Gas Leakage Monitoring And Alerting System for Industries

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Abstract:

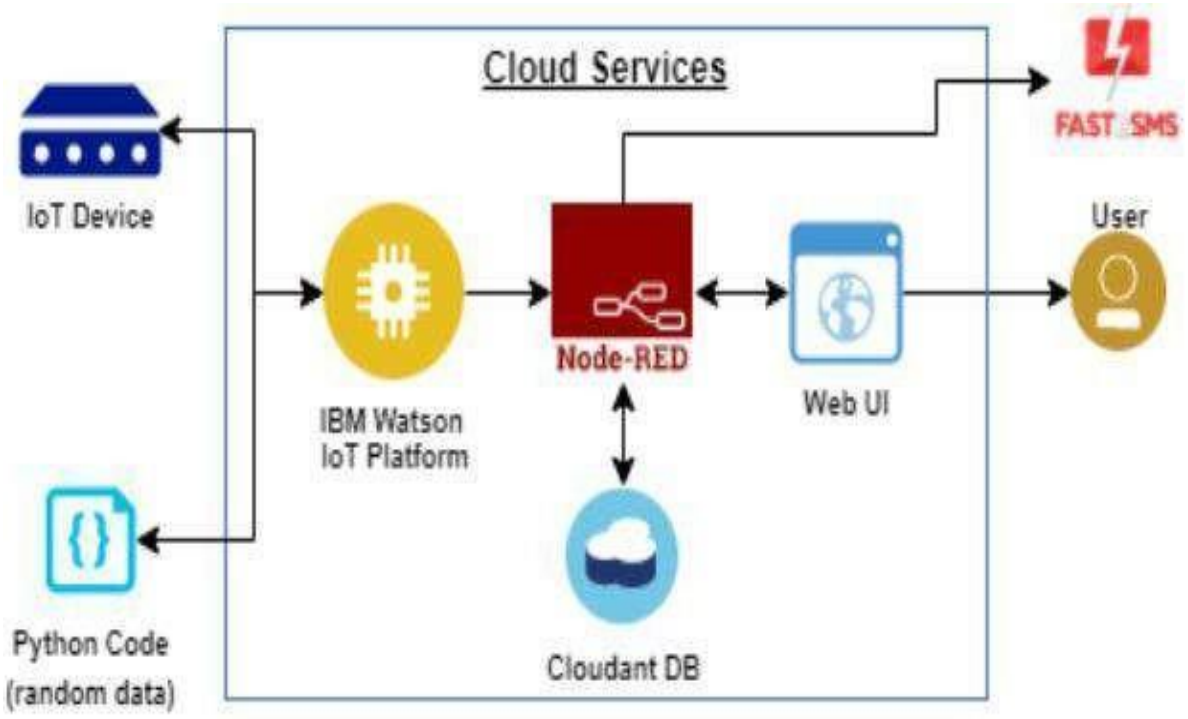
The Internet of Things (IOT) is a network of devices, cars, and home appliances that have the hardware, software, actuators, and networks necessary to communicate with each other, function together, and exchange information. IOT entails expanding the Internet network transcend standard hardware, such as workstations, workstations, mobilephones,and tablet, to any type of often unintelligent or web-enabled physicalhardware and everyday objects. These devices are loaded with innovation,allowingthem to communicate and connect via the Internet, as well as be monitored andmanaged from a distance. The industries benefit from this development's assistance in monitoring hazardous gas emissions.The gas sensors will be incorporated to monitorthe gas leakage so that we can prevent the discharge of gas in various places. If a gas leakis discovered anywhere, the admins will get an alert with the location now they can sensor it

Introduction:

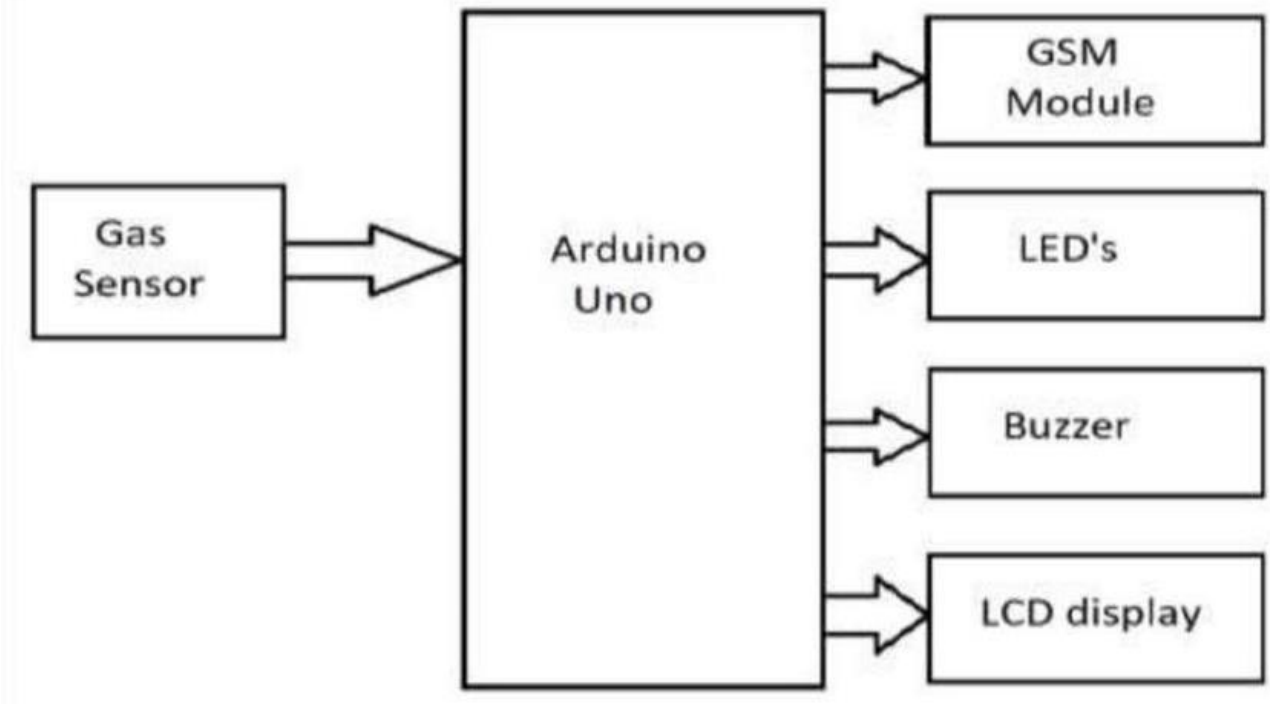
An increasing trend of technological, social, and financial centrality is the Internet of Things. Customers' products, durable goods, automobiles, fashionable and utility components, sensors, and other common items are being combined with Internet availability and fantastic information system capabilities that promise to transform how we work, live, and play. Numerous aspects of how we live are expected to alter as a result of the widespread use of IoT devices. The "smart home," which effectively improves security and efficiency, is becoming a reality thanks to new IoT products including Information devices, home automation components, and executive gadgets. The Internet of Things (IoT) is a crucial matter in the designing, planning, and innovation industries. We are getting closer to "wonderful urban areas," which reduce overcrowding and resource use, thanks to IoT systems like coordinated transportation, intelligent traffic systems, and sensors installed in streets and buildings. By increasing the accessibility of data along the value chain of generation using positioned sensors, Internet of Things technology offers the potential to alter horticulture, industry, and the creation and distribution of energy.

