# *Gas Leakage Monitoring and Alerting System for Industries*

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## Abstract:

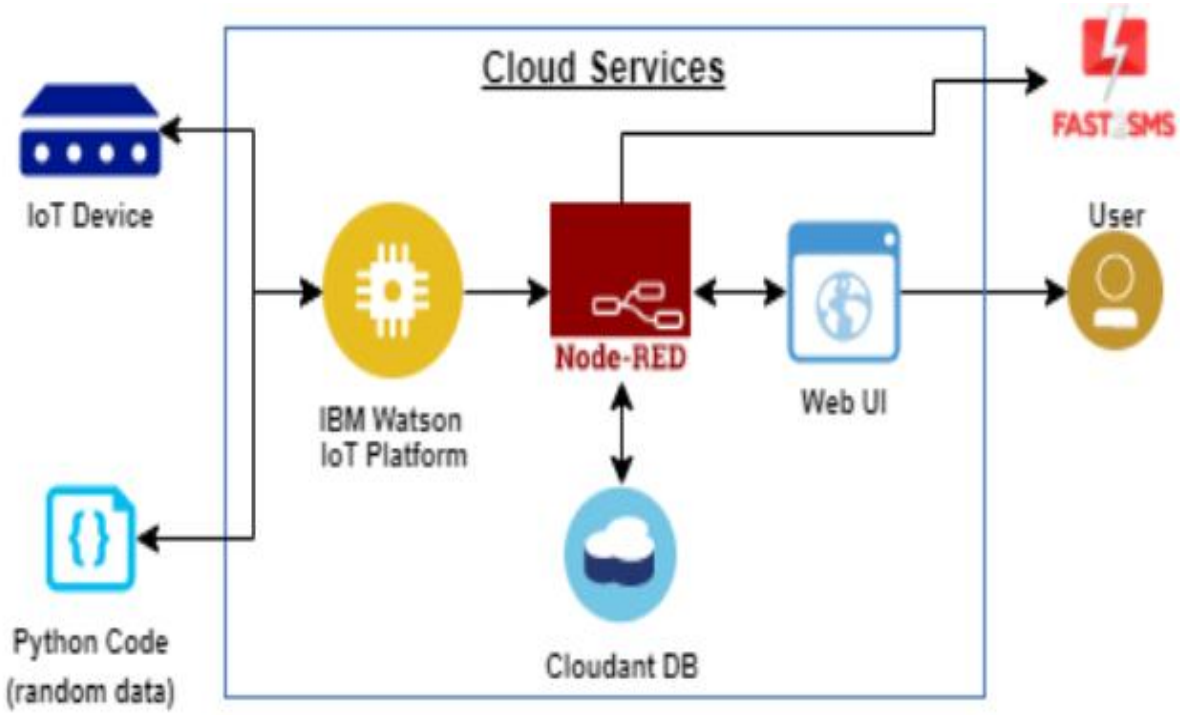
The Internet of things (IOT) is the system of gadgets, vehicles, and home machines that contain hardware, programming, actuators, and networks which enables these things to interface, collaborate and trade information. IOT includes broadening Internet network past standard device, for example, work areas, workstations, cell phones and tablets, to any scope of generally stupid or non-web empowered physical device and ordinary articles. Installed with innovation, these gadgets can convey and connect over the Internet, and they can be remotely observed and controlled. This project helps the industries in monitoring the emission of harmful gases. So that we can avoid emission of 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.

