IBM NALAIYA THIRAN PROJECT REPORT

# HAZARDOUS AREA MONITORING FOR INDUSTRIAL PLANT POWERED USING IOT

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## 1. INTRODUCTION:

### 1.1 PROJECT OVERVIEW:

In industrial plants, there are areas which need to be monitored . Sometimes the condition become critical that may lead to loss of property and also human loss and to monitor those condition we can install or create a smart devices in those areas which needs monitoring. Every device will be acting as a beacons and it be connected to cloud storage to monitor temperature data and location. After a power plant grown into a feet it is placed into an intelligent monitoring system. Plants are monitored and controlled by mobile phone using mobile application. Errors in system are mainly due to improper monitoring of this system. So plant growth is affected. To overcome this problem the parameters are monitored by these beacon devices to generate a alarm when so insecurity is developed, simultaneously the concentration of all gases are monitored and displayed in the LCD display The proposed system is placed in an industry where the hazardous gases have to be monitored. The individual sensors are placed to read the range of gaseous concentration in ppm. Each sensor is sensitive to its own specific gas. These sensor values are read by the microcontroller, and then it is programmed to monitor the range of all gases. When the concentration of any gas**.**

In this research, a computer program running online was created to detect leakage locations and act as an automatic supervisor in remote areas; simple gas leak detector is a simple device that is used to detect the leakage of gas and if the gas leak occurs, an equivalent message is conveyed by the means of a buzzer and powered by Wi-Fi, it is capable to broadcast messages to the stakeholders about the LPG leak through the cloud which is based on the IoT technology; where -IoT is defined as a system that permits the devices for communicating with each other directly without human intervention [4]-. The proposed system will continuously monitor the environment for any leakage. Just in case of any leakage detection, it'll alert the user via a buzzer and by using the ESP2866 wifi microcontroller and an IOT platform ; it'll alert the user about the environmental conditions to the gas level of that location of IBM cloud (as mentioned previously) notification.

### 1.2 PURPOSE:

In every day many people are facing some industrial hazards like fire hazards, chemical exposure. It causes workers have physical and psychological problems in industrial plants. Any industry in the world. Which work make a

electricity and other efficient products for peoples. So, we cannot avoid these industrial plants, but we can control the risk of power plants. Because we using automatic alarm based on IoT. Create mobile application it works detect the fire hazard and gas leak aging level in the industry. We using IoT device and web application it can protect the workers and protect the physical equipment’s of theplant. This intelligent device can help to growth of industries

and improve the security protection basics of IoT make automation and give solution to the risks. Tish IOT integrated with controller and sensors for intelligent monitoring and controlling purposes like avoid hazards in industrial sides. System is made automated through IOT which improves the efficiency and reduces the efforts and it reduce hazards fire, burn, gas leakage, toxic gases, explosion, physical problems of peoples and industry**.**

**KEYWORDS: Hazardous, IBM Cloud platform, LPG, Alarm system.**

## 2. LITERATURE SURVEY:

| S. No | Reference | Advantages | Date |
|---|---|---|---|
| 1. | Sulfur Hexafluoride Gas Leakage Monitoring and Early-Warning Method for Electrical Power Facilities | Device to maintain harmful gas(sulphur hexafluoride) below specified level | 14th July 2020 |
| 2. | Pervasive and Personalized Ambient Parameters Monitoring: A Wearable, Modular, and Configurable Watch | An innovative, small, compact, light-weighted, configurable, and low power consumption wrist-worn prototype in the area of ambient parameters monitoring | 6 February 2019 |
| 3. | Pre-Alarm System Based on Real-Time Monitoring and Numerical Simulation Using Internet of Things and Cloud Computing for Tailings Dam in Mines | Real-time pre-alarm for the instability of tailings dam is vital to ensure the normal mining and safety of human lives and properties | 18 September 2017 |

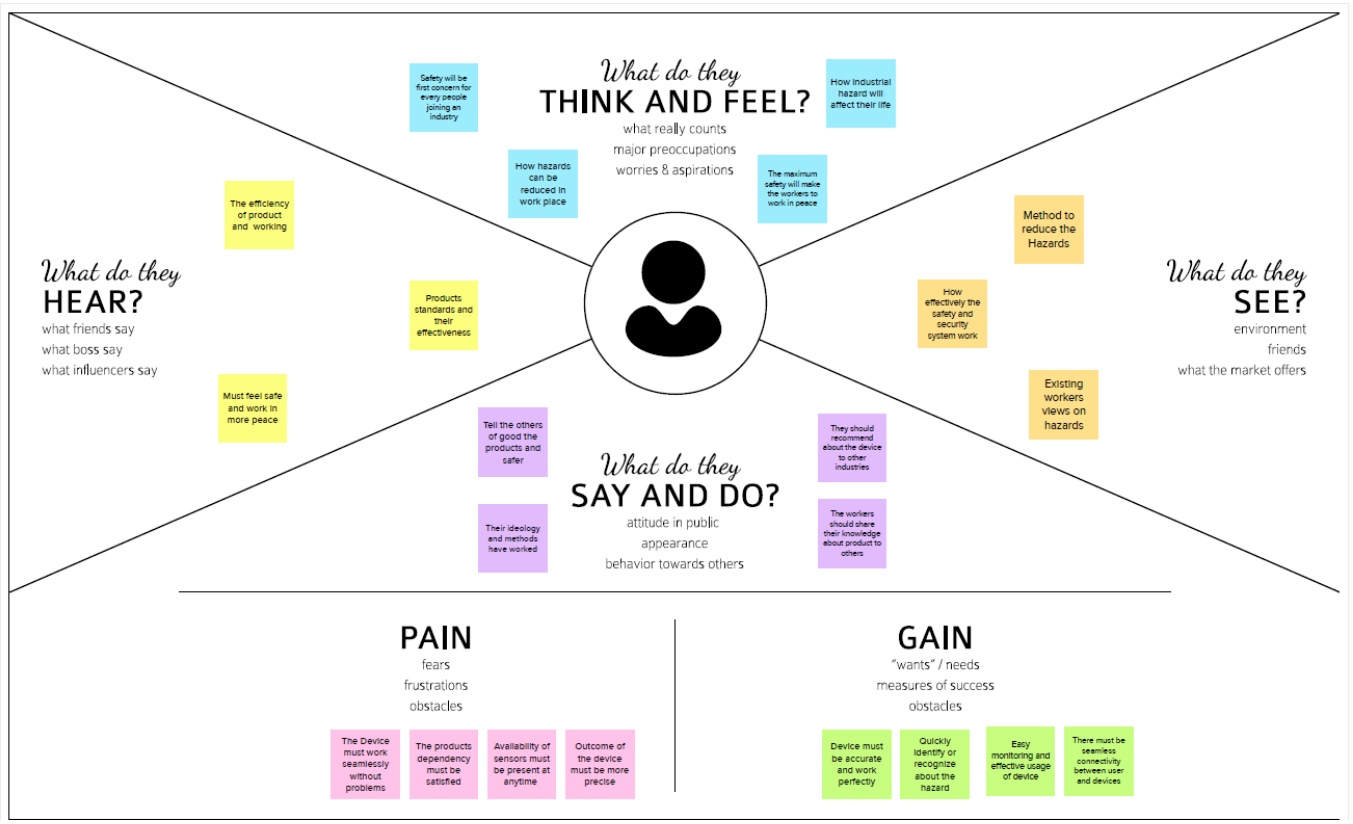
### 2.1 EXIXTING PROBLEM:

