GAS LEAKAGE MONITORING AND ALERTING SYSTEM

PROJECT REPORT

PROJECT NAME	**Gas Leakage Monitoring and Alerting System**
TEAM ID	**PNT2022TMID36762**
TEAM MEMBERS	**D.BEENA SHERIN** **S.JAYASRI** **R.KAMATCHI SONIYA** **R.VISHALI** **S.YAMINI**
BRANCH	**Electronics and communication**

ABSTRACT:-

The explosion due to gas leakage has become a serious problem in our country's daily activities .Now the world is evolving with technology, so it is necessary to use technology if possible in every case.In this paper development of an IOT based Gas Leakage MonitoringAnd Alerting System is processed.This paper elaborates design such an intelligent system that will help to save gas and smartly prevent accidents.Gas Leakages in open or closed areas can prove to be dangerous and lethal.The traditional Gas Leakage Monitoring System through have great precision, fail to acknowldege a few factors in the field of alerting the people about the leakage.Therefore we have used the IOT technology to make a Gas Leakage Monitoring for society which having Alerting System techniques involving sending text message to the concerned authority and an ability performing data analytics on sensors readings.The system is based on a microcontroller, which uses gas sensors as

well as IBM Watson display,LED and buzzer.The sensor will detect the gas leakage and transmit the information to the microcontroller. On this basis of those information the microcontroller make a decision and then display and the message will be sent the user via IBM Watson.The uses of the Arduino microcontroller with Ardunio,provide a suitable platform for implementing an embedded control system and it is possible to modify it to meet our future requriements easily and quickly.

1. INTRODUCTION

The Internet of things (IoT) is the system of gadgets, vehicles, and home machines that contain hardware, programming, actuators, and network 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.Gas sensors work on the principle of transforming the gas adsorption effects on the surface of the active material into a detectable signal in terms of its changed electrical, optical, thermal, mechanical, magnetic (magnetization and spin), and piezoelectric properties.The hazardous gases like LPG and propane were sensed and displayed each and every second in the LCD display. If these gases exceed the normal level then an alarm is generated immediately and also an alert message (SMS) is sent to the authorized person through on IBM Watson.

2. LITERATURE REVIEW

Existing Problem:

Gas leakage is a major problem with industrial sector, residential premises and gas power vehicles like CNG (compressed natural gas) buses, cars. The good system are of high cost and also the installation process is too complicated.

References:

1. Konersmann et al., 2009 which focuses on the risks of pipeline transportation, covers incidents that occurred in Europe and on the American continent presenting the main causes of pipeline failure.

2. In province of Alberta/Canada alone, there have been 1326 reported gas leaks in the 2001-2005 period.

3. The sub-sea pipeline systems (SLR, 2009), states that, between 1996 and 2006, a number of 80 pipeline rupture incidents were reported in the Gulf of Mexico and Pacific areas.

PROBLEM STATEMENT DEFINITION:

Domestically we use natural gas and it is very useful for burning purposes. If this gas is leaked in our kitchens, offices or factories and not sensed in time, it may lead to a fatal disaster, and may cause human loss. For this purpose, we came forward with an idea of making such an electronic device to sense that leakage and alarm the respective persons to solve that leakage problem and save assets and human lives. It also down our economical rate.

3. IDEATION & PROPOSED SOLUTION

Empathy Map Canvas:-

What we think to create device which helps us to control emission of flammable substance into environment. It should be user friendly and low cost for maintenance. For that we see continous monitoring device and buzzer is to indicate the leakage.

Ideation & Brainstorming:

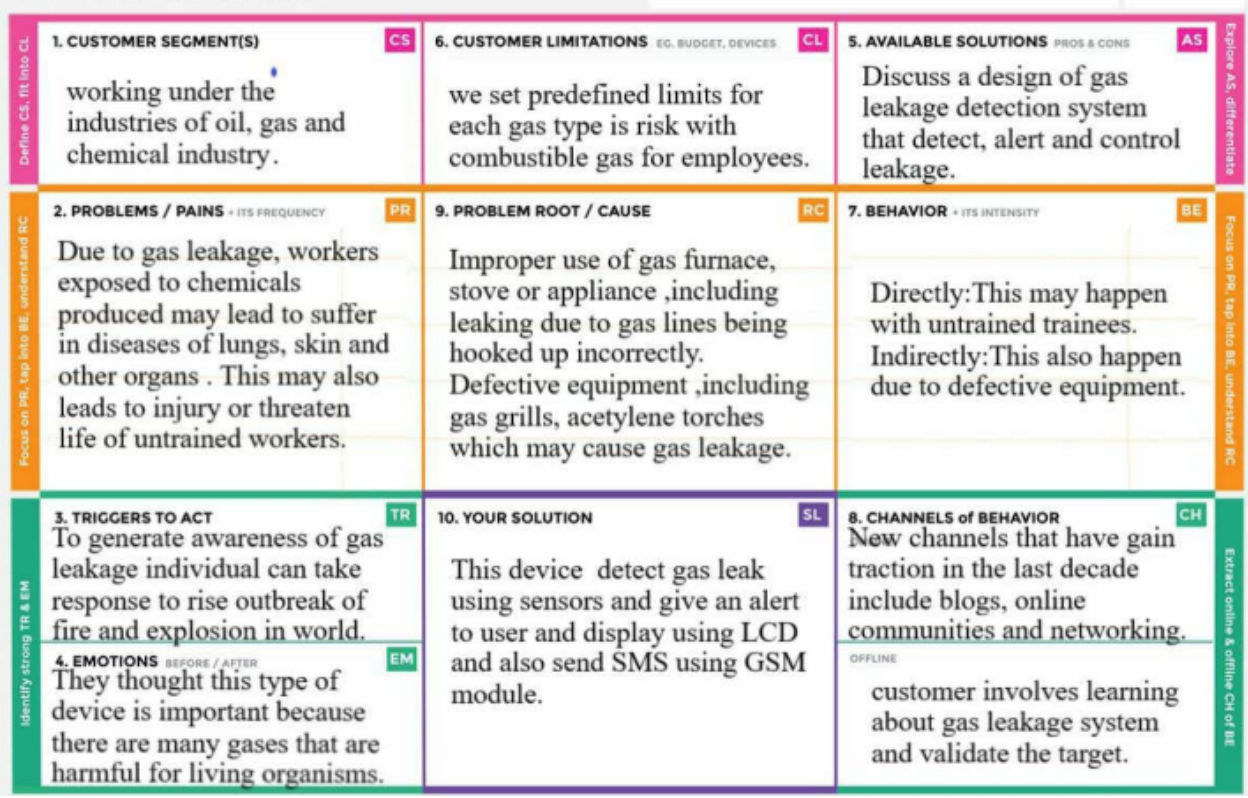
The ideas are In case of higher gas leakage and fire accidents, a notification can be given to the fire station and hospital through software application.The level of gas in the industry can be informed through speakers periodically.When gas gets leaked, a notification can be passed to hospital.Sensor can be placed in the entrance for counting the workers who have been moved out in case of emergency. In addition to alarm, a voice notes

which alerts by saying the level of leakage can be designed.The alerting message can also be forwarded to the management of the industry.Sprinklers or extinguishers can be fixed which helps in case of inflammation by the leakage.Windows and gates can be opened automatically through sensors placed on that.

Proposed Solution:-

To Develop an efficient system & an application that can monitor and alert the users(workers), our product helps the industries in monitoring the emission of harmful 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. It is fastest alerts to the workers and user friendly. For social impact it is Cost efficient and easy installation and provide efficient results and can work with irrespective of fear.Since the product is cost efficient, it can be placed in many places in the industries. Even when the gas leakage is more, the product sense the accurate values and alerts the workers effectively.

Problem Solution Fit:



4. REQUIREMENT ANALYSIS

Functional Requirement:

Following are the functional requirements of the proposed solution.