## Introduction:

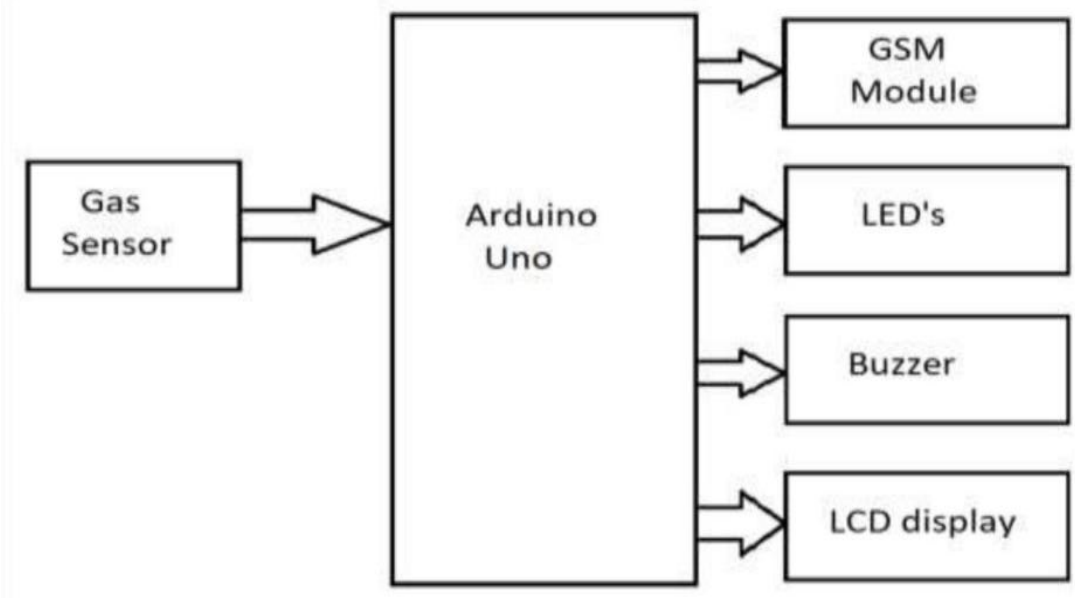
The Internet of Things is a developing theme of specialized, social, and monetary centrality. Customer items, tough goods, cars and trucks, modern and utility segments, sensors, and other regular articles are being joined with Internet availability and amazing information systematic capacities that guarantee to change the manner in which we work, live, and play. The expansive scale usage of IoT gadgets guarantees to change numerous parts of the manner in which we live. For shoppers, new IoT items like Internet-empowered machines, home mechanization parts, and vitality the executive’s gadgets are pushing us toward a dream of the "savvy home'', offering greater security and vitality effectiveness. The Internet of Things (IoT) is an essential theme in innovation industry, strategy, and designing circles. IoT frameworks like arranged vehicles, savvy traffic frameworks, and sensors implanted in streets and scaffolds draw us nearer to "brilliant urban areas'', which help limit clog and vitality utilization. IoT innovation offers the likelihood to change horticulture, industry, and vitality creation and dissemination by expanding the accessibility of International Journal of Scientific Research in Science and Technology data along the esteem chain of generation utilizing arranged sensors.

**Block diagram:**

**Technical Architecture:**




**System Architecture:**



## Literature Survey:

- In the year of 2008, Chen Peijiang and Jiang Xuehhua, “Design and implementation of Remote Monitoring System Based on GSM”, this paper focuses on the wireless monitoring system, because the wireless remote monitoring system has more applications than a remote monitoring system based on SMS through GSM.

- “Internet of Things (IOT) based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor” in the year of 2017, Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu. This paper's choice of using a real time gas leakage monitoring and Sensing the outputs levels of gas has been clearly observed by the help of this system.

- “Gas Leakage Detection and Smart Alerting System Using IoT '' in the year of 2018, Shital Image, Priyanka Rajmanes, Aishwarya Gavali. 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 safety against the leakage of harmful and toxic gases.

## Existing Problem:

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed.This is an affordable, less power using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere, but also wastage of gases will hurt our economy. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.

## Reference:


- ✓ 2013.Arun Raj, Athira Viswanathan, Athul T S, “LPG Gas Monitoring System”, International Journal of Innovative Technology and Research, Volume 3, Issue 2, February 2015, Pg – 1957 to 1960.

- ✓ S Shyamaladevi, V. G. Rajaramya, P. Rajasekar, P. Sebastin Ashok, “ARM7 based automated high-performance system for LPG refill booking & leakage detection”, Journal of VLSI Design and Signal Processing”, Volume 3, Issue 2, 2014.

- ✓ S. Sharma, V. N. Mishra, R. Dwivedi, R. Das, “Classification of gases/odours using Dynamic Response of Thick Film Gas Sensor Array”, IEEE Conference on Sensors Journal, 2013.

- ✓ Ankit Sood, Babalu Sonkar, Atul Ranjan, Mr. Ameer Faisal, “Microcontroller Based LPG Gas Leakage Detector Using GSM Module”, International Journal of Electrical and Electronics Research, Volume 3, Issue2, AprilJune 2015.

- ✓ Rajeev B. Ahuja, Jayant K. Dash, Prabhat Shrivastava, “A comparative analysis of liquefied petroleum gas (LPG) and kerosene related burns”, Burns, Volume 37, Issue 8, December 2011.

- ✓ Shivalingesh B. M, Ramesh C, Mahesh S. R, Pooja R, Preethi K. Mane, Kumuda S, “LPG Detection, Measurement and Booking System”, IJRSI, Volume 1, Issue 4, November 2014.