The need to industrialize to compete with global standards is a complete requisite to realize a booming economy.However, there is no question that it has wreaked havoc on the environment caused industrial emissions of dangerous chemicals. This study aimed to create a system that will allow Industrial plants and factories to monitor the emission of the smoke stacks. But leakage can take place through pipes or regulators or knobs which may cause

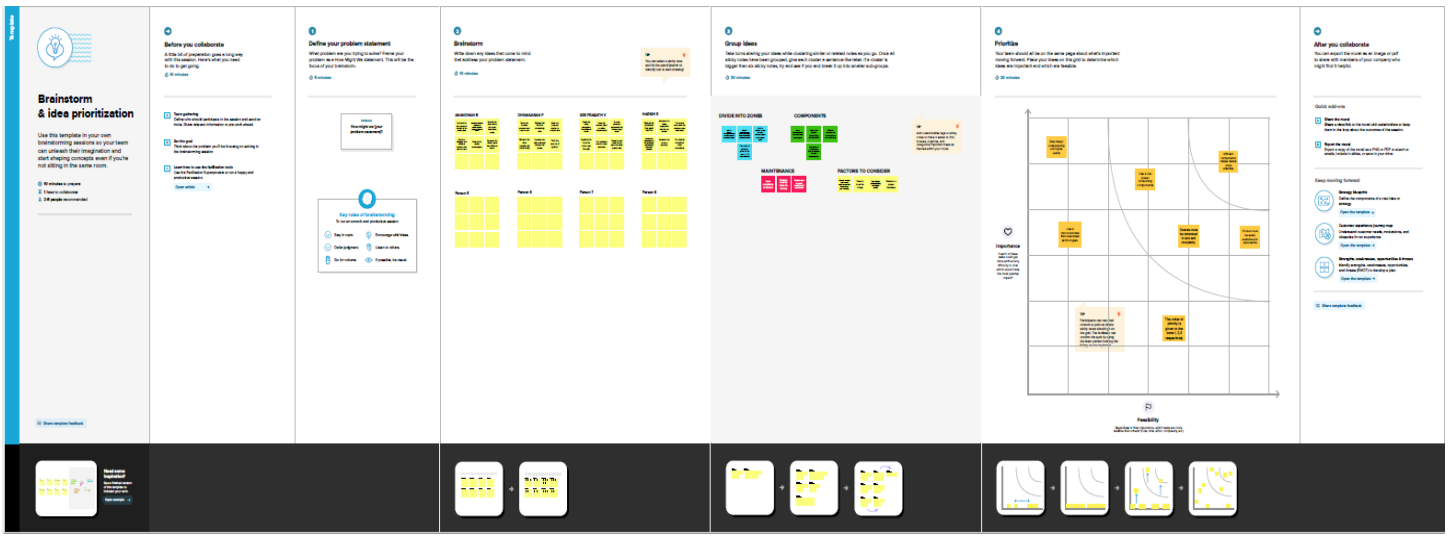
accidents like suffocation, uneasiness or sometimes.The existing system in gas leakage detection is done using microcontroller.This system contains only few application like gas leakage detection and producing an alarm signal whenever gas leakage is detected.

## 3. IDEATION & PROPOSED SOLUTION:

### 3.1 EMPATHY MAP CANVAS




### 3.2 IDEATION & BRAINSTORMING:



### 3.3 PROPOSED SOLUTION:

In industrial areas fire accidents can be prevented by fire detection using temperature and gas sensors. Harmful or toxic gas leakages can identified by the use of wireless technology, information from these sensors can be broadcasted to the particular individual. Alert messages are sent via an application and buzzer sound is enabled.

