

GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

PROJECT NAME	GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES
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BRANCH	ELECTRONICS AND COMMUNICATION ENGINEERING

1.INTRODUCTION

1.1 Project Overview

Leakage of any kind of gas has been a concern in recent years, whether it is in a residential setting, a business, a cafe, or a canteen. In this paper development of an IoT based gas wastage monitoring, leakage detecting and alerting system is proposed. This paper elaborates design such an intelligent system that will help save gas and smartly prevent accidents. The system needs to be integrated with the cooker. The technology includes ultrasonic sensors that determine if the cooker is being utilized for cooking purposes or not. If it is discovered that the cooker is not in use, the system uses an automatic switching off mechanism to cut off the gas supply. The moment gas leakage will probably be recognized, users will be informed via SMS through GSM, and so that user can solve the issue as soon as possible. The system will monitor flame and fire through flame sensor. When a fire is detected, the

buzzer begins to sound. Aside from that, the system also has a cloud storage capability. The usage of gas for each user each day may be tracked with the aid of this cloud storage solution. At the end of the day, this procedure will assist in detecting per user natural gas usage. The system has been tested and it is able to monitor gas wastage, leakage and send a SMS to the use. The resulting performance indicated its effectiveness toward saving a significant portion of the wasted gas in domestic.

1.2 purpose

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.

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 order 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.

2.2 References

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- Attia, Hussain A., and Halah Y. Ali. "Electronic Design of Liquefied Petroleum Gas Leakage Monitoring, Alarm, and Protection System Based on Discrete Components." International Journal of Applied Engineering Research, vol. 11, no. 19, pp. 9721-9726, 2016.
- Apeh, S. T., K. B. Erameh, and U. Iruansi. "Design and Development of Kitchen Gas Leakage Detection and Automatic Gas

Shut off System." Journal of Emerging Trends in Engineering and Applied Sciences, vol. 5, no. 3, pp. 222-228, 2014.

- Mahalingam, A., R. T. Naayagi, and N. E. Mastorakis. "Design and implementation of an economic gas leakage detector." Recent Researches in Applications of Electrical and Computer Engineering, pp. 20-24, 2012.
- Phalak; Kowekar; & Joshi. 2015. International Journal for Research In Emerging Science And Technology, Vol. 1.2, Issue 9.