## Problem Statement:

Gas Leaks from equipment can become dangerous. Conducting routine leak detection inspections to a facility can help prevent unexpected incidents. By Installing gas leakage detection system to prevent these unexpected incidents.

| | |
|---|---|
| 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. |

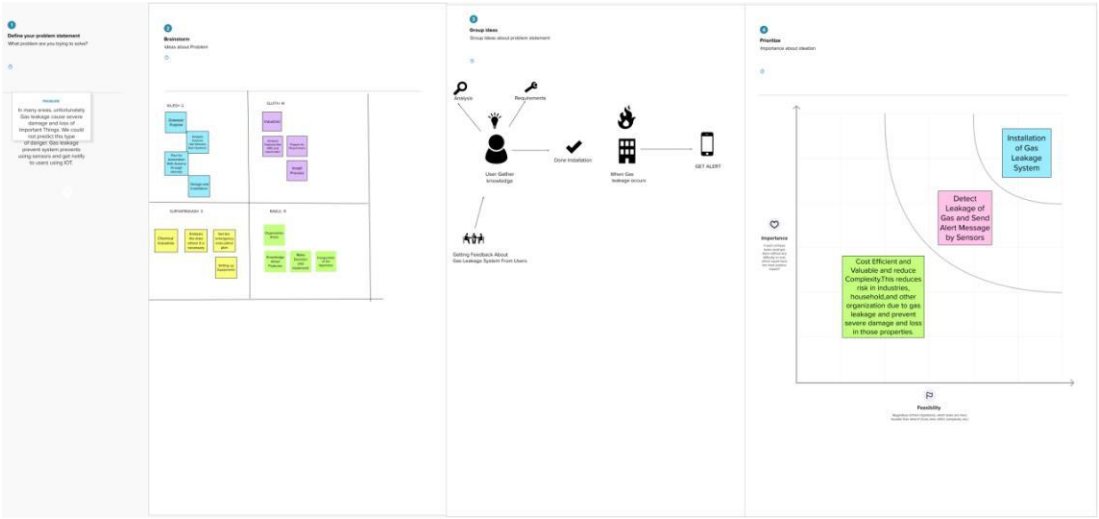
Example:


| Problem Statement (PS) | I am (Customer) | I'm trying to | But | Because | Which makes me feel |
|---|---|---|---|---|---|
| PS-1 | worker | detect leakage in gas | it is difficult to identify leakage in gas | there is no device for identifying gas leakage. | confusion |
| PS-2 | Chemical Engineer | to detect gas leakage with detail of temperature | it is difficult to identify leakage in | there is no device for identifying gas leakage. | frustration |

# Ideation and Proposed solution:

## Empathy map canvas:


## Ideation and Brainstorming:



## Proposed Solution:

| S.no | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | Gas Leaks from equipment can become dangerous. Conducting routine leak detection inspections to a facility can help prevent unexpected incidents. By Installing gas leakage detection system to prevent these unexpected incidents. |
| 2. | Idea / Solution description | The gas leakage detectors can be used for the detection of combustible, flammable and poisonous gaseous, and also to detect a gas leak or other pollutants. It makes the area where the leak occurs an warning sound and instructs operators to leave the area. The System proposed is planned, built and sent an SMS warning system for detection of gas leakage. Infrared imaging sensors have recently been used for a number of applications in industrial plants and refineries. |
| 3. | Novelty / Uniqueness | It will detect gas leakage with help of Internet of Things technology and alert the customer using an alerting device. |
| 4. | Social Impact / Customer Satisfaction | 1.spending power,<br>2.Budget,<br>3.Network connection,<br>4.available devices,<br>5.Gadgets to monitor leakage. |
| 5. | Business Model (Revenue Model) | By using this model, we can detect gas leakage and it will |

| | | |
|---|---|---|
| | | alert the user when gas leakage occurs. |
| **6.** | Scalability of the Solution | As this model depends on Internet of Things, It will works on through the Internet and send SMS to mobile if gas leakage happen in user residential area |

## Problem Solution fit:

# Requirement Analysis:

## Functional Requirement:

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through Form<br>Registration through Gmail<br>Registration through LinkedIN |
| FR-2 | User Confirmation | Confirmation via Email<br>Confirmation via OTP |
| FR-3 | Hardware Requirement | Optical, Soil, Ultra flow meter. |
| FR-4 | Software Requirement | Pressure point, Flow change, Statistic. |
| FR-5 | User welfare | Calibration<br>No Poisoning of the Sensor<br>Reliable in all environment conditions<br>Easy to use. |

