PROJECT REPORT

Gas Leakage Monitoring and Alerting System

Team ID : PNT2022TMID21386

(Department of Electronics and Communication Engineering)

Muthu Veni V	917719D053
Nandhini P	917719D054
Senthilkumar C	917719D084
Swetha K	917719D134

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE NO
1	Introduction	2
2	Literature Survey	4
3	Ideation and Proposed Solution	6
4	Requirement Analysis	12
5	Project Design	14
6	Project Planning &Scheduling	17
7	Coding and Soluiton	21
8	Testing	25
9	Results	25
10	Advantages and disadvantages	27
11	Conclusion	28
12	Future Scope	29
13	Appendix	30

Abstract :-

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 thispaper 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 cookeris 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 theissue 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 gasfor 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 user. The resulting performance indicated its effectiveness toward saving a significant portion of the wasted gas in domestic.

1.Introduction :-

Now a days the home safety detection system and in industry plays the important role for the security of people. Since all the people from the home goes to work on daily bases, it makes impossible to check on the appliances available at home specially LPG gas cylinder, wired circuits, Etc. Since last three years there is a tremendous hike in the demands of liquefied petroleum gas (LPG) and natural gas. To meet this access amount of demand for energy and replace oil or coal due to their environmental disadvantage, LPG and natural gas are preferred. These gases are mostly used on large scale in industry, heating, home appliances and motor fuel. So as to track this leakage gas, the system includes MQ6 gas sensor. This sensor senses the amount of leak gas present in the surrounding atmosphere. Through this, explosion or getting affected by the leakage of gas could be avoided.

1.1Project Overview :-

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 oureconomy. The need for ensuring safety in workplaces is expected to be thekey driving force for the market over the coming years.

1.2Purpose:-

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 this insecticide plant. Methyl Isocyanate is an organic compound and a chemical that could come from the carbamate pesticides. This colorless, 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 colorless 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 toprevent the issue.

2.Literature survey :-

2.1 Existing Problem

S.NO	Paper Title	Author name	Publication Year	Results
1	Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor	Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu	2017	This paper choice of using a real time gas leakage monitoring and Sensing the output levels of gas has been clearly observed by the help of this system.
2	Gas Leakage Detection and Smart Alerting and Prediction Using IoT	Asmita Varma, Prabhakar S, Kayalvizhi Jayavel	2017	The proposed gas leakage detector is promising in the Field of safety.
3	IOT Based Gas Leakage Detection System with Database Logging, Prediction and Smart Alerting	Chaitali Bagwe, Vidya Ghadi, Vinayshri Naik, Neha Kunte	2018	Thesystem provides constant monitoring and detection of gas leakage along with storage of data in database for predictions and analysis.

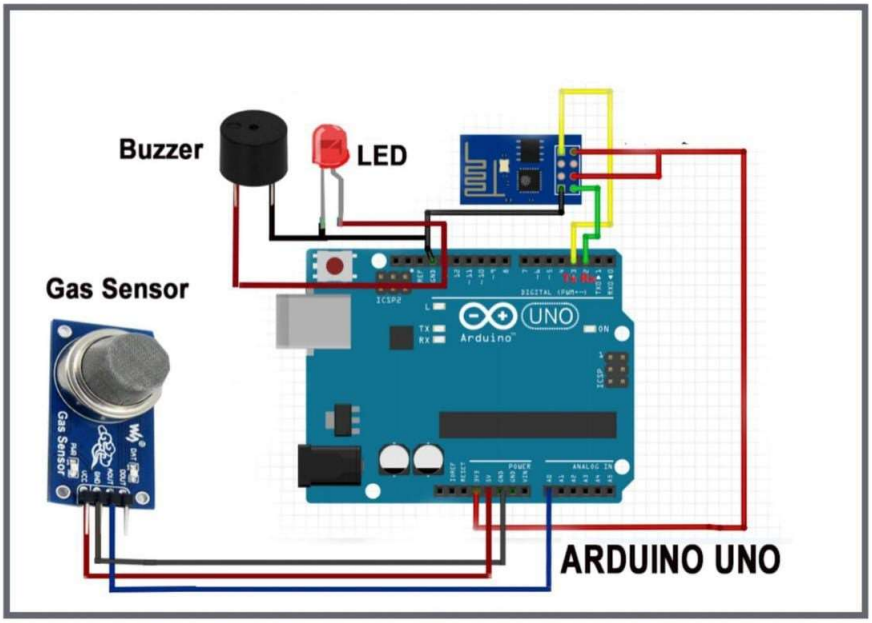
4	Internet of Things (IoT) Based Gas Leakage Monitoring and Alerting System with Mq-6 Sensor	Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu, Saurabh Deshmukh	2018	A discussion on how the aims and objectives are met is presented. An overall conclusion IOT based toxic gas detector is it has become more efficient, more applicable to today's applications and smarter.
5	Gas Leakage Detection and Smart Alerting System Using IoT	Shital Imade, Priyanka Rajmanes, Aishwarya Gavali	2018	In this paper we use IOT technology for enhancing the existing safety standards. While making this prototype has been to bring a revolution in the field of safety against the leakage of harmful and toxic gases

2.2Problem Statement:

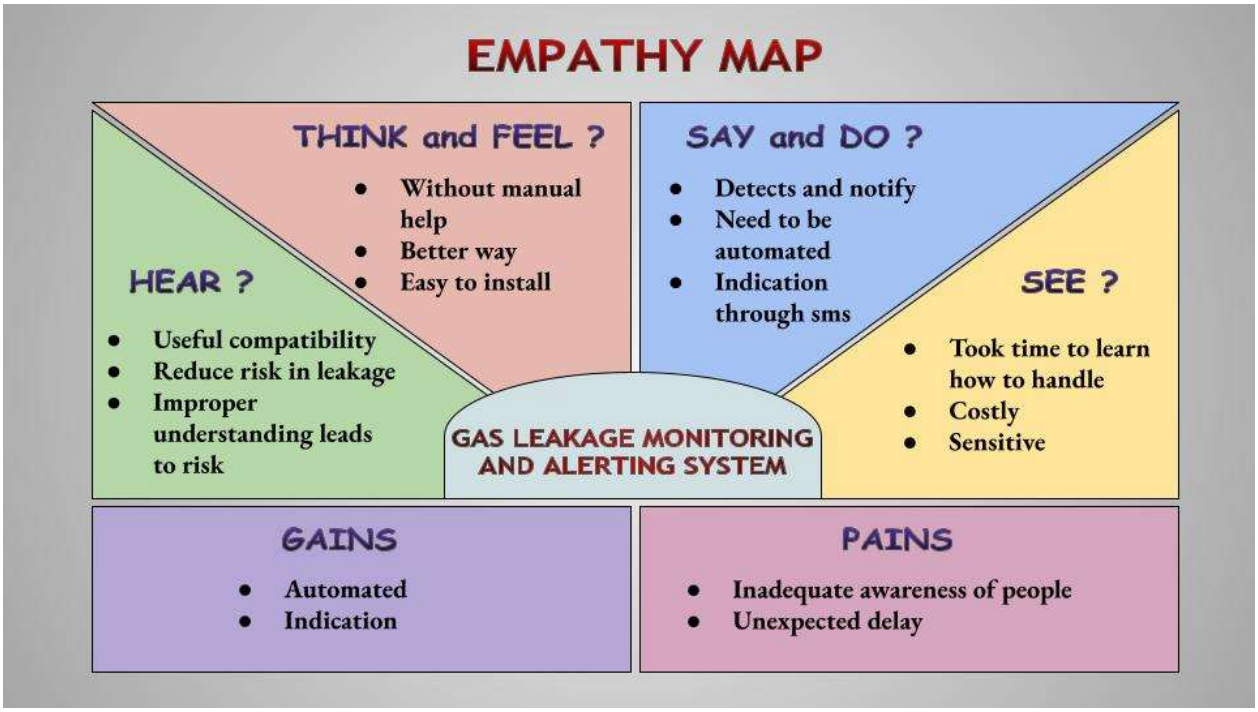
A homemaker trying to detect the gas leakage, but manual detection of leakage may not be accurate. Because it requires an alerting and monitoring mechanism. Which makes them feel that could cause a field accident**.**

3.Ideation &Proposed Solution:-

System consists of gas detector sensors, Arduino board, ESP8266 and Cloud server. One Society authority person can registerthe 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 oneach 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. Server also sends the notification message to user



3.1Empathy Map :-



3.2Ideation &Brainstorming:

Step-1:

Team Gathering, Collaboration and Select the Problem Statement.
We have followed the first step of brainstorming, we have discussed as a team todecide a problem statement.

As per the guideline the following is done

- ✓ TEAM GATHERING
- ✓ COLLABORATION
- ✓ DECIDING THE PROBLEM STATEMENT

Step-2:

Brainstorm, Idea Listing and Grouping

Brainstorming is done to have a discussion on how we solve the problem as with many people we can have wider perception rather figuring italone, so we had a discussion to in order to have an overview of our perceptionof the problem.

Brainstorming:

TEAM MEMBER	MEMBERS OPNION	IDEAS
MUTHU VENI V	MAY GIVE	Collecting various sensor values and reporting to the user through application using Arduino UNO
NANDHINI P	GOOD	Collecting values from sensors and gives alarm through buzzers when the leakage is detected
SWETHA K	BEST	Collecting various sensor values and reporting to the user through application using ESP32
SENTHILKUMAR C	COSTLY	Using raspberry pi instead of Arduino UNO

By grouping ideas:

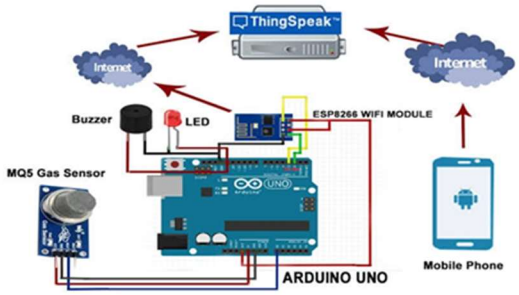
- We have planned to use gas sensor for detection
- The values when surpasses the threshold value will send a notification to the user
- The notification is also sent in case of emergencies

Step-3: Idea Prioritization:

1) Using gas sensor in order to detect thegas leakage.
2) The sensor is connected to IOT application in order notify thefarmers
3) If necessary, use additional sensors to detect the fire
4) Using automation without the knowledge of user

3.3Proposed Solution :-

1.	Problem Statement (Problem to be solved)	To detect the gas leakage to alert the user through notification
2.	Idea / Solution description	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.
3.	Novelty / Uniqueness	• Ability to predict the hazardous situation • Low cost

4.	Social Impact / Customer Satisfaction	This model is vital for the society as there are lot of people unable to detect the gas leakage prior the fire accident. 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 readings.
5.	Business Model (Revenue Model)	The main target of our solution is Industries so we have planned to visit industries and explain them about the benefits of our products. So that they can aware of the importance of this solution 
6.	Scalability of the Solution	Develop a proposed system which include some safety factors..