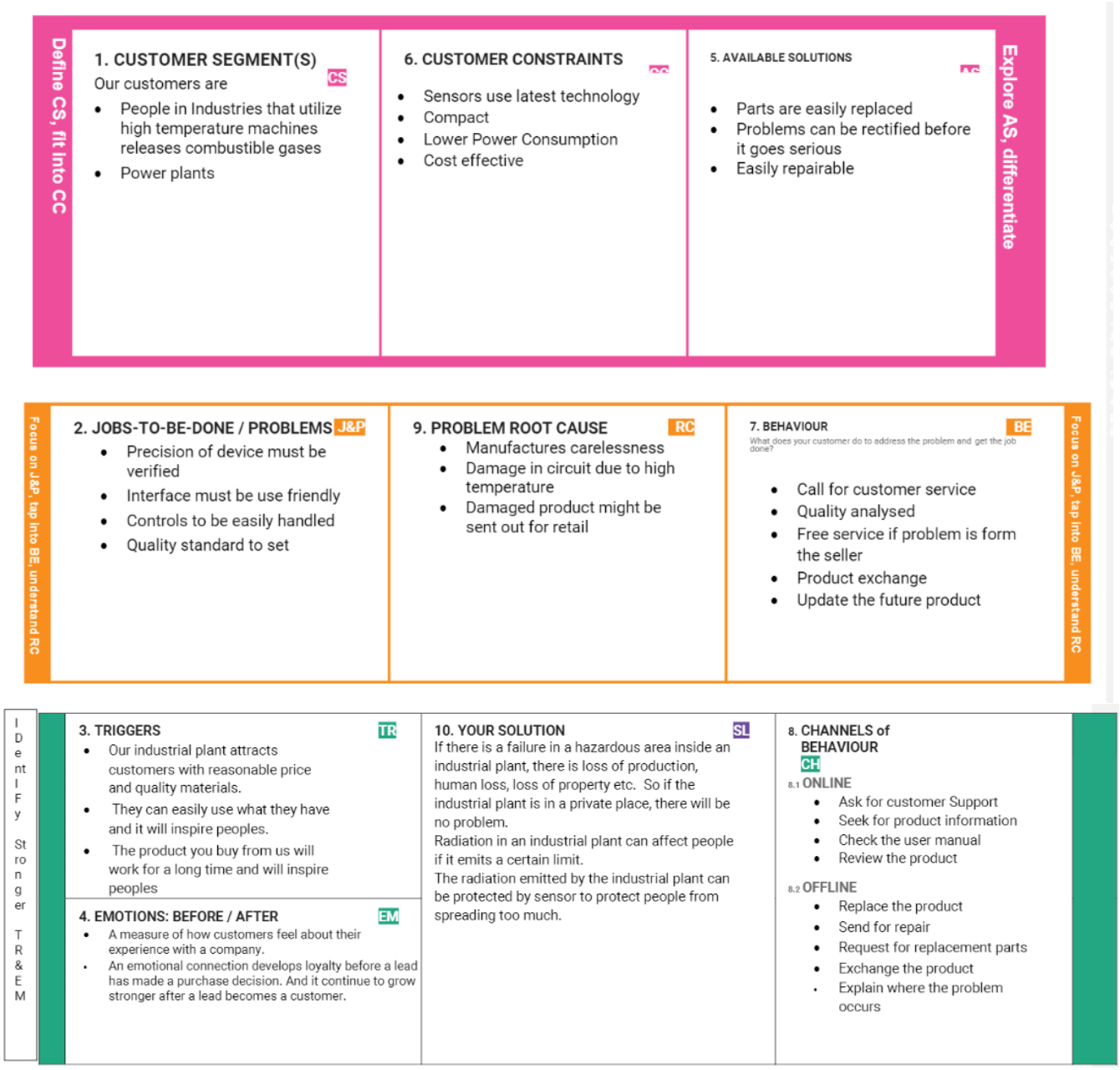
A versatile modular monitoring equipment for the proactive diagnosis and monitoring of a wide range of industrial equipment [2, 3] is becoming more and more useful. Automation systems have started to be modularized in order to be able monitor a wide range of equipment (such as compressors, electric motors, gas turbines, blowers etc.) A properly designed automation cabinet [4, 5] can increase productivity, lowers costs, and ensure processes reliability.

This application has a powerful impact not only on the people but also on the environment. By using this application ,individuals are alerted in case of dangeror threat. Thereby environment as well as thousands of life can be saved which in turn causes contentment.

Industrial plans are the one that contain both hazardous and non-hazardous area .The monitoring of the hazardous area in industrial plants in important from time to time.If the damage that occurs in hazardous areas can result in the loss ofproperty or lives.So monitoring for Industrial plants is a project that focuses on the necessity of the monitoring of hazardous area in industrial plants .There can be smart devices integrated at the hazardous area that can help in detecting any fishy things that can occur in the particular area. The software needs to monitor the temperature parameters of the hazardous area in industrial plants.

The uniqueness of our application we will get live updates of temperature, humidty and radiation in and around the workers environment using IoT.

## 3.4 PROPOSED SOLLUTION FIT




# 4. REQUIREMENT ANALYSIS:

## 4.1 FUNCTIONAL REQUIREMENT:

In infrastructure and industrial plants the rapid growth is creating environmental issues like pollution, climate change and malfunctioning. It has a great consequence for the requirement of an operationally adaptable, efficient, cheap and smart monitoring systems. For this purpose we come up with idea to use these kind of technology the Internet of Things (IoT) inform of a solution.

In this paper, we suggest wireless data gathering frameworks that enable each detector node to track the changes in the pattern of gases and to identify their role in gas leakage problem, whilst at the same time trying to minimize power consumption.

The sensor converts the physical quantity into the voltages, when concentrationincreases the input voltage to microcontroller through sensor is also simultaneously increases

## 4.2 HARDWARE REQUIREMENTS:

3.2.1 Alarm
3.2.2 Fire sensor
3.2.3 Gas sensor
3.2.4 Driver
3.2.5 Smart wearables
3.2.6 Beacons

**a) Alarm**

The four ways your fire alarm system works to protect your property and its occupants from the dangers of fire are by detecting fire, alerting occupants, managing risk.

**b) Smart wearable's**

To inform the client around the temperature of the zone.

**c) Beacons**

Beacons are small, wireless ,battery operated sensors that are powered by Bluetooth low energy (BLE) technology that can detect and measure things like the temperature in a cold case, motion in a black room, the amount of items on aself, spills in the forecourt, of when a customer who signed into the store's mobile.

**d) Cloud storage**

To store and get to the information. Using IBM cloud server .installed by use.

**e) Temperature sensor**

Temperature sensors monitor about the surrounding temperature and givethe alert when the temperature level exceeds.

**f) IoT**

Internet of things is the method that used for the mobile access of the system where ever we live.

Here we used to monitor about the system though microcontroller unit.

j**) Mobile phone**

Mobile phone used to view the monitoring of hydroponic system. Which operate through the IoT. Monitoring parameters are obtained in that mobile phone itself.

## 4.3 NON-FUNCTIONAL REQUIREMENTS:

A non-functional requirement defines the quality attributes of a software system.It specifies “What should the software system do?” it places constraines on “How should the software system fulfil the functional requirements?”.In system engineering and requirements engineering a non functional requireementsus a requireemnts that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. They are constrasted with non-functional requirements that define specific behaviour or functions. The pklan for implementing functional requirements is detailed in the system desigh. The plan for implementing functional requirements is detailed in the system architecture, because they are usually architecturally siginificant of non-functional requirements.

