

GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES

FINAL REPORT

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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 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 user. The resulting performance indicated.

1.Introduction:

1.1 Project Overview

Now a days the home safety detection system 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.

1.2 Purpose

The design of a sensor-based automatic gasleakage 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:

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 Gasleak. 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.

2.2 References:

1. **TITLE :** Automated unified system for LPG using microcontroller and GSM module

AUTHOR: B. B. Did paye, Prof. S. K. Nanda

SUBJECT: Their paper Proposed an advance and innovative approach for LPG leakage detection, prevention and automatic Booking for refill. In advance, the system provides the automatic controlling of LPG regulator also if leakage is detected the system will automatically turn off the main switch of power supply. Hence it helps to avoid the explosion and blast.

2. **TITLE :** leakage detection and analysis of leakage point in the gas pipeline system

AUTHOR: Zhao Yang, Mingliang Liu, Min Shao, and Yingjie Ji, 2011

SUBJECT: In this paper they gave various model which used SCADA I/F Model: The SCADA system has the function of transferring the acquired data from a pipeline system to Transient Simulation Model every 30

seconds. This module communicates with SCADA. Dynamic parameters are collected every 30 seconds, such as pressure, flow and temperature. Transient Simulation Model: Transient flow is simulated utilizing perfect numerical methods based on actual data. Pressure and temperature served as independent variables are provided in order to get average pressure and average temperature. Then all the parameters of the gas in the pipeline system can be acquired. Leakage Detection: The leakage detection is carried out by comparing the data acquired through the SCADA system with that by the Transient Simulation Model. This model could provide leakage point judgment and prompt warning based on transient simulation and volume balance

3. **TITLE :** Gas detection using an integrated circuit and MQ-9

AUTHOR: Falohun A.S., Oke A.O., and Abolaji B.M. 2016

SUBJECT: In this basically, they used an embedded design which includes typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light level etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer, and may lack human interaction device. The amount and type of detectors and the type of fire alarm system that one chooses for property protection will depend on the owner's property protection goals, the value of the property and the requirements of the owner's insurance company.

4. **TITLE :** gas leakage and LPG levels where gas leakage occurs automatically

AUTHOR: Ms.Shinde Sayali P , Ms. Chavan Sakshi S, Ms. Dhas Snehal S (June 2021)

SUBJECT: The authors suggests that gas leakage is performed by various gas sensors. Whose author has worked on gas leaks and mentions that we can take care if a found using a sensor and gas booking can be done automatically when a small amount of gas is taken closed. RFID tag microcontroller, pressure sensors and buzzers are used to monitor gas. Through this paper important parameters are used to find the level of gas in the container.. Arduino was originally created as a tool for fast sampling and activities for Students with no knowledge for electronics.

This paper uses a microcontroller, buzzer and a gas sensor to detect gas leakage system. When a gas leak is detected by a gas sensor ,the microcontroller turn on the buzzer in critical condition. The proposed system detects LPG leaks and alerts customers. The alarm starts when the system notice and increases in LPG leakage concentration by sending an alarm and sending a message to specific mobile phone. The device assures safety and prevents explosions.A microcontroller based system based on gas sensor(MQ6) has been developed in proposed system to detect LPG leakage . The unit is also integrated with an alarm unit to detect signal a leak.

5. **TITLE :** Leakage detection and analysis of leakage point in the gas pipeline system

AUTHOR: The Manichandana Simrah et.al (2019)

SUBJECT: In this paper they gave various model which used SCADA I/F Model: The SCADA system has the function of transferring the acquired data from a pipeline system to Transient Simulation Model every 30 seconds. This module communicates with SCADA.Dynamic parameters are collected every 30 seconds, such as pressure, flow and temperature. Transient Simulation Model: Transient flow is simulated utilizing perfect numerical methods based on actual data. Pressure and temperature served as independent variables are provided in order to get average pressure and average temperature.

6. **TITLE :** ARM7 primarily based machine-driven high performance system

is used for LPG refill booking and outpouring detection

AUTHOR: Rahul Nalawade et.al, (2018)

SUBJECT: That decreases the outpouring resistance.Microcontroller sends a message “EMERGENCY ALERT: LPG gas outpouring found in your home to needed cell numbers via GSM module and therefore the same are going to be displayed on digital display. This technique detects the outpouring of the LPG associated alerts the patron regarding the leak by SMS and as an emergency live the system can shut down the ability offer, whereas activating the alarm

2.3 Problem Statement Definition:

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 1m radius of the rover and the sensor output datas are continuously transferred to the local server. The accuracy of sensors are not upto 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. Further the availability and storage of toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware. As the system operates outside the pipeline, the complication of system maintenance and material selection of the system in case of corrosive gases is reduced. Thus the system at this stage can only be used as a primary indicator of leakage inside a plant.