3.4 Proposed Solution Fit :-

1. CUSTOMER SEGMENT(S) CS • Oil, Gas, Polymer Industries • Hospitals • Safety Control Personals • Mining	**6. CUSTOMER CONSTRAINTS** CC • Network Connection • Complexity in Installation • High budget in installing other products make them to move far from modern technologies	**5. AVAILABLE SOLUTIONS** AS • Upgrading to a premium network plan. • Availing network connection from a reliable Service provider.
2. JOBS-TO-BE-DONE / PROBLEMS J&P • Suffering from many losses due to gas leakage. • Having no proper system for controlling or monitoring the leakage. • Facing heavy budget problems in buying and installing a system for monitoring and controlling	**9. PROBLEM ROOT CAUSE** RC • 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** BE • 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

4.Requirement Analysis

4.1 Functional Requirements :-

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Business Requirements	This system can be implemented in homes Industries. The main advantage of this IoT and Arduino-based application is that it can determine the leakage and send the data over to a site. It can be monitored, and preventive measures can be taken to avoid any disaster.
FR-2	User Confirmation	Send the details through message.
FR-3	Future Requirements	The gas leakage detection system can be optimized for detecting toxic gasses along with upgrading them with smoke and fire detectors to identify the presence of smoke and fire. Ensuring worker safety is important but making using of the right technology is even more vital.
FR-4	Product Requirements	Detect the gas is necessary regardless of your business role or individual purpose. Certain technologies make such IoT devices what they are, and if you want to indulge in IoT application development, you must know what they are and what purpose they can fulfil.

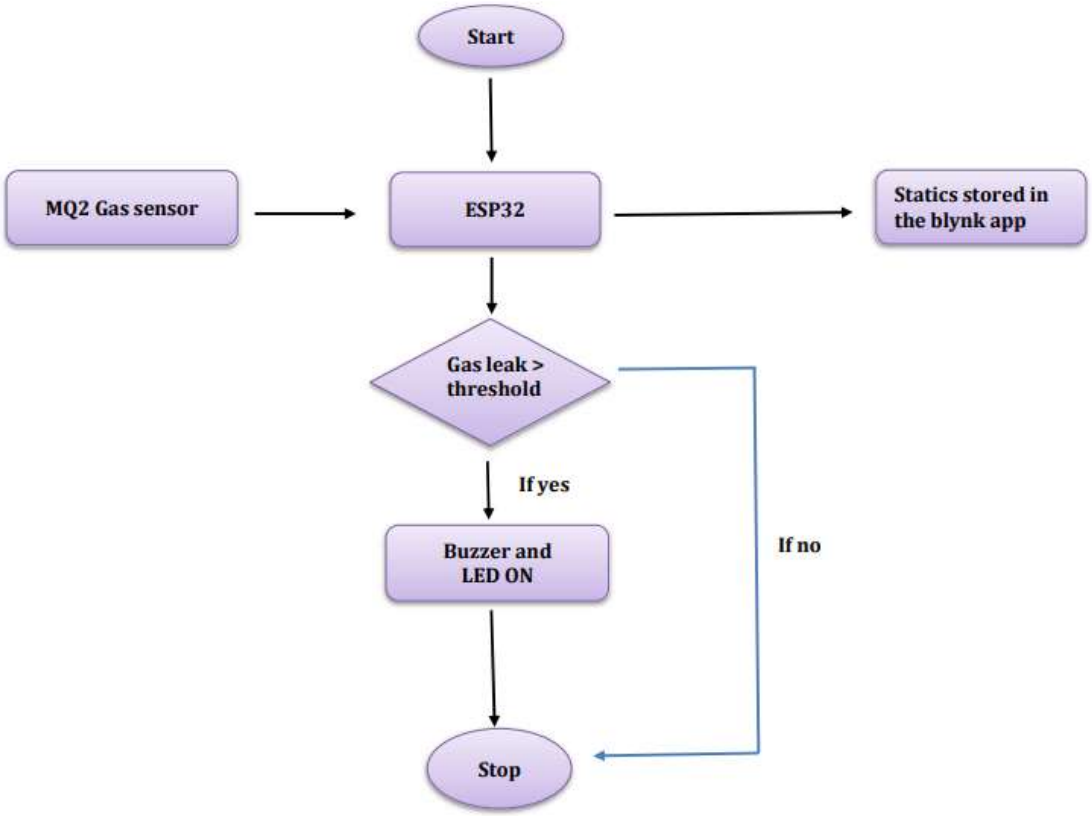
4.2Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

