HINDUSTHAN INSTITUTE OF TECHNOLOGY
(An Autonomous Institution, Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai, Accredited with "A" Grade by NAAC) Valley Campus, Pollachi Main Road, Coimbatore 641 032.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REPORT ON

HX 8001 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP
(Naalaiya Thiran Program)

PROJECT TITLE

Gas Leakage monitoring & Alerting system for Industries

TEAM ID: PNT2022TMID10394

TEAM MEMBERS

1. MANASA M(TEAM LEAD)
2. DEEPTHI P
3. NIKHILA V
4. MANOJ KUMAR N

MENTOR

TAMIZHARASU

EVALUATOR

VIDHYA

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1.INTRODUCTION

1.1. PROJECT OVEVIEW

Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for enhancing the existing safety standards. Safety has always been an important criterion while designing home, buildings, industries as well as cities. The increased concentration of certain gases in the atmosphere can prove to be extremely dangerous. These gases might be flammable at certain temperature and humidity conditions, toxic after exceeding the specified concentrations limits or even a contributing factor in the air pollution of an area leading to problems such as smog and reduced visibility which can in turn cause severe accidents and also have adverse effect on the health of people.

Most of the societies have fire safety mechanism. But it can use after the fire exists. In order to have a control over such conditions we proposed system that uses sensors which is capable of detecting the gases such as LPG, CO2, CO and CH4. This system will not only able to detect the leakage of gas but also alerting through audible alarms. Presence of excess amounts of harmful gases in environment then this system can notify the user. System can notify to society admin about the condition before mishap takes place through a message.

System consists of gas detector sensors, Arduino board, ESP8266 and Cloud server. One Society authority person can register the all flat member user to our system. Society admin can add the details of per flat user such as user name, mobile number, per user flat sensor details information. Society admin can configure the threshold value of each sensor. System hardware can be deployed on each flat. Sensors can sense the value per time. System can send the values to cloud server. Server can Check that the sensor values was existed the threshold value. If sensor value can cross the limit the server can send the command to hardware for buzzing the alarm.[3] Server also sends the notification message to user.

1.2 PURPOSE

Fixed Flammable Gas Detection System is to be installed to detect flammable gases (cargoes) leaked to cargo equipment spaces, pump rooms, double hull spaces, cofferdams, void spaces and other spaces in or adjacent to cargo area.

The purpose of this system is to detect gas leakage, neutralize it, and prevent the explosion.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

Liquid problem gas is a flammable mixture of hydrocarbon gases used as fuel in heating appliances,cooking equipment, and specifically as a vehicle fuel (it is often referred to as autogas). It is an odorless gas due to ethyl mercaptan is added as an odorant to be easily detected when leakage occurs for safety precaution. LPG is made by refining petroleum or wet natural gas and is almost entirely derived from fossil fuels sources being manufactured during the refining of crude oil as theory emerged from the natural state. It was classified as a hazardous material because of its explosive potentials when under pressure, due to this hazardous property leading to fire explosion. The gas detection process was made by the chemically infused paper that change its color when it's been exposed to gas before the development of the electronics gas detector. The electronics leakage detector was an active approach to initial fault detection in other to achieve the utmost safety of humanity and properties as a whole they introduced an android base automatic gas detection).different approaches have been used alongside several research in the detection of leakage and were also implemented alongside some incident toward some decades. The existing leakage detection is optical sensor method, cable sensor, negative pressure, vapor sampling, signal processing, mass volume, and pressure point analysis, in which have been implemented using a different framework. Some groups of researchers have classified the technology as two fitting categories, which are software and hardware method but research continues and to technical nature research effort which led them to three group methods.

Classification of Leakages Detection

There are different classes of leakage detection which have been used to monitor the leakage, several criteria are classified into their classification, some of which are critical principles and abilities needed from humans. The detection is classified into three, which are automated detection, manual detection, and semi-automated detection. Automated Detection involves monitoring of detecting leakage without the help of the operator, once the detector device is installed and been connected to the display of the personnel in charge and can be automatically shut down from the display unit. (SCADA); Manual Detection - These are methods in which the device can only be operated by humans. Like thermal imager or light detection and ranging (Lidar)
devices; Semi-automated detection – solutions that necessitate a certain amount of input or

assistance in carrying out certain tasks (e.g. statistical or digital signal processing methods) (Batzias et al., 2011). The echnology used in leakages detection can be classified into two categories which are, Direct method and the Indirect method The direct method is making use of a handheld detector by the patrol team along the pipeline and in the aspect of the very long pipeline, the airplane mounted optical imaging device is used along the pipeline for measuring gas emanation for fast result

2.2 REFERENCES

[1.]Punch newspaper 2021, Panic as gas leakage occurs in Ikeja. Available at https://punchng.com/breaking-panic-as-gas-leakage-occurs-in-ikeja retrived January 17, 2021.

[2.]A., L. (2017). Wireless gas leak detection improves employee protection, environs, and production
value.

[3.]Arpitha, T. K. (2016). FPGA-GSM-based gas leakage detection system. Bangalore. IEEE Annual India Conference (INDICON), 1-4.

[4.}]Chengjun, D. X. (2011). Development of gas leak detection and location system based on wireless
sensor networks. Shanghai. Third International Conference on Measuring Technology and Mechatronics Automation, 1067–1070.

[5.]Kareem, H. (2019). Embedded real-time system for detecting leakage of the gas used in Iraqi kitchens. Indonesia J. Elect Eng Comp Sci .vol 14, 1171-1176.

[6.]Loth, J. M. (2003). Technology Assessment of online Acoustic monitoring Leak In fragment in the
underground, natural gas Transmission Lines. USA: West Virginia University.

[7.]Manohar, R. a. (2018). Android Introduction to Detection. Hindu: Nwebweze, O. (December 2015)
vanguard News .com .

[8.]Murvaya, P. (2011). A survey in Gas leak Detection and localization technology. Journal of loss
prevention in the Process Industries, 11-25.

[9.]Park, G. L. (2013). Development of gas safety management system for smart-home services. Distributor
Sensor Network, 9-10.

[10.]Sonkar, B. S. (2015). Microcontroller-based LPG Leakage Detector using GSM Module. International
Journal of Electrical and Electronics Research, Vol .111, 264-269.

[11.]Sperl, J. (2005). System pinpoints Leak s on point Arguello Offshore Lines. Oil and Gas Journal. vol .99, no 36, 47-55.