3. Ideation & Proposed Solution:

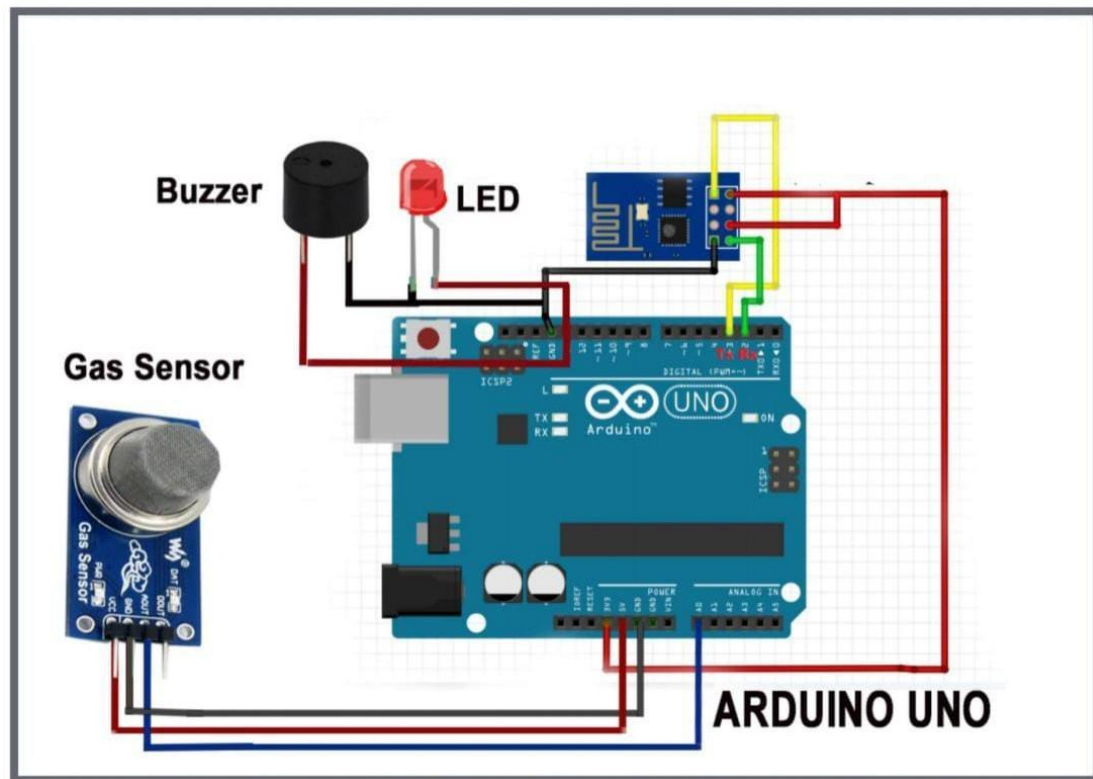
3.1. Empathy Map Canvas:



3.2 Ideation and Brainstorming:

Internet of Things aim towards making life simpler by automating every small task around us. As much as IoT is 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 homes, 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 specific concentration 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 an adverse effect on the health of people. Most of the societies have a fire safety mechanism. But it can be used only after the fire exists. In order to have a control over such conditions, we proposed a system that uses sensors which is capable of detecting the gases such as LPG, CO₂, CO and CH₄. This system will not only be able to detect the leakage of gas but also alerting through audible alarms. Presence of excess amounts of harmful gases in the environment then this system can notify the user. The system can notify the society admin about the condition before a mishap takes place through a message.

3.2 Proposed Solution:



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. Server also sends the notification message to user.

3.4 Problem Solution fit:

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 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 problem.

4.Requirement Analysis

4.1 Functional Requirements

Business Requirements	User Requirements	Product Requirements
The mentioned technology is usable in residences, hotels, industrial settings, LPG cylinder storage places, etc. The ability to detect leakage and transmit the information to a location is the primary benefit of this IoT and Arduino-based application. It is observable, and precautions can be taken to avert any catastrophe.	The gas leakage detection system can be upgraded with smoke and fire detectors to detect the presence of smoke and fire in addition as being optimized for detecting dangerous gases. Although ensuring worker safety is critical, adopting the appropriate technology is even more crucial.	Regardless of your professional position or personal goals, gas detection is essential. Such IoT devices are what they are due to certain technologies in use, therefore understanding these technologies and the functions they can serve is necessary if you want to engage in IoT application development.

4.2 Non Functional Requirements:

Data Gathering:

Using multiple sensors, we are going to gather the necessary data.

Data Store:

Collected data is stored in Cloud and Necessary databases.