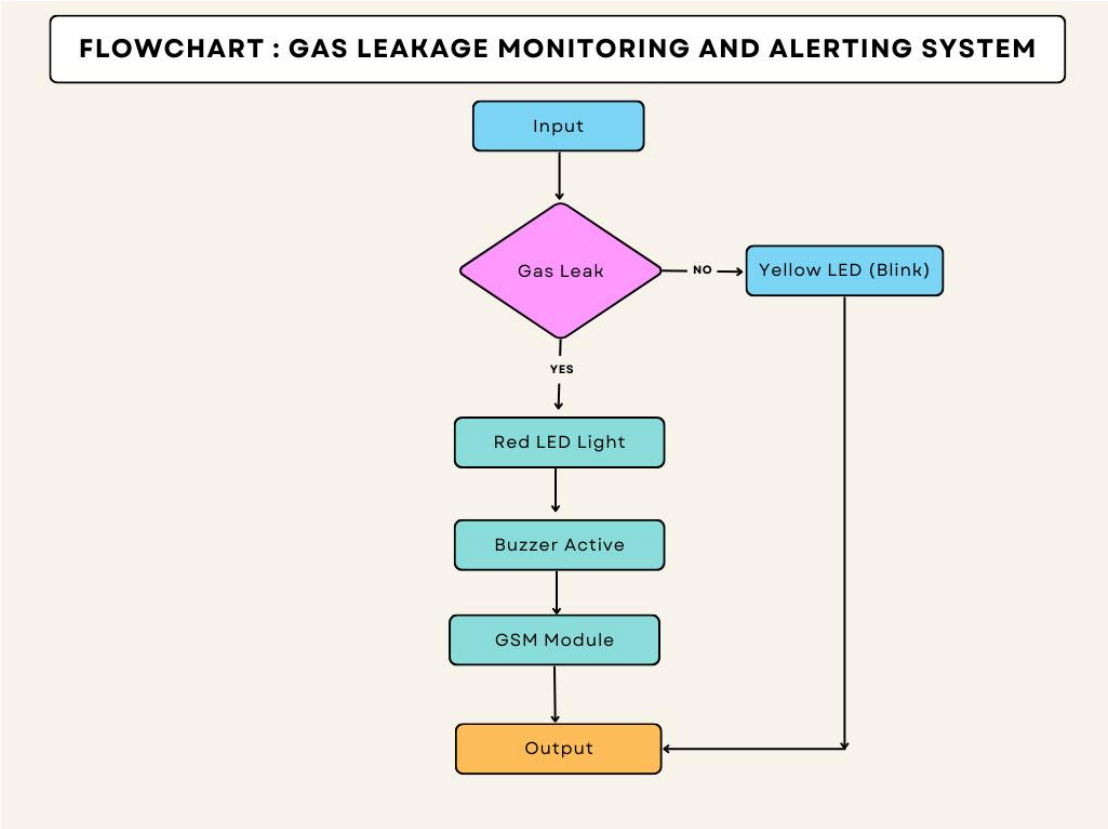
## Non Functional Requirement:

| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | The sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises |
| NFR-2 | **Security** | The device is intended for use in household safety where appliances and heaters that use natural gas and liquid petroleum gas (LPG) may be a source of risk. |
| NFR-3 | **Reliability** | Gas Leakage Detection System (GLDS) can detect leakage at homes, commercial premises or factories. GLDS detects the leakage soon after it happened and sends users an immediate alarm on the incident. |
| NFR-4 | **Performance** | The Gas Leakage Detector is a wall mounted device fitted close to the floor level with an alarm setting at 20% of lower explosive limit. Whenever there is a leak, the in-built sensor detects and alerts the user in less than 5 minutes, much before it can cause any accidents. |
| NFR-5 | **Availability** | The circuit for an LPG leakage detector is readily available in the market, but it is |