Block diagram:

Technical Architecture:



System Architecture:



Literature Survey:

- Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor by Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu in the year of 2017 and it was for the choice of using a real time gas leakage monitoring and sensing the output levels of gas has been clearly observed by the help of this system

- Gas Leakage Detection and Smart Alerting and Prediction Using IoT by Asmita Varma,Prabhakar S, Kayalvizhi Jayavel in the year of 2017 and it was the proposed gas leakage detector that is promising in the Field of safety.

- IOT Based Gas Leakage Detection System with Database Logging, Prediction and Smart Alerting by Chaitali Bagwe, Vidya Ghadi, Vinayshri Naik, Neha Kunte as a result of this the system provides constant monitoring and detection of gas leakage along with storage of data in database for predictions and analysis. The IOT components used help in making the system much more cost effective in comparison with traditional Gas detector systems.

Existing Problem:

A warning and controlling system-equipped sensor-based automatic gas leakage detector has been proposed. This equipment for detecting gas is competitively priced, uses less power, is lightweight, portable, safe, easy to use, effective, and has an uncomplicated system. Not only will gas leak detection be crucial for our health, but it will also help our economy grow because gas leaks not only contaminate the atmosphere but also waste gases, which is bad for business. Over the next few years, the industry is forecasted to be driven mainly by the necessity to guarantee worker safety.

Reference:

- Anusha, Nagesh, Venkata Sai, Srikanth, Rupalin Nanda,.LPG Leakage Detection and Alerting System with Customer SMS Alerts. International Journal for Modern Trends in Science and Technology (IJMTST) ISSN: 2455-3778: Volume: 06, Issue No: 05, May 2020.

- Title = Implementation of automatic gas accident prevention system using arduino, author=Chafekar, Zamir Khan, Mohd Husain,Lakra, Kuldeep Dhonde,SB, journal International Journal of Computer Applications, volume=180, number= 47, pages 5–7, year=2018

- Title=LPG LEAKAGE DETECTION AND PREVENTION SYSTEM, author Kadam, Swapnil More, Sumit Borkar, Prathamesh Gailwad, Ritesh Gadhire, Prachi, year=2018

- Title=LPG Gas Leakage Detection and Alert System, author=Leavline, Jebamalar Singh, Asir, Antony Gnana, Abinaya, Deepika, H, journal=International Journal of Electronics Engineering Research, volume=9, number=7, pages=1095–1097, year=2017.

- Huan Hui Yan, Yusnita Rahayu, Design and Development of Gas Leakage Monitoring System using Arduino. Proceeding of International Conference on Electrical Engineering, Computer Science and Informatics (EECSI 2014), Yogyakarta, Indonesia, 20-21 August 2014.

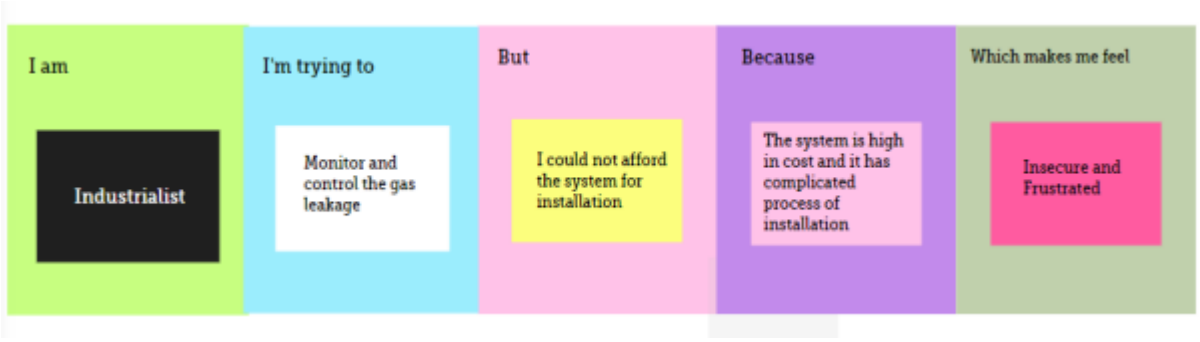
- Premalatha, Aswini, Haritha, Ajitha,. A HOME SAFETY GAS LEAKAGE DETECTION SYSTEM. International Journal of Advanced Research in Science, Engineering and Technology. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395- 0056 Volume: 05 Issue: 03 — Mar-2018 www.irjet.net p-ISSN: 2395-0072.

Problem Statement:

Equipment leakages might become harmful. A facility's periodic leak detection inspections can minimize unplanned incidents.By installing a gas leak detection system, many unforeseen incidents can be avoided.

I am	I am worker who was working in an industries.
I am trying to	I want to device which will detect gas leakage in industries.
But	There is no device to detect gas leakage and alerting system in industries.
Because	There is no installation of gas leakage detecting device to identify gas leakage.
Which makes me feel	Which will makes me to feel confusion.

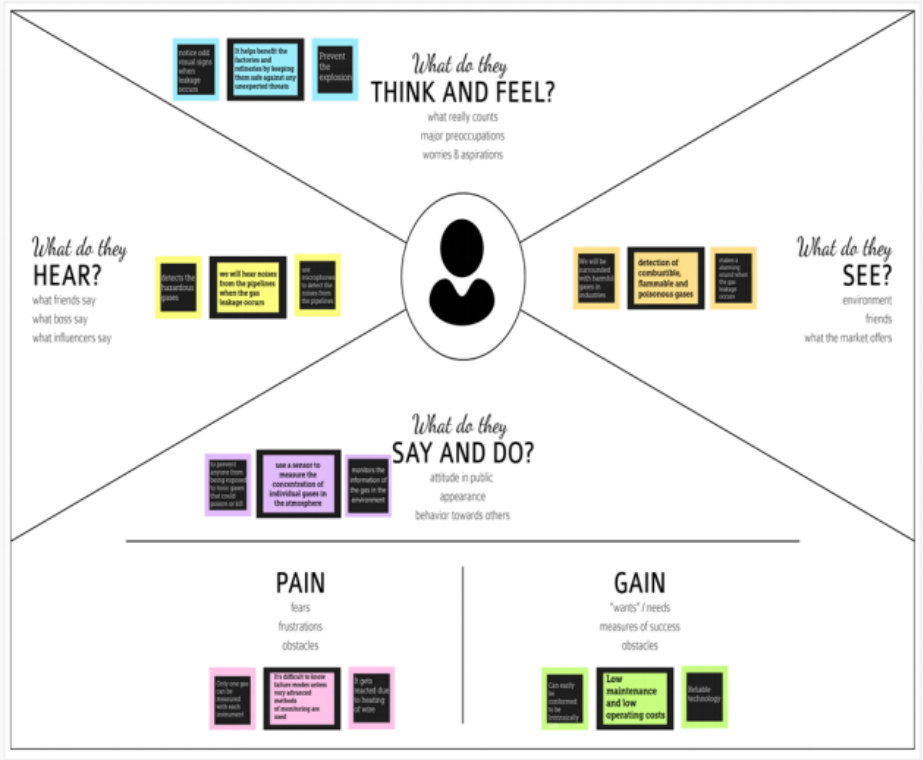
Example:



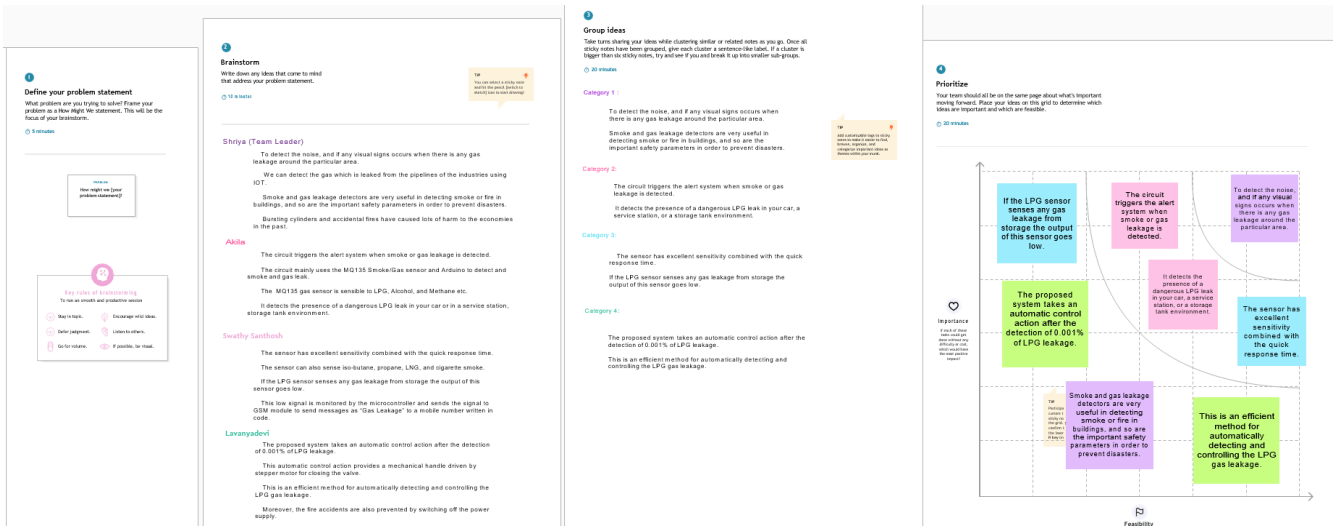
Problem Statement (PS)	I am (Customer)	I am trying to	But	Because	Which makes me feel
PS-1	Industrialist	Monitor gas leakage	I don't know about the monitoring system and the process to monitor it	The system is high in cost and not affordable and it also causes disaster	Insecure
PS-2	Industrialist	Control the gas leakage	The installation process of the system is too complicated	The sensor required for the process is unpredictable and also it might not go off in a proper position	Frustrated

Ideation and Proposed solution:

Empathy map canvas:



Ideation and Brainstorming:



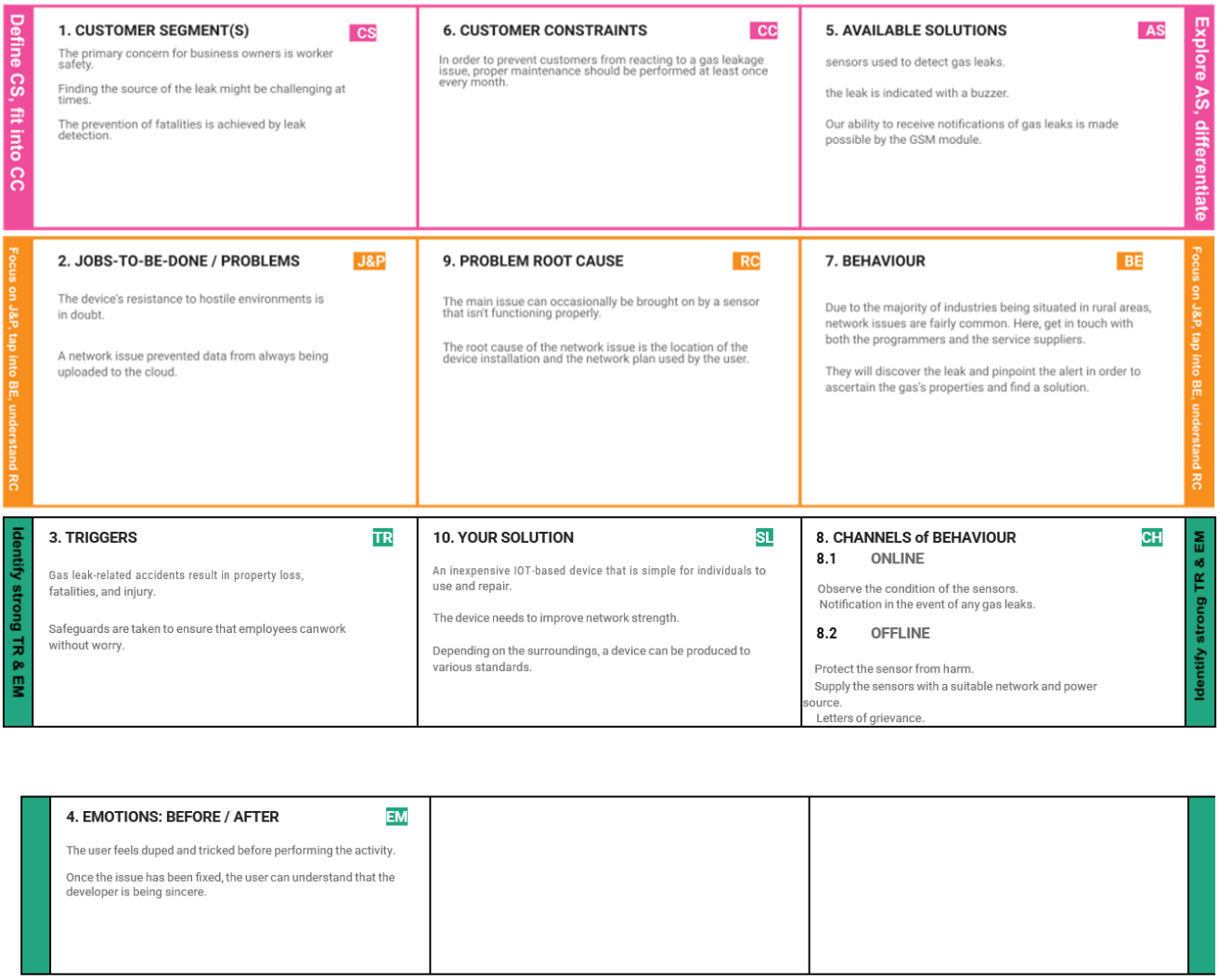
Proposed Solution:

S.no	Parameter	Description
1.	Problem Statement (Problem to be solved)	Workers in busy businesses that use gas—whether it's harmful or not—need a mechanism to continuously check their gas pipelines.Find any gas leaks in their system as soon as possible.Environment that will allow them to work effectively on big disasters as opposed to being concerned with monitoring a gas leak, this will in fact lessen the human resources of the sector and foster a environment.
2.	Idea / Solution description	Workers in busy industries that use gas, either dangerous or innocuous, require a mechanism to continuously check their gas pipelines. Detecting any gas leaks in their systems as soon as possible so that they can operate productively rather than stressing about monitoring, significant crises or gas leakage, this will lower the build a tranquil environment by using the industry's personnel environment.
3.	Novelty / Uniqueness	Despite the number of rational individuals to this issue, none have been able to meet client demands. Some methods only detect certain gases, while others fail to notify the primary department, and yet others experience delays. Our system will inform the workers even if there is a little gas leak, notifying the industry person as well as the fire fighters so they can take care of the issue.

4.	Social Impact / Customer Satisfaction	For the staff and the community who surrounds or are affiliated with the industry, our solution will be highly beneficial. Our method will stop major catastrophes like the Bhopal Gas Tragedy, saving countless lives. The goal of this initiative is to relieve the workers' mental strain so they may relax or focus on other tasks .
5.	Business Model (Revenue Model)	Since industries are the primary audience for our solution, we have scheduled visits to inform them of the advantages of our products.In order for them to understand the significance

		of this solution and implement it.
6.	Scalability of the Solution	Because the solution we've provided will be the foundation or first stage of any improved version, it can be integrated for additional future use.

Problem Solution fit:



Requirement Analysis:

Functional Requirement:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	Users can check the gas level and receive alerts through texts if there is a leak.
FR-2	User Reception	Messages can be used to communicate data, such as gas level information.
FR-3	User Understanding	With the aid of the data, the user may keep an eye on the gas level. The warning will be issued if the gas level rises. The warning also notifies them.
FR-4	User Convenience	Through messages, we can quickly obtain information about the gas level, and in the event of a gas leak, it can immediately notify the local hospital and police station.
FR-5	User Performance	When the user receives notification, the user may activate the sprinkler or exhaust fan.

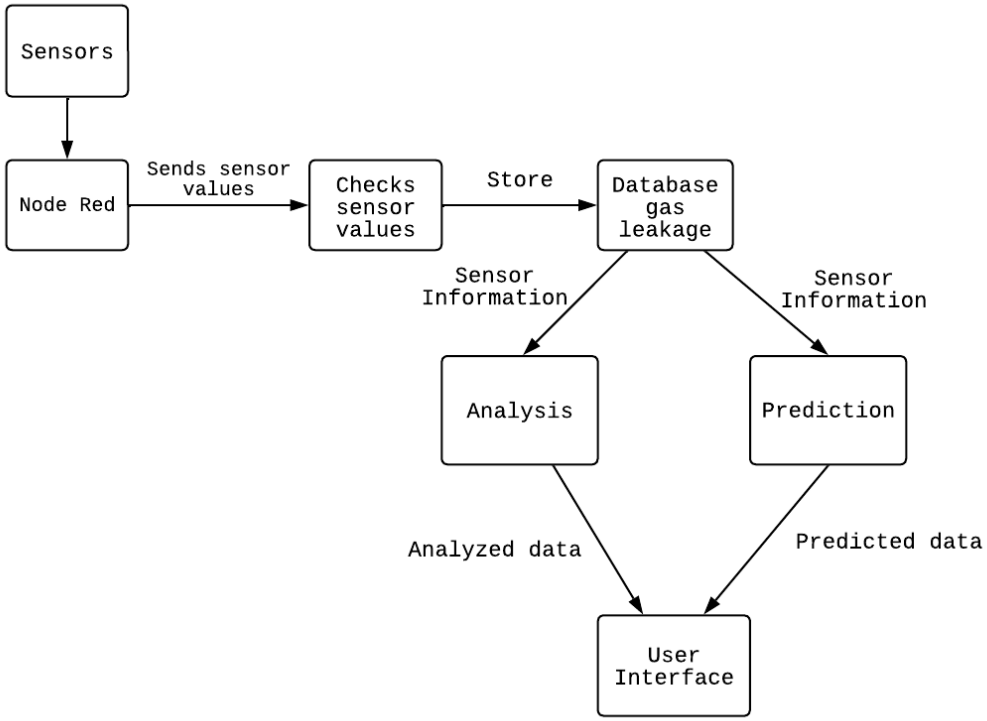
Non-Functional Requirement:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It safeguards the workers while also routinely updating the data.
NFR-2	**Security**	Our ability to protect people and property is made possible by emergency alerts.
NFR-3	**Reliability**	It can be in a position to give reliable values. It may be capable of precisely identifying the smoke and does not provide a misleading reading.
NFR-4	**Performance**	When there is a crisis, sprinklers and exhaust fans are deployed.
NFR-5	**Availability**	It contains both the day and the night, so it can be used every day.