Data Analysis:

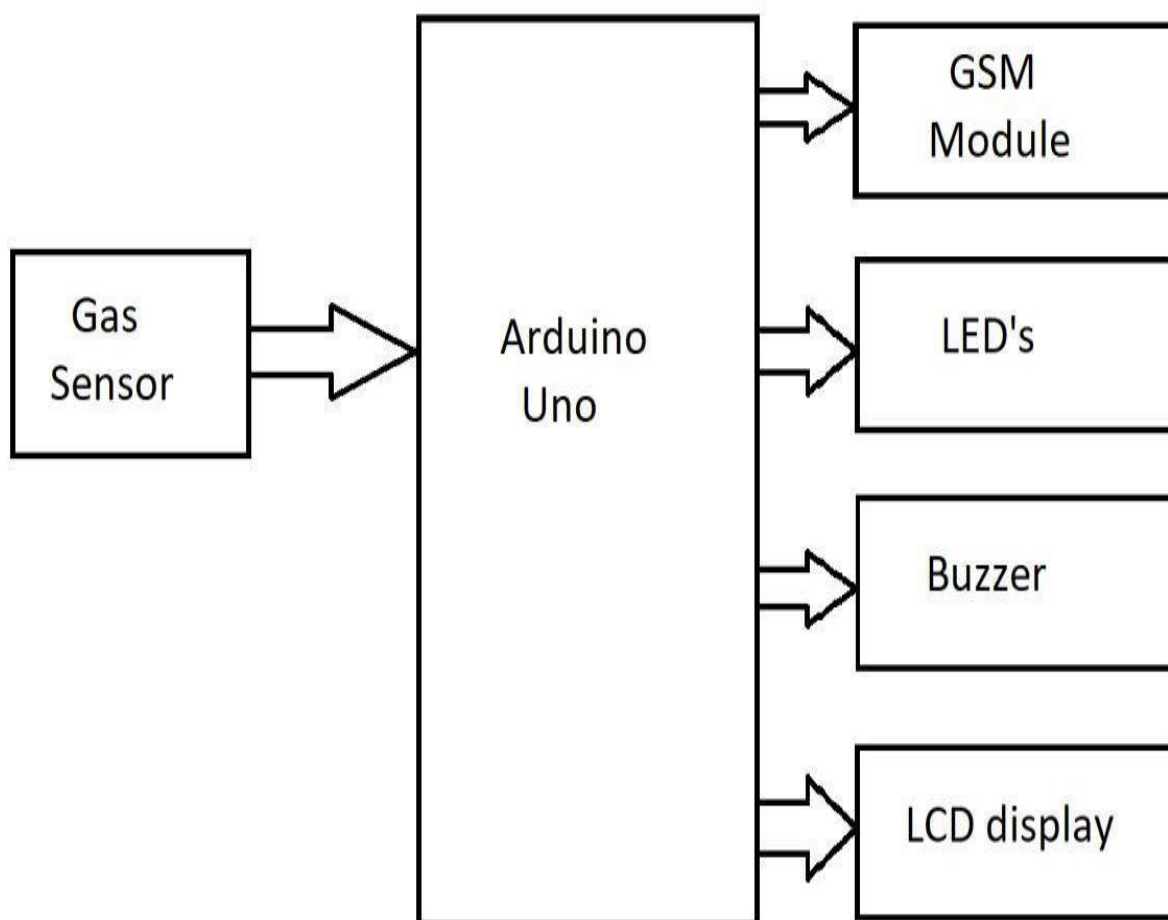
Data from the store must be analyzed for raising alerts in case of necessity

Data Monitoring:

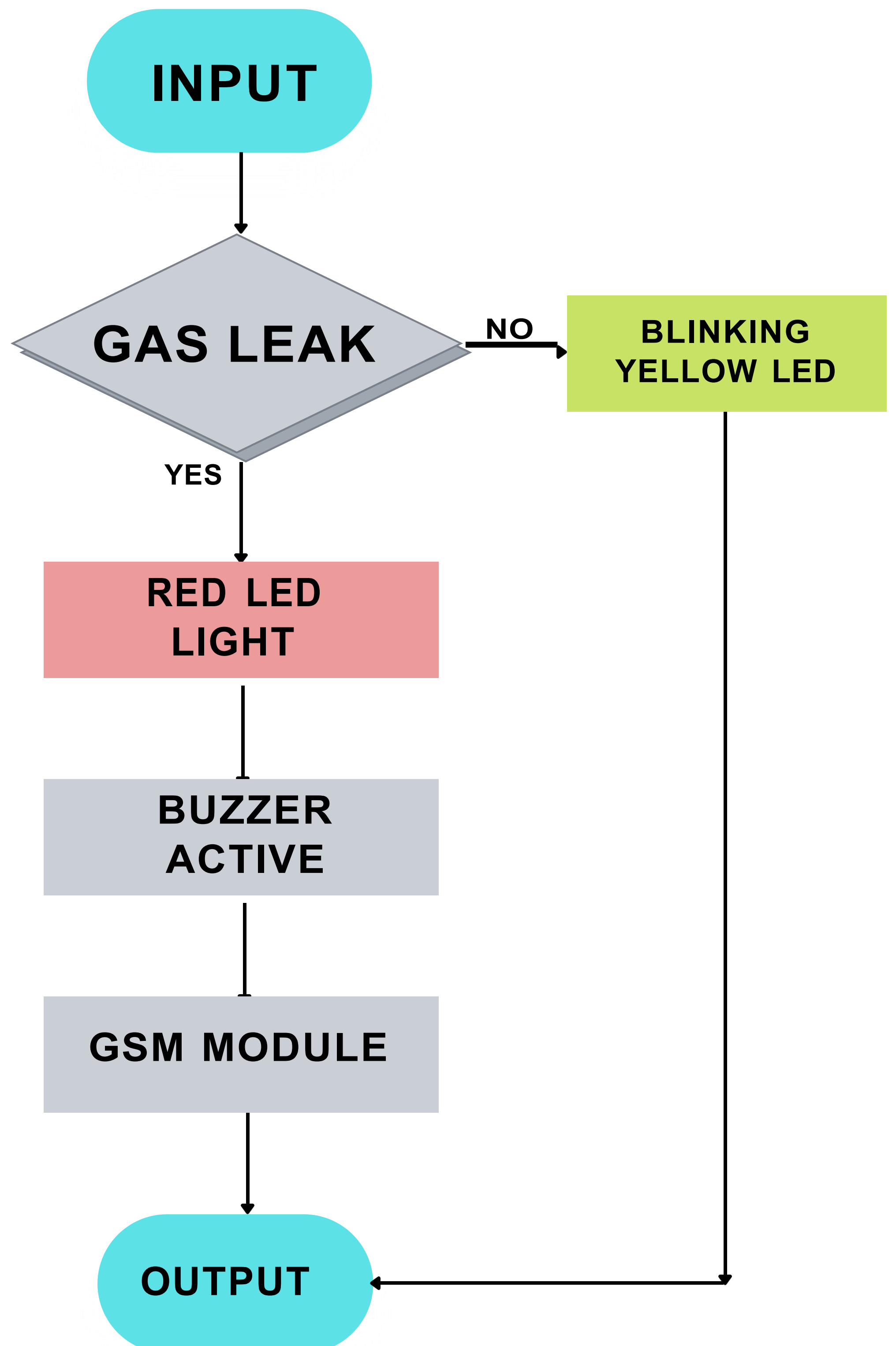
Gathered data must be displayed to the user for monitoring.