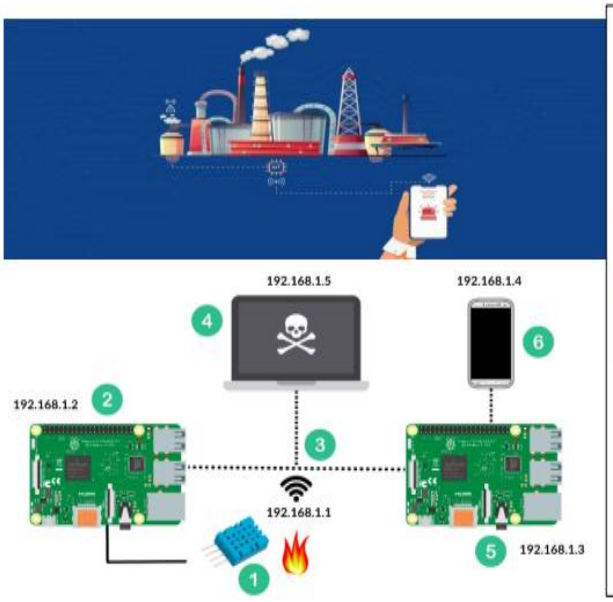
| | | |
|---|---|---|
| | | extremely expensive). Presented here is a low -cost circuit for a Gas Leakage Detection that you can build easily. |
| NFR-6 | **Scalability** | The system proves the need for gas detection alarm systems to be 100% reliable. A backup power supply can be included in the system design to augment for power failure condition. Also, calibration of the gas sensor can be done in other for a specific gas to be sensed instead of the LPG numerous gases it sens e |

# Project Design:

## Data flow Diagram:



## Techincal Architecture:




Guidelines:

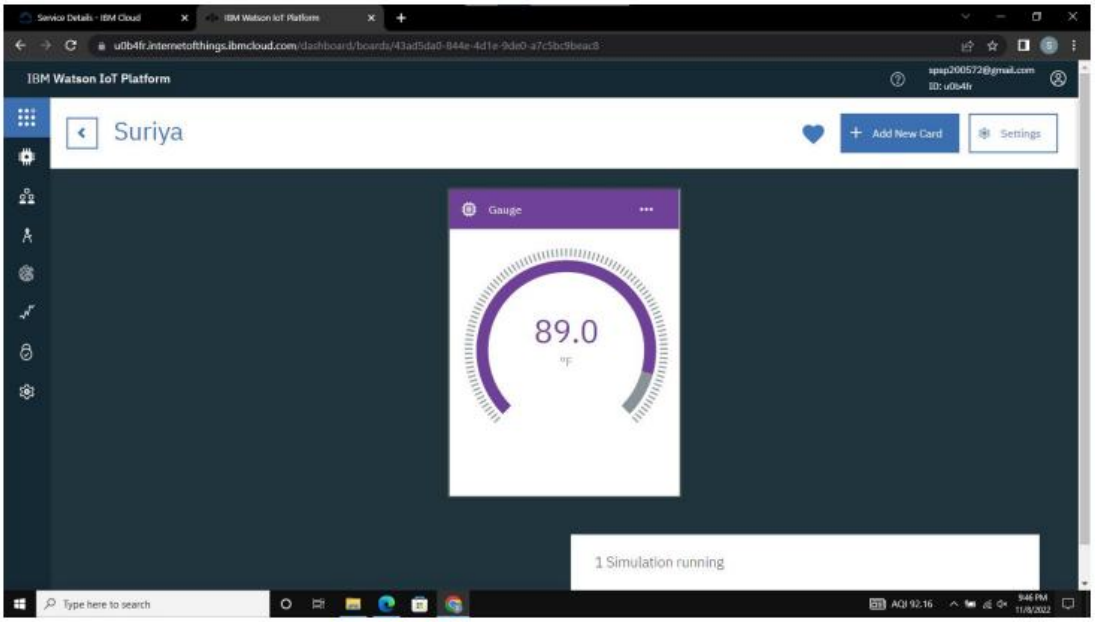
1. Include sensor to detect gas leakage.
2. Provide light and sound alerting gas leakage.
3. Using Internet of Things, alerting gas leakage in mobile phone.
4. By using Internet of Things, wifi will used for alerting worker through their mobile devices.