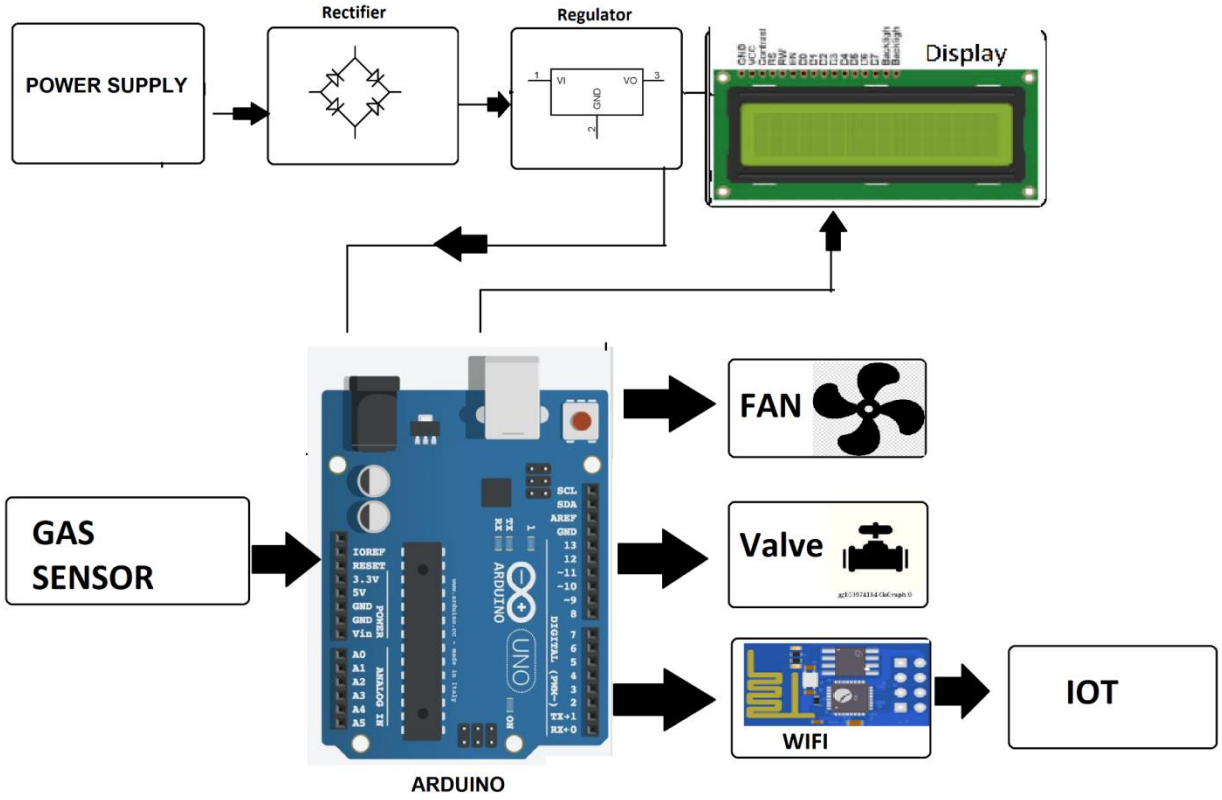
NFR-6	**Scalability**	Every time the sensor malfunctions, another one can be installed

Project Design:

Data flow Diagram:



Technical Architecture:

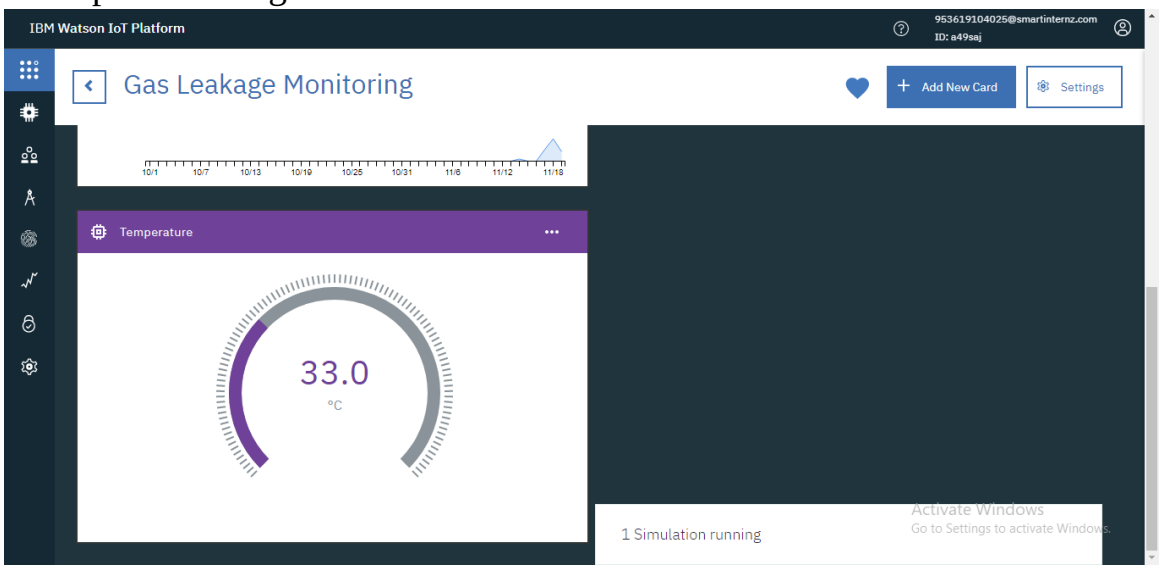


User Stories:

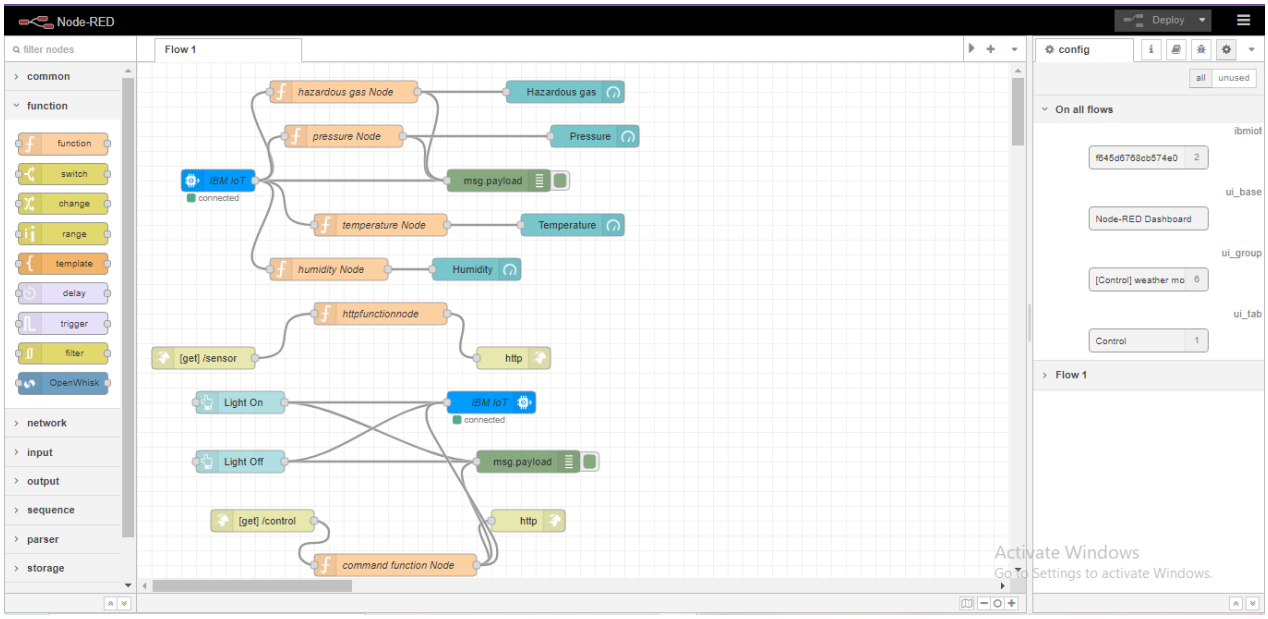
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	My email address, password, and password confirmation are required for me to register for the application as a user.	I can access my account / dashboard	High	Sprint-1
		USN-2	When I register for the application as a user, I will get a confirmation email.	I can receive confirmation email & click confirm	High	Sprint-1
	Login	USN-3	By providing my email address and password, I can access the application as a user.	I can login into my account	High	Sprint-1
	Dashboard	USN-4	The user may see the temperature.	I can view the data given by the device	High	Sprint-2
		USN-5	The user may see the level of gas.	I can view the data given by the device	High	Sprint-2
Customer (Web user)	Usage	USN-1	The user can access the website and obtain the data.	I can view the data given by the device	High	Sprint-3
Customer	Working	USN-1	User responds as directed by the device's alert.	I can get the data work according to it	High	Sprint-3
		USN-2	When a leak develops, the user activates the exhaust fan or sprinkler.	I can get the data work according to it	High	Sprint-4
Customer Care Executive	Action	USN-1	When someone encounters any usage problems, the user resolves the issue.	When someone doesn't comprehend the process, I can fix the problem	High	Sprint-4
Administrator	Administration	USN-1	User maintains all information.	The knowledge I have acquired can be stored	High	Sprint-4