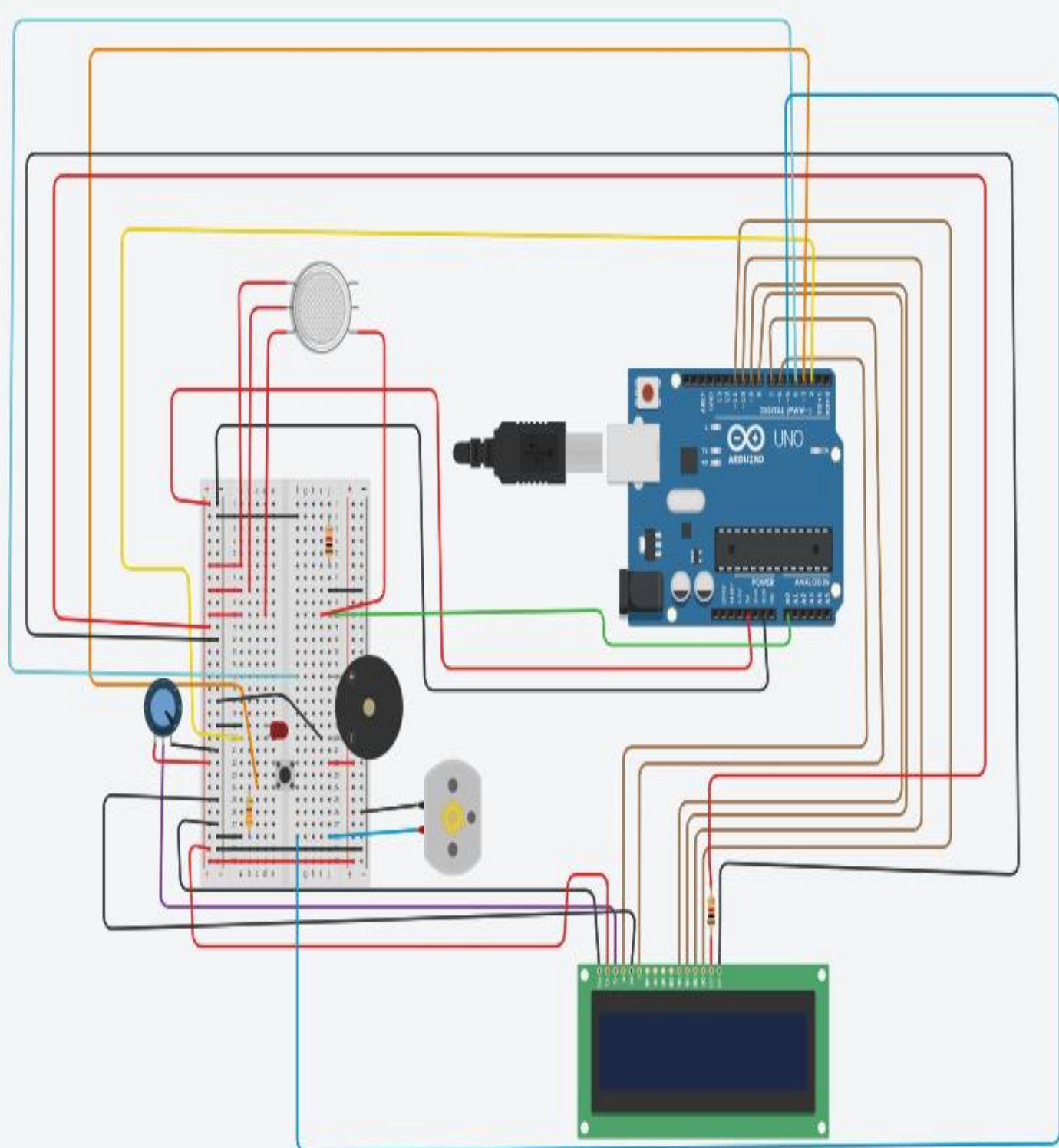
5. Project Design

5.1 Data flow



5.2 Solution and Technical Architecture:





6. Project Planning and Scheduling:

6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Objective	USN-1	As a system, the gas sensor should detect the gas	8	High	KOWSIK
Sprint-1	Features	USN-2	As a system, the gas sensor values should be displayed in a LCD screen	2	Low	BAALA
Sprint-1	Features	USN-3	As a system, as soon as the detected gas reaches the threshold level, the red color LED should be turned ON.	5	High	MANOJ
Sprint-1	Features	USN-4	As a system, as soon as the detected gas reaches the threshold level, the siren should be turned ON.	5	High	KOGUL
Sprint-2	Focus	USN-5	As a system, it should the send the location where the gas is detected	8	High	KOWSIK
Sprint-2	Focus	USN-6	As a system, it should also send the alerting SMS to the registered phone number	2	Low	MANOJ

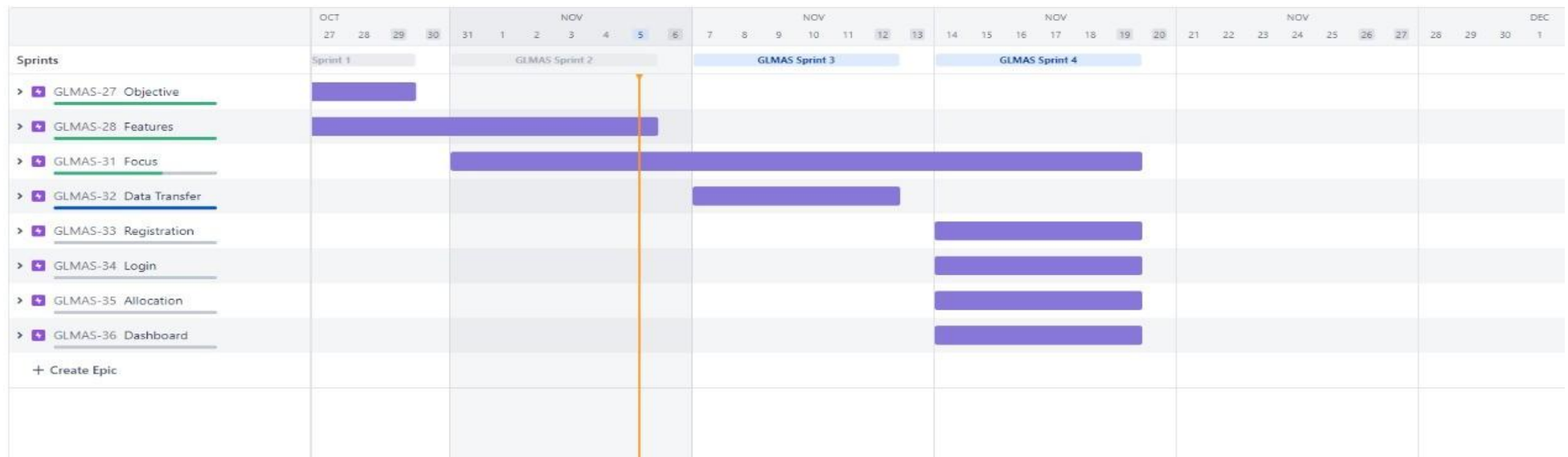
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Features	USN-7	As a system, the gas leakage pipe should be closed automatically once there it attains the threshold value	5	Medium	KOGUL
Sprint-2	Features	USN-8	As a system, it will indicate that the gas leakage pipe is closed in the LCD screen and send SMS to the registered mobile number.	5	Medium	BAALA
Sprint-3	Data Transfer	USN-9	As a program, it should retrieve the API key of the IBM cloud to send the details of the system.	2	Low	BAALA
Sprint-3	Data Transfer	USN-10	As a system, it should send the data of sensor values along with latitudes and longitudes to the IBM cloud	5	Medium	KOWSIK
Sprint-3	Data Transfer	USN-11	As a cloud system, the IBM cloud should send the data to NodeRed	2	Medium	MANOJ
Sprint-3	Data Transfer	USN-12	As a system, it should collect the data from the NodeRed and give it to the backend of the mit app.	3	Medium	MANOJ
Sprint-3	Data Transfer	USN-13	As an application, it should display the details of the gas level and other details to the user through the frontend of the mit app.	8	High	KOGUL
Sprint-4	Registration	USN-14	As a user, I must first register my email and mobile number in the website	2	High	KOWSIK