## User Stories:

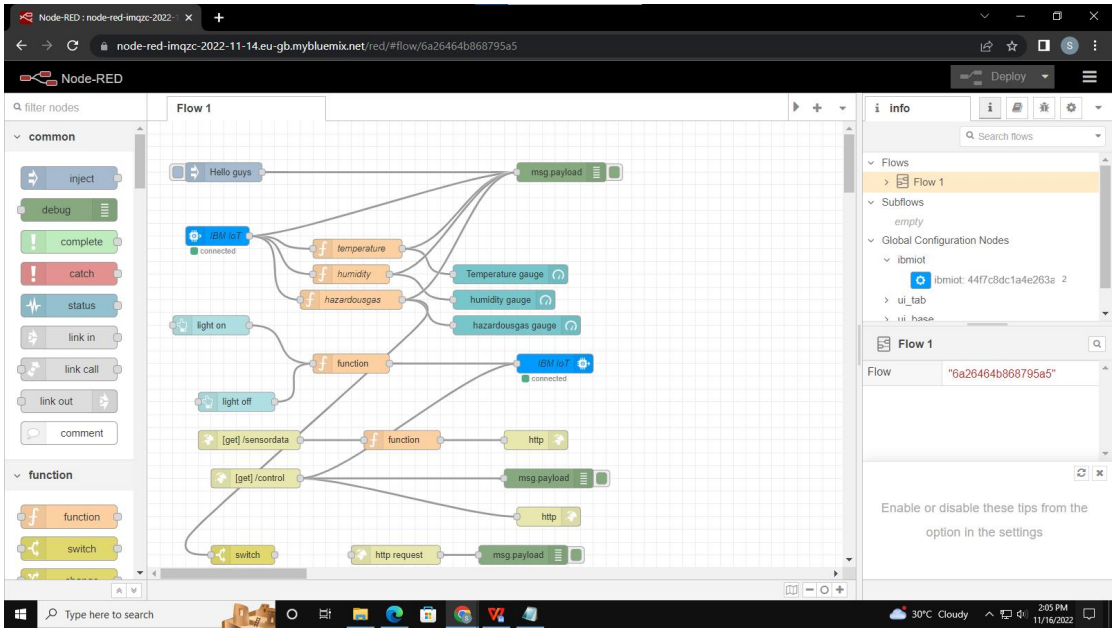
| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| OBJECTIVES | Write a goal or activity | Gas leakage detection systems protect personnel and the environment from potentially hazardous exposure to gases. | The system comprises of sensors for detecting gas leak interfaced 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! |

## Project planning and Scheduling:

Step 1: Creating IBM Watson and Node red.

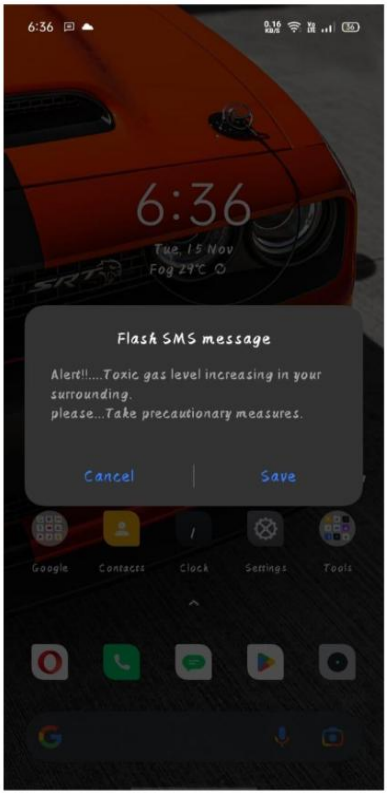



Step 2: Connecting the flow with IBM modules with node red package.



Step 3:
By using Python we have connecting with Ibm aunthenication keys.


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



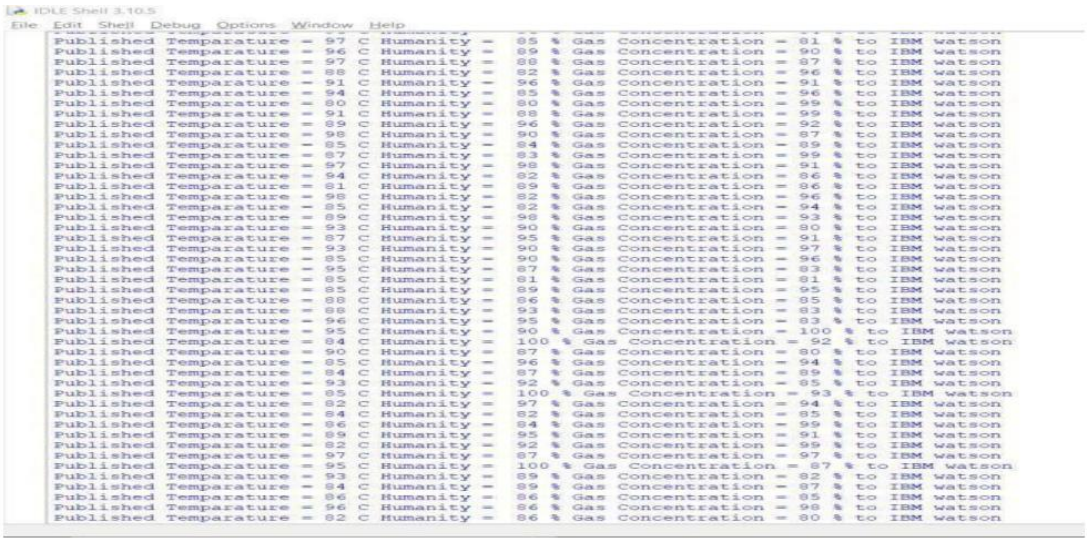
Step 5: Using MIT  inventor app, user interface is created.