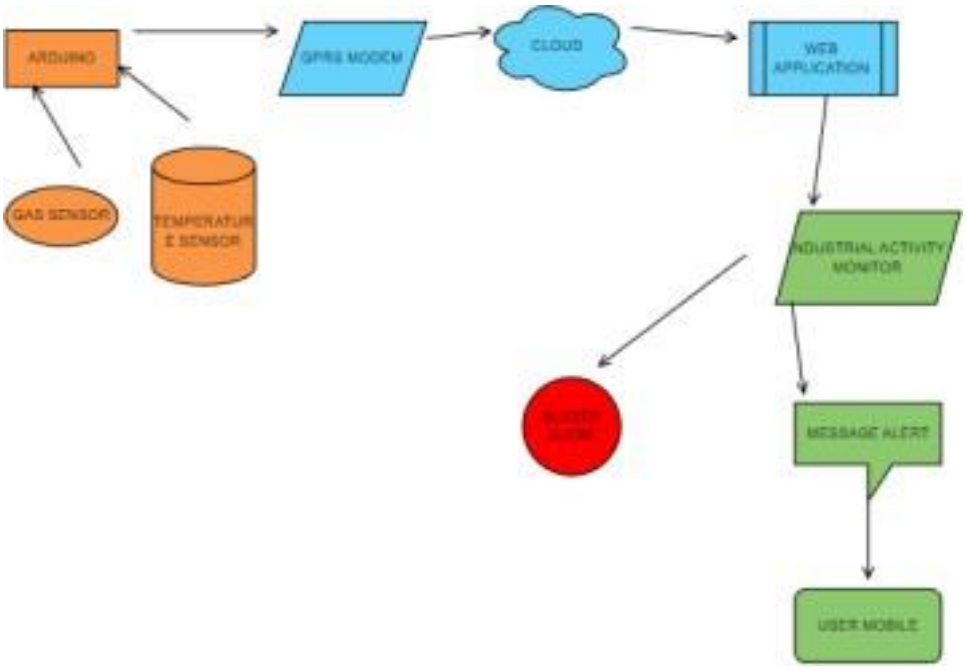
## 4.4SOFTWARE REQUIREMENTS:

Arduino IDE
Microcontroller
Power supply unit

It consists of microcontroller (PIC 16F877A), gas sensor, weight sensor (Load Cell- L6D), GSM module (SIMCOM 300), and display(s). To monitor the LPG, **an efficient and fast working microcontroller** is required. The microcontroller also controls the working of the gas sensor and load sensor output.

# 5 .PROJECT DESIGN:

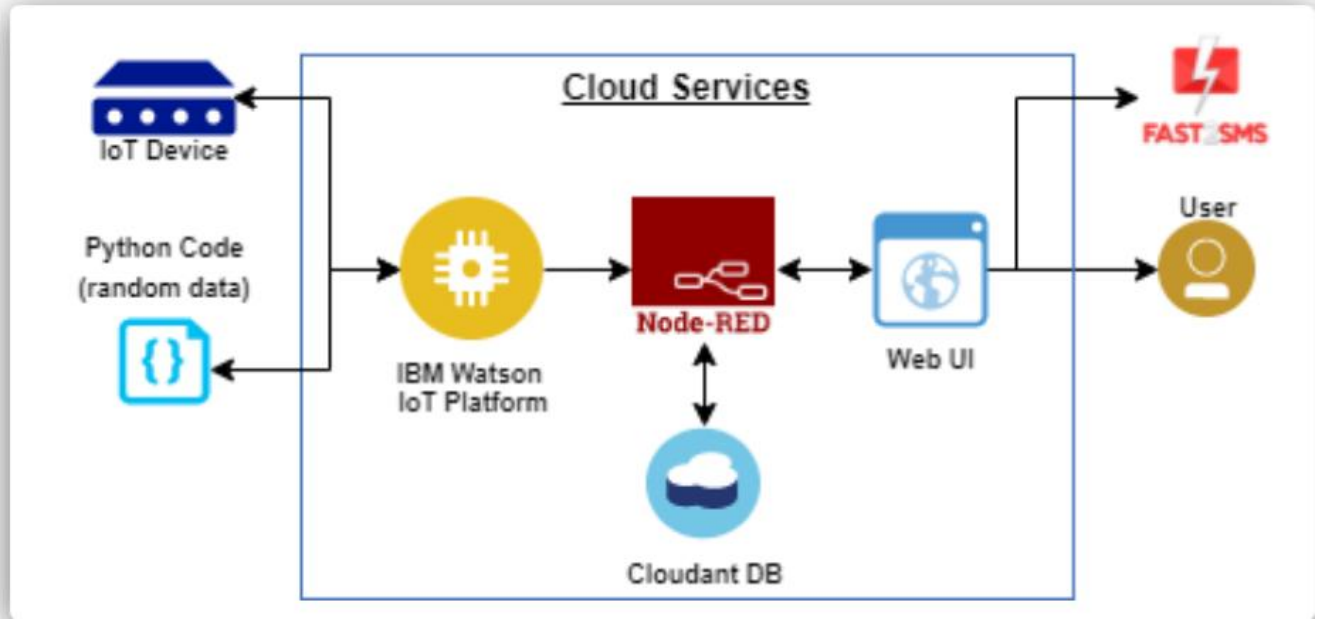
## 5.1 DATA FLOW DIAGRAMS:



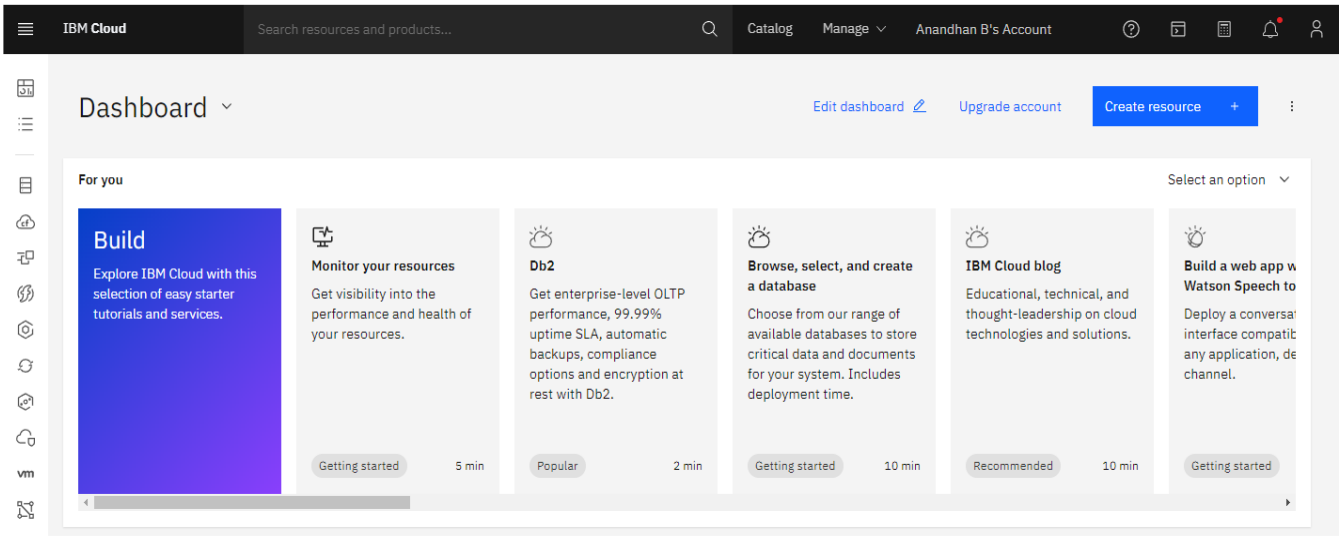
## 6. SOLUTION & TECHNICALARCHITECTURE:

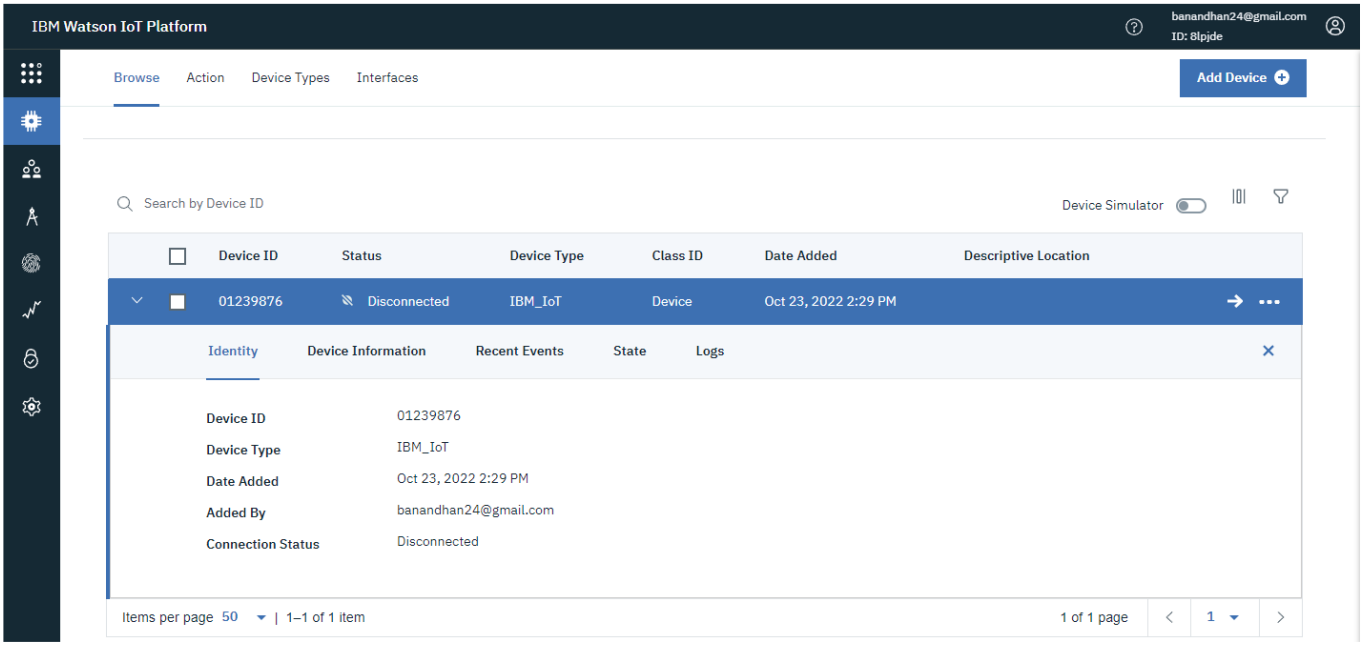
Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