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Registration	USN-15	As a user, I must receive confirmation mail and SMS on registration	2	Medium	MANOJ
Sprint-4	Login	USN-16	As a user, I can login into the web application through email and password.	3	High	BAALA
Sprint-4	Dashboard	USN-17	As a user, I can access the dashboard and make use of available resources.	2	Medium	KO
Sprint-4	Focus	USN-18	As a user, I must receive an SMS once the leakage is detected.	5	High	MANOJ
Sprint-4	Allocation	USN-19	As an admin, I must receive information about the leakage along with location and share exact location and route to the person.	3	High	BAALA
Sprint-4	Allocation	USN-20	As an admin, I must allot particular person to look after the leakage in a particular location.	3	High	MANOJ

6.2 Sprint Delivery Schedule:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date	Sprint Release Date
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	19 Nov 2022

6.3.Reports:



Sprint burndown chart

How to read this report

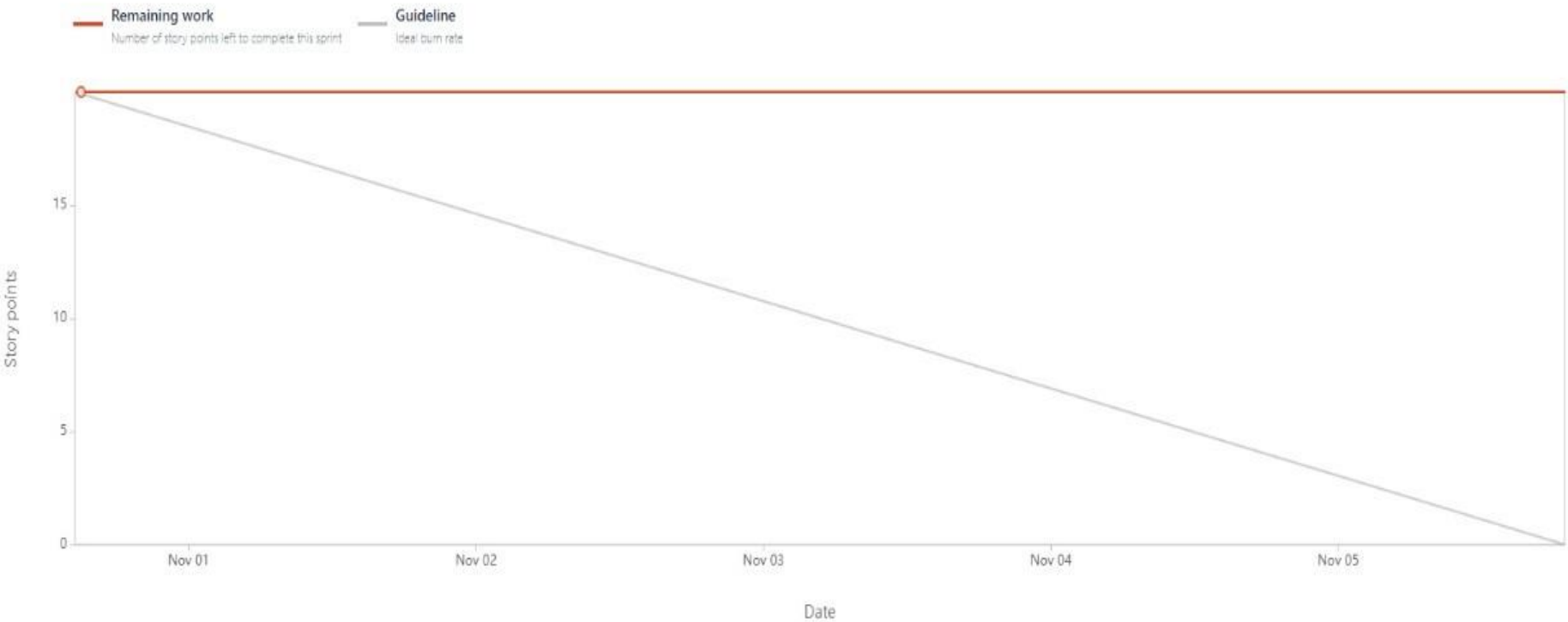
Sprint

GLMAS Sprint 2

Estimation field

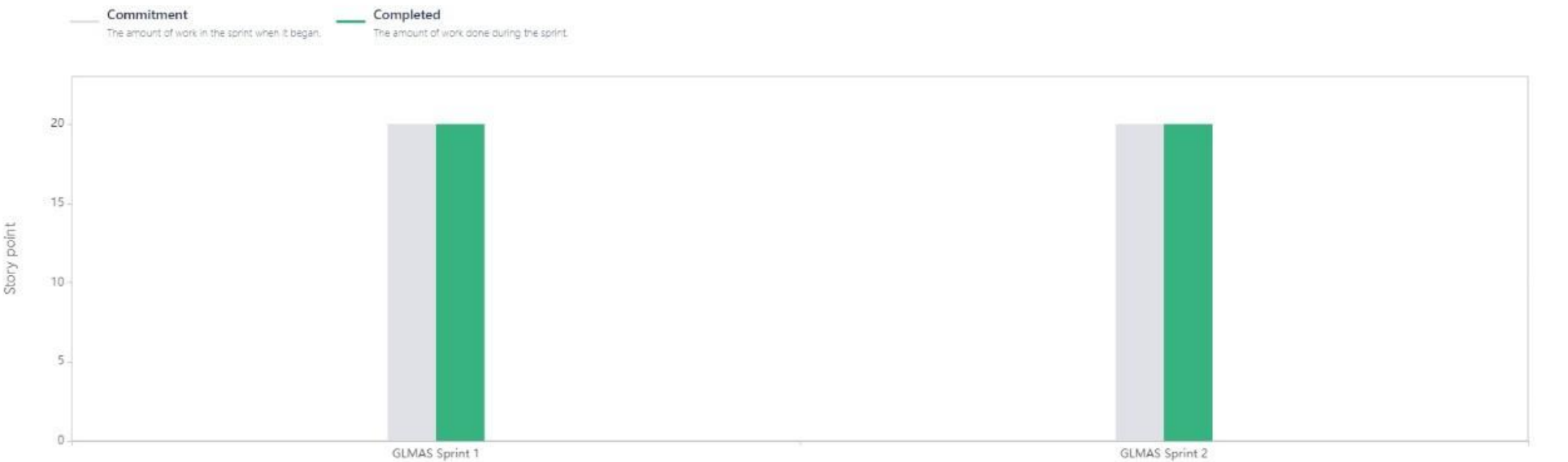
Story points

Date - October 31st, 2022 - November 5th, 2022



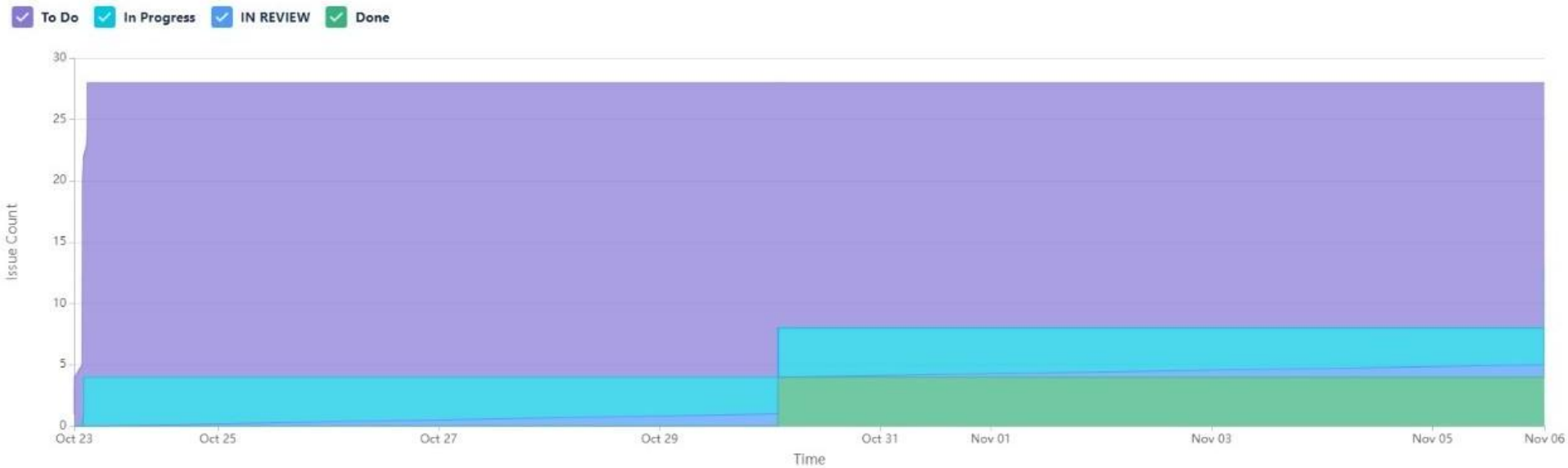
Velocity report

➤ [How to read this report](#)



Sprint	Commitment	Completed
GLMAS Sprint 1	20	20
GLMAS Sprint 2	20	20