FR NO	Functional Requirement (Epic)	Sub Requirement (Story)	Acceptance criteria
FR-1	Registration	• As a user, I can register for the	To monitor the measure of

		application through website • User can register for the application through E-mail	water and air quality
FR-2	Reception	• As a user, I receive the gas level data as a message in mobile	By updating the user frequently, the problem will be detected soon
	Convenience	• As a user, through message user can easily get level.	In case of gas leakage, it can directly send notifications to nearby police station and hospital FR.
FR-3	Performance	• As a user, I get notified and could turn on the exhaust fan or sprinkler.	The gas gets dissipated and keep the user away from danger .
FR-4	Confirmation	• As a user, I shall be able to turn off the electricity • As a user, I shall be able to make calls to 101 and 108 .	This prevents any damage and explosion

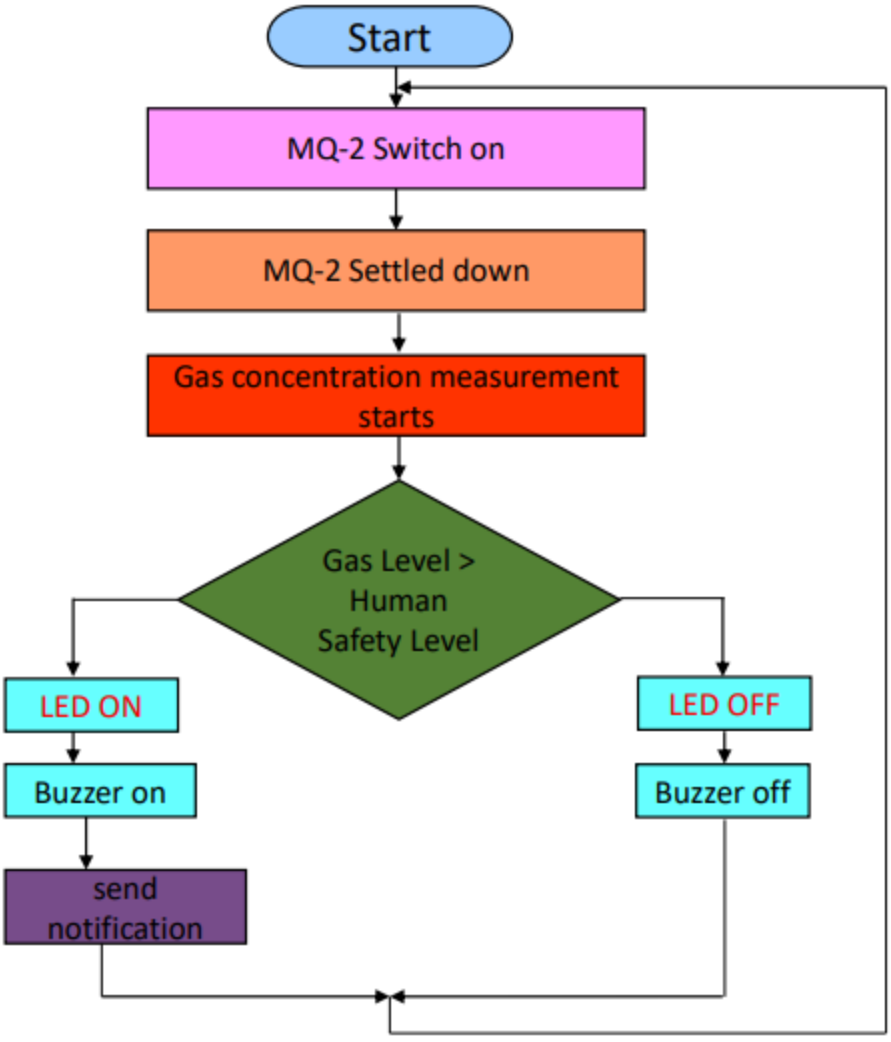
Non-Functional Requirement:

FR NO	Non-Functional Requirement	Description
NFR-1	Usability	It protects the employees and updates regularly
NFR-2	Security	With the help of emergency alert, we can protect the humans as well as the properties
NFR-3	Reliability	It measures the gas level and gives accurate results
NFR-4	Performance	These sensors are mainly used in oil,

		gas, mining, chemical and semiconductor manufacturing industries
NFR-5	**Scalability**	**Sensors can be replaced every time it fails**

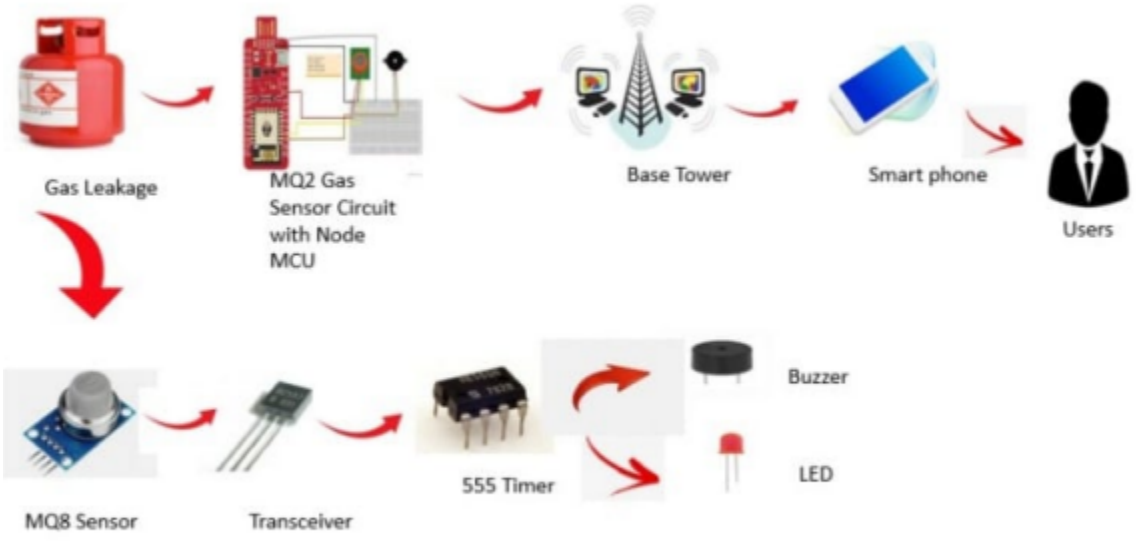
5. PROJECT DESIGN

Data flow diagram:



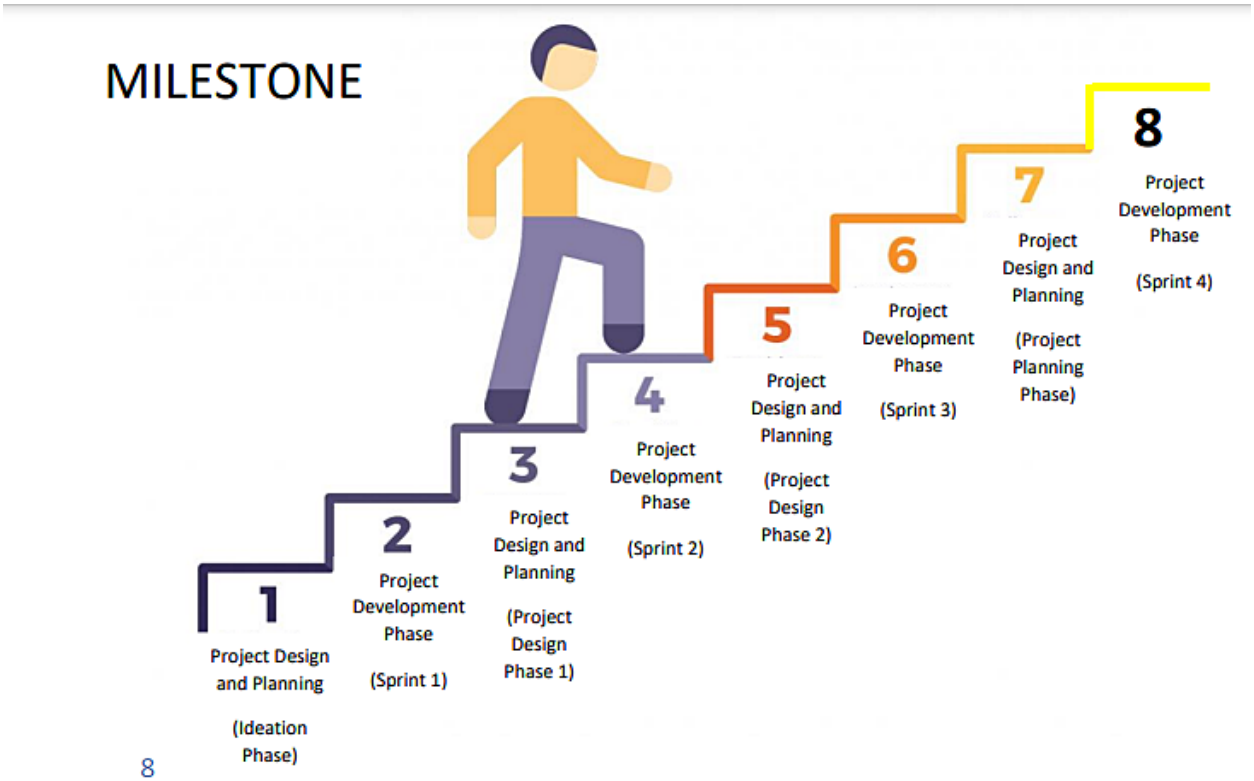
This is the data flow diagram of Gas Leakage Monitoring And Alerting System.Here the data from temperature sensor and gas sensor is collected from IOT device and the data is analyzed. If the alert and the requried measures are taken.

Solution & Technical Diagram:



This is the technical diagram of Gas Leakage Monitoring And Alerting System.Here the usage of the gas brings great problems in the domestic as well as working places.The main objective of this project is that it is extremely accurate with least cost.This project system is the best to detect gas leakage and also warm people around by buzzer beep sound.