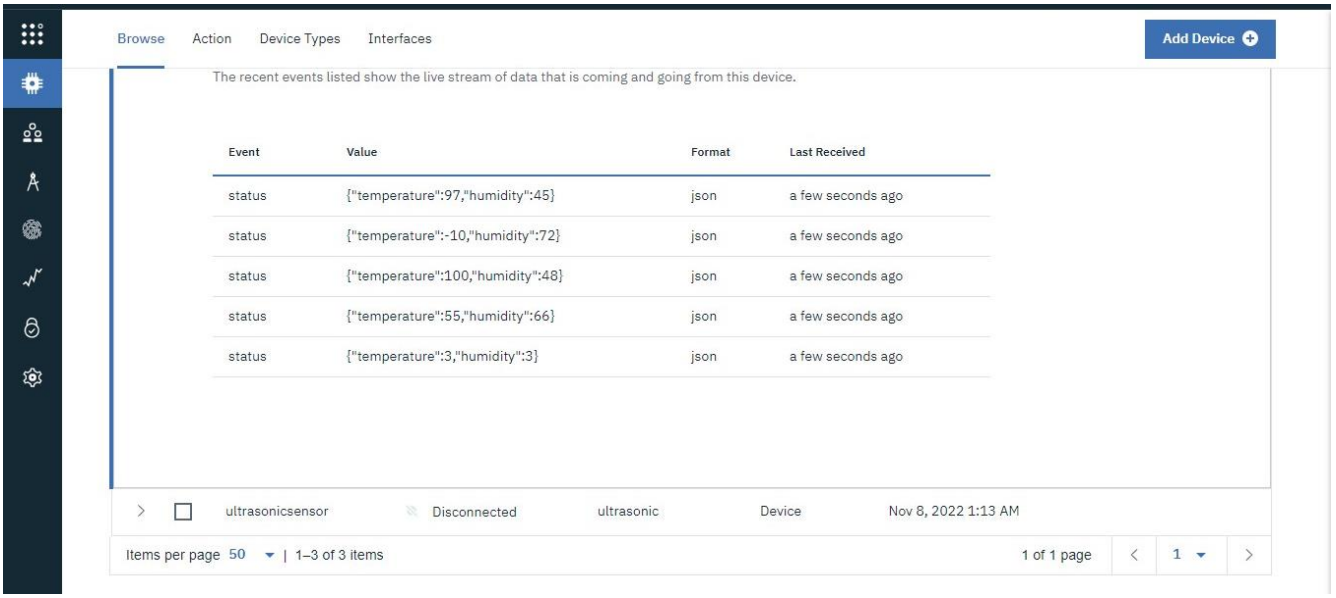
- In industries parameters (**temperature and combustible gases**) must be monitored contagiously
- To follow the working of machine and units these parameters must be stored in a cloud using IOT **(Industry 4.0).**
- During deviation from regular working an **alert message** must be sent to **control room and workers** present the unit
- The product must be **very efficient**.
- The device will be compact, and microcontroller used is an **Arduino UNO rev3** or **Pyboard** for utilizing advanced technology.
- Uses **Infrared temperature sensor** for monitoring temperature.
- We product will include a **Miniaturized MOS sensor** for monitoring the **fuel gas level** inside the power plant