2.3 PROBLEM STATEMENT DEFINITION

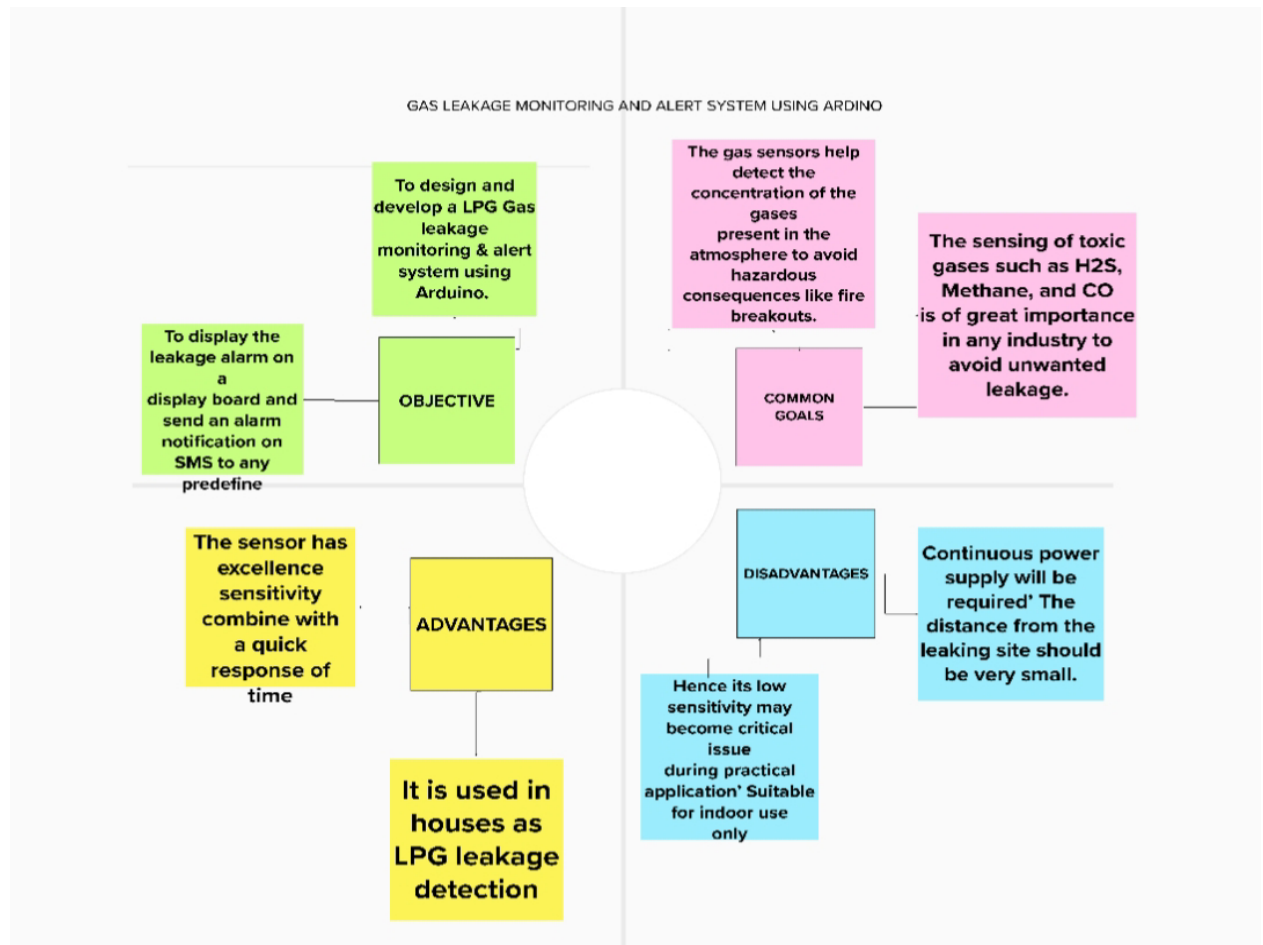
Gas leakage is nothing but the leak of any gaseous molecule from a stove, or a pipeline, or cylinder etc. This can occur either purposefully or even unintendedly. As we are aware that these kinds of leaks are dangerous to our health, and when it becomes explosive it could cause great danger to the people, home, workplace, industry and the environment.

Few of the major incidents that took place due to gas leakage include the Bhopal disaster and the vizag gas leak. The Bhopal disaster is known to be the worst industrial accident ever. Approximately 45 tons of methyl isocyanate was leaked from the insecticide plant. Methyl isocyanate is an organic compound and a chemical that could come from the carbamate pesticides. This colourless, poisonous and flammable liquid is something that human beings have to be away from.

Vizag gas leak was a resultant of the escape of styrene that were unattended for a long period. This colourless oily liquid can spread in fumes. So, a detector must be made in such a way that could detect any kind of gas, fume, leak, smoke etc. However harmful and dangerous it can be, the detector could be attached with certain parameters that could help to prevent the issue.

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 IDEATION & BRAINSTORMING

Microcontroller Based LPG Gas Leakage Detector Using GSM Module, in this system where used gas sensor, GSM module, microcontroller, if the gas concentration is increases the gas sensors will sense the leakage of the gas and then send to the microcontroller. Then the GSM module is connected to the microcontroller which will gives the command to stop the main supply. The system is highly reliable, tamper-proof and secure. In the long run the maintenance cost is efficient. It is highly accurate.(A.sood, B.Sonkar, A.Ranjan, Mr. A.Faisal, June-2015)

Liquefied Petroleum Gas commonly known as LPG consists of a mixture of Commercial Propane and Commercial Butane having saturated as well as unsaturated hydrocarbons. It is an odorless gas due to which Ethyl Mercaptan is added as powerful odorant so that leakage can easily be detected. LPG is commonly used in homes for heating and cooking. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. LPG was first produced in 1910 by Walter Snelling (Didpaye1, 2015) and is classified as a hazardous material because of its flammable properties and explosive potential when stored under pressure. Before the development of electronic.