[12.]Yalmar, A. P. (2015). Implementation of automatic safety gas stove. Ann IEEE India Conference (pp. 1-
6). New Delhi: INDICON.
[13.]Zhang, X. (2006). Statistical Leak Detection in Gas and Pipelines. pipes and pipelines international ,vol
68 .no 4, 20-30

2.3 PROBLEM STATEMENT DEFINITION

Problem Statement (PS)	I am (Customer)	I am trying to	But	Because	Which makes me feel
PS-1	Industrialist	Monitor gas leakage in the industry	I don't have any system for monitoring	The affordable of the system is high and the systems are sometimes making disasters	Unsafe
PS-2	Industrialist	Control the gas leakage	Also, the installation process is too complicated	The number of sensors is unpredictable and the positioning of equipment is improper	Disastrous

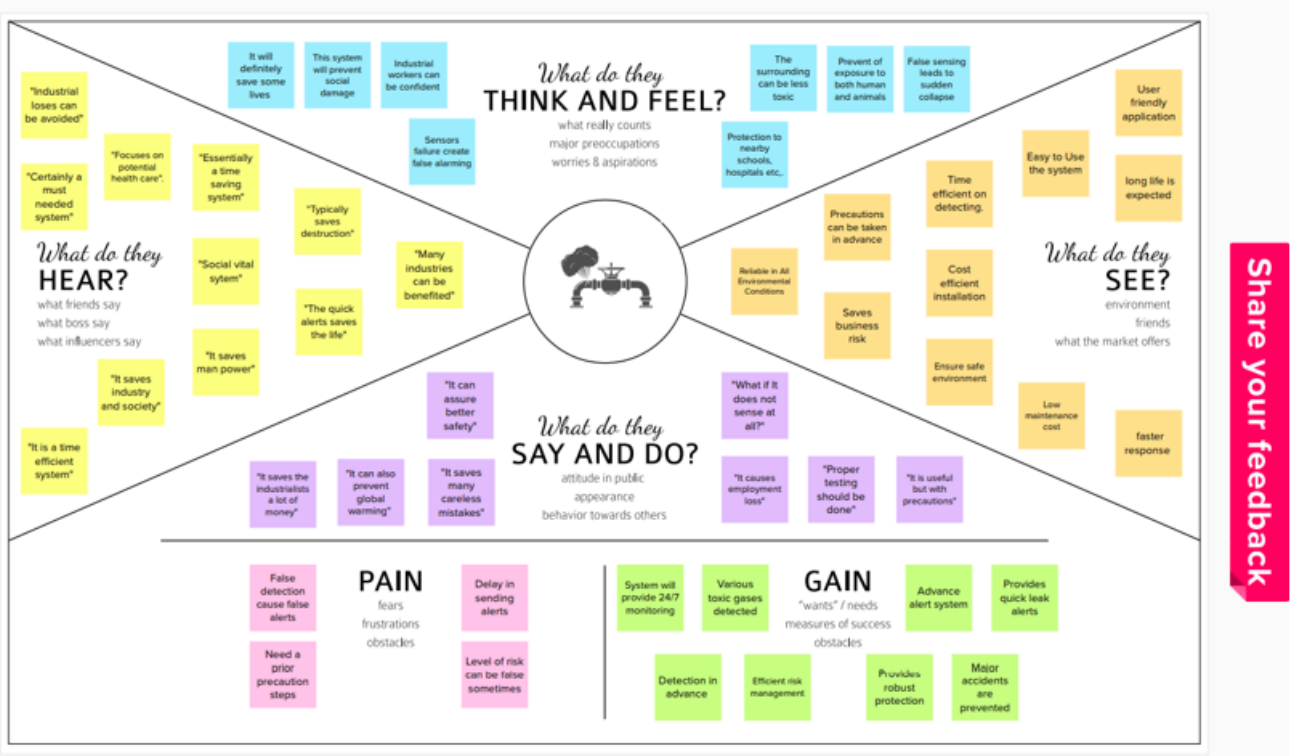
3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATY MAP CANVAS

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

It is a useful tool to helps teams better understand their users. Creating an effective solution requires

understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 IDEATION AND BRAINSTROMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

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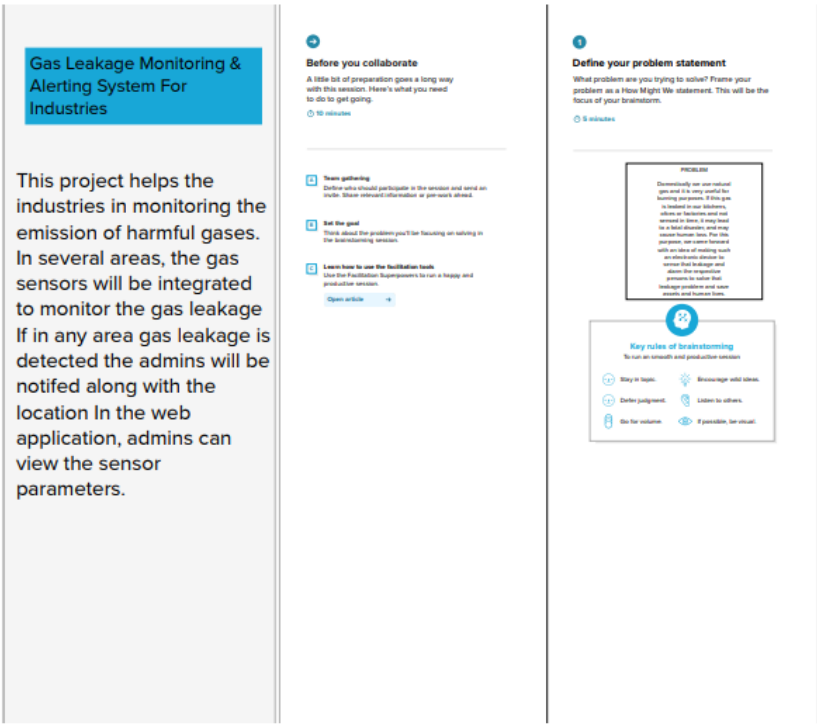


Gas Leakage Monitoring & Alerting System For Industries

This project 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 notifed along with the location In the web application, admins can view the sensor parameters.

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

Team gathering

Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

Set the goal

Think about the problem you'll be focusing on solving in the brainstorming session.

Learn how to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

Open article

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

Domestically we use natural gas and it is very useful for burning purposes. If this gas is leaked in our kitchens, idustries 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 responsible persons to solve that leakage problem and save assets and human lives.

Key rules of brainstorming

To run an smooth and productive session

Stay in topic.

Encourage wild ideas.

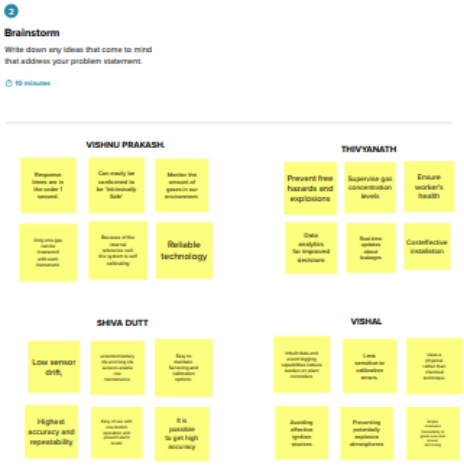
Defer judgment.

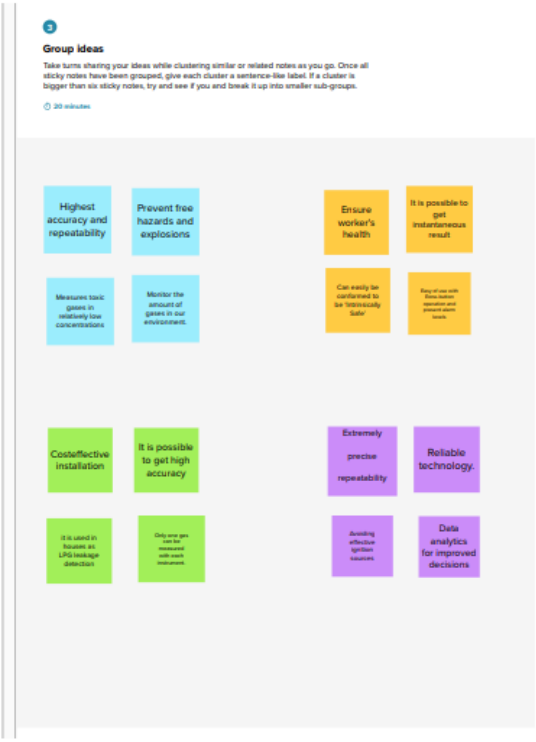
Listen to others.

