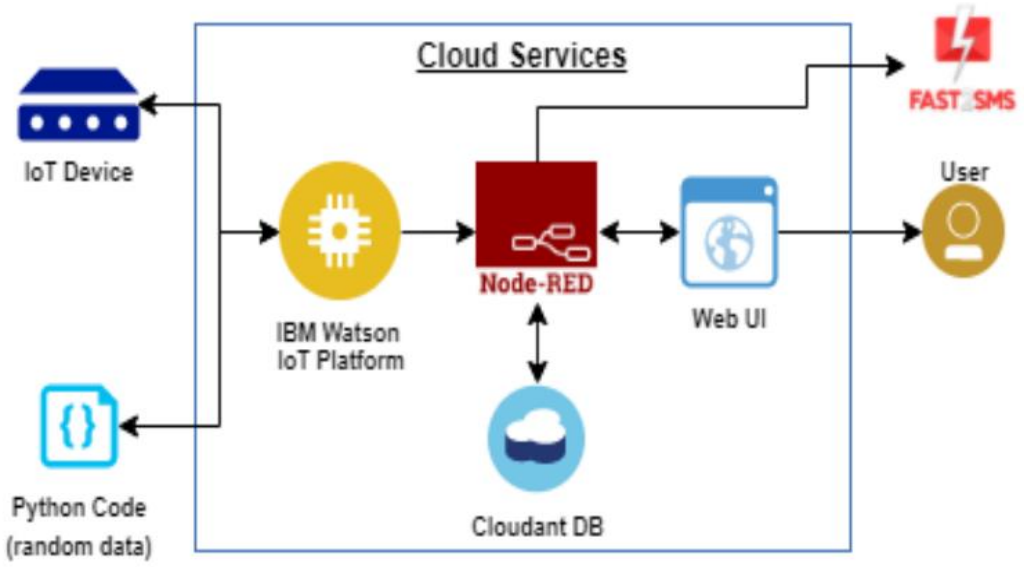
Project Design Phase-I - Solution Fit Template **Team ID:** PNT2022TMID17768

PROPOSED SOLUTION:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To detect the gas in the industry and prevent from making hazardous damages.
2.	Idea / Solution description	To detect the gas in the industry and prevent from making hazardous damages.
3.	Novelty / Uniqueness	Sensor automatically restores the gas and saves the data in IoT cloud.
4.	Social Impact / Customer Satisfaction	Customer feel great about this invention because, huge damage is prevented.
5.	Business Model (Revenue Model)	The cost is very low for manufacturing this product.
6.	Scalability of the Solution	It is more reliable and flexible.

SOLUTION ARCHITECTURE:

The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of 1m radius of the rover and the sensor output data are continuously transferred to the local server. The accuracy of MQ sensors are not upto the mark thus stray gases are also detected which creates an amount of error in the outputs of the sensors, especially in case of methane. Further the availability and storage of toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware. As the system operates outside the pipeline, the complication of system maintenance and material selection of the system in case of corrosive gases isreduced. Thus the system at this stage can only be used as a primary indicator of leakage inside a plant.