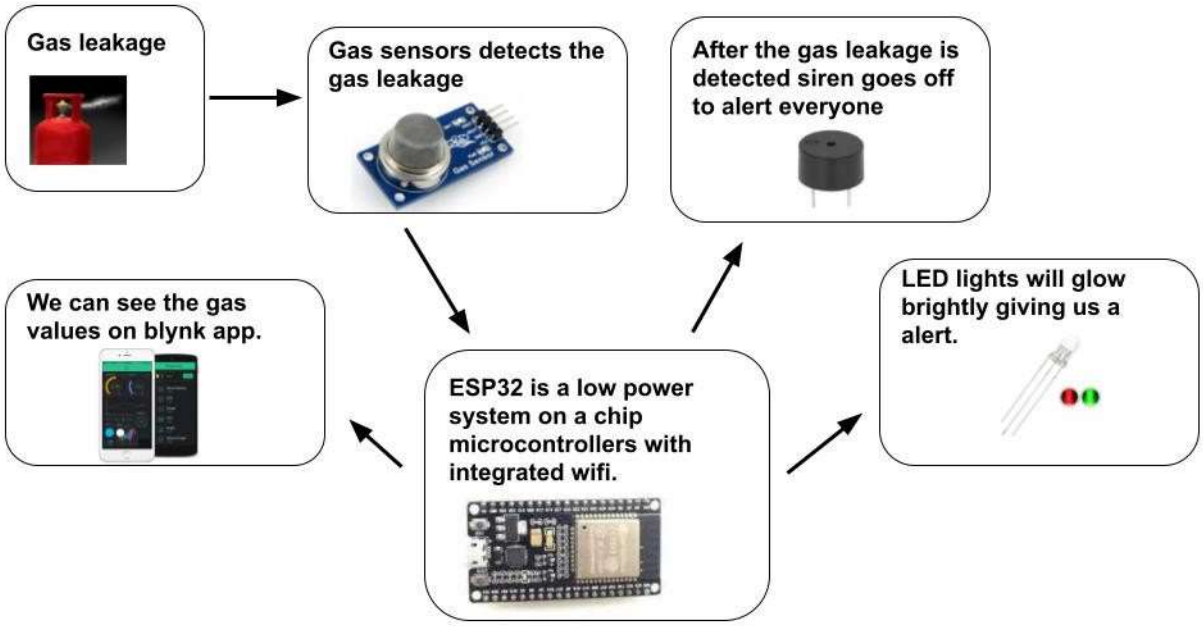
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The system must be able to detect and update whenever & wherever required.
NFR-2	Security	Select a software option that securely backs your data up nearly every second, onto safe and reliable servers, with real-time database application
NFR-3	Reliability	We using application for monitoring the data software takes an hour to run a basic report if it can run reports but you get an error message half of the time, there's a reliability problem.
NFR-4	Performance	The system should be able to detect properly at times of fatal conditions and provide necessary driving measures.
NFR-5	Availability	Under a given set of environmental conditions how the operational element performed in a set of time.
NFR-6	Scalability	The system should be compatible with developed specifications and also be open for future upgradation.

5.Project Design

5.1 Data Flow Diagram :-



5.2 Solution &Technological Architecture:



Technological architecture:

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js /React Js etc
2.	Application Logic-1	Logic for a process in the application	Java/Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
6.	Infrastructure (Server / Cloud)	Application Deployment on Cloud	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	**Characteristics**	**Description**	**Technology**
1.	Scalable Architecture	We can implement in Industries, Hotels, Publicplaces	IOT
2.	Availability	To detect leakage 24/7 for uninterrupted serviceswe have implemented in distributed servers (cloud)	IBM cloud
3.	Performance	If we implemented in industries, it needs many gas sensors to detect	

5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, I can see the updates by using my account in blynk app.	I can access my account	High	Sprint-1
		USN-2	As a user, I will receive information through Wi-Fi module	I can perfectly get details	Medium	Sprint-2
	Login	USN-3	As a user, I can log into the application through my account	I can login to the application	High	Sprint-1
Customer Care Executive	Problem Solving	USN-4	As a user, I am able to solve the problems of the users with the given instructions	Easy maintenance and problem solving	Medium	Sprint-2
Administrator	Administering the timely data	USN-5	As an admin I am able to get through the interface and administer the data functionality	Easily administration when data is timely updated	High	Sprint -1

6.Project Planning and Scheduling

6.1Sprint Delivery Plan :-

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	To find thegas leakage	USN-1	The business owner takes the required precautions to protect his employees or a person who wishes to protect their family from anexplosion.	2	High	Muthu Veni V Nandhini P Senthilkumar C Swetha K
Sprint-1	Preventing from explosion	USN-2	Explosions caused by gas leaks, which couldresult in many fatalities.	1	High	Muthu Veni V Nandhini P Senthilkumar C Swetha K
Sprint-2	To detect the gas leakage	USN-3	To detect the gas leakage we may usethe gas sensors and alerting system.	2	Low	Muthu Veni V Nandhini P Senthilkumar C Swetha K
Sprint-3	Testing and training of themodel device	USN-4	By using the dataset as training data, the programmer can createa model for gas leak detection	2	Mediu m	Muthu Veni V Nandhini P Senthilkumar C Swetha K
Sprint-4	Alerting system	USN-5	The model's ability to detect gas leaks allows for an alarming system .	1	High	Muthu Veni V Nandhini P Senthilkumar C Swetha K

Project Tracker, Velocity & Burndown Chart:

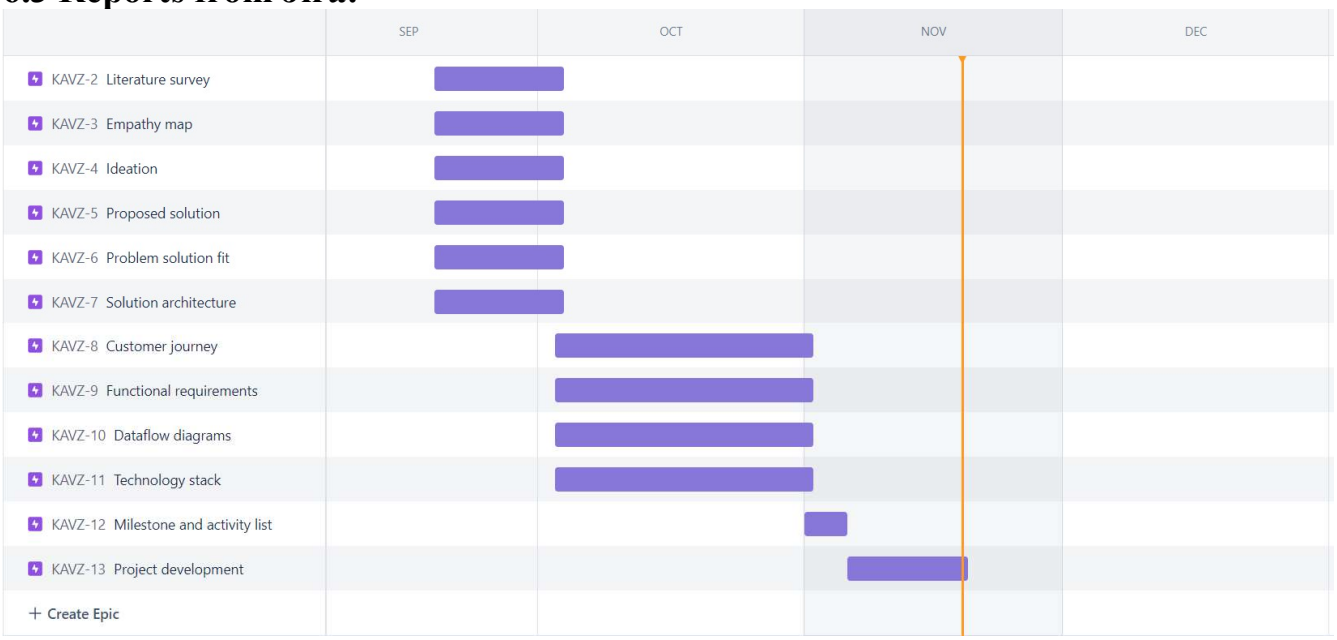
Sprint	Total Story Points	Duration	Sprint StartDate	Sprint EndDate (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.2Sprint Delivery Schedule

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on theselected project & gathering information byreferring the, technical papers, research publications etc.	19 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the userPains & Gains, Prepare listof problem statements	19 SEPTEMBER 2022
Ideation	List the by organizing the brainstorming session andprioritize the top 3 ideas based on the feasibility & importance.	19 SEPTEMBER 2022

Proposed Solution	Prepare the proposed solutiondocument, which includes the novelty, feasibility of idea, business model, social impact,scalability of solution, etc.	19 SEPTEMBER 2022
Problem Solution Fit	Prepare problem - solution fitdocument.	19 SEPTEMBER 2022
Solution Architecture	Prepare solution architecturedocument.	19 SEPTEMBER 2022
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	3 OCTOBER 2022
Functional Requirement	Prepare the functional requirement document.	3 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams and submit for review.	3 OCTOBER 2022
Technology Stack	Prepare the technology architecture diagram.	3 OCTOBER 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	1 NOVEMBER 2022
Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	19 NOVEMBER 2022

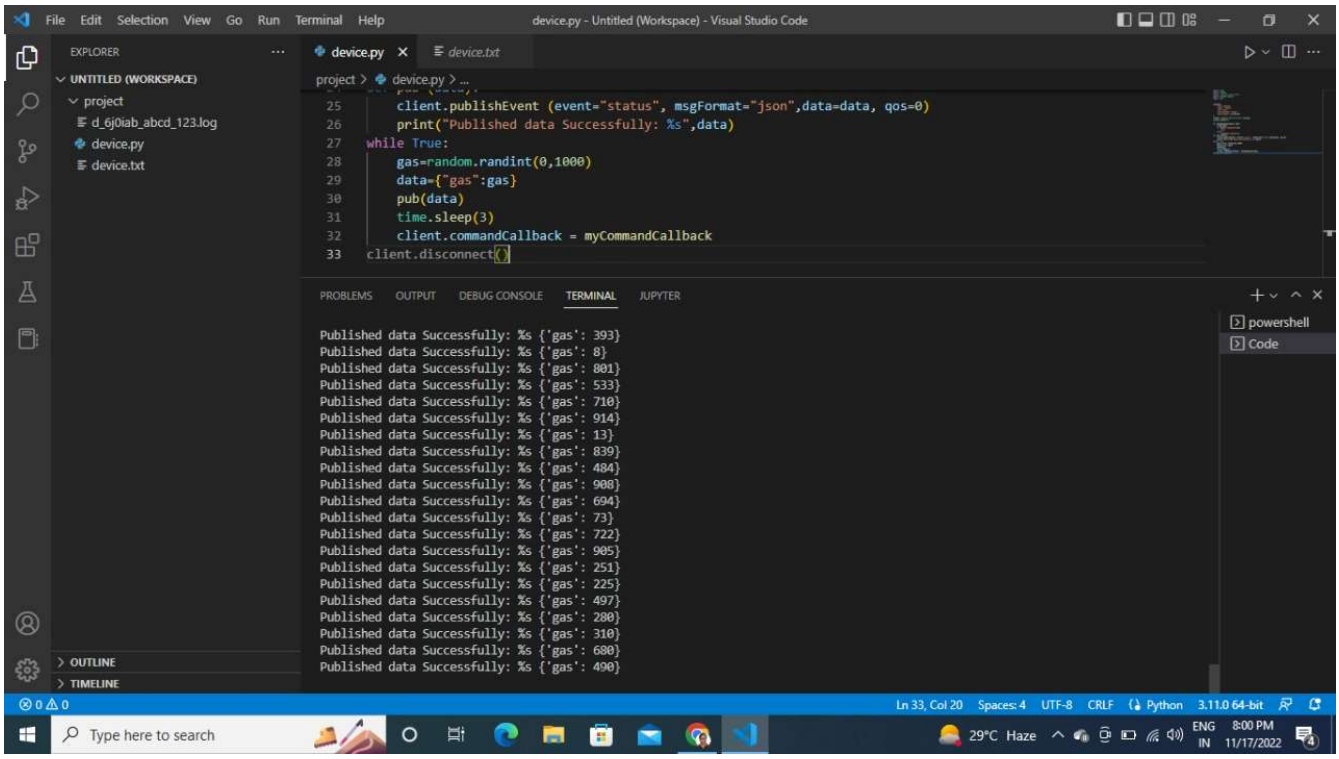
6.3 Reports from Jira:



7.Coding and Solution:

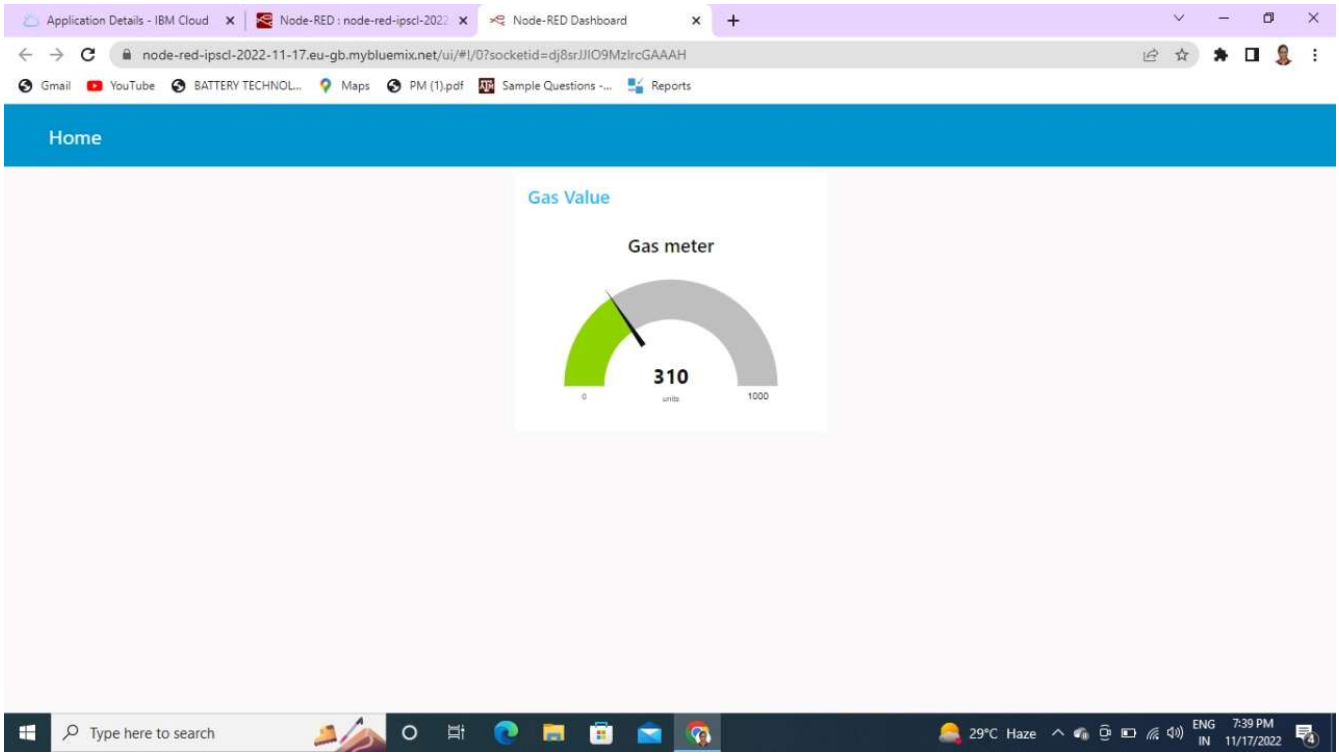
```
import time
import random
#import ibmiotf.application
import ibmiotf.device
import sys


config={
    "org":"6j0iab",
    "type" :"abcd",
    "id":"123",
    "auth-method":"token",
    "auth-token":"123456789"
}
client= ibmiotf.device.Client (config)
client.connect()

def myCommandCallback (cmd):
    a=cmd.data
    if len(a["command"])==0:
        pass
    else:
        print(a["command"])
def pub (data):
    client.publishEvent (event="status", msgFormat="json",data=data, qos=0)
    print("Published data Successfully: %s",data)
```

```
while True:
    gas=random.randint(0,1000)
    data={"gas":gas}
    pub(data)
    time.sleep(3)
    client.commandCallback = myCommandCallback
client.disconnect()
```