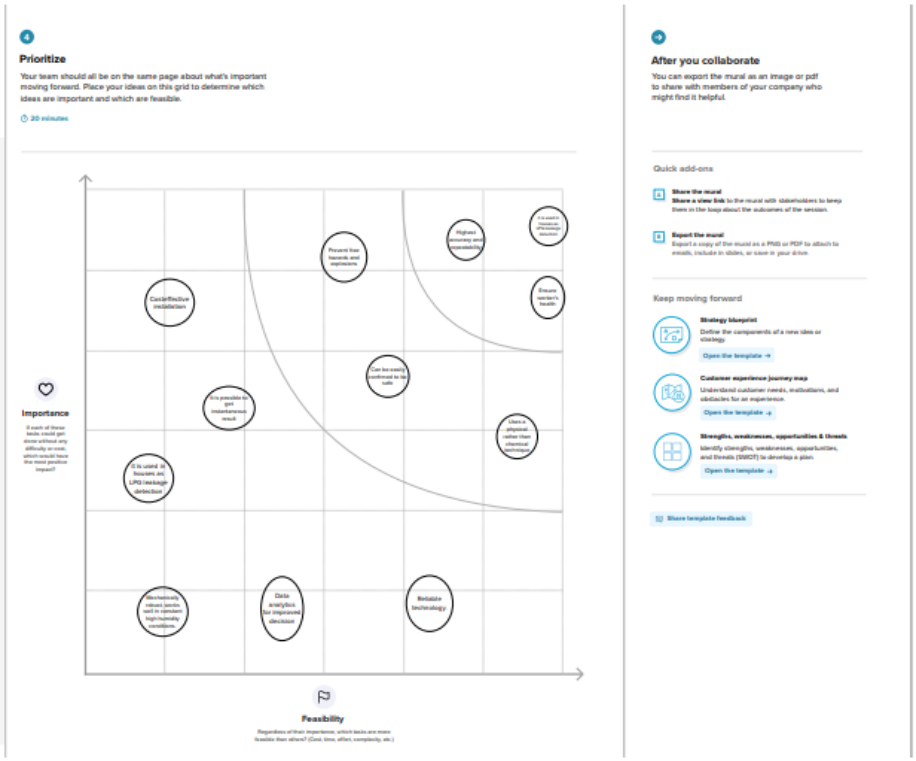
Go for volume.

If possible, be visual.

Step-2: Brainstorm, Idea Listing and Grouping







3.3 PROPOSED SOLUTION

S.no	Parameter	Description
1.	Problem Statement (Problem to be solved)	➢ Develop an efficient system & an application that can monitor and alert the users(workers)
2.	Idea / Solution description	1. This product helps the industries in monitoring the emission of harmful gases 2. In several areas, the gas sensors will be integrated to monitor the gas leakage 3. If in any area gas leakage is detected the admins will be notified along with the location 4. In the web application, admins can

		view the sensor parameters.
3.	Novelty / Uniqueness	1. Fastest alerts to the workers 2. User friendly
4.	Social Impact / Customer Satisfaction	1. Cost efficient 2. Easy installation and provide efficient results 3. Can work with irrespective of fear
5.	Business Model (Revenue Model)	1. The product is advertised all over the platforms. Since it is economical, even helps small scale industries from disasters. 2. As the product usage can be understood by everyone, it is easy for them to use it properly for their safest organization
6.	Scalability of the Solution	1. Since the product is cost efficient, it can be placed in many places in the industries. 2. Even when the gas leakage is more, the product sense the accurate values and alerts the workers effectively

3.4 PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT(S)

- Industrialists
- Engineers
- Safety Control Personals

6. CUSTOMER CONSTRAINTS

- Network Connection
- Complexity in Installation

5. AVAILABLE SOLUTIONS

- Upgrading to a premium network plan.
- Availing network connection from a reliable Service provider.

Explore AS, differentiate

2. JOBS-TO-BE-DONE / PROBLEMS

- Capability of the device to withstand in harsh environment is questionable.
- Due to network issue data couldn't be uploaded to the cloud at all times.

9. PROBLEM ROOT CAUSE

- Quality of the material using which the device is made up of plays a vital role in the capability of the device to work in harsh environment.
- Location of the device installation and the network plan used by the user are the cause of Network issue.

7. BEHAVIOUR

- Harsh environment is prevailing only on certain industry; thus, the frequency of the said problem is low. In such a case the customer complaints multiple times to get the attention.
- Network issue is very common as most of the industries are located at the country side. Here the contact both the developers and the service providers

Focus on J&P, tap into BE, understand RC

3. TRIGGERS

- Usage of the device is portrayed in the news.
- In real life situation, the device has helped in saving number of individuals.

4. EMOTIONS: BEFORE/AFTER

- Before the action is taken, the user feels deceived and cheated.
- After the problem is resolved, user feels the sincerity of the developers.

10. YOUR SOLUTION

- Network strength must be boosted in the device
- Device can be manufactured in multiple standards based on the environment.

8. CHANNELS OF BEHAVIOUR

8.1 ONLINE

- E-Mail to developers
- Online Community

8.2 OFFLINE

- Complaint Letters

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	➢ Registration through Form ➢ Offline Registration
FR-2	User Confirmation	➢ Confirmation via Email ➢ Confirmation via OTP
FR-3	User Authentication	➢ User verification through valid User ID and password.
FR-4	User Access	➢ Realtime Monitoring of Gas Leakage System, through web portal for Authorized Users.
FR-5	User Alert	➢ User receives an alert through SMS. ➢ Turn on Alerting System in Industry.
FR-6	Review and Feedback	➢ Receive Feedback from Users.