MILESTONE:


MILESTONE
1
Project Design and Planning
(Ideation Phase)
2
Project Development Phase
(Sprint 1)
3
Project Design and Planning
(Project Design Phase 1)
4
Project Development Phase
(Sprint 2)
5
Project Design and Planning
(Project Design Phase 2)
6
Project Development Phase
(Sprint 3)
7
Project Design and Planning
(Project Planning Phase)
8
Project Development Phase
(Sprint 4)

6. PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation:-

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team members
sprint-1	Monitor the gas leakage	USN-1	The industries have own industries so the industry owner must take care of workers. The workers have family so the industries give security assurance of workers.	2	High	• Jayasri • Kamatchi soniya • Vishali • Beena sherin • Yamini
sprint-2	Avoid from disaster	USN-2	The gas leakage occurs at the time, fire service will take care to protect the people from the disaster.	1	Low	• Jayasri • Kamatchi soniya • Vishali • Beena sherin • Yamini
sprint-3	Detect the gas	USN-3	it monitors the gas by 24/7 hours to avoid leakage. The	2	High	• Jayasri • Kamatchi soniya

			industry has quality pipes to transfer the gas and proper maintenance service once in a month. The industry must take care of what are the necessary process to avoid the gas leakage.			• Vishali • Beena sherin • Yamini
sprint-4	The model is trained and by sample dataset	USN-4	The programmer designs the model to detect the gas leakage.	2	High	• Jayasri • Kamatchi soniya • Vishali • Beena sherin • Yamini

CODING AND SOLUTIONING

SPRINT 1

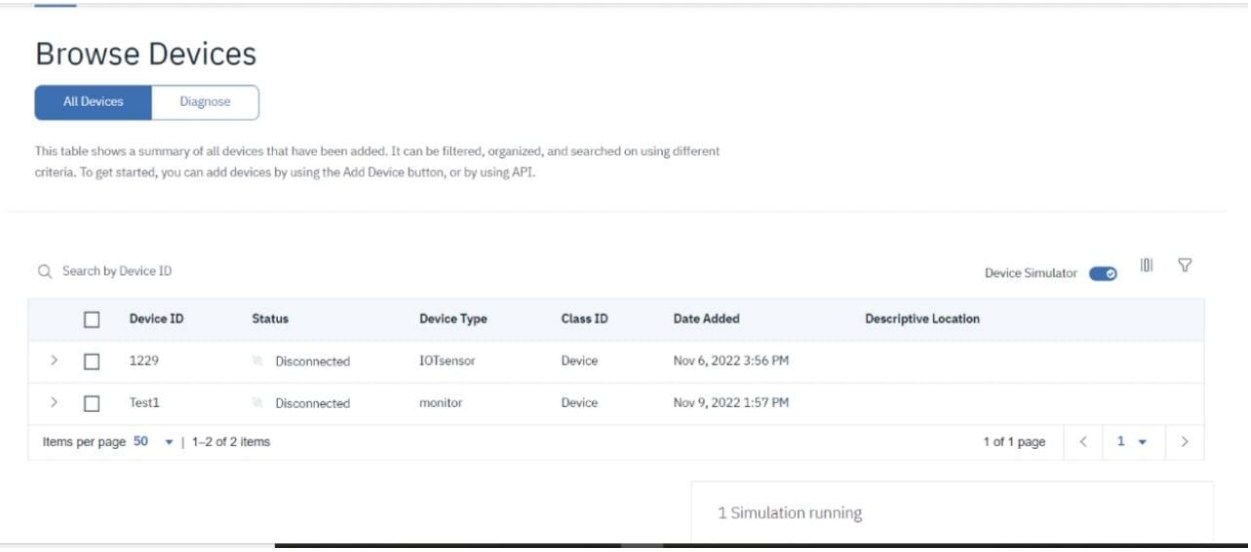
Monitor the gas pressure using IBM Watson Platform . Display the temperature and humidity value.

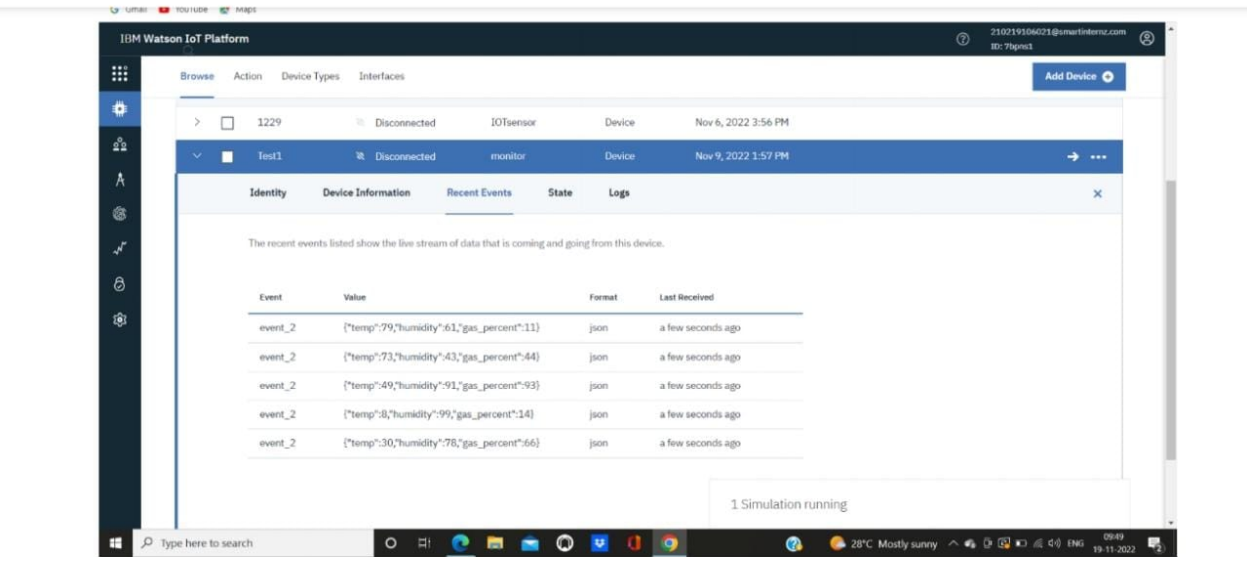
Submitted by : Kamatchi soniya, Beena sherin, Vishali, Yamini, Jayasri

IBM Watson link :

https://7bpns1.internetofthings.ibmcloud.com/dashboard/devices/browse

Turn on device simulation and then create a random function for temperature, humidity and gas level.





SPRINT 2

Submitted by : Kamatchi soniya, Beena sherin, Vishali, Yamini, Jayasri

Node red link : http://159.122.179.50:31329/red/#flow/6f5fb75fb6a52592
UI software link : http://159.122.179.50:31329/ui
IBM Watson link :
https://7bpns1.internetofthings.ibmcloud.com/dashboard/devices/browse

Create device in the IOT Watson platform, workflow for IOT scenarios using local node red

SOURCE CODE:

TEMPERATURE:

```
msg.payload=msg.payload.temp
global.set('h',msg.payload)
 return msg;
```

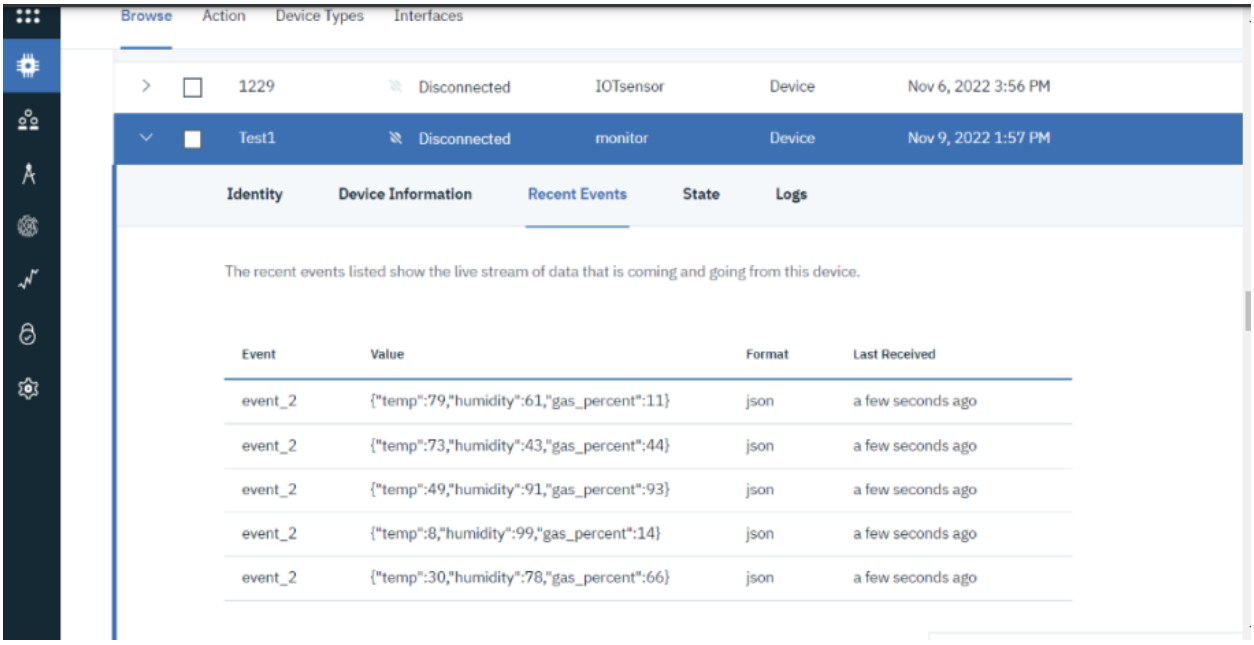
HUMIDITY:

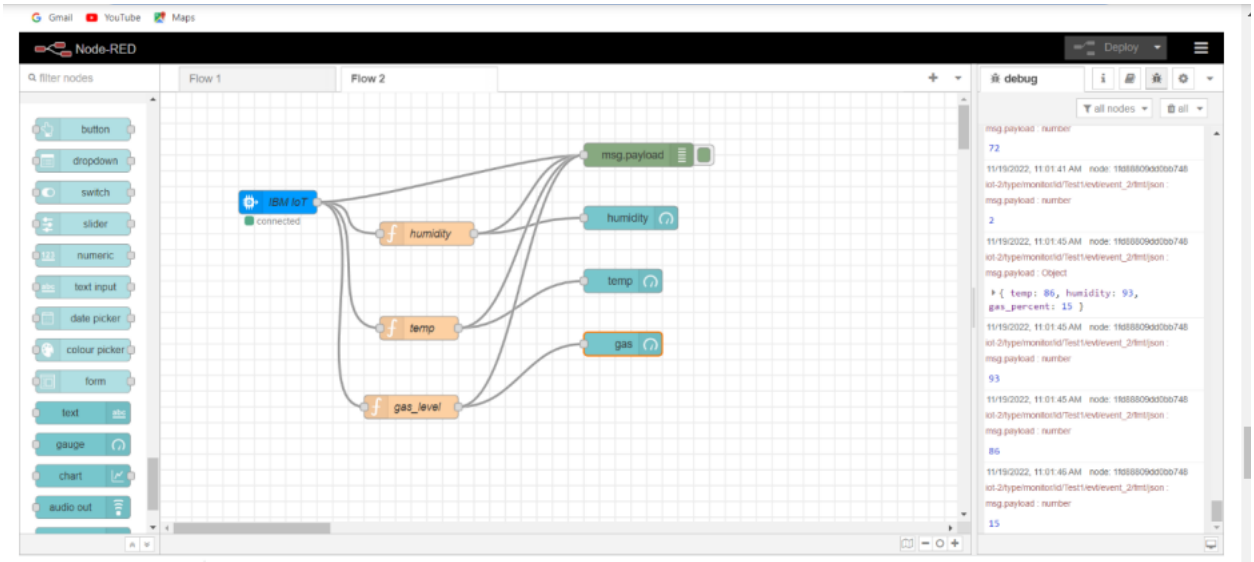
```
msg.payload=msg.payload.humidity
global.set('h',msg.payload)
return msg;
```

GAS LEVEL:

```
msg.payload=msg.payload.gas_percent
global.set('h',msg.payload)
 return msg;
```

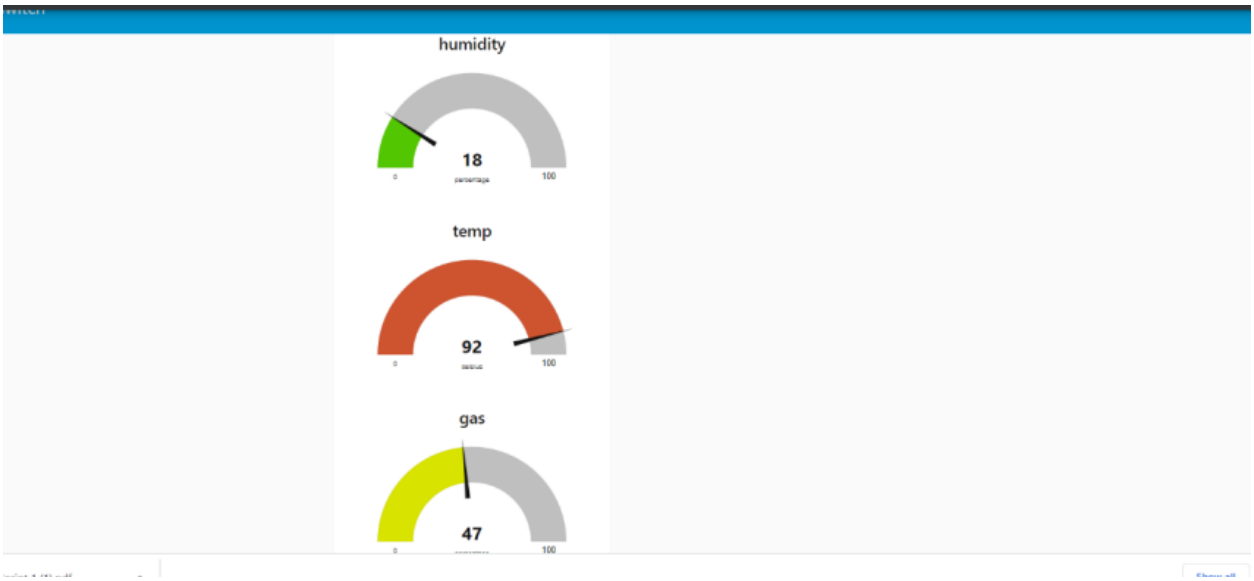
OUTPUT:


Browse
Action
Device Types
Interfaces
1229
Disconnected
IOTsensor
Device
Nov 6, 2022 3:56 PM
Test1
Disconnected
monitor
Device
Nov 9, 2022 1:57 PM
Identity
Device Information
Recent Events
State
Logs
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
Last Received
event_2
{"temp":79,"humidity":61,"gas_percent":11}
json
a few seconds ago
event_2
{"temp":73,"humidity":43,"gas_percent":44}
json
a few seconds ago
event_2
{"temp":49,"humidity":91,"gas_percent":93}
json
a few seconds ago
event_2
{"temp":8,"humidity":99,"gas_percent":14}
json
a few seconds ago
event_2
{"temp":30,"humidity":78,"gas_percent":66}
json
a few seconds ago


Node-RED
Deploy
Flow 1
Flow 2
debug
IBM IoT
connected
humidity
temp
gas_level
msg.payload
humidity
temp
gas

Performance Metrics:

Below image represents the results of node red dash board



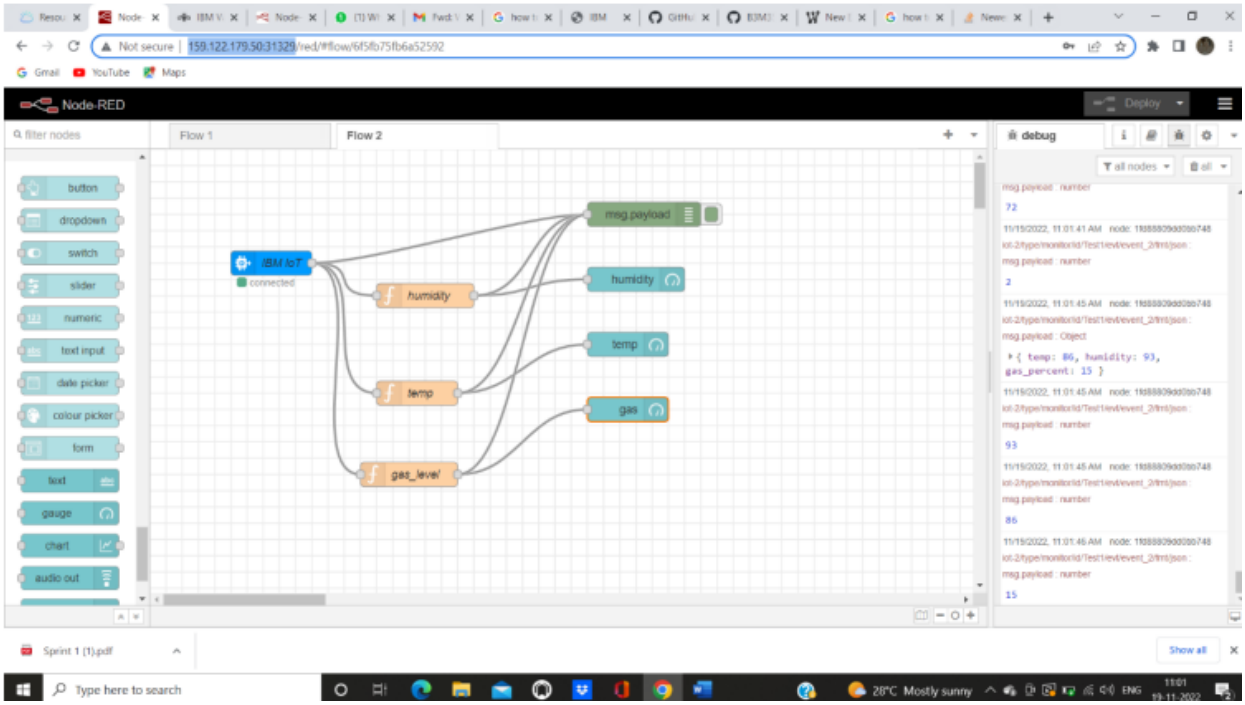
SPRINT 3

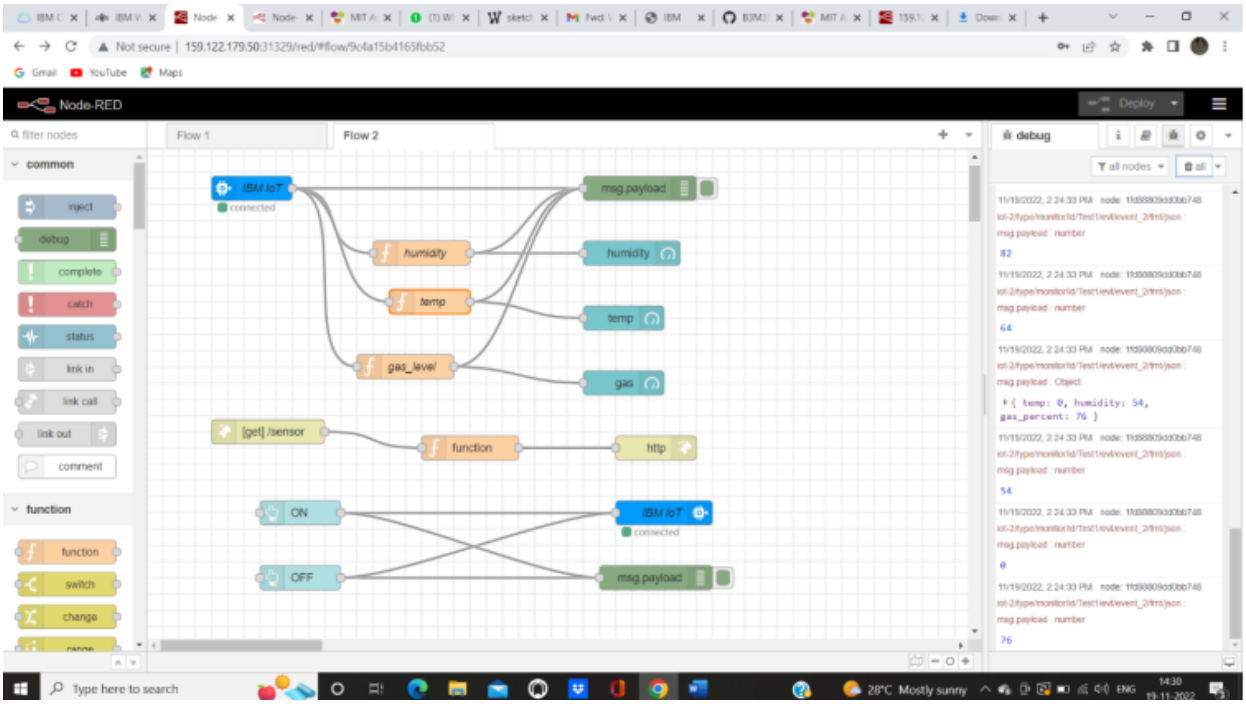
MIT app inventor, dashboard(application for your project using MIT app,design the model and test the app)

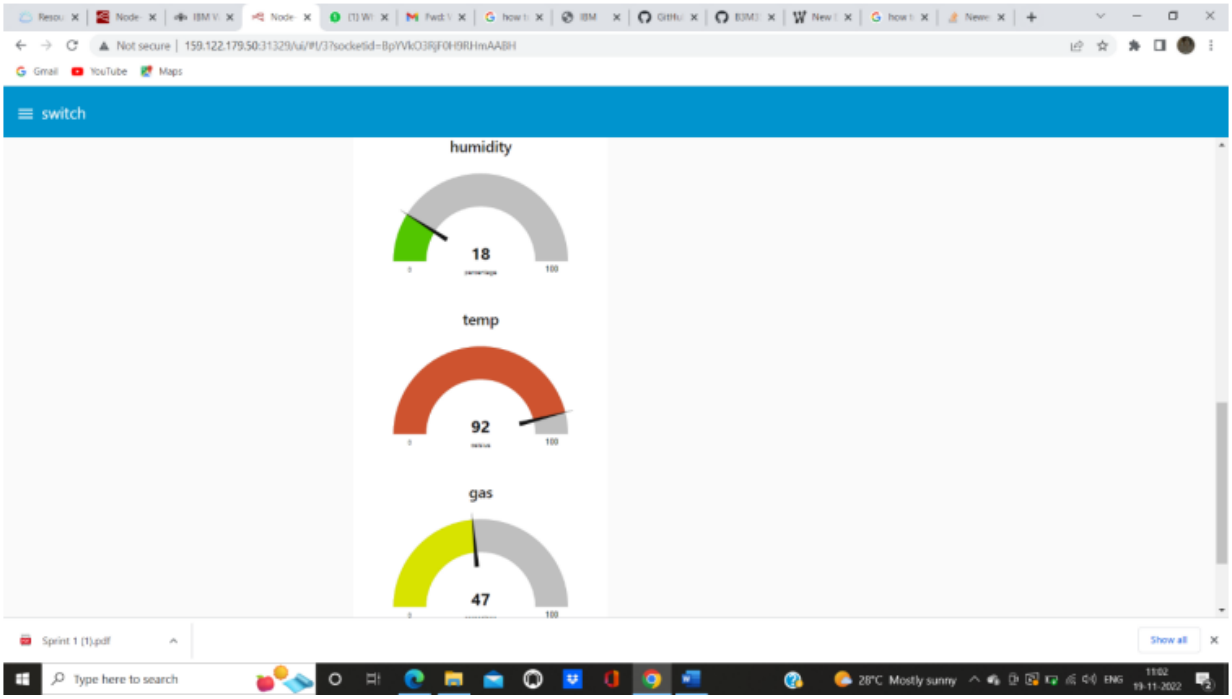
Node red link: http://159.122.179.50.31329/red/#flow/9c4a15b4165fbb52

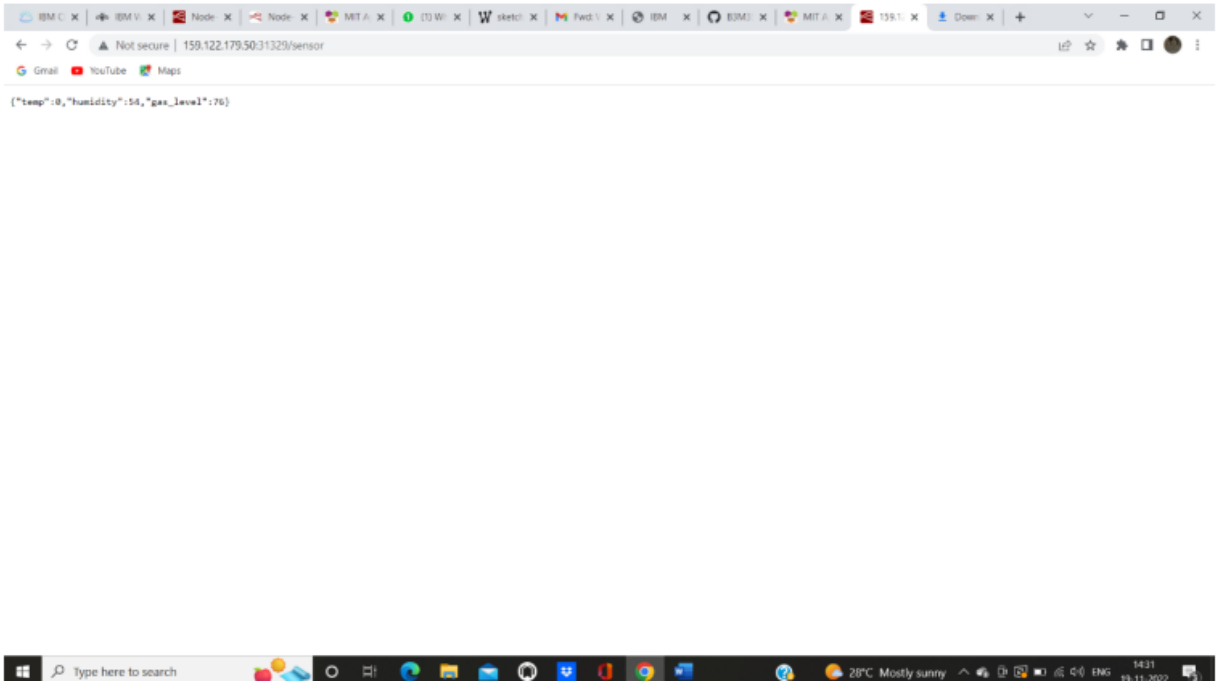
UI software: http://159.122.179.50.31329/ui