Project planning and Scheduling:

Step 1: Creating IBM Watson and Node red.

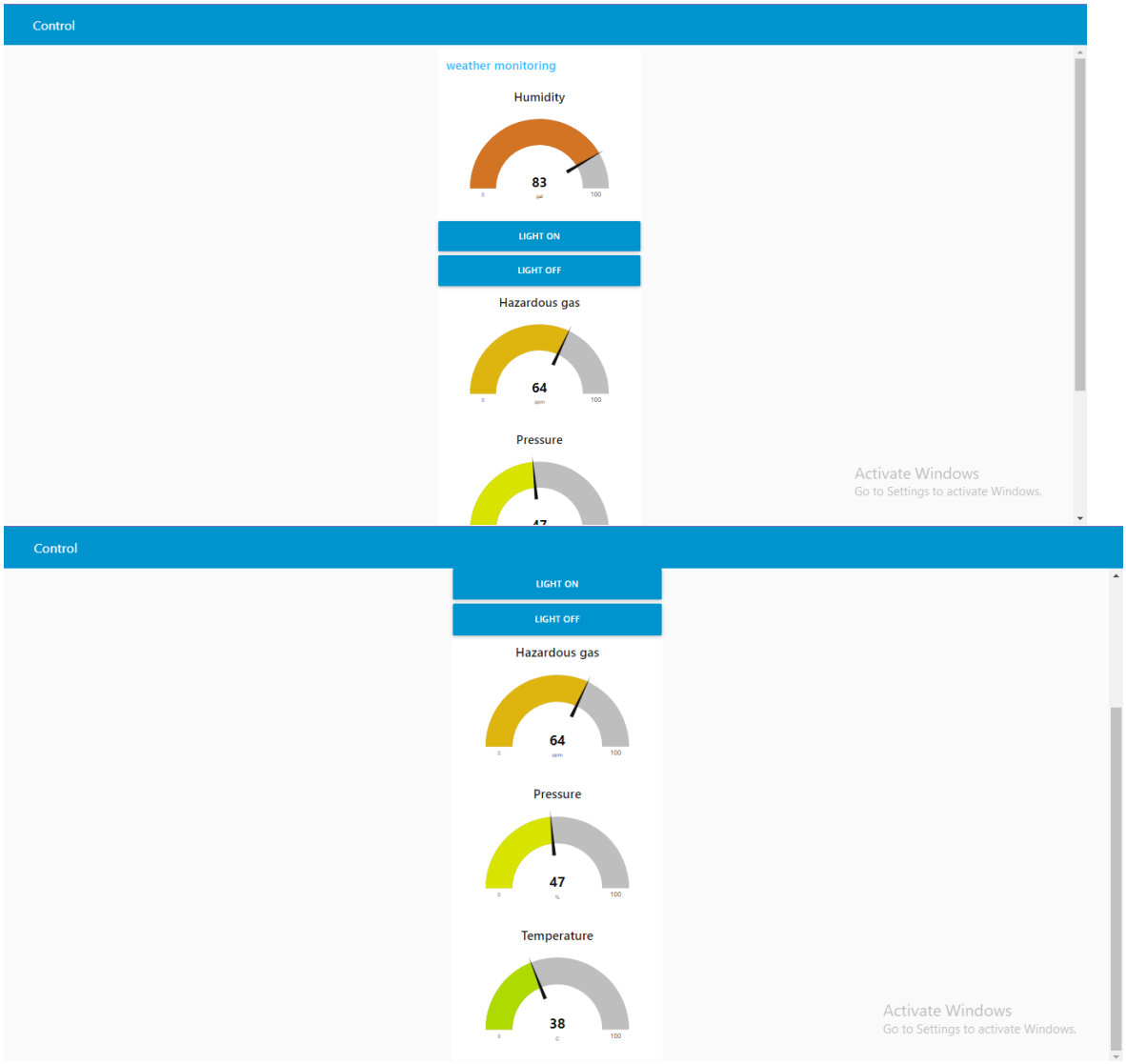


Step 2: Connecting the flow with IBM modules with node red package.

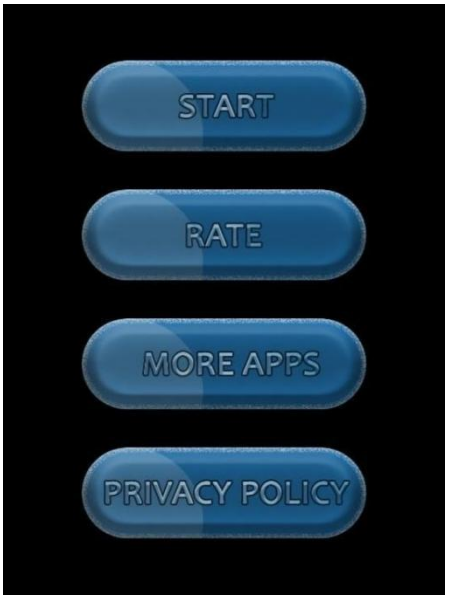


Step 3:

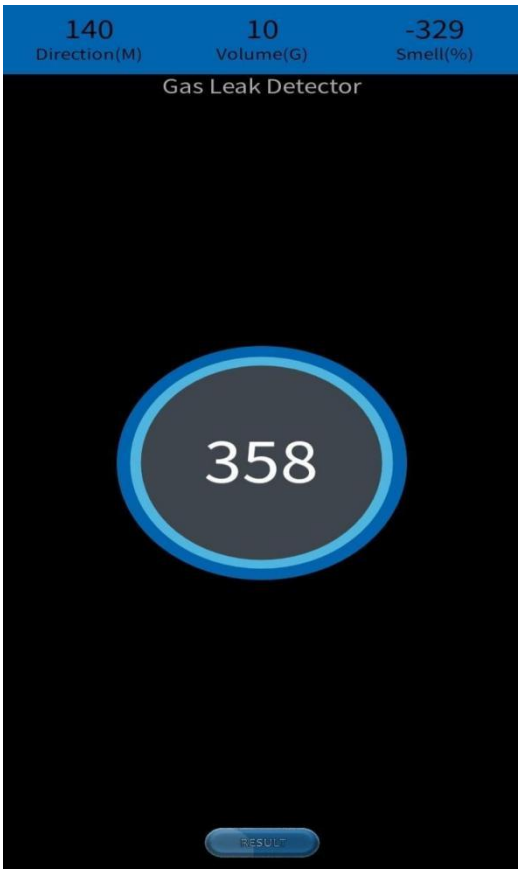
By using Python we have connecting with Ibm aunthenication keys.