3.2 NON FUNCTIONAL REQUIREMENTS

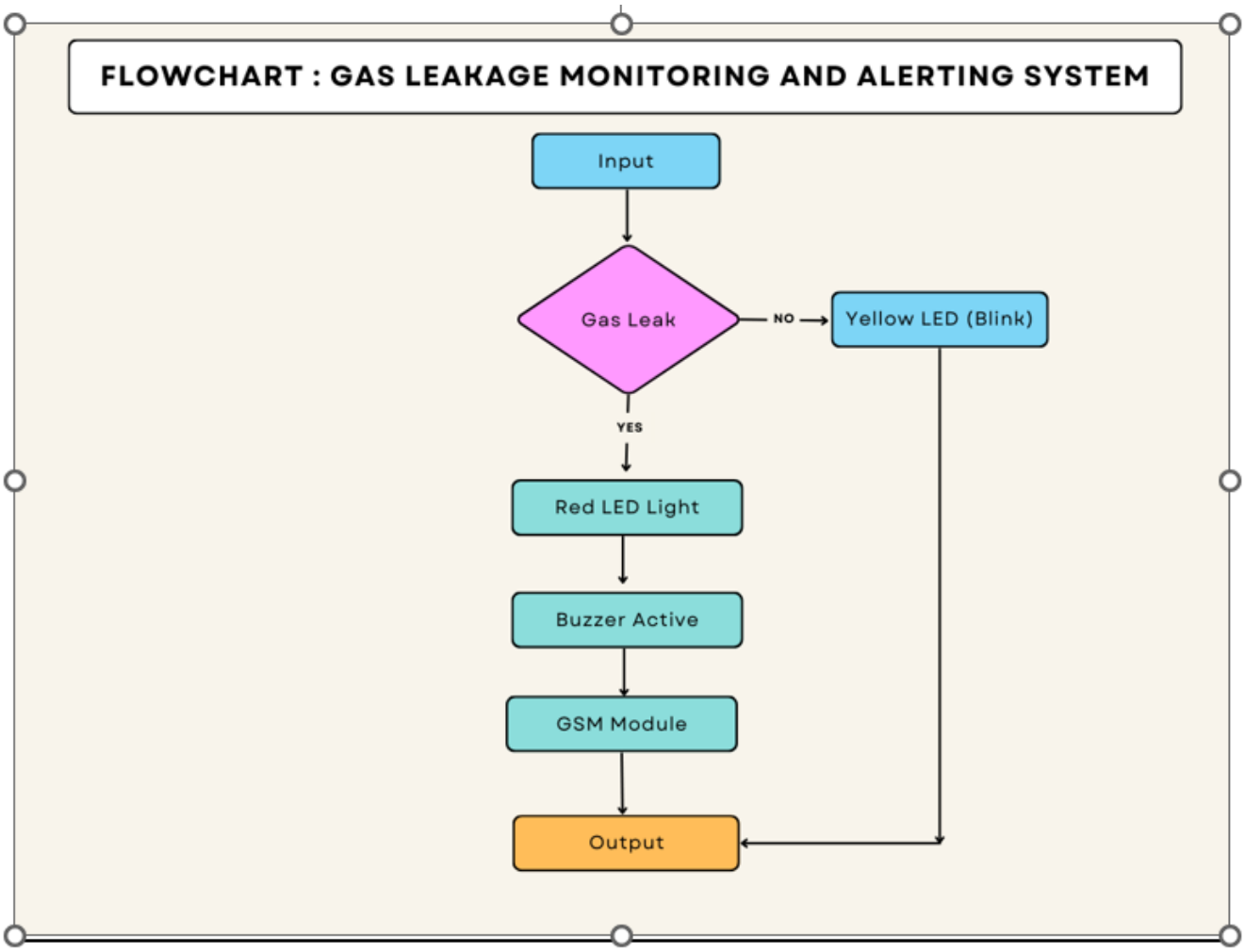
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	➢ Easier Installation process, and Realtime Monitoring Service.
NFR-2	**Security**	➢ Data transmission and handling through secured protocols. ➢ Data encryption & Cloud security.
NFR-3	**Reliability**	➢ Only authorised personnel have access to the system. ➢ Assured Data Security and Information conciseness. ➢ Longer Lifetime of Product/Service.
NFR-4	**Performance**	➢ High Accuracy of gas leakage detection in localized area. ➢ Faster Response to Gas Leakage Detection (SMS alert, valve closing).
NFR-5	**Availability**	➢ The user can access the System 24/7. ➢ Realtime monitoring system.
NFR-6	**Scalability**	➢ The system is scalable even in case of many

		gas sensors. Or in case of many supervisors.

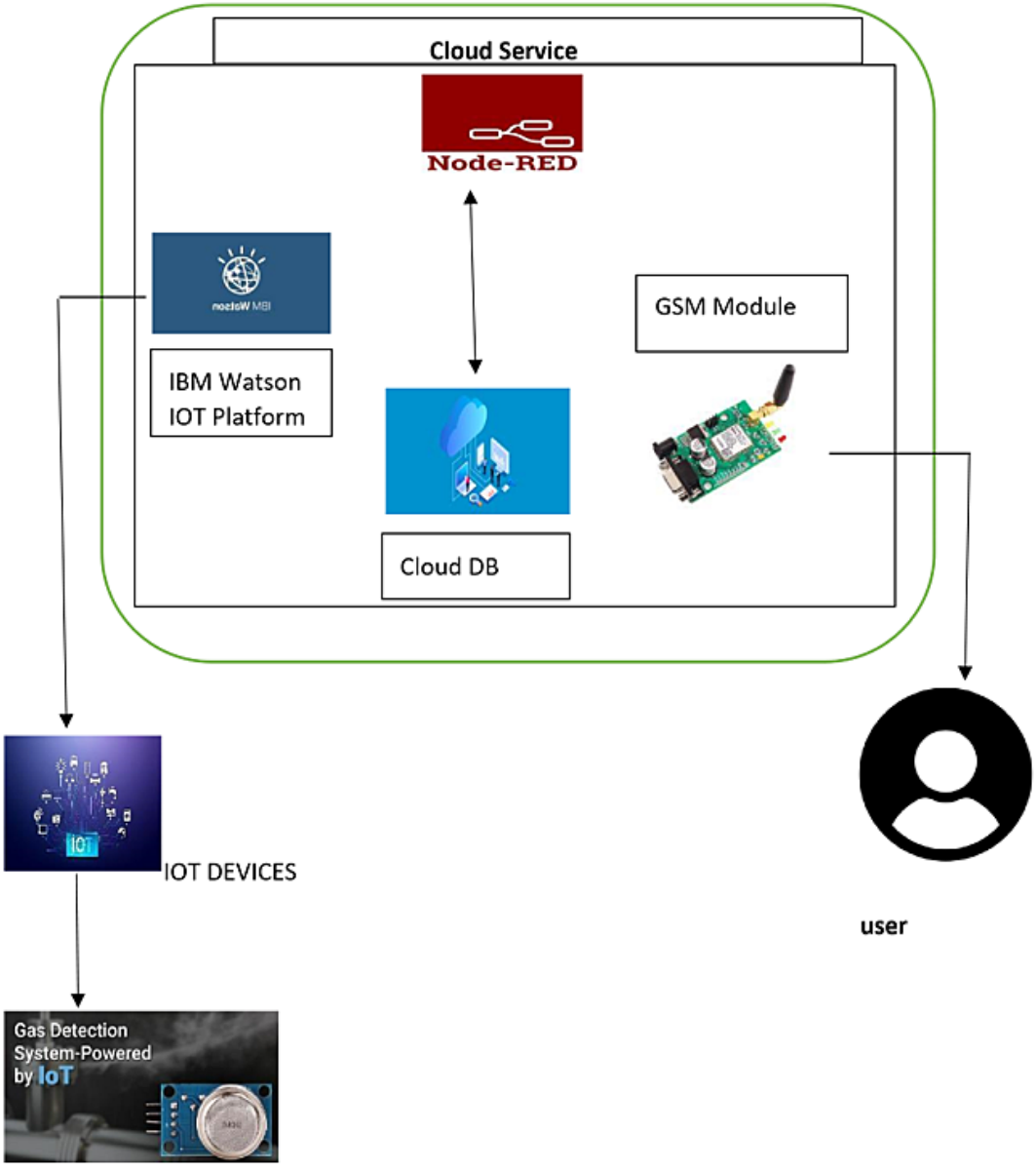
5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

- A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored


FLOWCHART : GAS LEAKAGE MONITORING AND ALERTING SYSTEM
Input
Gas Leak
NO
Yellow LED (Blink)
YES
Red LED Light
Buzzer Active
GSM Module
Output