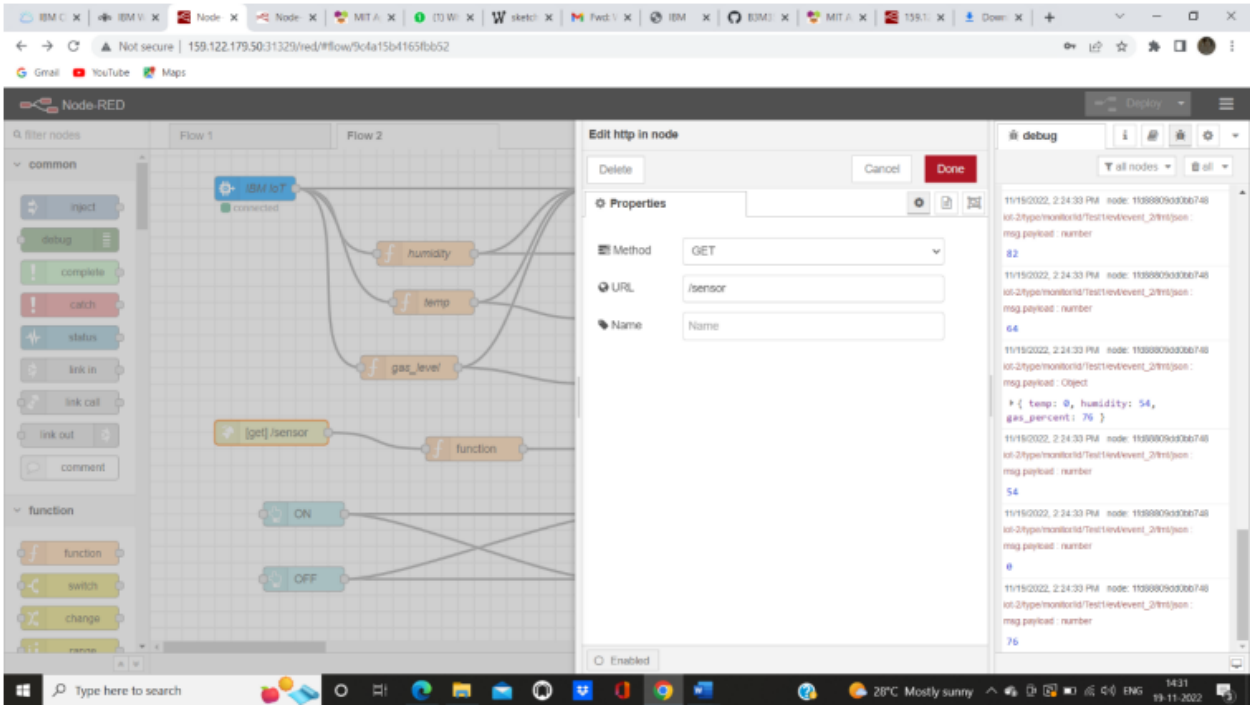
Comment: http://159.122.179.50:31329/sensor

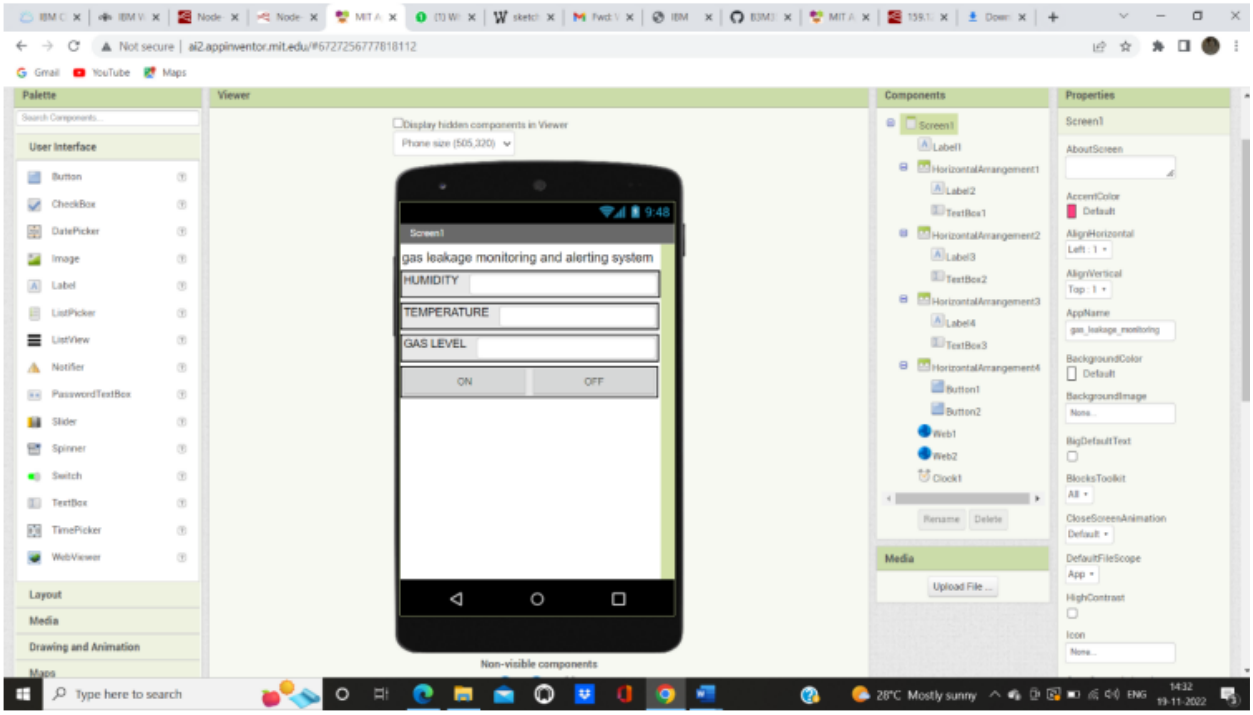

Not secure | 159.122.179.50:31329/red/#flow/6f5fb75fb6a52592
Node-RED
Deploy
Flow 1
Flow 2
debug
button
dropdown
switch
slider
numeric
text input
date picker
colour picker
form
text
gauge
chart
audio out
IBM IoT
connected
humidity
temp
gas_level
msg.payload
humidity
temp
gas
Type here to search
28°C Mostly sunny
ENG

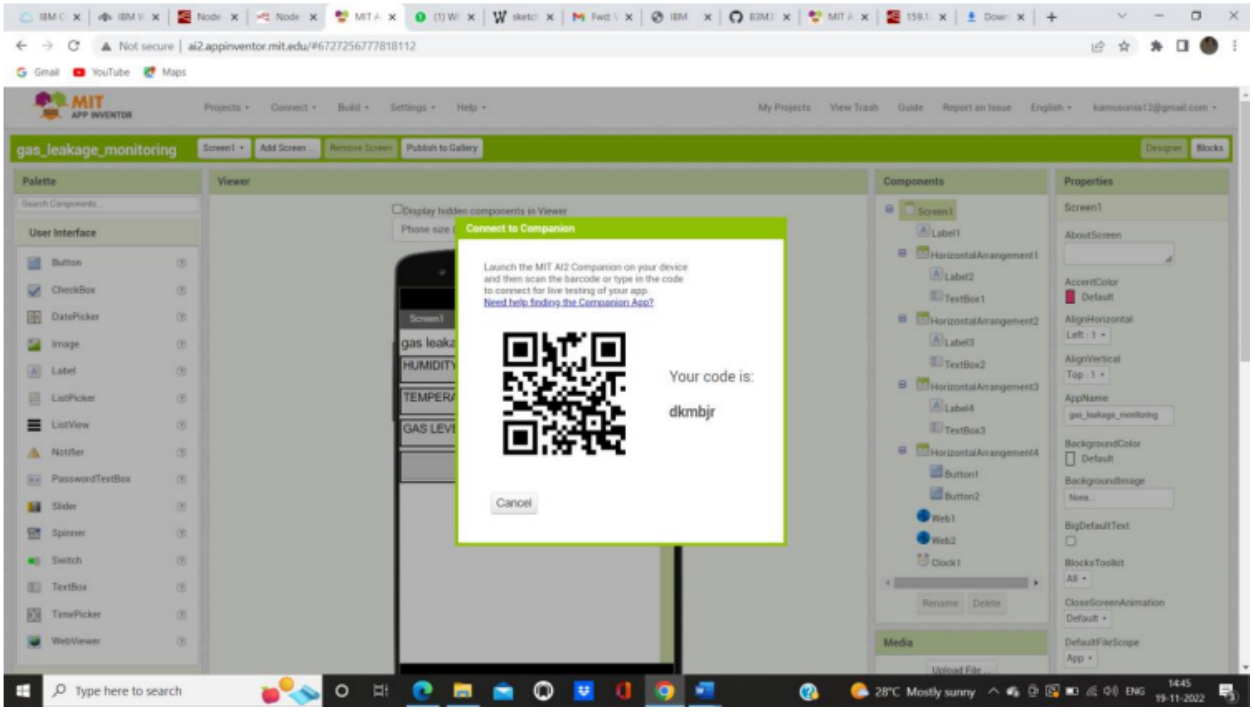

Not secure | 159.122.179.50:31329/red/#flow/9c4a15b4165fbb52
Node-RED
Deploy
Flow 1
Flow 2
debug
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
IBM IoT
connected
humidity
temp
gas_level
msg.payload
humidity
temp
gas
[get] /sensor
function
http
ON
OFF
IBM IoT
connected
msg.payload
Type here to search
28°C Mostly sunny
ENG