Step 4: Using fast2SMS it will notification to our mobile.



Step 5: Using MIT inventor app, user interface is created.



Coding and Solution:

TINKERCARD CODE:

```
int gasSensor=A1;
int buzzer=13;
int led=12;
void setup()
{
   pinMode(A1, INPUT);
   pinMode(buzzer, OUTPUT);
   pinMode(led, OUTPUT);
   Serial.begin(9600);
 }

void loop()
{
int sensorValue=analogRead(gasSensor);
Serial.print("GAS LEVEL:");
Serial.println(sensorValue);
delay(1000);
if (sensorValue>250)
  {
     digitalWrite(buzzer,HIGH);
     digitalWrite(led,HIGH);

  }
else
  {
     digitalWrite(buzzer,LOW);
     digitalWrite(led,LOW);
  }
}
```

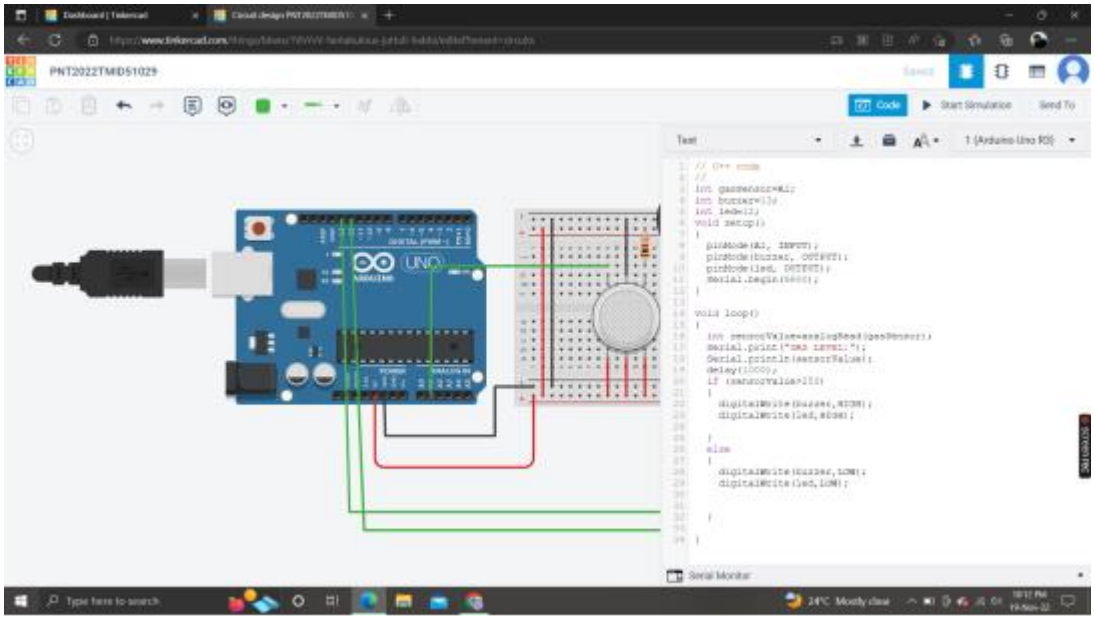
PYTHON CODE:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random


#Provide your IBM Watson Device Credentials
organization = "a49saj"
deviceType = "weather_device"
deviceId = "weather_device_1"
authMethod = "token"
authToken = "T?GTpUXf2q7+MrvYil"

# Initialize GPIO


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

```
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    else :
        print ("led 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)
        hazard=random.randint(0,100)
        pres=random.randint(0,100)

        data = { 'temp' : temp, 'Humid': Humid, 'hazard' : hazard, 'pres' : pres }
        #print data
        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s gal" % Humid, "Hazardous Gas
= %s ppm" % hazard, "Pressure = %s %%" % pres, "to IBM Watson")

        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 and application from the cloud
deviceCli.disconnect()
```

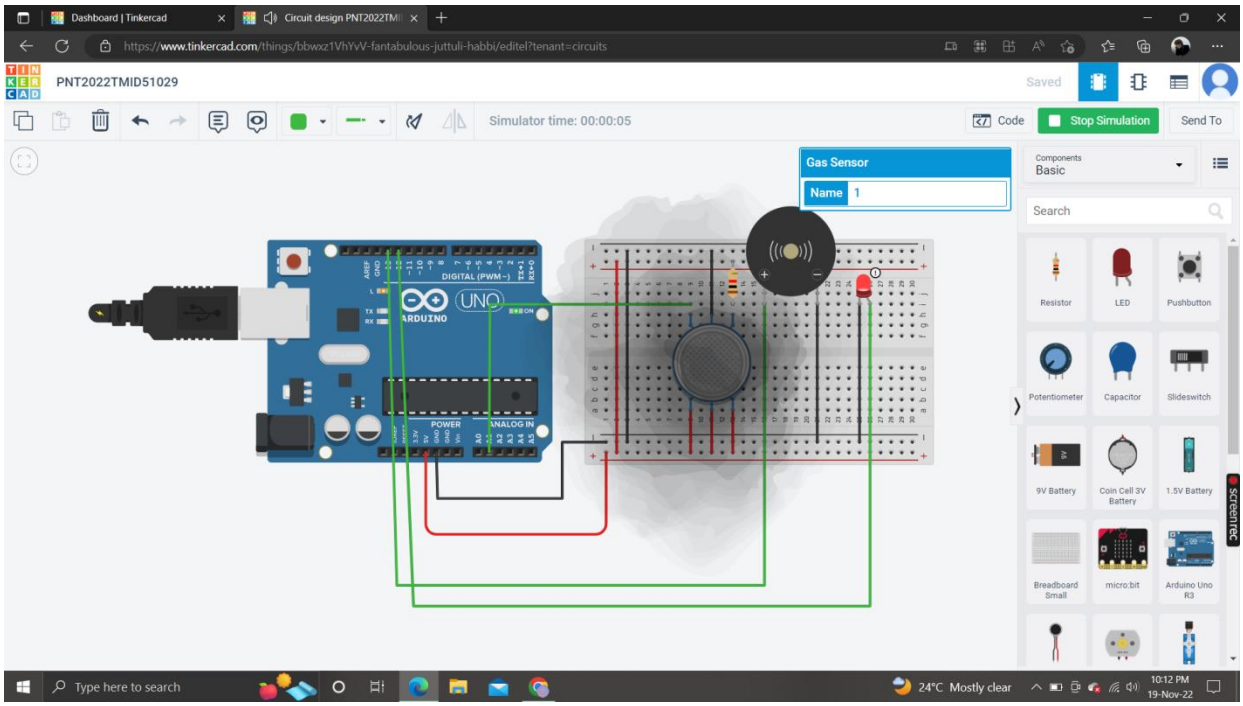
Testing:

Test case 1:



Industries at normal temperature, it is not alerted.