3.3 Proposed Solution

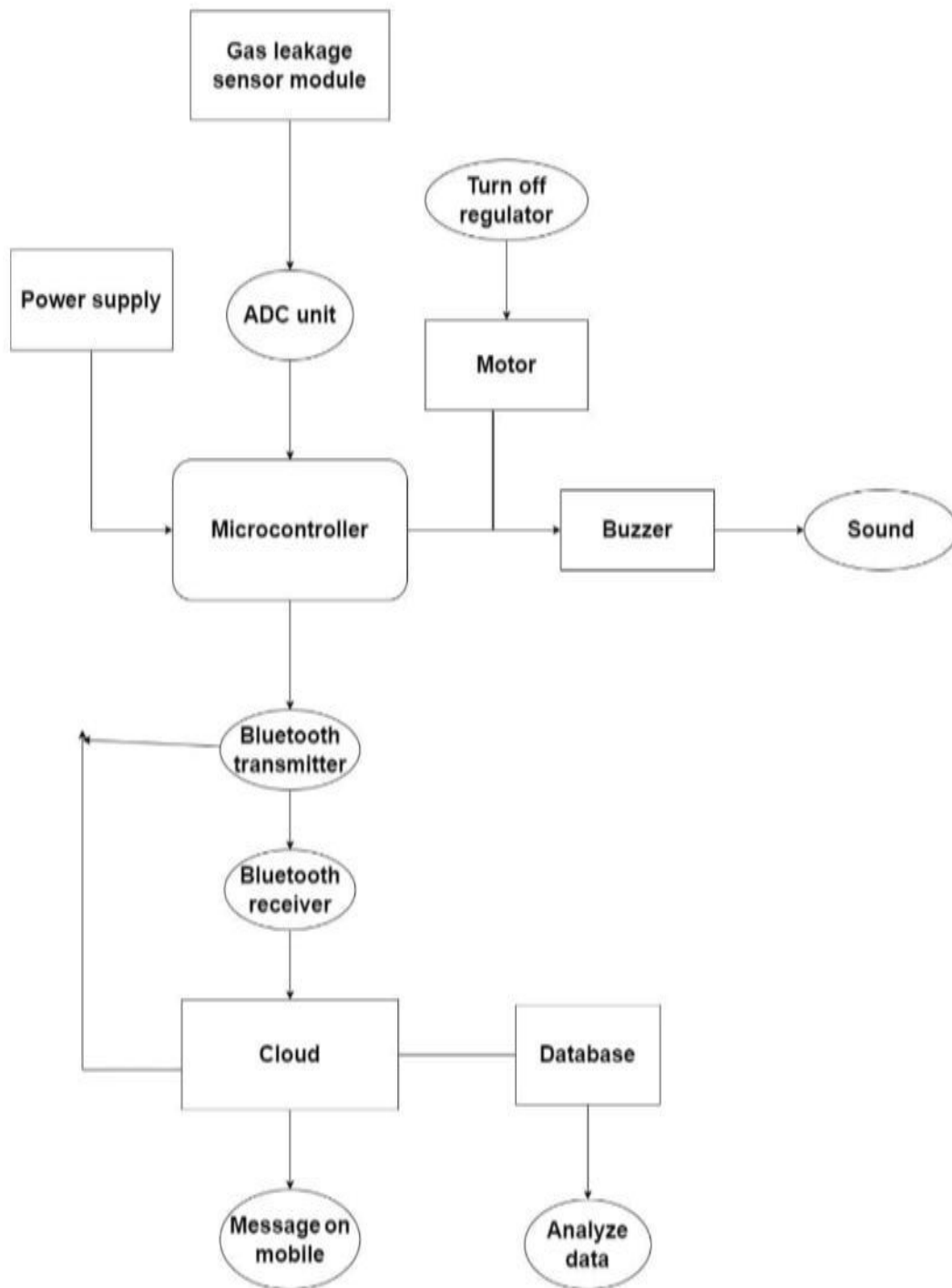
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Gas leakage leads to various accidents resulting in financial loss as well as human injuries and loss.
2.	Idea / Solution description	The work aims at designing a system that detects gas leakage and alerts these describer through alarm and status display besides turning off the gas supply valve.
3.	Novelty / Uniqueness	It sends messages to mobile number specifically mentioned in the program of the source code for alerting danger to the people
4.	Social Impact / Customer Satisfaction	Using GSM facility every customer can get update of their gas leakage and they can monitor from their own place
5.	Business Model (Revenue Model)	Our project model is more efficient and low cost compared to that in market
6.	Scalability of the Solution	In danger situation we are able to save the life by using this gas leakage detection system.