Cumilative flow diagram:



7. Coding and Solutioning:

```
#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);
}

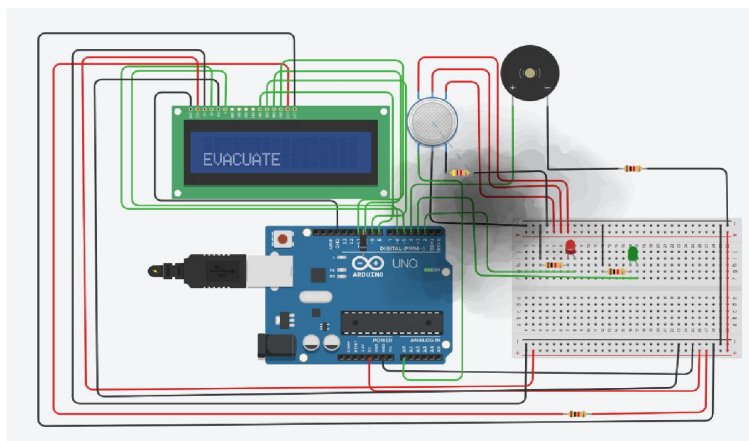
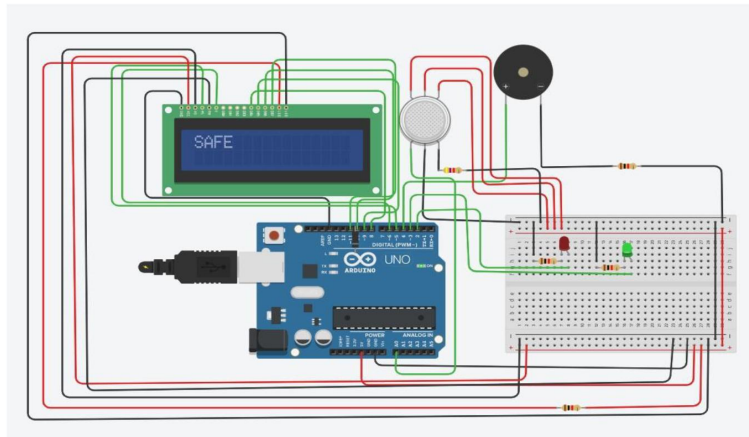
void loop()
{
  int analogValue = analogRead(sensor);
  Serial.print(analogValue);
  if(analogValue>sensorThresh)
  {
    digitalWrite(redled,HIGH);
    digitalWrite(greenled,LOW);
    tone(buzzer,1000,10000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("ALERT");
    delay(1000);
    lcd.clear();
  }
}
```



```
    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:



9. 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 by the GSM module. A sensor node senses gaslike 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.

10. Future Scope:

We propose to build the system using an MQ6 gas detection sensor and interface it with an Aurdino Uno microcontroller along with an LCD Display. Our system uses the gas sensor to detect any gas leakages. The gas sensor sends out a signal to the microcontroller as soon as it encounters a gas leakage. The microcontroller processes this signal and a message is displayed on the LCD to alert the user.

13. Appendix:

GitHub & Project Demo Link:

<https://github.com/IBM-EPBL/IBM-Project-30504-1660147627>

<https://www.tinkercad.com/things/jKLP8fX65Ge-pnt2022tmid16099/editel?sharecode=cdKUwhwJK7oimjNo6--eqezvDNiy-MKpeUULMgqwF5g>