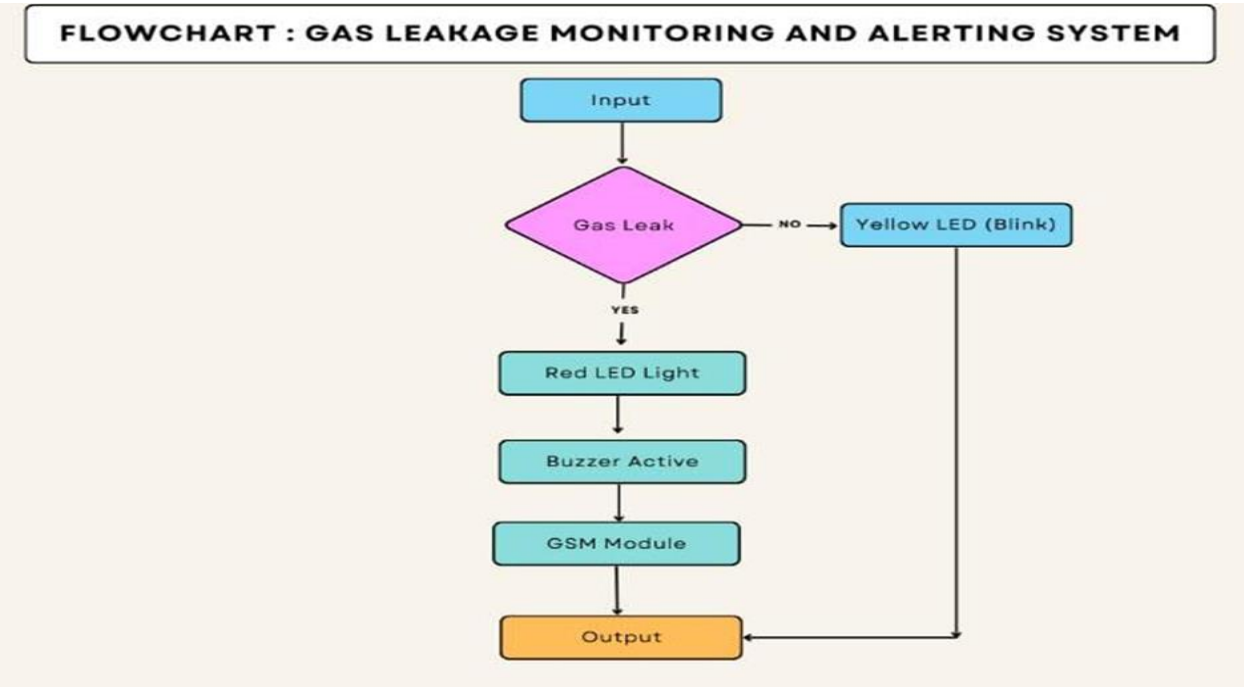
REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT:

Business Requirements	User Requirements	Product Requirements
The mentioned system is usable in residences, hotels, industrial settings, LPG cylinder storage places, etc. The ability to detect leakage and transmit the information to a location is the primary benefit of this IoT and Arduino-based application. It is observable, and precautions can be taken to avert any catastrophe.	The gas leakage detection system can be upgraded with smoke and fire detectors to detect the presence of smoke and fire in addition as being optimised for detecting dangerous gases. Although ensuring worker safety is critical, adopting the appropriate technology is even more crucial.	Regardless of your professional position or personal goals, gas detection is essential. Such IoT devices are what they are due to certain technologies in use, therefore understanding these technologies and the functions they can serve is necessary if you want to engage in IoT application development.

PROJECT DESIGN:

DATA FLOW DIAGRAM:



SOLUTION AND TECHNICAL ARCHITECTURE:

PROJECT PLANNING & SCHEDULING:

SPRINT PLANNING AND ESTIMATION

CODING AND SOLUTIONING:

CODE FOR IBM Watson IoT Platform:

```
import time

import sys

import ibmiotf.application

import ibmiotf.devicex

import random

#Provide your IBM Watson Device Credentials

organization = "jjrtf7"

deviceType = "ESP32"

deviceId = "1234"

authMethod = "token"

authToken = "12345678"

# Initialize GPIO

def myCommandCallback(cmd):

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

status=cmd.data['command']

if status=="switchon":

print ("Switch is on")

else :

print ("Switch is off")

#print(cmd)

try:

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

deviceCli = ibmiotf.device.Client(deviceOptions)

#.....
```