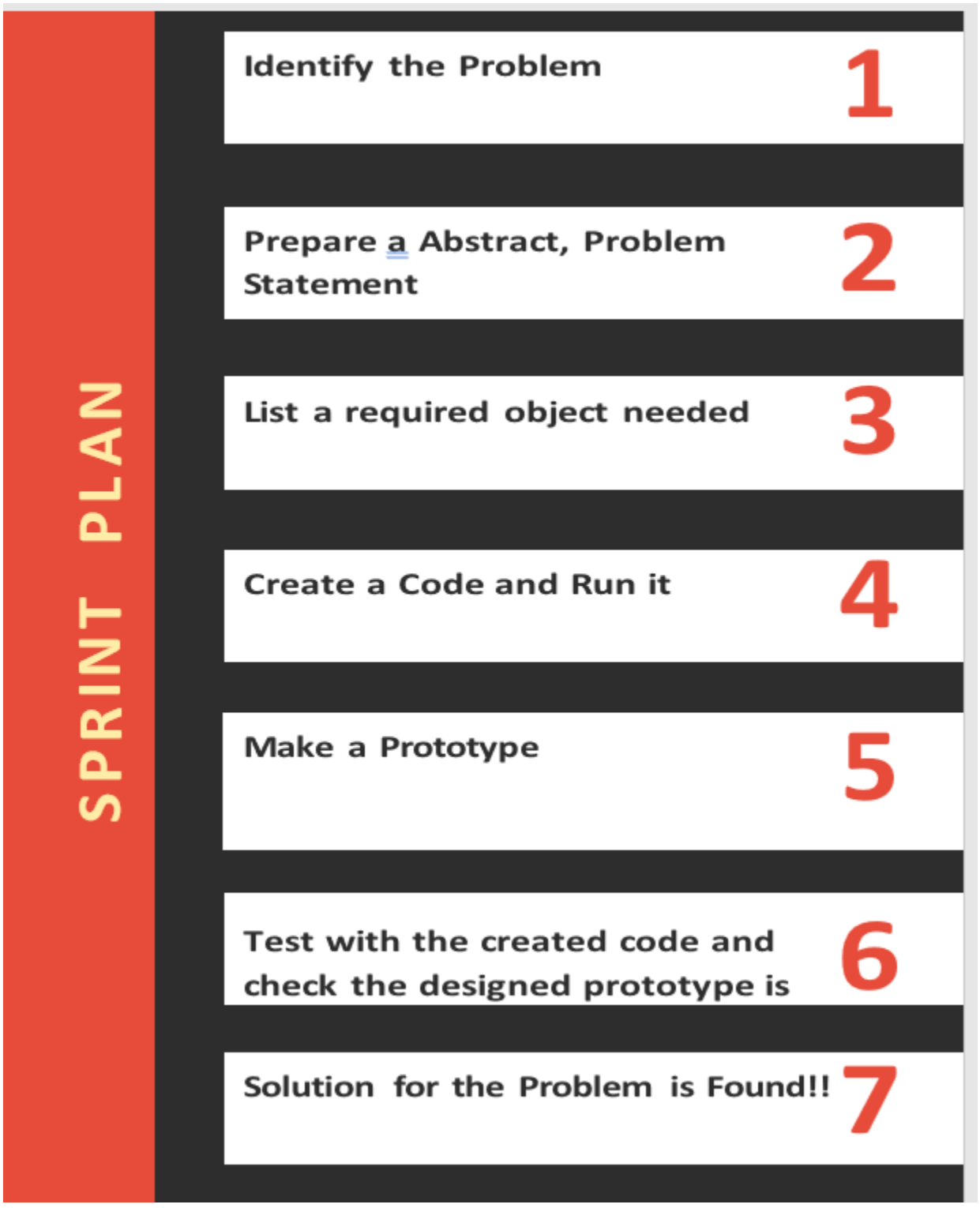
5.2 SOLUTION AND TECHNICAL ARCHITECTURE



6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

6.2 SPRINT DELIVERY SCHEDULE



7.CODING AND SOLUTIONING

7.1 FEATURE 1

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(5,6,8,9,10,11);


int redled = 2;

int greenled = 3;

int buzzer = 4;

int sensor = A0;

int sensorThresh = 400;


void setup()

{

pinMode(redled, OUTPUT);

pinMode(greenled,OUTPUT);

pinMode(buzzer,OUTPUT);

pinMode(sensor,INPUT);

Serial.begin(9600);

lcd.begin(16,2);

}


void loop()

{

  int analogValue = analogRead(sensor);

  Serial.print(analogValue);

  if(analogValue>sensorThresh)

  {
```

```
  digitalWrite(redled,HIGH);
  digitalWrite(greenled,LOW);
  tone(buzzer,1000,10000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALERT");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("EVACUATE");
  delay(1000);
 }
else
{
  digitalWrite(greenled,HIGH);
  digitalWrite(redled,LOW);
  noTone(buzzer);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("SAFE");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALL CLEAR");
  delay(1000);
 }
```

```
}
```

7.2 FEATURE 2

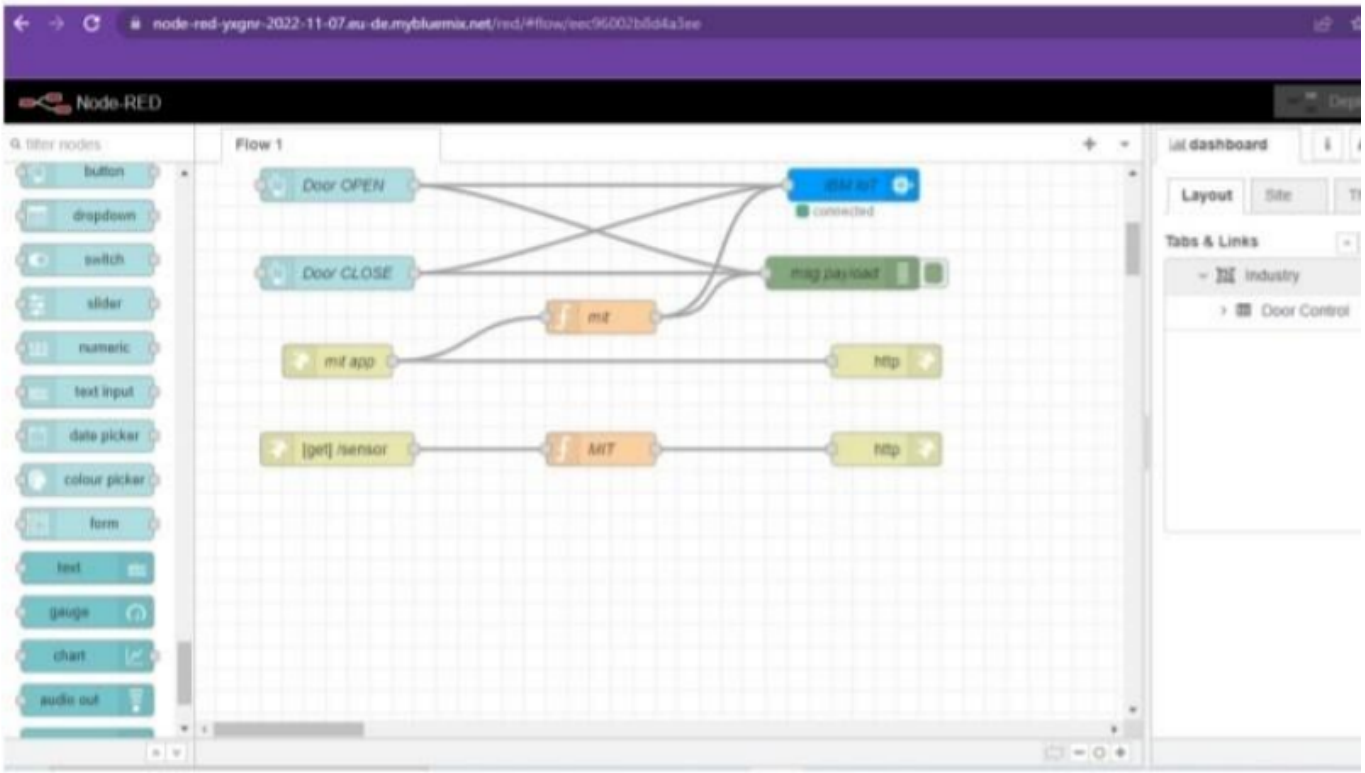
```
#include <LiquidCrystal.h>
LiquidCrystal lcd(5,6,8,9,10,11);