Not secure | 159.122.179.50:31329/ui/#!/3?socketid=BpYVkO3RjF0H9RHmAABH
Gmail
YouTube
Maps
switch
humidity
18
temp
92
gas
47
Sprint 1 (1).pdf
Show all
Type here to search
28°C Mostly sunny
ENG
11:02
19-11-2022


Not secure | 159.122.179.50:31329/sensor
Gmail
YouTube
Maps
{"temp":0,"humidity":54,"gas_level":76}
Type here to search
28°C Mostly sunny
ENG
14:31

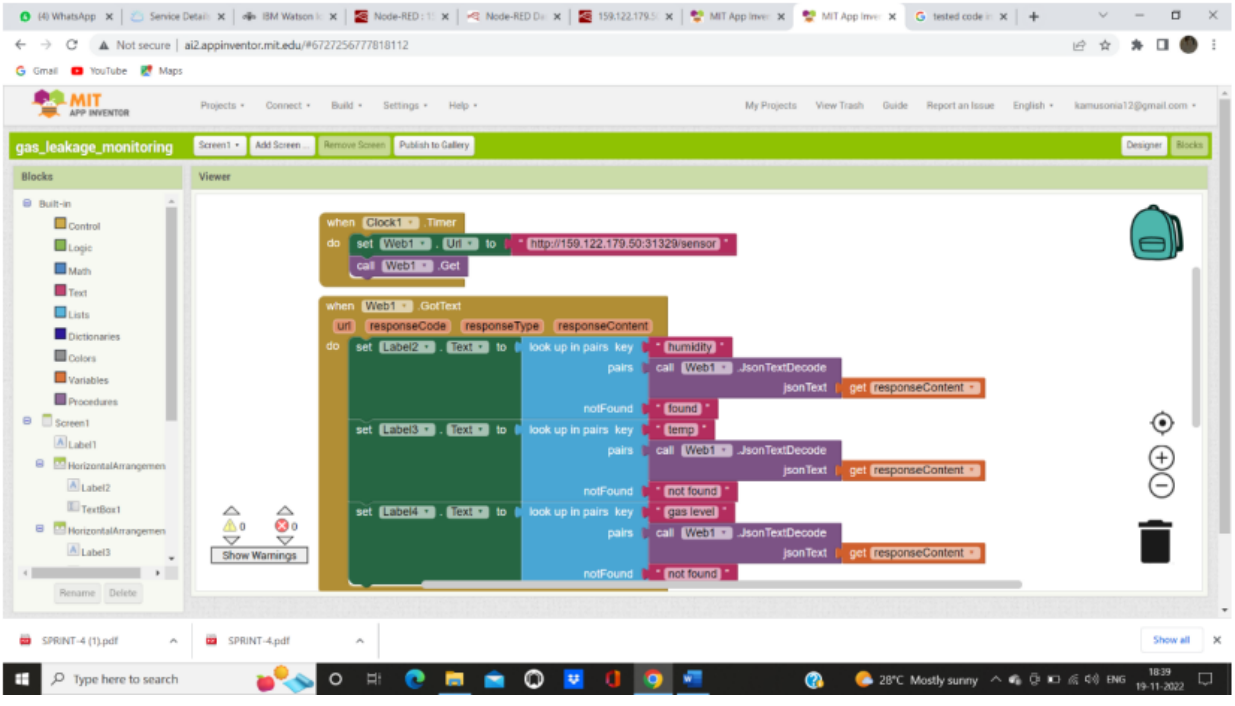

Node-RED
Flow 1
Flow 2
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
IBM IoT
connected
humidity
temp
gas_level
[get] /sensor
function
ON
OFF
Edit http in node
Delete
Cancel
Done
Properties
Method
GET
URL
/sensor
Name
Name
Enabled
debug
all nodes
82
64
{ temp: 0, humidity: 54, gas_percent: 76 }
54
0
76
Type here to search
28°C Mostly sunny
ENG
14:31
19-11-2022

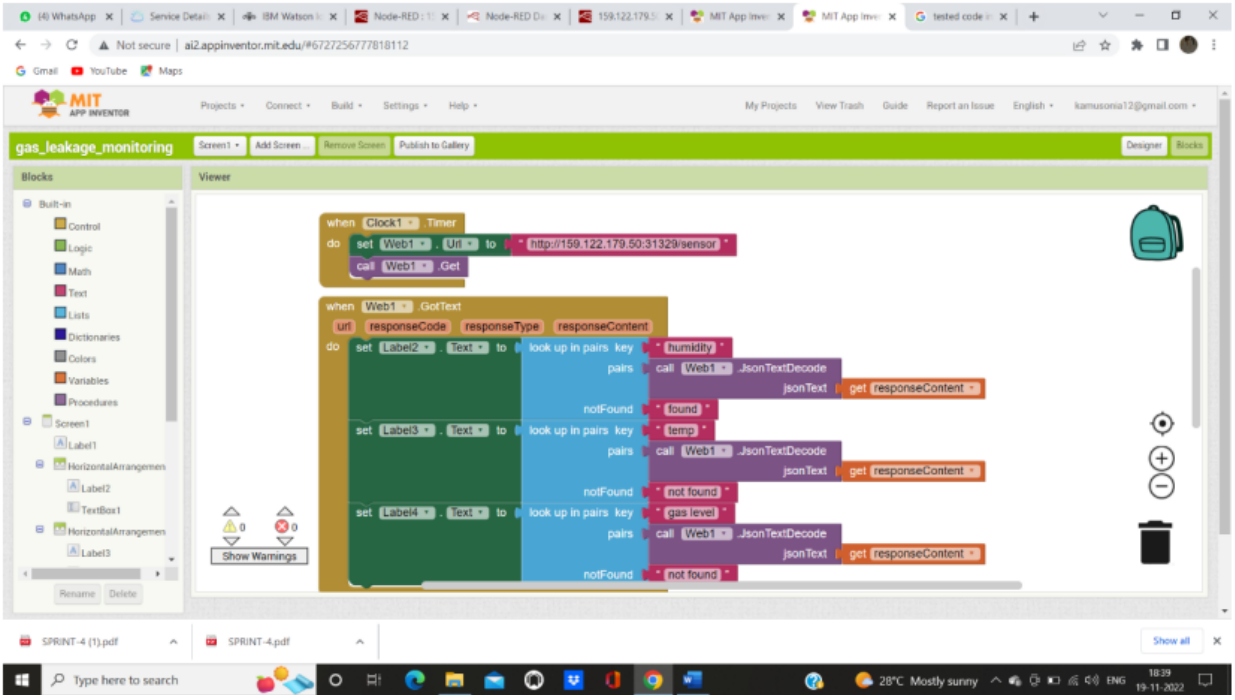

Palette
Viewer
Components
Properties
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Drawing and Animation
Maps
Display hidden components in Viewer
Phone size (505,320)
Screen1
gas leakage monitoring and alerting system
HUMIDITY
TEMPERATURE
GAS LEVEL
ON
OFF
Non-visible components
Screen1
Label1
HorizontalArrangement1
Label2
TextBox1
HorizontalArrangement2
Label3
TextBox2
HorizontalArrangement3
Label4
TextBox3
HorizontalArrangement4
Button1
Button2
Web1
Web2
Clock1
Rename
Delete
Media
Upload File ...
AboutScreen
AccentColor
Default
AlignHorizontal
Left : 1
AlignVertical
Top : 1
AppName
gas_leakage_monitoring
BackgroundColor
Default
BackgroundImage
None...
BigDefaultText
BlocksToolkit
All
CloseScreenAnimation
Default
DefaultFileScope
App
HighContrast
Icon
None...
Type here to search
28°C Mostly sunny
ENG
14:32
19-11-2022



SPRINT 4

WEB UI (to make the user interact with the software)