Test case 2:



Due to gas leakage in industries, this circuit model is alerting the worker through their mobile phone. It will be monitored and rectified by workers in industries.

List of component

Name	Quantity	Component
GAS1	1	Gas Sensor
PIEZO1	1	Piezo
M1	1	DC Motor
S2	1	Pushbutton
D1	1	Red LED
Rpot2	1	250 kΩ Potentiometer
R1,R3	2	1 kΩ Resistor
R2	1	330 Ω Resistor
U2	1	LCD 16 x 2
U3	1	Arduino Uno R3

Arduino UNO R3:

One type of ATmega328P-based microcontroller board is the ArduinoUno R3.It comes with everything needed to operate the microcontroller; all you need to do is use a USB cable to connect it to a computer and also provide power using an AC-DC adapter or a rechargeable to get things going. The word "Uno" was chosen to signify the launch of the Arduino IDE 1.0 software. "Uno" is Italian for "one." The third and most latest version of the Arduino Uno is called the R3. The reference versions of the Arduino board and IDE software are currently being updated.

Breadboard:

A breadboard is a common tool for circuit design and testing. Using a bread board reduces the need for soldering wires and components together to form a circuit.Component installation and reuse are simpler. Components are not soldered together, allowing for straightforward circuit design changes at any time.

LED:

An optoelectronic LED (Light Emitting Diode) operates on the electro-luminance principle. The ability of a substance to transform electrical energy into light energy and then emit that light energy is known as electro-luminance. The semiconductor in an LED operates similarly, emitting light when an electric field is present

Resistor:

A passive electrical device that has two terminals and is utilized in electrical circuits to limit or manage the flow of current.

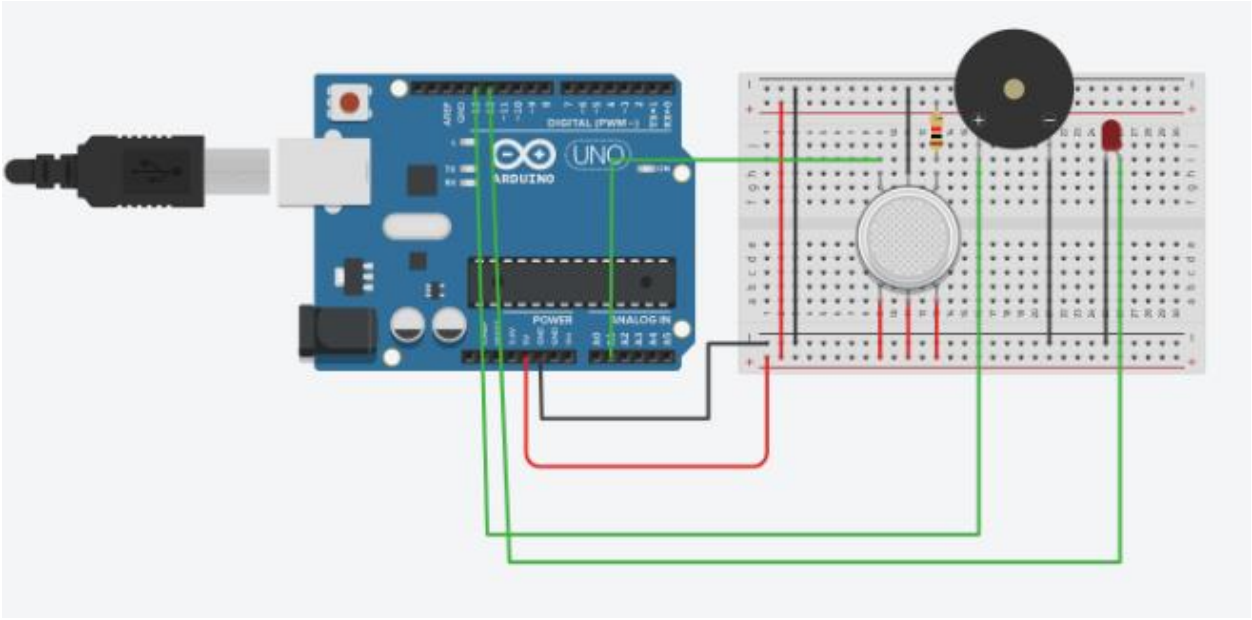
Gas Sensor:

A device that detects the existence or intensity of gases in the environment is called a gas sensor. By altering the resistance of the substance inside the sensor, the sensor generates a proportional potential difference based on the gas concentration, which may be recorded as output voltage. The type and concentration of something like the gas can be inferred from this voltage value.

LCD 16*2:

One type of electronic gadget used to display the information and data is a 162 LCD. Liquid Crystal Display is indeed the term's full name. Since it has 16 Columns and 2 Rows, the display is known as a 162 LCD. It can display a total of (16 + 2) 32 characters, each of which is composed of 5 x 8 pixels.

Circuit Diagram:



Advantage and Disadvantage:

Advantage:

- This project is useful for finding gas leakage in industrial settings.
- Equipment and Components are more functional.
- Low power consumption and dependability.
- Can also be used for LPG gas leakage in the household.

Disadvantage:

- Since numerous locations have gas cylinders, the exact location of the leak cannot be determined.
- Temperature and relative humidity both affect how sensitive it is.
- This won't function and run without the internet.
- Installation is challenging.

Conclusion:

We can infer 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 Microcontroller.

Appendix:

```
  // C++ code
 //
int gasSensor=A1;
int buzzer=13;
int led=12;
void setup()
{
   pinMode(A1, INPUT);
   pinMode(buzzer, OUTPUT);
   pinMode(led, OUTPUT);
   Serial.begin(9600);
 }

void loop()
{
int sensorValue=analogRead(gasSensor);
```

```
Serial.print("GAS LEVEL:");
Serial.println(sensorValue);
delay(1000);
if (sensorValue>250)
  {
     digitalWrite(buzzer,HIGH);
     digitalWrite(led,HIGH);

  }
else
  {
     digitalWrite(buzzer,LOW);
     digitalWrite(led,LOW);
  }
}
```

Github Link: https://github.com/IBM-EPBL/IBM-Project-17296-1659633652