int redled = 2;
int greenled = 3;
int buzzer = 4;
int sensor = A0;
int sensorThresh = 400;

void setup()
{
pinMode(redled, OUTPUT);
pinMode(greenled,OUTPUT);
pinMode(buzzer,OUTPUT);
pinMode(sensor,INPUT);
Serial.begin(9600);
lcd.begin(16,2);
}

void loop()
{
  int analogValue = analogRead(sensor);
```

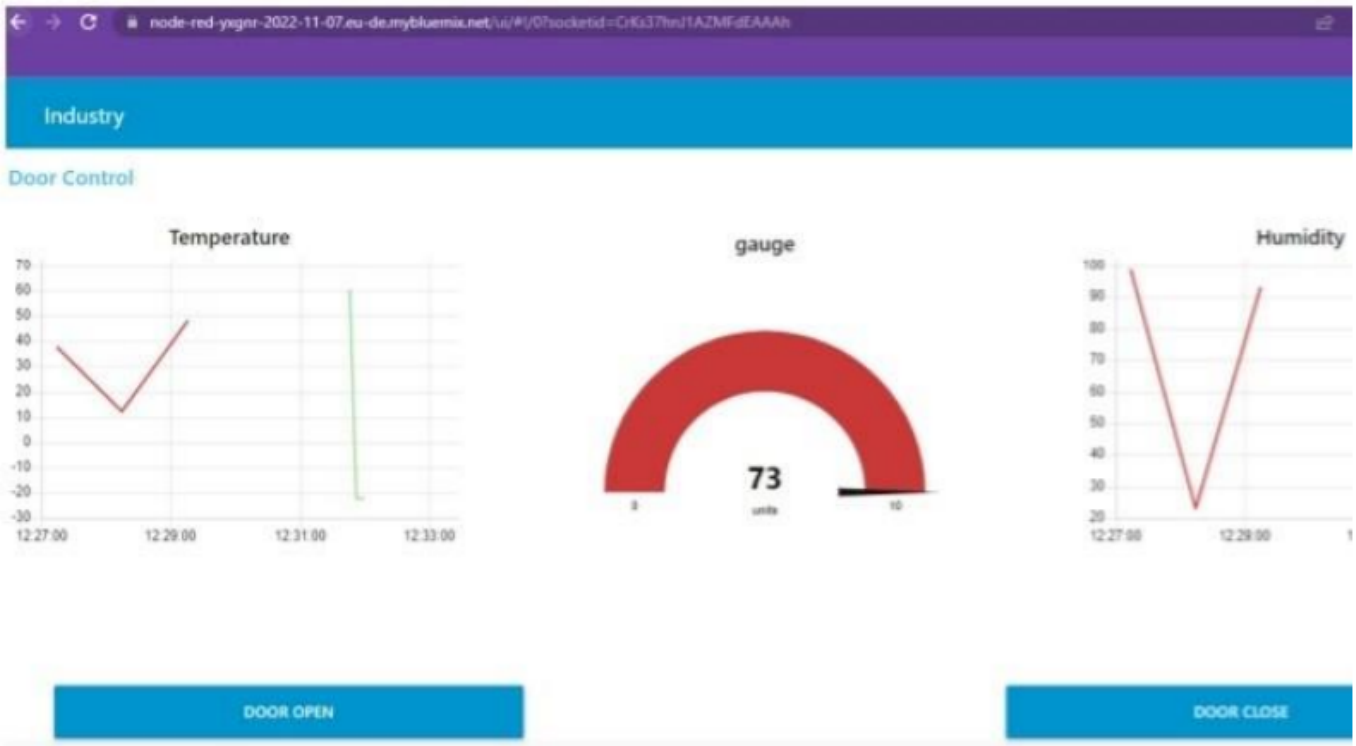
```
Serial.print(analogValue);
if(analogValue>sensorThresh)
{
  digitalWrite(redled,HIGH);
  digitalWrite(greenled,LOW);
  tone(buzzer,1000,10000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALERT");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("EVACUATE");
  delay(1000);
}
else
{
  digitalWrite(greenled,HIGH);
  digitalWrite(redled,LOW);
  noTone(buzzer);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("SAFE");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALL CLEAR");
```