## Coding and Solution:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization = "u0b4fr"
deviceType = "TestdriveDevice"
deviceId = "TestdriveDevice_1"
authMethod = "token"
authToken = "8300113450”

try:
```

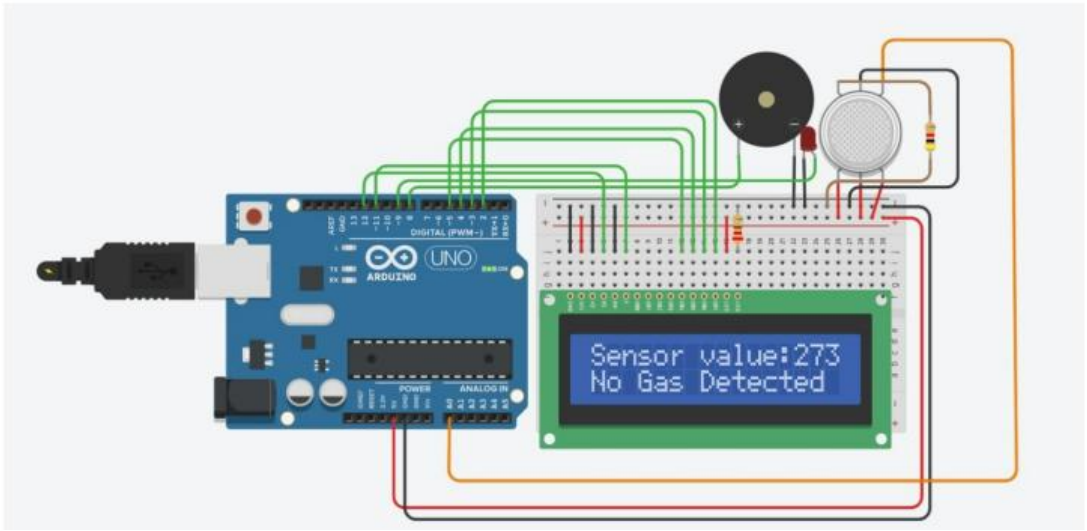
```
    deviceOptions={“org”:organization,
                “type”: deviceType,
                 “id”: deviceId,
                 “auth-method”:authMethod,
                 “auth-token”: authToken
                  }
  except Exception as e:
       print("Caughtexceptionconnecting device: %s" %str(e))
       sys.exit()
      deviceCli.connect()

  while True:
     temp=random.randint(0,100)
           Humid=random.randint(0,100)
           Gas=random.randint(0,100)
           data = { 'temp' : temp, 'Humid': Humid,’Gas’:gas }
     def myOnPublishCallback():
           print ("Published Temperature = %s C" % temp,"Humidity
= %s %%" %Humid, “Gas Concentration = %s”%Gas"to IBM Watson")
           success = deviceCli.publishEvent("IoTSensor", "json",data, qos=0,
on_publish=myOnPublishCallback)
      if not success:
        print(“Not connected to IoTF”)
        time.sleep(10)