3.4 Problem solution fit

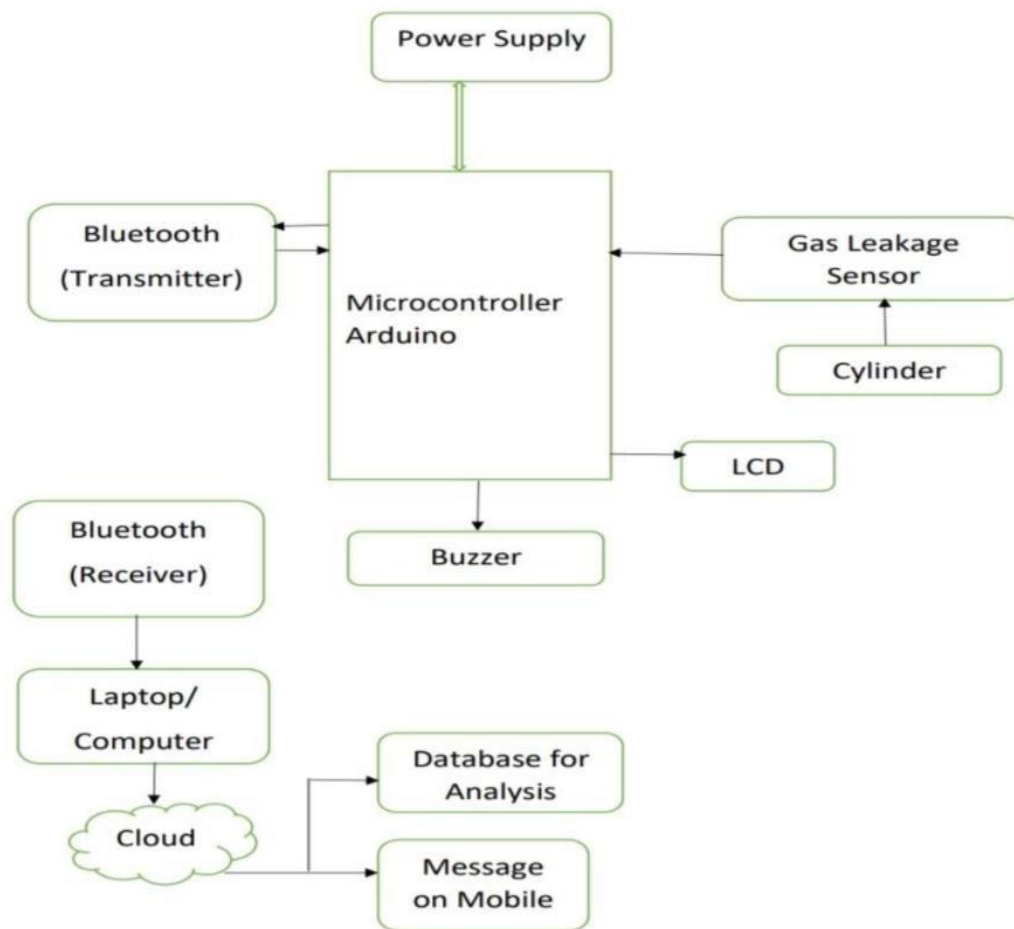
<p>1. CUSTOMER SEGMENT(S) CS</p> <p>Who is your customer? i.e. working parents of 0-5 y.o. kids</p> <p>The industrialists who use gases for their manufacturing.</p>	<p>6. CUSTOMER CONSTRAINTS CC</p> <p>What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.</p> <p>High budget in installing other products make them to move far from modern technologies.</p>	<p>5. AVAILABLE SOLUTIONS AS</p> <p>Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking</p> <p>Then sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises. the gas sensors help detect the concentration of the gas: present in the atmosphere to avoid hazardous consequences like fire breakouts.</p>
<p>2. JOBS-TO-BE-DONE / PROBLEMS J&P</p> <p>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.</p> <p>most of gas explosions are caused by undetected gas leakage in the pre-detection condition. so that, gas leakage monitoring and altering system is needed. the purpose of this system is to detect gas leakage, neutralize it, and prevent the explosion.</p>	<p>9. PROBLEM ROOT CAUSE RC</p> <p>What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.</p> <p>when the workers failed to monitor properly, the gas can cause high risk to their health or the properties of the industry.</p>	<p>7. BEHAVIOUR BE</p> <p>What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)</p> <p>using manpower as the source of monitoring the leakage causes high hazards. if the gas leaked is heavily toxic, there is a chance of causing hereditary health issues too.</p>
<p>3. TRIGGERS TR</p> <p>What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</p> <p>most of gas explosions are caused by undetected gas leakage in the pre-detection condition. so that, gas leakage monitoring and altering system is needed.</p> <p>4. EMOTIONS: BEFORE / AFTER EM</p> <p>How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design.</p> <p>Before: the heavy losses due to the leakage made them feel of guilt due to reduced reputation of their products. After: increased the level of confidence and feel.</p>	<p>10. YOUR SOLUTION SL</p> <p>If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</p> <p>Develop an efficient system & an application and alter the workers.</p>	<p>8. CHANNELS of BEHAVIOUR CH</p> <p>#1 ONLINE What kind of actions do customers take online? Extract online channels from #7</p> <p>#2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</p> <p>ONLINE: Promoting through social media with the help of social media entrepreneurs/influencer. OFFLINE: Newspaper advertisements.</p>