```
  delay(1000);
 }
   }
```

8.TESTING

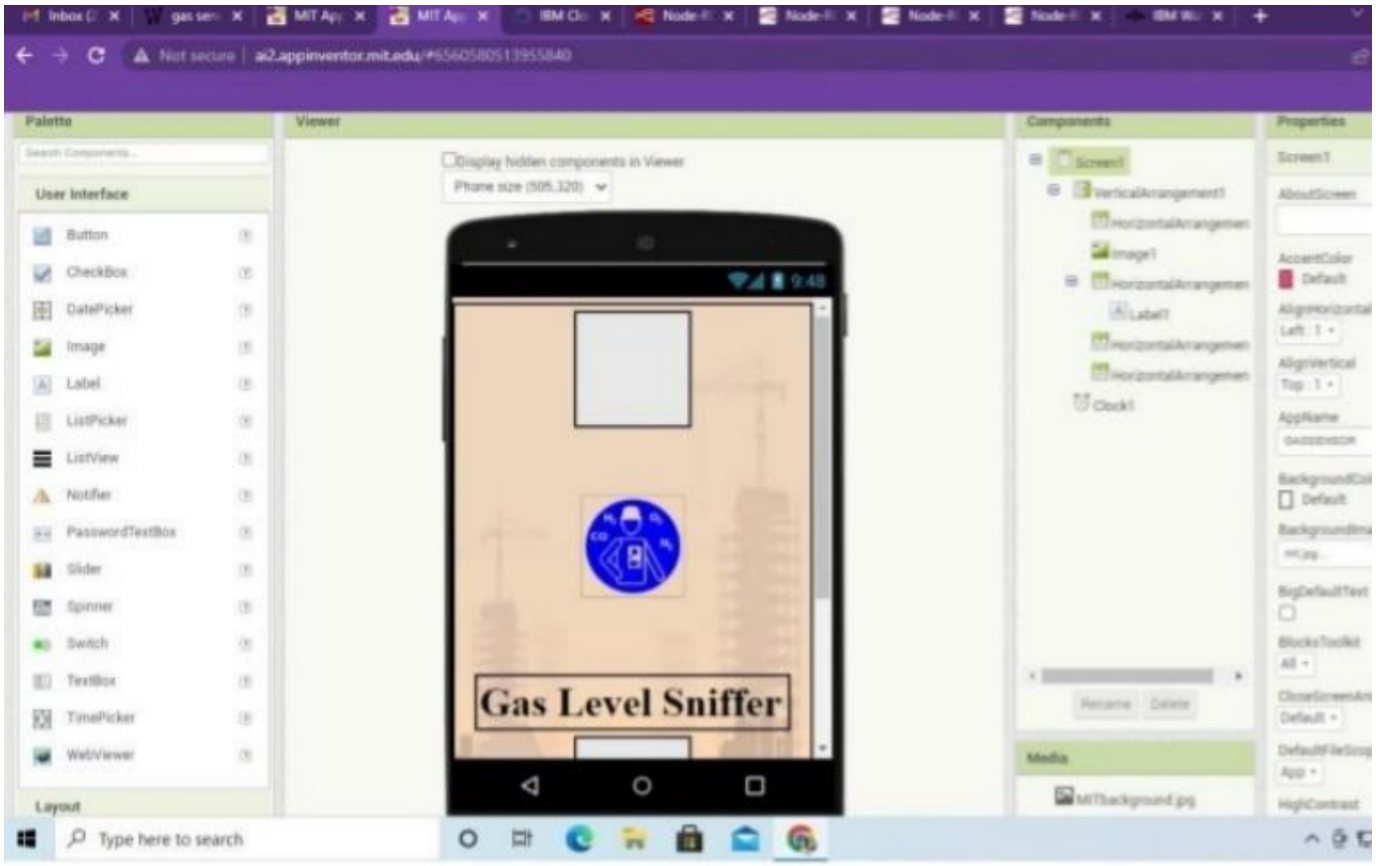
8.1 TESTCASES





8.TESTING

8.1 TEST CASES


Not secure | ai2.appinventor.mit.edu/#6560580513955840
Palette
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Viewer
Display hidden components in Viewer
Phone size (505,320)
Gas Level Sniffer
Components
Screen1
VerticalArrangement1
Image1
Label1
Clock1
Rename
Delete
Media
MITbackground.jpg
Properties
Screen1
AboutScreen
AccentColor
Default
AlignHorizontal
Left : 1
AlignVertical
Top : 1
AppName
BackgroundColor
Default
BigDefaultText
BlocksToolkit
All
Default
App
HighContrast
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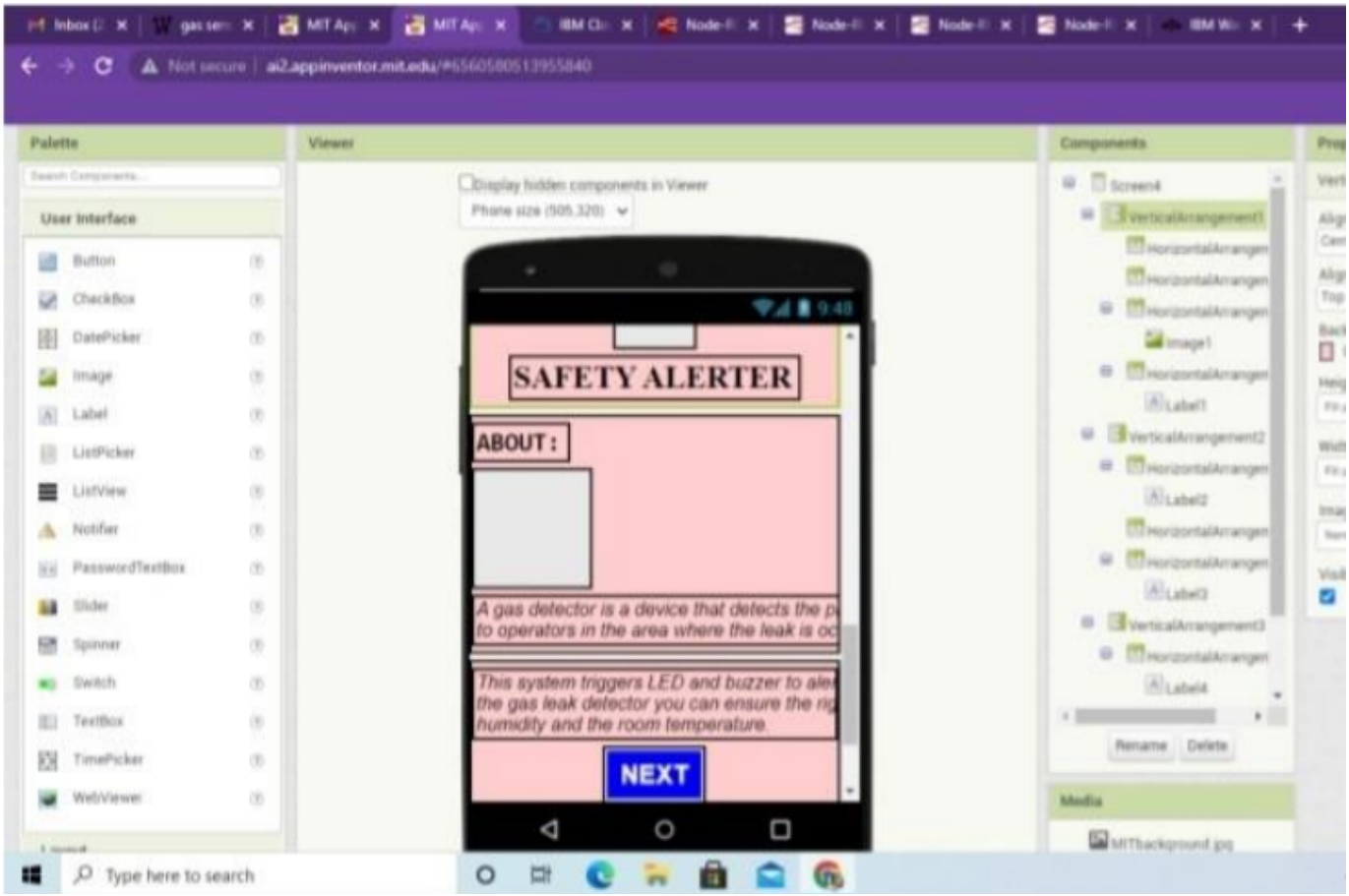
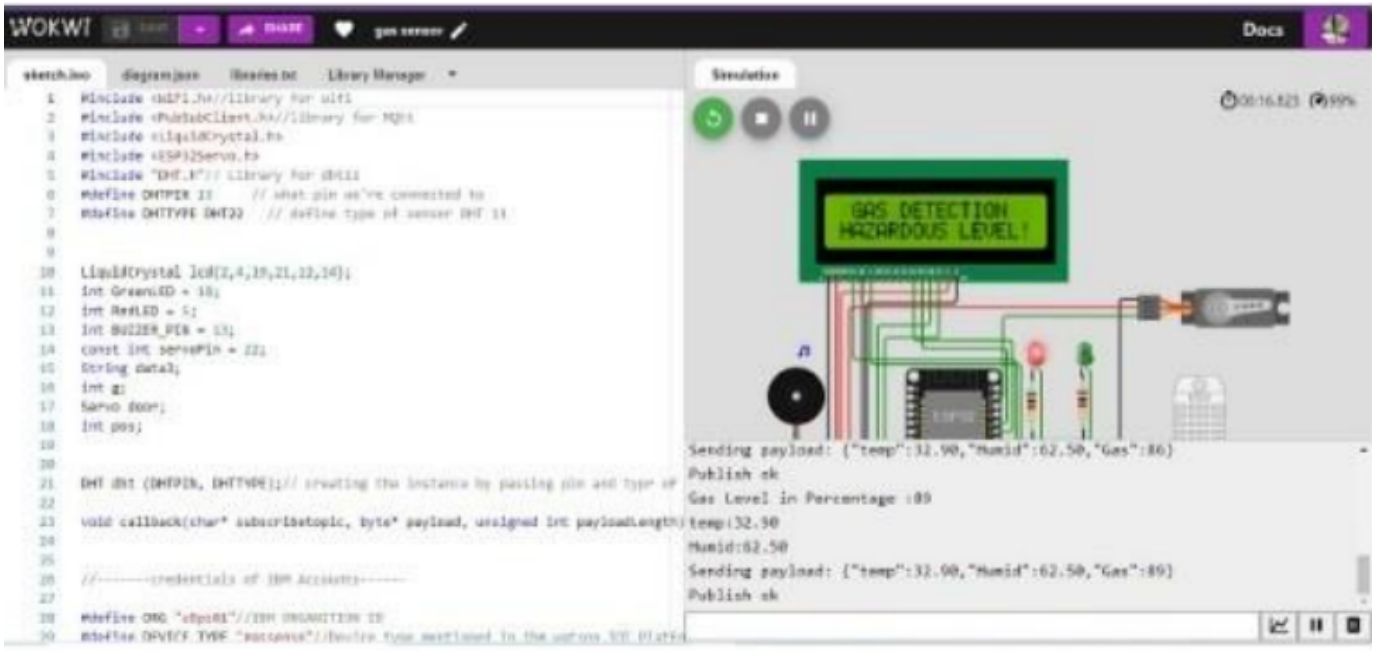
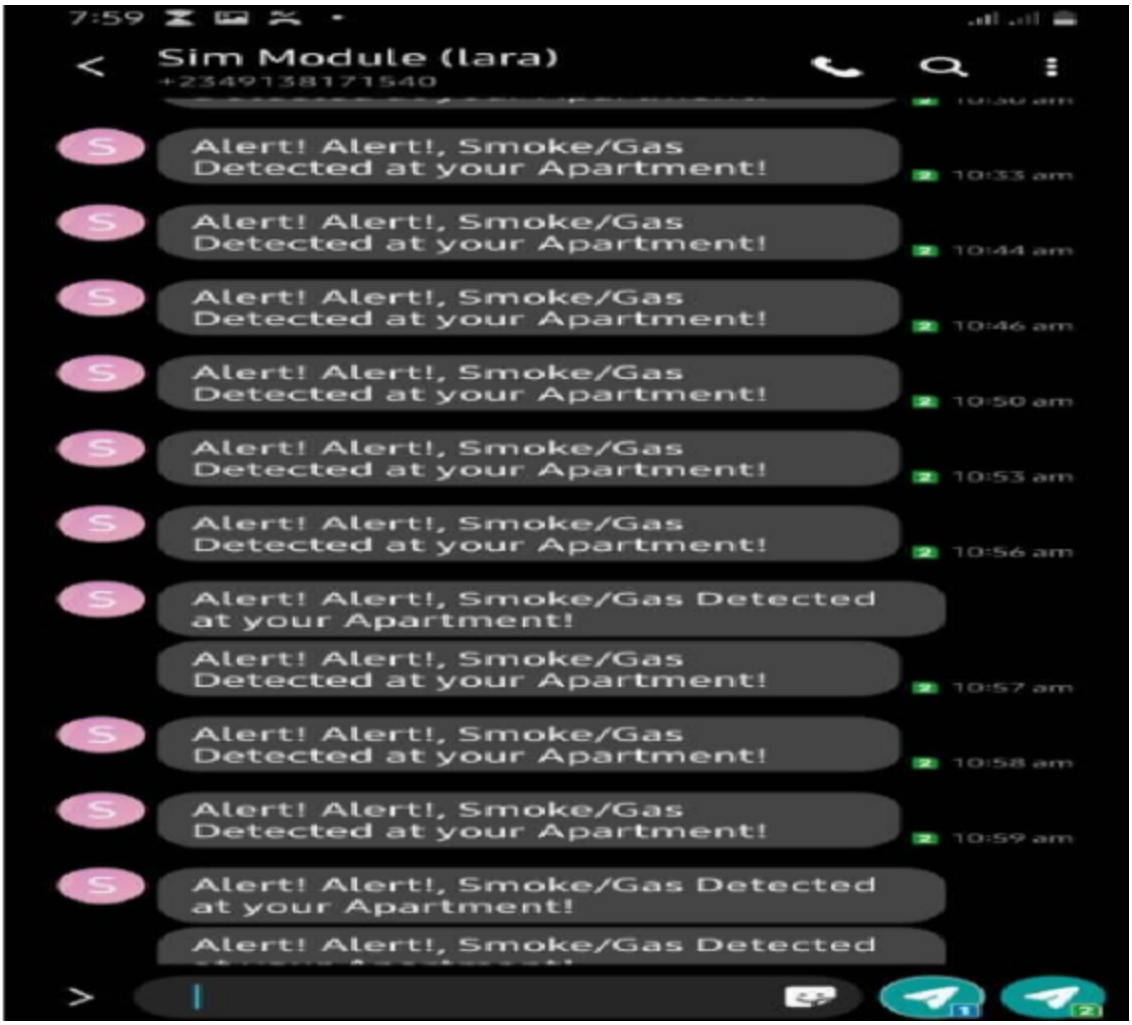

Palette
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Viewer
Display hidden components in Viewer
Phone size (505,320)
SAFETY ALERTER
ABOUT :
A gas detector is a device that detects the p
to operators in the area where the leak is oc
This system triggers LED and buzzer to ale
the gas leak detector you can ensure the ri
humidity and the room temperature.
NEXT
Components
Screen4
VerticalArrangement1
Image1
Label1
VerticalArrangement2
Label2
Label3
VerticalArrangement3
Label4
Rename
Delete
Media
MITbackground.jpg
Type here to search

8.2


WOKWI
gas sensor
Docs
sketch.ino
diagram.json
Library Manager
Simulation
GAS DETECTION
HAZARDOUS LEVEL!
Sending payload: {"temp":32.90,"Humid":62.50,"Gas":86}
Publish ok
Gas Level in Percentage :89
temp:32.90
Humid:62.50
Sending payload: {"temp":32.90,"Humid":62.50,"Gas":89}
Publish ok

9.RESULT



10.ADWANTAGES AND DISADWANTAGES

Advantages:

• Because of the very narrow 0.3 nm line width of the laser emission, there is no interference from other gases.