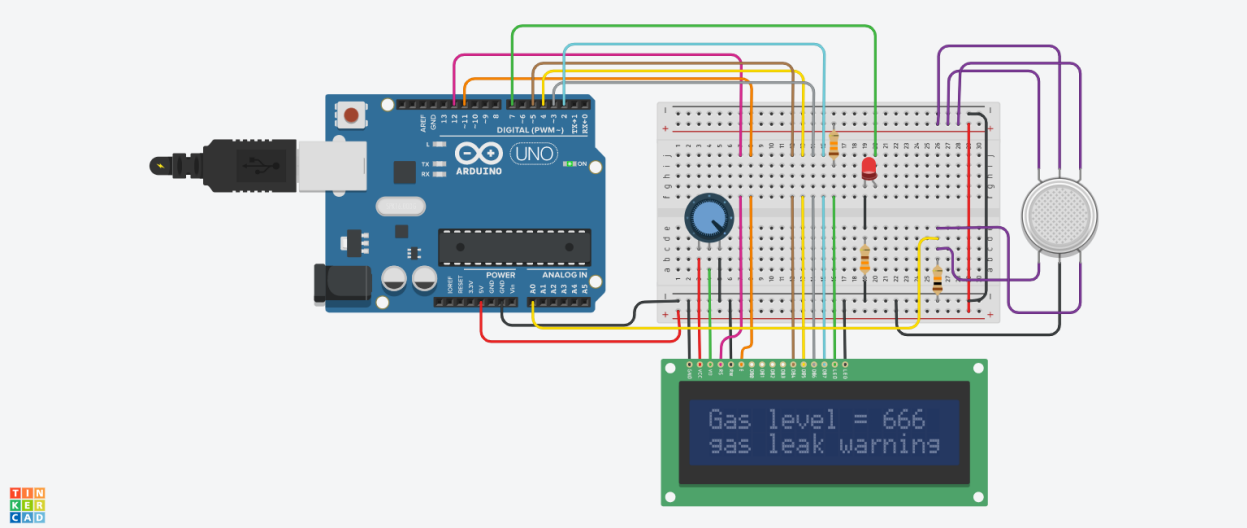




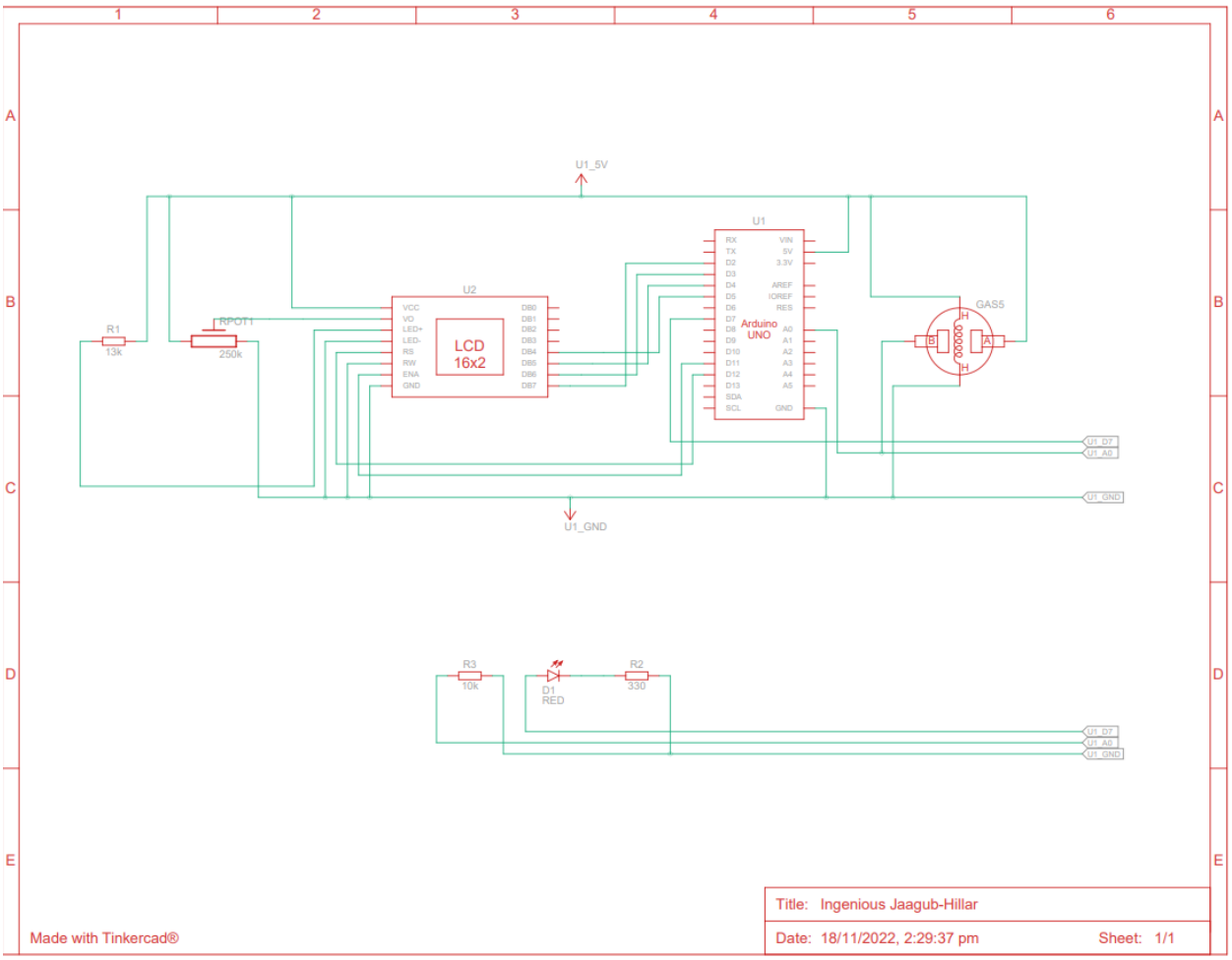
7. FINAL DELIVERABLES

CIRCUIT:

The simulation of the circuit is done in Tinkercad software.



Circuit diagram :



Components:

The design of a sensor - based automatic gas leakage detector with an alert and control system. The components are

S.No.	Name of the component	Quantity
1.	Arduino UNO R3	1
2.	Breadboard	1
3.	Gas Sensor	1

4.	**LED**	**1**
5.	**Resistor**	**3**
6.	**LCD(16x2)**	**1**

Source code :

```
#include <LiquidCrystal.h>
int gas;
int wait = 100;
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void setup() {
lcd.begin(16, 2);
pinMode(7,OUTPUT);
pinMode(A0,INPUT);
}
void loop() {
gas = analogRead(A0);
  if(gas>650){
digitalWrite(7,HIGH);
lcd.setCursor(0,0);
lcd.print("Gas level = ");
lcd.print(gas);
lcd.setCursor(0,1);
lcd.print("gas leak warning");
delay(wait);
}
  else {
digitalWrite(7,LOW);
lcd.setCursor(0,0);
lcd.print("Gas level = ");
lcd.print(gas);
```

```
lcd.setCursor(0,1);
lcd.print("no gas leak ");
delay(wait);
}
}
```

8. ADVANTAGES & DISADVANTAGES:

Advantages:

- **Get immediate gas leak alerts.**
- **Measure oxygen level accuracy.**

Disadvantages:

- **Most elemental organic vapors are toxic to the sensor**
- **Non-selective in the flammable gas range.**

9. CONCLUSION:

The proposed gas leakage detector is promising in the field of safety. The attempt while making this prototype has been to bring a revolution in the field of safety against the leakage of harmful and toxic gases to minimize and hence nullify any major or minor hazard being caused due to them. Nevertheless there is always scope of improvement and some of the features that will improve the system and make it even better and reliable have been mentioned below:

A. Extended Features of System:

The behaviour of the gases is dependent on the temperature and humidity of the air around. A gas at certain concentration might not be flammable at low temperature but might have explosive nature at high temperature. For this reason addition of a Temperature and Humidity Sensor will be very helpful.

B. Performing Big Data Analytics on the sensor readings:

Analytics could be performed on the sensor readings. The readings from sensors could be used for forming predictions of situations where there can be a mishap. Instead of straightaway alarming when the concentrations have gone high, algorithms could be worked upon which could determine such situations prior to their occurrence. Combining the gas sensor readings with the readings from temperature and humidity sensor would increase the precision of the system. The cases of false alarms being raised will reduce down to very small percentages.

C. Dedicated Application for System:

A dedicated mobile application could be made for the system. The features of the application would be:

1. Getting the details of the concentration levels of the house within a tap of a button.

2. Since it is a safety device it is important for it to be perfectly calibrated and maintained at all times. The app can make sure to send reminders about getting the system checked every once in a while.

3.The user can add or remove the recipients who will receive the information of leakage whenever they require.

10. FUTURE SCOPE :

We propose to build the system using an MQ6 gas detection sensor and interface it with an Arduino Uno microcintroller along with an LCD display .

Our system uses the gas sensor to detect any gas leakages. The gas sensor sends out the signal to the microcontroller as soon as it encounters a gas leakage. The microcontroller processes the signal and a message is displayed on the LCD to alert the user.

GitHub link : https://github.com/IBM-EPBL/B3M35E

Project demo link : https://www.tinkercad.com/things/dKtdLD5zAaE-ingenious-jaagub-hillar/editel