4 PROJECT DESIGN

4.1 Data Flow Diagrams



4.2 Solution & Technical Architecture



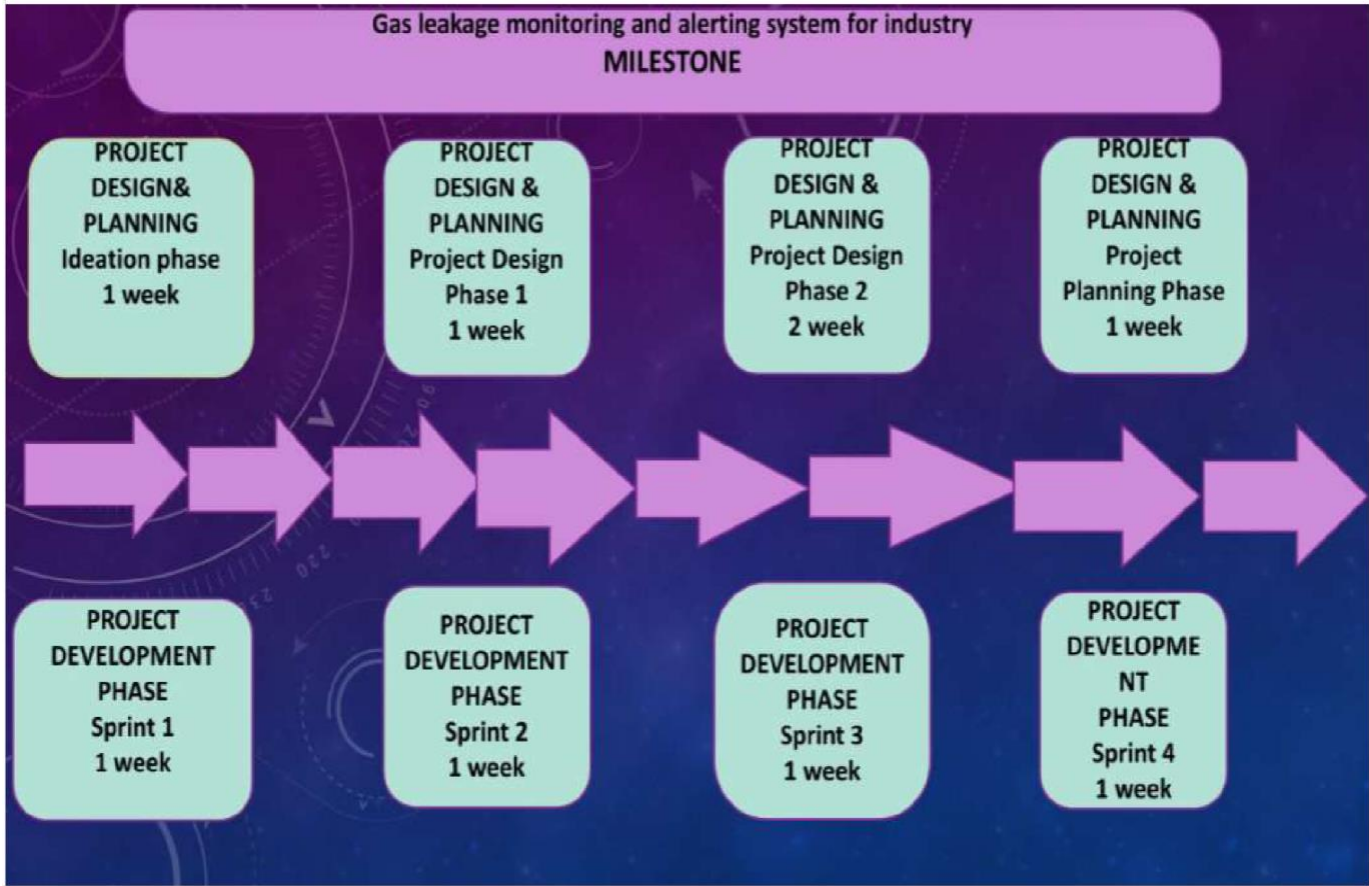
5.PROJECT PLANNING AND SCHEDULING:

5.1 SPRINT PLANNING AND ESTIMATION:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task
Sprint-1	Simulation Creation	USN-1	Ibm Watson account creating and node js application creating
Sprint-1	Software	USN-2	Python idle 3.9.6 version download
Sprint-2	Software	USN-3	Develop code for gas leakage monitoring
Sprint-2	Software	USN-4	Application creation in ibm Watson account

Sprint-3	Software	USN-5	Establishing Node-Red connection
Sprint-3	Software	USN-6	Upload program to node js and seeing output in ibm Watson
Sprint-4	Testing	USN-7	Testing and developing web application

5.2 SPRINT DELIVERY SCHEDULE:



6 CODING AND SOLUTIONING:

6.1.FEATURE 1:

PYTHON PROGRAM:

```
#IBM Watson IOT Platform
#pip install wiotp-sdk
import wiotp.sdk.device
import time
```

```

import random

myConfig = {
    "identity": {
        "orgId": "yy65z9",
        "typeId": "NodeMCU",
        "deviceId": "12345 },
    "auth": {
        "token": "12345678"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:
    co2gas=random.randint(400,5000)
    if co2gas<1000:
        sts="no leakage of co2"
    else:
        sts="danger, co2 is leaking"
    methane=random.randint(1000,4000)
    if methane<2000:
        st="no leakage of methane"
    else:
        st="danger, methane is leaking"
    temp=random.randint(-20,50)

```

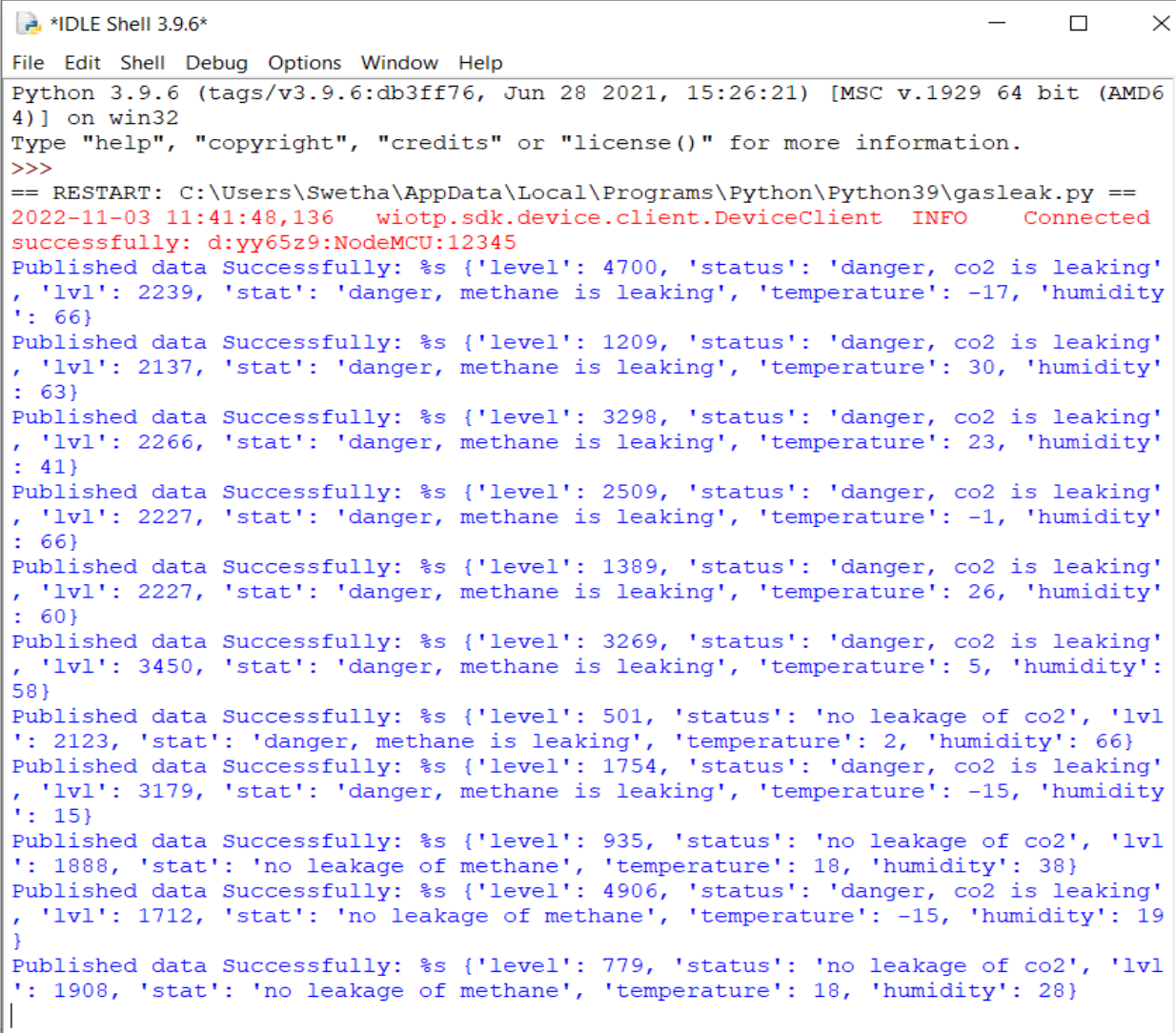
```

humidity=random.randint(0,100)
myData={'level':co2gas,"status":
sts,"lvl":methane,"stat":st,"temperature":temp,"humidity":humidity}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)

print("Published data Successfully: %s", myData)
client.commandCallback = myCommandCallback
time.sleep(2)
client.disconnect()