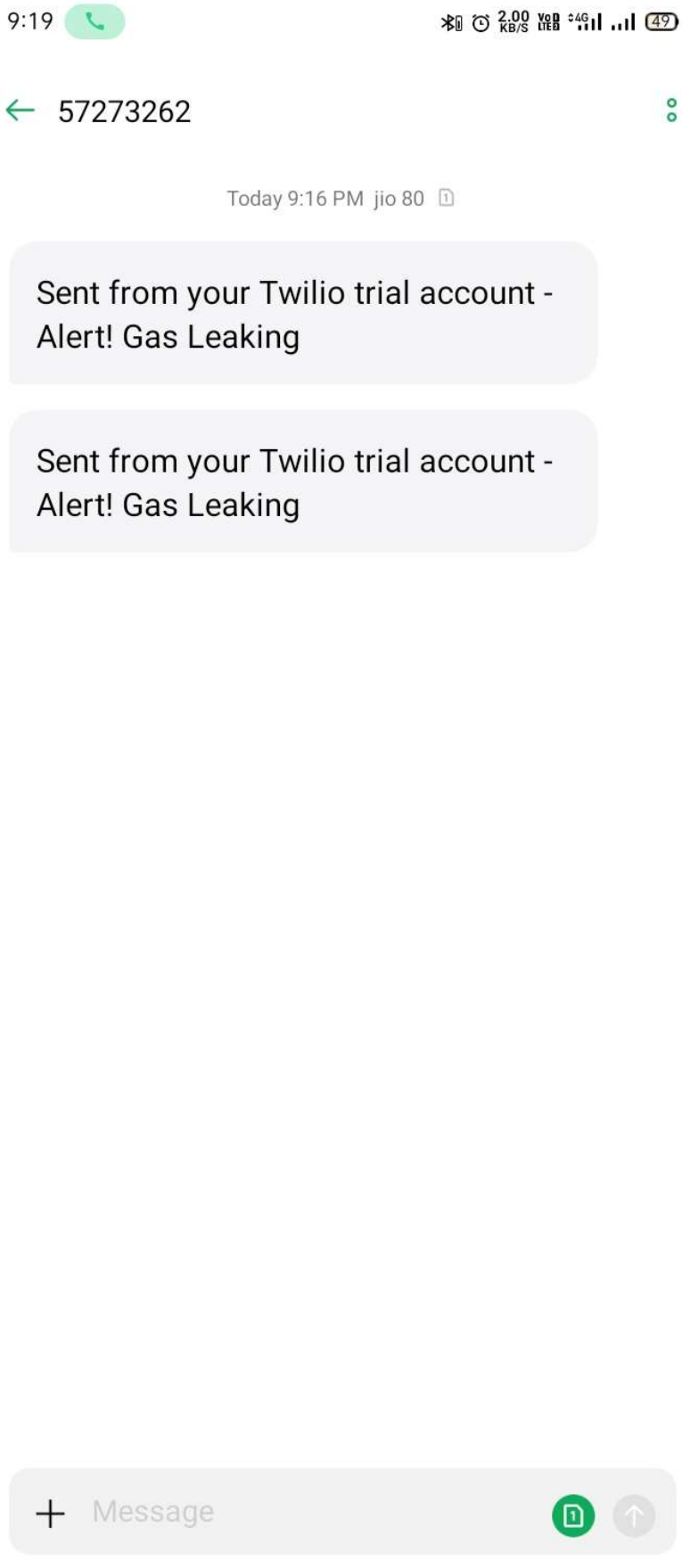
FEATURES:

FEATURE 1: The first feature is the use of web application inorder to indicate the gas value



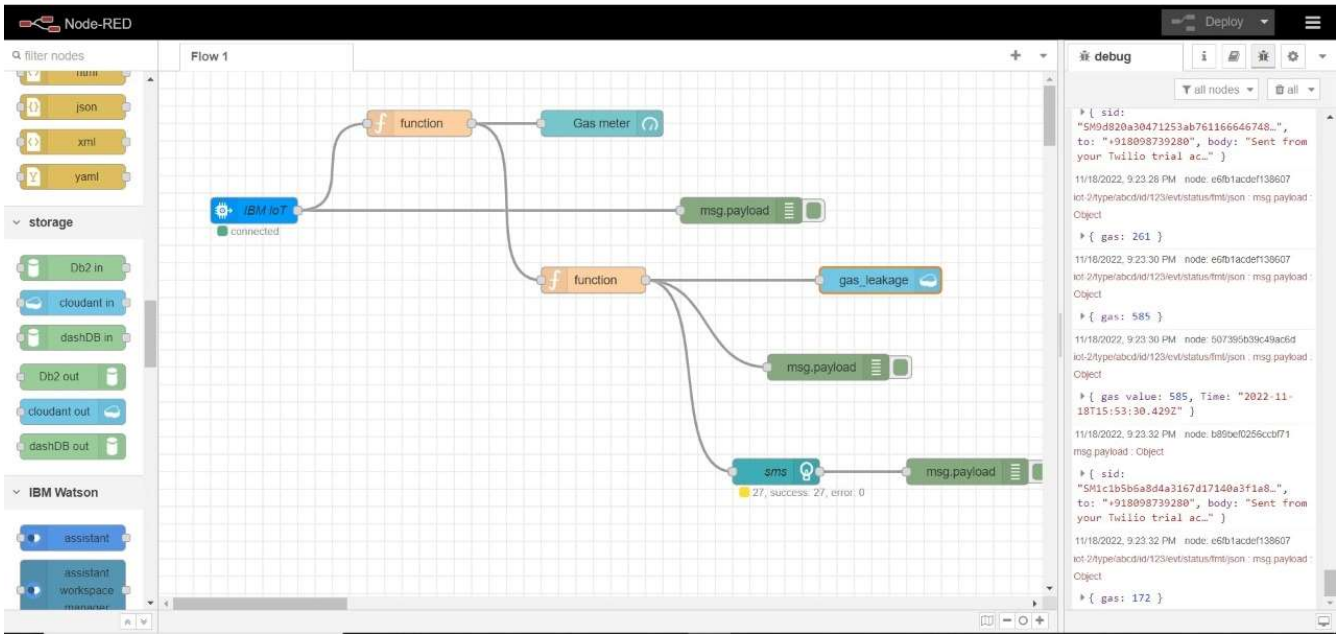
FEATURE 2:

The other feature is to sense the information available anywhere when the farmer wishes to view it. (i.e) MESSAGE IN MOBILE

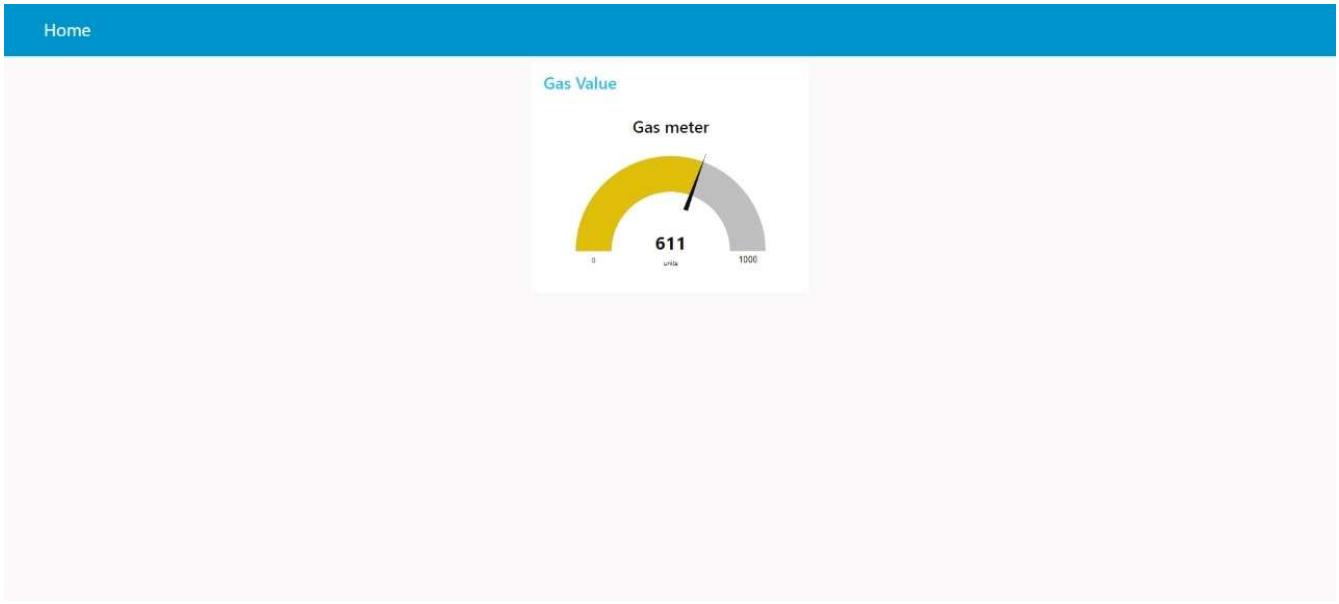

9:19
57273262
Today 9:16 PM jio 80
Sent from your Twilio trial account - Alert! Gas Leaking
Sent from your Twilio trial account - Alert! Gas Leaking
Message

8.Testing&Use Cases

Test Cases:



9.Result:



10.Advantages&Disadvantages:

Advantages:

- The sensor-enabled solutions helps prevent the high risk of gas explosion and affecting any casualties within and outside the premises.
- Prevent fire hazards and explosions.
- Ensure worker's health.
- Real-time updates about leakages.
- Get immediate gas leak alerts.

Disadvantages:

- Poor stability.
- Only one gas can be measured with each instrument.
- Greater environmental impact.
- It can be poisoned by lead, chlorine and silicon.
- It requires more user expertise.

11.Conclusion :-

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

12.Future Scope:

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. The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of 10m radius of the rover and the sensor output data's are continuously transferred to the local server. The accuracy of sensors are not up to the mark thus stray gases are also detected which creates an amount of error in the outputs of the sensors, especially in case of methane. Hence in the future we have to come up with better solutions for these Problems.

13.Appendix:

```
import time
import random
#import ibmiotf.application
import ibmiotf.device
import sys


config={
   "org":"6j0iab",
   "type" :"abcd",
   "id":"123",
   "auth-method":"token",
   "auth-token":"123456789"
}
client= ibmiotf.device.Client (config)
client.connect()

def myCommandCallback (cmd):
   a=cmd.data
```

```
if len(a["command"])==0:
        pass
    else:
        print(a["command"])
def pub (data):
    client.publishEvent    (event="status",    msgFormat="json",data=data,
qos=0)
    print("Published data Successfully: %s",data)
while True:
    gas=random.randint(0,1000)
    data={"gas":gas}
    pub(data)
    time.sleep(3)
    client.commandCallback = myCommandCallback
client.disconnect()
```