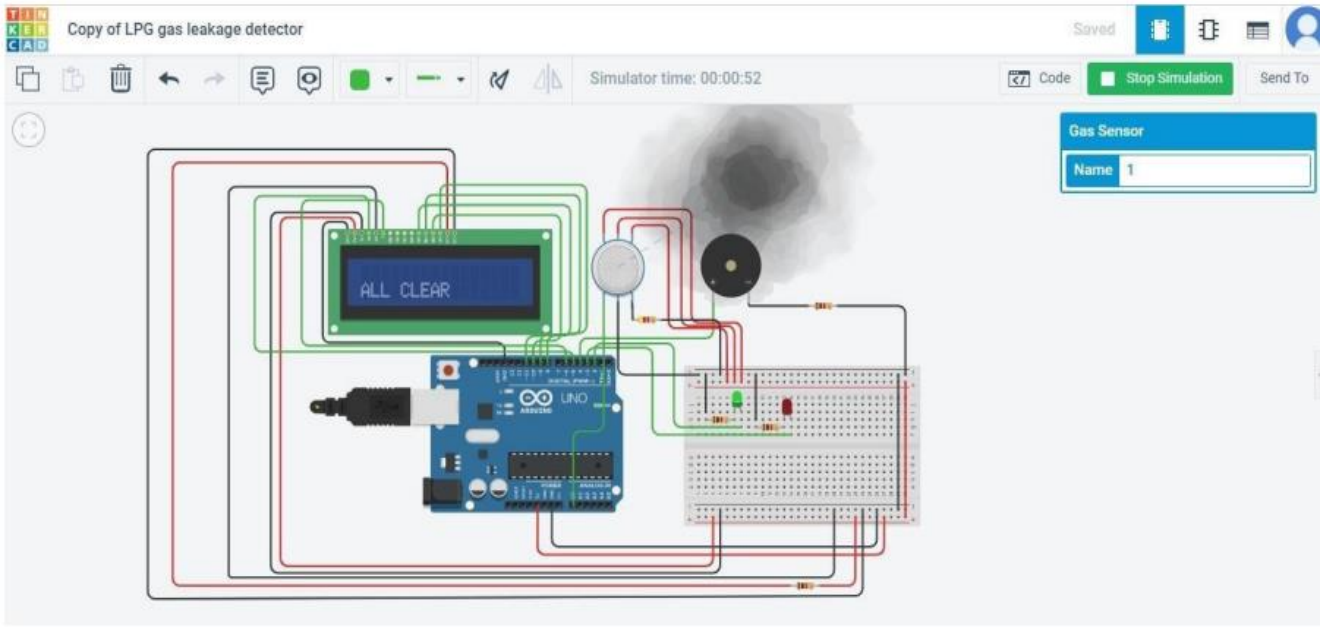
```
except Exception as e:
print("Caught exception connecting device: %s" % str(e))
sys.exit()
# Connect and send a datapoint "hello" with value "world" into the cloud as an
event of type "greeting" 10 times
deviceCli.connect()
while True:
#Get Sensor Data from DHT11
temp=random.randint(0,100)
Humid=random.randint(0,100)
gasconcentration=random.randint(0,100)
data = { 'temp' : temp, 'Humid': Humid, "gasconcentration":
gasconcentration}
#print data
def myOnPublishCallback():