```

OUTPUT:



```

*IDLE Shell 3.9.6*
File Edit Shell Debug Options Window Help
Python 3.9.6 (tags/v3.9.6:db3ff76, Jun 28 2021, 15:26:21) [MSC v.1929 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
== RESTART: C:\Users\Swetha\AppData\Local\Programs\Python\Python39\gasleak.py ==
2022-11-03 11:41:48,136   wiotp.sdk.device.client.DeviceClient  INFO      Connected
successfully: d:yy65z9:NodeMCU:12345
Published data Successfully: %s {'level': 4700, 'status': 'danger, co2 is leaking'
, 'lvl': 2239, 'stat': 'danger, methane is leaking', 'temperature': -17, 'humidity'
': 66}
Published data Successfully: %s {'level': 1209, 'status': 'danger, co2 is leaking'
, 'lvl': 2137, 'stat': 'danger, methane is leaking', 'temperature': 30, 'humidity'
: 63}
Published data Successfully: %s {'level': 3298, 'status': 'danger, co2 is leaking'
, 'lvl': 2266, 'stat': 'danger, methane is leaking', 'temperature': 23, 'humidity'
: 41}
Published data Successfully: %s {'level': 2509, 'status': 'danger, co2 is leaking'
, 'lvl': 2227, 'stat': 'danger, methane is leaking', 'temperature': -1, 'humidity'
: 66}
Published data Successfully: %s {'level': 1389, 'status': 'danger, co2 is leaking'
, 'lvl': 2227, 'stat': 'danger, methane is leaking', 'temperature': 26, 'humidity'
: 60}
Published data Successfully: %s {'level': 3269, 'status': 'danger, co2 is leaking'
, 'lvl': 3450, 'stat': 'danger, methane is leaking', 'temperature': 5, 'humidity':
58}
Published data Successfully: %s {'level': 501, 'status': 'no leakage of co2', 'lvl
': 2123, 'stat': 'danger, methane is leaking', 'temperature': 2, 'humidity': 66}
Published data Successfully: %s {'level': 1754, 'status': 'danger, co2 is leaking'
, 'lvl': 3179, 'stat': 'danger, methane is leaking', 'temperature': -15, 'humidity
': 15}
Published data Successfully: %s {'level': 935, 'status': 'no leakage of co2', 'lvl
': 1888, 'stat': 'no leakage of methane', 'temperature': 18, 'humidity': 38}
Published data Successfully: %s {'level': 4906, 'status': 'danger, co2 is leaking'
, 'lvl': 1712, 'stat': 'no leakage of methane', 'temperature': -15, 'humidity': 19
}
Published data Successfully: %s {'level': 779, 'status': 'no leakage of co2', 'lvl
': 1908, 'stat': 'no leakage of methane', 'temperature': 18, 'humidity': 28}

```

Along with gas leakage monitoring and detecting we have also added temperature and humidity monitoring also in this program to know the environmental conditions.