• Response times are in the order 1 second. This allow for fine resolution/control when making process measurements.

• The intense laser light concentrated at the absorption wavelength enables path lengths up to 1 km to be measured.

• An average measurement is taken over the total path so that a narrow plume of gas has less chance of escaping detection.

• The range of measurement can be up to 4 orders of magnitude, enabling concentrations of 0.1 ppm to 1000 ppm to be measured.

• Because of the internal reference cell, the system is self calibrating.

• There is no ‘poisoning’ or degradation of the instrument with long term exposure to a gas.

• Can easily be conformed to be ‘Intrinsically Safe’. • Low maintenance and low operating costs. • Reliable technology. Disadvantages: • Only one gas can be measured with each instrument. • When heavy dust, steam or fog blocks the laser beam, the system will not be able to take measurements. This is also the case when a person or vehicle blocks the path.

11 CONCLUSION

IOT technology for enhancing the existing safety standards. While making this prototype has been to bring a revolution in the field of safety against the leakage of harmful and toxic gases in environment and hence nullify any major or minor hazard being caused due to them. We have used the IOT technology to make a Gas Leakage Detector for society which having Smart Alerting techniques involving sending text message to the concerned authority and an ability performing data analytics on sensor. This system will be able to detect the gas in environment using the gas sensors. This will prevent form the major harmful proble

GITHUB LINK:
https://github.com/IBM-EPBL/IBM-Project-35600-1660286592