print ("Published Temperature = %s C" % temp, "Humidity = %s %%" %
Humid, "gasconcentration = %s %%" % gasconcentration, "to IBM Watson")
success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
if notsuccess:
print("Not connected to IoTF")
time.sleep(1)
deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

SOLUTION STATEMNET:

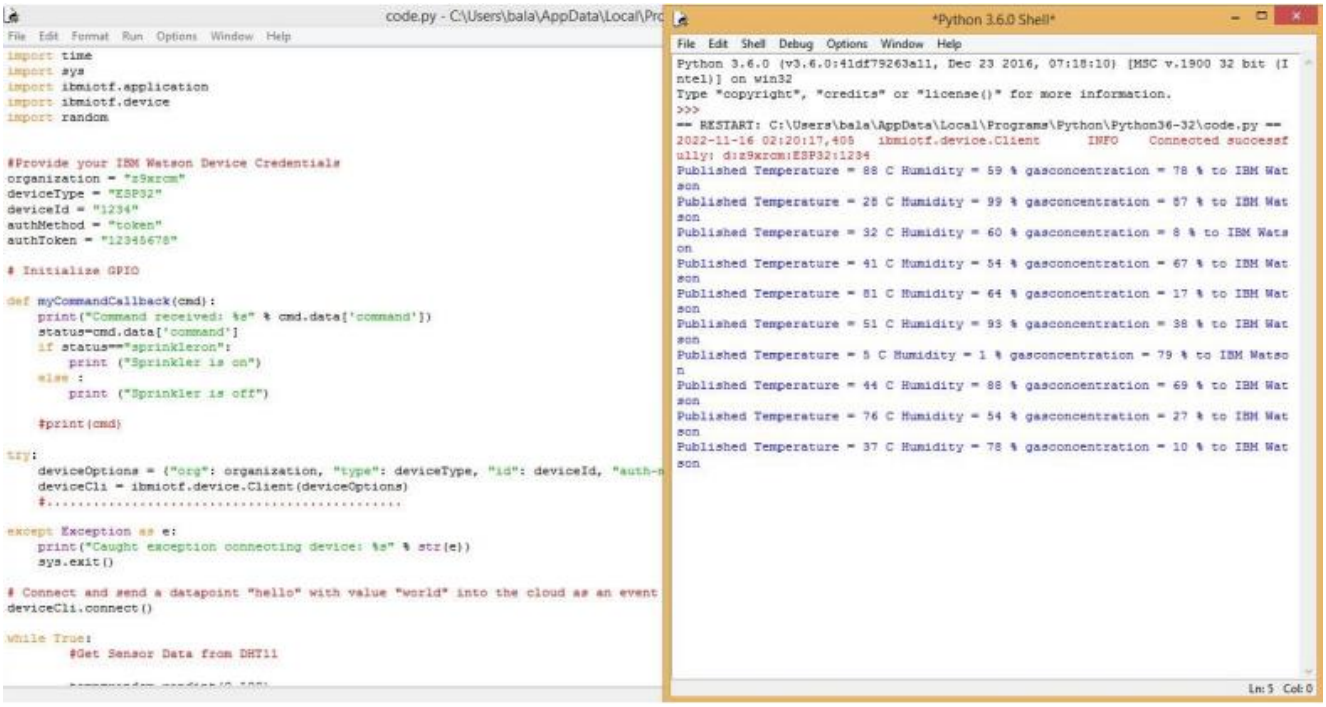
The system might be viewed as a modest attempt to link up the principal gas detection techniques now in use with a mobile platform