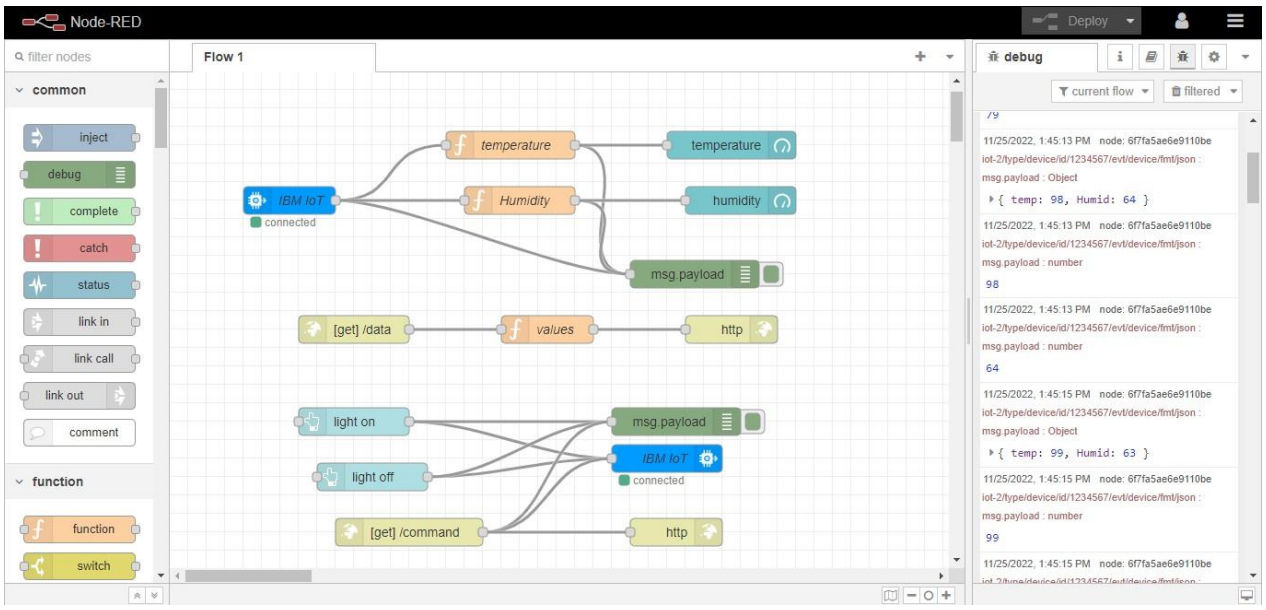

## 7. CLOUD DATABASE:

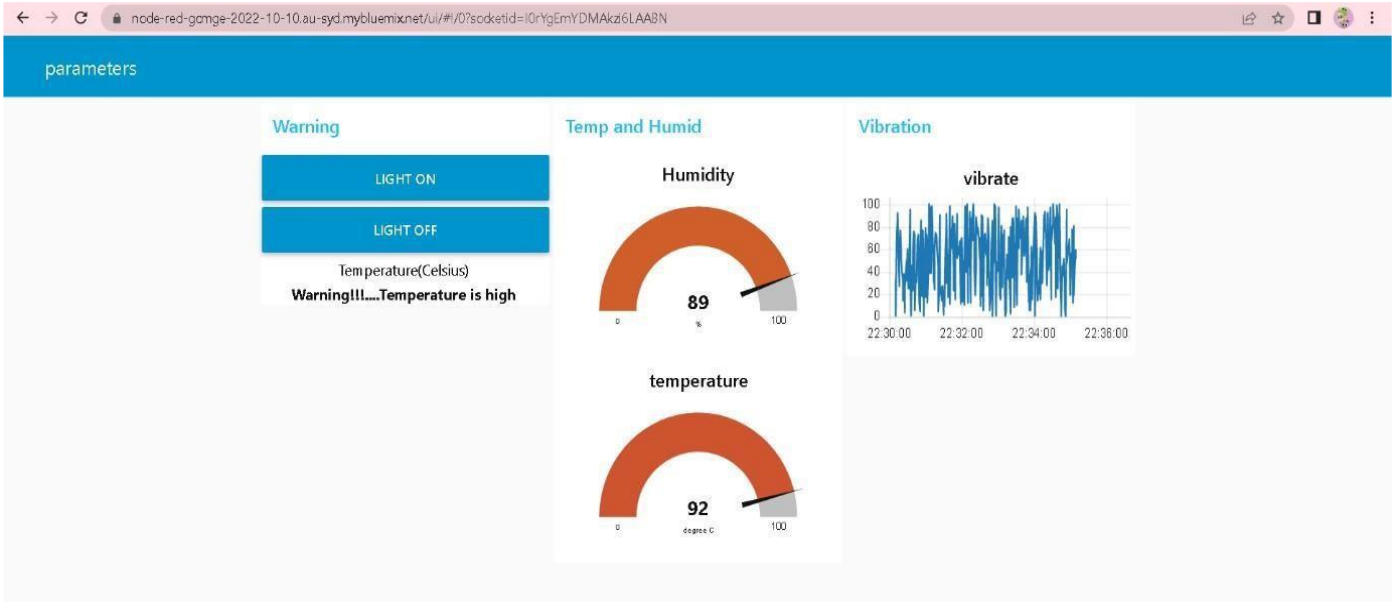

IBM Cloud
Search resources and products...
Catalog
Manage
Anandhan B's Account
Dashboard
Edit dashboard
Upgrade account
Create resource
For you
Select an option
Build
Explore IBM Cloud with this selection of easy starter tutorials and services.
Monitor your resources
Get visibility into the performance and health of your resources.
Getting started
5 min
Db2
Get enterprise-level OLTP performance, 99.99% uptime SLA, automatic backups, compliance options and encryption at rest with Db2.
Popular
2 min
Browse, select, and create a database
Choose from our range of available databases to store critical data and documents for your system. Includes deployment time.
Getting started
10 min
IBM Cloud blog
Educational, technical, and thought-leadership on cloud technologies and solutions.
Recommended
10 min
Getting started


IBM Watson IoT Platform
banandhan24@gmail.com
ID: 8lpjde
Browse
Action
Device Types
Interfaces
Add Device
Search by Device ID
Device Simulator
Device ID
Status
Device Type
Class ID
Date Added
Descriptive Location
01239876
Disconnected
IBM_IoT
Device
Oct 23, 2022 2:29 PM
Identity
Device Information
Recent Events
State
Logs
Device ID
01239876
Device Type
IBM_IoT
Date Added
Oct 23, 2022 2:29 PM
Added By
banandhan24@gmail.com
Connection Status
Disconnected
Items per page 50
1–1 of 1 item
1 of 1 page
1


Browse
Action
Device Types
Interfaces
Add Device
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
Last Received
status
{"temperature":97,"humidity":45}
json
a few seconds ago
status
{"temperature":-10,"humidity":72}
json
a few seconds ago
status
{"temperature":100,"humidity":48}
json
a few seconds ago
status
{"temperature":55,"humidity":66}
json
a few seconds ago
status
{"temperature":3,"humidity":3}
json
a few seconds ago
ultrasonicsensor
Disconnected
ultrasonic
Device
Nov 8, 2022 1:13 AM
Items per page 50
1–3 of 3 items
1 of 1 page
1

# 8. NODE RED:


Node-RED
Deploy
filter nodes
Flow 1
debug
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
temperature
temperature
IBM IoT
connected
Humidity
humidity
msg.payload
[get] /data
values
http
light on
msg.payload
IBM IoT
connected
light off
[get] /command
http
current flow
filtered
11/25/2022, 1:45:13 PM node: 6f7fa5ae6e9110be
iot-2/type/device/id/1234567/evt/device/fmt/json :
msg.payload : Object
{ temp: 98, Humid: 64 }
11/25/2022, 1:45:13 PM node: 6f7fa5ae6e9110be
iot-2/type/device/id/1234567/evt/device/fmt/json :
msg.payload : number
98
11/25/2022, 1:45:13 PM node: 6f7fa5ae6e9110be
iot-2/type/device/id/1234567/evt/device/fmt/json :
msg.payload : number
64
11/25/2022, 1:45:15 PM node: 6f7fa5ae6e9110be
iot-2/type/device/id/1234567/evt/device/fmt/json :
msg.payload : Object
{ temp: 99, Humid: 63 }
11/25/2022, 1:45:15 PM node: 6f7fa5ae6e9110be
iot-2/type/device/id/1234567/evt/device/fmt/json :
msg.payload : number
99
11/25/2022, 1:45:15 PM node: 6f7fa5ae6e9110be


node-red-gcmge-2022-10-10.au-syd.mybluemix.net/ui/#!/0?socketid=I0rYgEmYDMAkzi6LAABN
parameters
Warning
LIGHT ON
LIGHT OFF
Temperature(Celsius)
Warning!!!....Temperature is high
Temp and Humid
Humidity
89
0
%
100
temperature
92
0
degree C
100
Vibration
vibrate
100
80
60
40
20
0
22:30:00
22:32:00
22:34:00
22:36:00

# 9. CODING & SOLUTIONING:

```
import time
import sys
import random
import ibmiot.application
import ibmiot.device
organization = "8lpjde"
deviceType = "Ultrasonic"
deviceId = "123654"
authMethod = "use-token-auth"
authToken = "qwerty1234"
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()
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 )
    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

deviceCli.disconnect()
```