     deviceCli.commandCallback = myCommandCallback
     deviceClie.disconnect()
```

## Output:



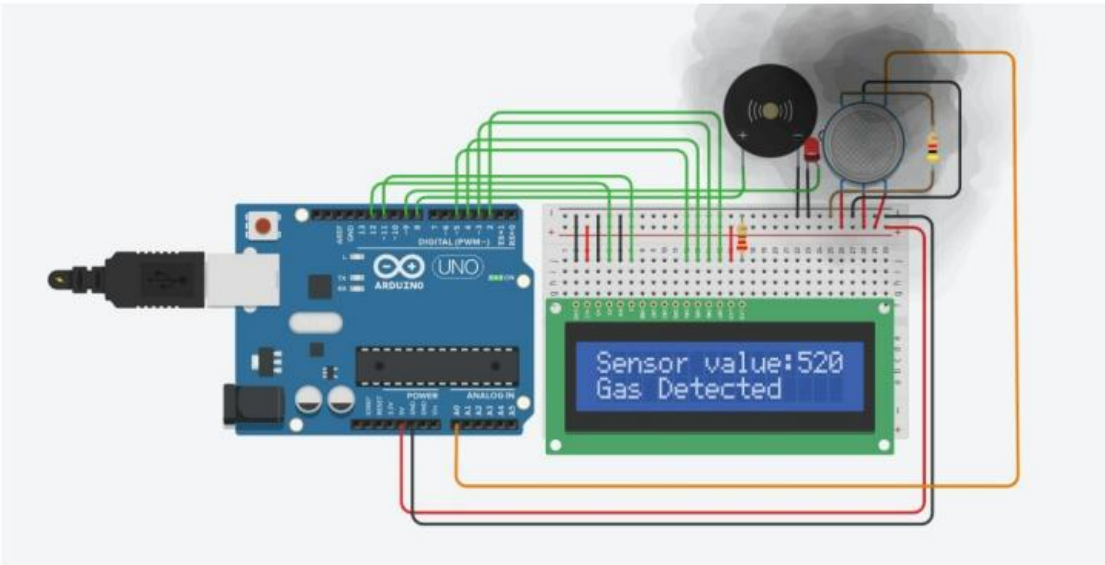

## Testing:

## 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 monitor and rectify by workers in industries.

## List of components:

| 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:

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The term Uno means “one” in the language of “Italian” and was selected for marking the release of Arduino’s IDE 1.0 software. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the reference versions of Arduino and currently progressed to new releases.

## Breadboard:

A breadboard is a widely used tool to design and test circuit. You do not need to solder wires and components to make a circuit while using a bread board. It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle.

## LED:

LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electro-luminance. Electro-luminance is the property of the material to convert electrical energy into light energy and later it radiates this light energy. In the same way, the semiconductor in LED emits light under the influence of electric field.

## Resistor:

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

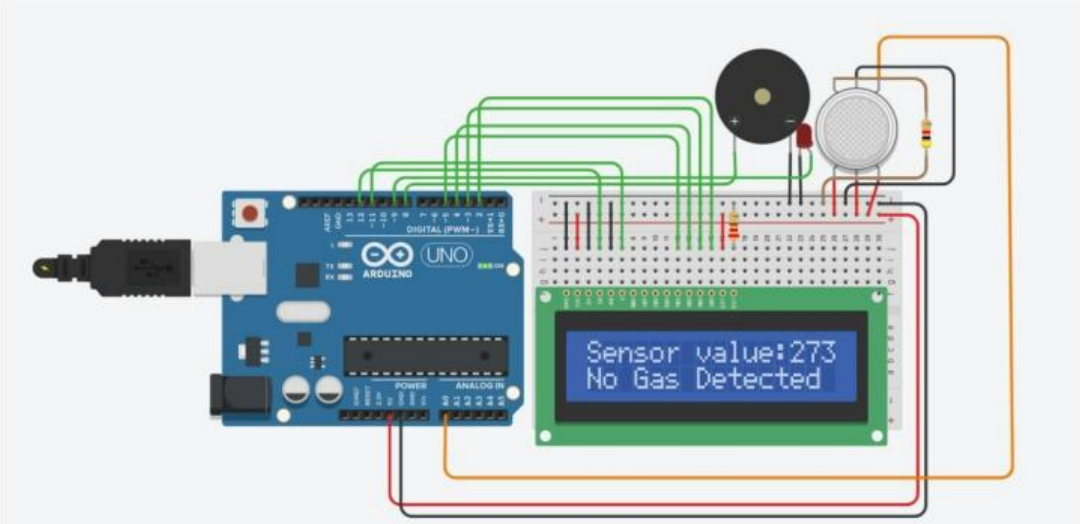
## Gas Sensor:

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.

## LCD 16*2:

16×2 LCD is one kind of electronic device used to display the message and data. The term LCD full form is Liquid Crystal Display. The display is named 16×2 LCD because it has 16 Columns and 2 Rows. it can be displayed (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots.

## Circuit Diagram:




## Advantage and Disadvantage:

### Advantage:

- This project helpful for detecting gas leakage in Industries.
- Component and Equipment are more efficient.
- Lower power consumption and reliable.
- It is also used in house for LPG gas leakage.

### Disadvantage:

- Location cannot be identify where gas leaking because there are several areas contain gas cylinder.

- It is sensitivity depends on Humidity and Temperature.
- Without Internet, This will not run and work.
- Installation is difficult.

## Conclusion:

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas like CO2, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.