coupled with IoT platforms. One metre around the rover, the gases are detected, and the sensor output data is continually sent to the nearby server. Stray gases are also detected because of the sensors' subpar precision, which introduces some inaccuracy into their results, 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 is reduced because the system operates outside the pipeline. The system can only be used as a primary indicator of leakage inside a plant at this point.

TESTING & RESULTS:

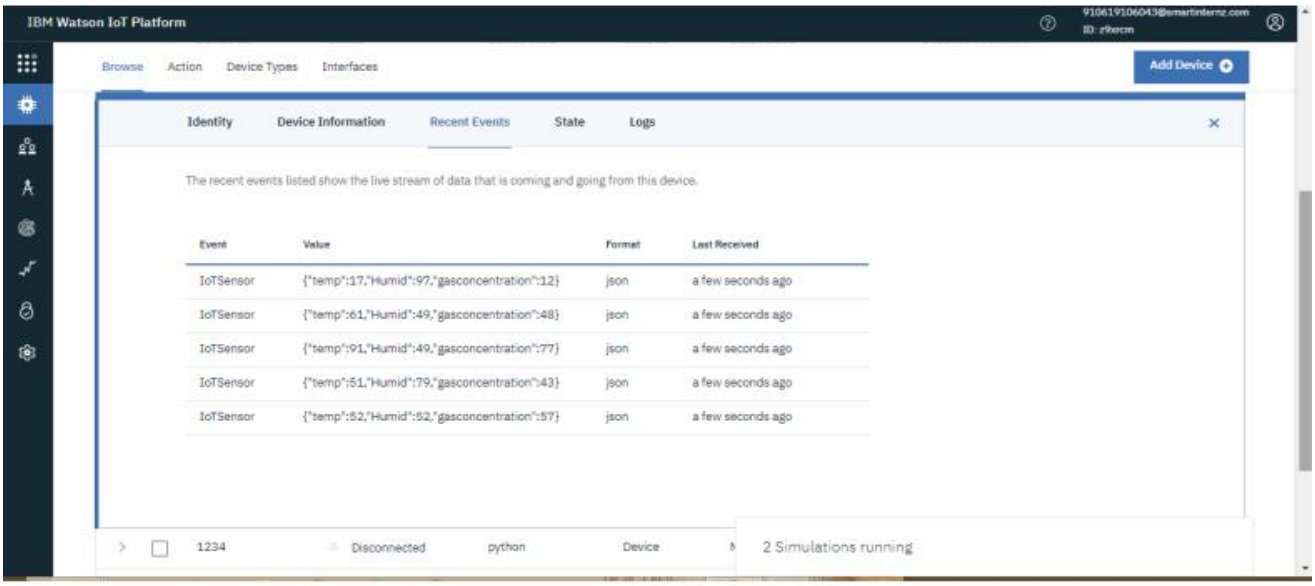
TINKERCAD:

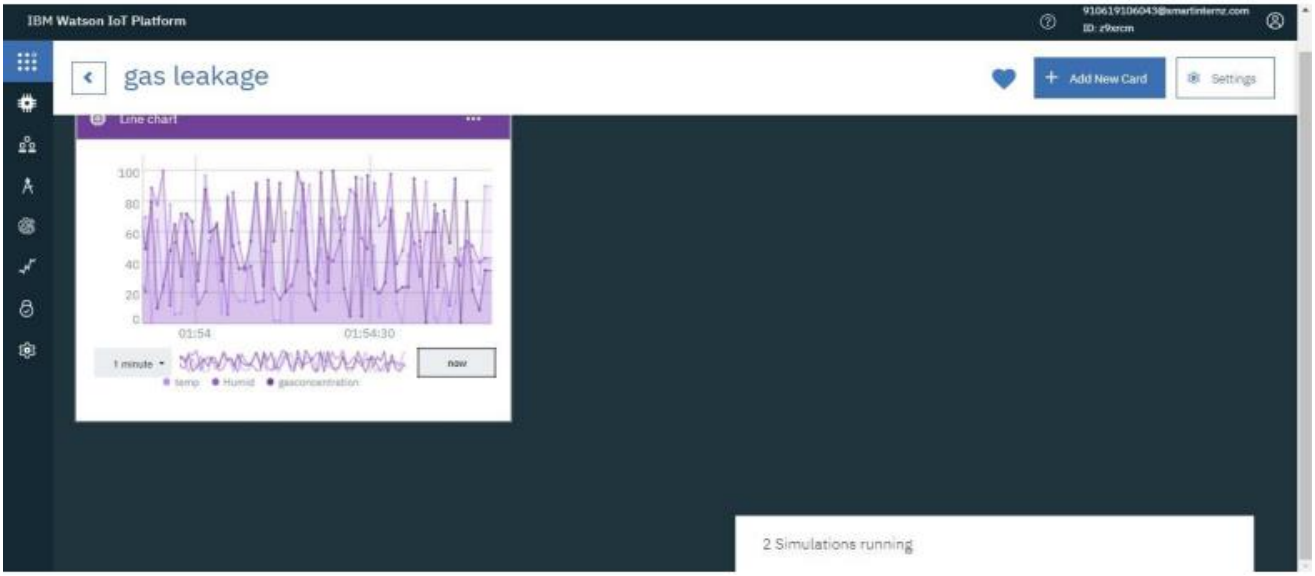


PYTHON CODE EXECUTION:

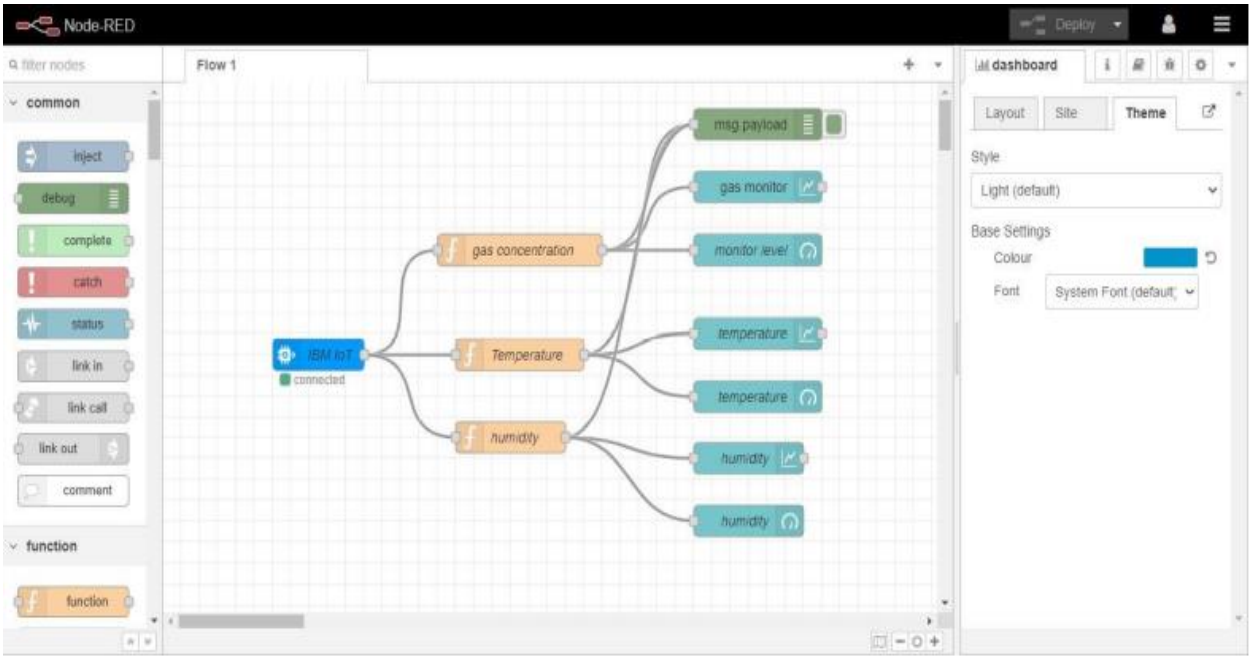


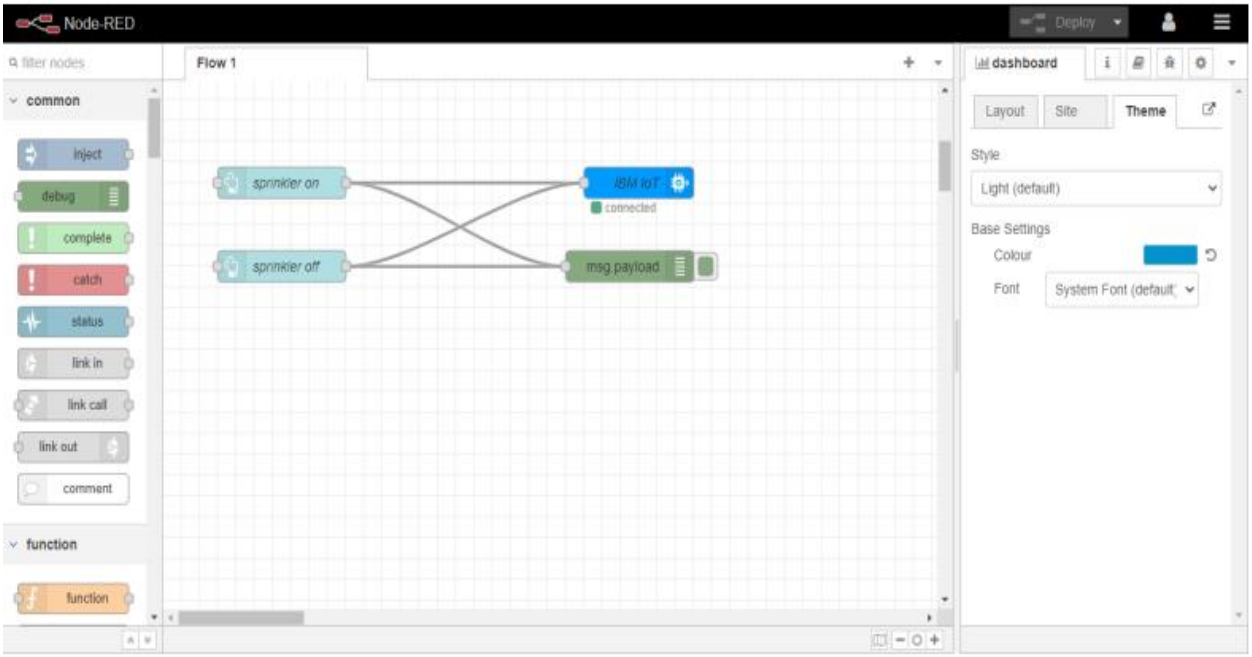
RECENT EVENTS IN IBM WATSON IOT PLATFORM:



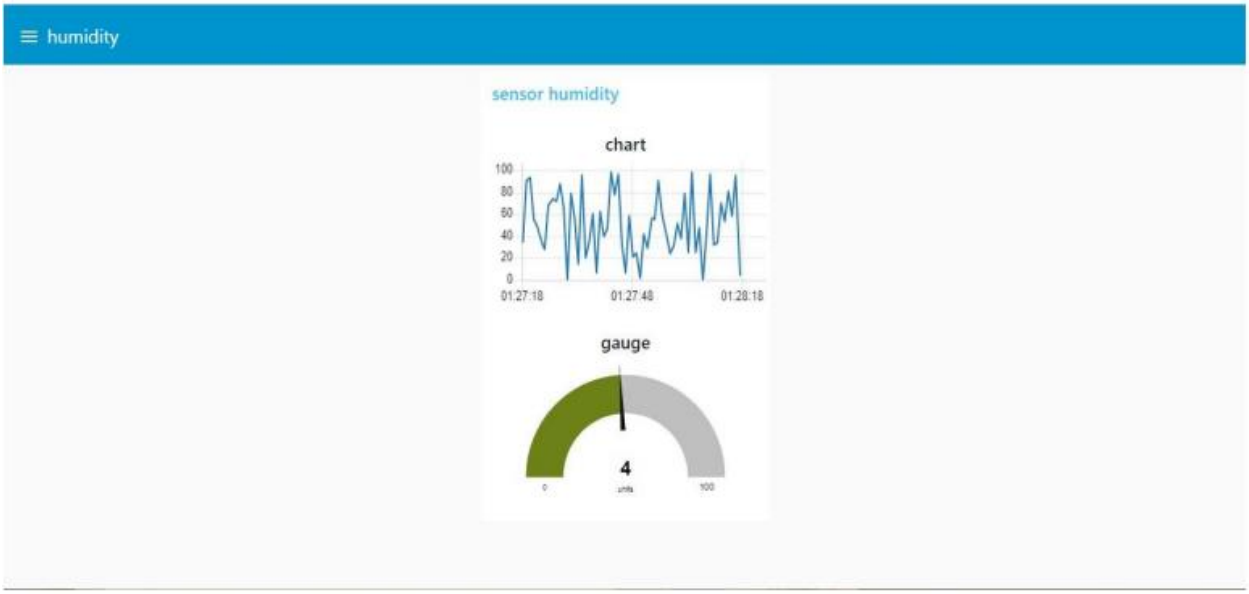


NODE RED FLOW:





DASHBOARD CREATED USING NODE:



CONCLUSION:

We can conclude from the project's performance that the system's detection of LPG gas leakage is remarkable. Useful for both residential and commercial purposes. We can use this technique to save lives in dangerous situations. The GSM module indicates an alert. Propane, CO2, and other gases 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.

APPENDIX:

SOURCE CODE:

```
#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;
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);
  }
}
```

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-46245-1660743712.git

PROJECT DEMO LINK:

https://drive.google.com/file/d/1Cdk1fOfQ1dNHqwJ1g33uHdaJzRxx0DDF/view?usp=sharing