*Python 3.7.4 Shell*

File Edit Shell Debug Options Window Help

```
Published Temperature = 37 C Humidity = 99 % Gas Concentration = 58
Published Temperature = 7 C Humidity = 53 % Gas Concentration = 1
Published Temperature = 73 C Humidity = 78 % Gas Concentration = 42
Published Temperature = 74 C Humidity = 52 % Gas Concentration = 2
Published Temperature = 61 C Humidity = 64 % Gas Concentration = 69
Published Temperature = 7 C Humidity = 84 % Gas Concentration = 80
Published Temperature = 58 C Humidity = 91 % Gas Concentration = 95
Published Temperature = 20 C Humidity = 26 % Gas Concentration = 37
Published Temperature = 90 C Humidity = 85 % Gas Concentration = 98
Published Temperature = 14 C Humidity = 18 % Gas Concentration = 49
Published Temperature = 85 C Humidity = 38 % Gas Concentration = 8
Published Temperature = 42 C Humidity = 37 % Gas Concentration = 84
Published Temperature = 2 C Humidity = 88 % Gas Concentration = 34
Published Temperature = 6 C Humidity = 72 % Gas Concentration = 69
Published Temperature = 35 C Humidity = 100 % Gas Concentration = 78
Published Temperature = 80 C Humidity = 100 % Gas Concentration = 48
Published Temperature = 12 C Humidity = 98 % Gas Concentration = 37
Published Temperature = 38 C Humidity = 50 % Gas Concentration = 11
Published Temperature = 10 C Humidity = 14 % Gas Concentration = 24
Published Temperature = 90 C Humidity = 76 % Gas Concentration = 94
Published Temperature = 33 C Humidity = 17 % Gas Concentration = 92
Published Temperature = 71 C Humidity = 14 % Gas Concentration = 47
Published Temperature = 26 C Humidity = 56 % Gas Concentration = 43
Published Temperature = 100 C Humidity = 85 % Gas Concentration = 43
Published Temperature = 36 C Humidity = 37 % Gas Concentration = 34
Published Temperature = 6 C Humidity = 80 % Gas Concentration = 53
Published Temperature = 78 C Humidity = 4 % Gas Concentration = 70
Published Temperature = 50 C Humidity = 65 % Gas Concentration = 7
Published Temperature = 19 C Humidity = 60 % Gas Concentration = 47
Published Temperature = 28 C Humidity = 74 % Gas Concentration = 14
Published Temperature = 82 C Humidity = 17 % Gas Concentration = 73
Published Temperature = 5 C Humidity = 98 % Gas Concentration = 80
```

## 10. RESULTS:

### 10.1 PERFORMANCE METRICS:

The result of this project is determined by using a lighter to collect leakedgas around the gas sensor,after sensing procedure if sensor value is greater than the threshold value then ESP 8266(NODE MCU) will perform its programmed tasks : Immediately turn off the regulator knob to stop further leakage. After detecting the gas leakage, the relay will be on the Enhanst fan to prevent any further accidents. Buzzer starts beeping to alert the nearby people. The exhaust fan will fan out all enclosed gas from the environment. The wi-fi module updates the information to the cloud. The user can get to know the gas values and status of the system through the app and also control of the power supplycan be done manually by the user through the app.

### 1.2 ADVANTAGES :

The smart box has been developed as a prototype to measure the level of airquality, dust, temperature, and humidity. It is suitable to implement and apply in a smart city for the near future.

This will help companies in maintaining the machine Technology, and provide them emission data of gaseous elements such as carbon monoxide, particulatematter, sulfur and nitrogen dioxide that will help them in complying with the environmental standards of industrial emission.

- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Supervise gas concentration levels
- Ensure worker's health
- Real-time updates about leakages
- Cost-effective installation
- Data analytics for improved decisions
- Measure oxygen level accuracy
- Get immediate gas leak alerts

### 10.3 DISADVANTAGS:

It gets reacted due to heating of wire.

- It measures toxic gases in very low concentrations.

- It has ability to detect wide range of gases.
- It is difficult toknow failure modes unless very advanced methods of monitoring are used.
- Itcauses suffocation, in case of leakage as it heavier than air.
- It is hazardous as it inflammable gas.
- It is consumed more as it has low energy density.
- It does not provide power to the vehicle in mountains or roughterrains.
- It is costlier than CNG.

## 10.4 APPLICATIONS:

### Harmful Gas Detection:

The sensing of toxic gases such as H2S, Methane, and CO is of great importance in any industry to avoid unwanted leakage and consequences like poisoning or explosions. The presence of these gases can be easily detected in the industrial facilities and commercial buildings with the help of IoT-powered gas monitoring solution. Moreover, a gas detector or sensor device is a crucial part to carry out safe industrial operations. The sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises.

## 11. CONCLUSION:

It is always better to have preventive measure, rather than taking actions after a disaster. Having a system to monitor the changes in the surroundings should help the owners of the industry to keep their industries safe and also keeptheir workers safe. Though the initial cost of installation of the device is higher,it is always better to spend on precaution, than spending on fixing any harmful situation.

## 12. FUTURE SCOPE:

Another major future scope could be including a Automatic Shut-off device which will turn off the gas supply whenever it will detect any gas leakage.

When the temperature of the power plant unit goes higher than the safe level it will alert messages. This system can be implemented in Industries, Hotels and wherever the LPG cylinders are used.

1) Fast Speed of response.
2) Immune to catalytic poisons.
3) High Reliability & Repeatability.

4) Heated optics eliminates condensation.
5) Ability to operate in the absence of oxygen or in enriched oxygen

As detectors measure a specified gas concentration, the sensor response serves as the reference point or scale. When the sensors response surpasses a certain
pre-set level, an alarm will activate to warn the user. There are various types of detectors available and the majority serves the same function: to monitor and warn of a dangerous gas level. However, when considering what type of detectorto install, it is helpful to consider the different sensor technologies.

Gas Detector Technologies :-
Gas detectors are categorized by the type of gas they detect: combustible or toxic. Within this broad categorization, they are further defined by the technology they use: catalytic and infrared sensors detect combustible gases and electrochemical and metal oxide semiconductor technologies generally detect toxic gases.

Measurement of Combustible Gases :-
Infrared sensors or IR detectors work via a system of transmitters and receivers to detect combustible gases, specifically hydrocarbon vapors. Typically, the transmitters are light sources and receivers are light detectors. If a gas is present in the optical path, it will interfere with the power of the light transmission between the transmitter and receiver. The altered state of light determines if and what type of gas is present.

## 13. APPENDIX:

Fire detection using temperature and gas sensors. Harmful or toxic gas leakages can identified. By the use of wireless technology, information fromthese sensors can be broadcasted to the particular individual. Alert message are sent via an application and buzzer sound is enabled. The uniqueness of our application we will get live updates of temperature, humidity and radiation inand around the workers environment using IoT. This application has a powerful impact not only on the people but also on the environment.by using this application, individuals are alerted in case of danger or threat. there by environment as well as thousands of lives can be saved which causes contentment.