7.RESULTS:

7.1 IOT WATSON OUTPUT:

IBM Watson IoT Platform

732919ecf
ID: yy65z9

← Back

Device Drilldown - 12345

Connection Information

Recent Events

State

Device Information

Metadata

Diagnostics

Connection Logs

Device Actions

State

This table shows a list of data points that are reported by this device.

Showing Raw Data | No Interfaces Available

Property	Value	Type	Event	Last Received
level	4154	Number	status	a few seconds ago
status	danger, co2 is leaking	String	status	a few seconds ago
lvl	3948	Number	status	a few seconds ago
stat	danger, methane is leaking	String	status	a few seconds ago
temperature	43	Number	status	a few seconds ago
humidity	5	Number	status	a few seconds ago

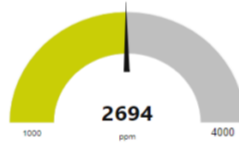
7.2 NODE RED WEB APPLICATION OUTPUT:

gas leakage

status of
carbondioxide

no leakage of
co2

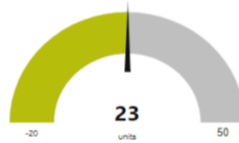
methane level



status of
methane

danger, methane is
leaking

temperature



humidity



co2 level



8.ADVANTAGES AND DISADVANTAGES

8.1 Advantage

It is used in houses as LPG leakage detection

- It also detects alcohol so it is used as liquor tester'
- The sensor has excellence sensitivity combine with a quick response of time'
- Unidentifiable gas leaks give rise to explosions that are harmful to the employees working in the hazardous environment. There comes a need to install smart systems to

accurately identify combustible, flammable and toxic gases along with detecting oxygen depletion in industry premises for improved safety.

- In the automotive industries like oil and gas, hotels, and places where flammable gases are used in abundance, a gas detection system is a basic requirement for safety. An IoT powered gas detection solution uses gas sensors to identify the presence of toxic gases such as CO₂, CO, NO_x in the industrial facilities.
- Especially, in the oil and gas industry where many gaseous products like propane, butane, and hydrogen are manufactured at a greater level. Hence, the chances of gas explosions are higher as these gases are easily combustible in the oxygen-rich environment. Apart from these, toxic gases like hydrogen sulfide (H₂S) is produced during refining processes that might harm the workers' health. Thus, it becomes a necessity to keep a real-time check on gas production. If these toxic gases are released untreated, their harmful contaminants result in air pollution and acid rains.

8.2 Disadvantage

- Continuous power supply will be required' The distance from the leaking site should be very small.
- Hence its low sensitivity may become critical issue during practical application' Suitable for indoor use only.

9. CONCLUSION

Gas leakage may leads to severe accidents which results in material losses and humaninjuries. Gas leakage occurs mainly due to poor maintenance of equipments and inadequate awareness of the people. Hence LpG leakage detection will be helpful to prevent accidents and to save human lives. This project presented LpG leakage detection and alert system. This system triggers buzzer displays the severity of the leakage to alert people when LPG leakage is detected. This system is very sirnple yet reliable.

10. FUTURE SCOPE

Major cities of India are pushing Smart Home application, gas monitoring system is a part of Smart Home application. Enhancing Industrial Safety using IoT. IoT turns drone into gas detection sensor. 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. This system can be implemented in Industries, Hotels and wherever the LPG cylinders are used. This system can be used in industries involving applications such as Furnace, Boilers, Gas welding, Gas cutting, Steel Plants, Metallurgical industries, Food processing Industries, Glass Industries, Plastic industries, Pharmaceuticals, Aerosol manufacturing. As hospitals require to provide maximum possible safety to patients, this system can be used to keep track of all the cylinders used in it. Some of the cylinders used are Oxygen cylinder, Carbon dioxide cylinder, Nitrous oxide cylinder. As many students are naïve the risk of causing accidents is high. Hence, our system can also be used in schools, colleges. Many colleges have well established labs including chemistry lab and pharmaceutical labs where gas burners are used. Plenty of medical equipment requires gas cylinders.

