Gas Leakage Monitoring & Alerting System for Industries

A PROJECT REPORT

Submitted by

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ABSTRACT

Gas leakage is a major problem in industries, residential premises and gas powered vehicles. The leakage if not detected may lead to explosion and cause severe damages life and environment. The Conventional leakage system uses onsite alarms for warning. In this project, we propose a leakage detection method in which the leakage information is also sent to first response team through wireless media. This ensures, the detection system used FPGA (Field Programmable Gate Array) to detect the leakage and automatically initiate a warning call through a GSM. A prototype of the gas leakage detection system will be developed and test with the LPG. This can be used across many industries and canteens to avoid explosion.

1.Introduction :

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

1.1 Project Overview:

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.

1.2 Purpose:

The gas detectors can be used for the detection of combustible, flammable and poisonous gases and for loss of oxygen, and also to detected a gas leak or other pollutants. It makes the area where the leak occurs an warning sound and instructs

operators to leave the area.

The purpose of this system is to detect gas leakage, neutralize it, and prevent the explosion.Portable Gas Monitor - is equipment used to test the condition of air prior to entering an area that could have a hazardous atmosphere. It will alarm when the alarm levels set on the equipment are reached.

2.Literature Survey:

A system was designed to identify and measure methane gas in the zones of flammable gas stockpile sites. The device measures the air and water quality, including every parameter that can have deviation as the result of gas leakage in the water or air. The sensors measure the amount of CH4 and CO2 gas in the air while the temperature, pH, and electrical conductivity of the water are monitored. The device is controlled by an Arduino UNO microcontroller that transmits measured data to the database on Raspberry Pi 3.

Different advancements in pipeline leakage detection were put forward. This includes acoustic emission, optic fiber sensor, ground penetrating radar, Vapour sampling and infrared thermography [. A system with sensors are connected to arduino for data collection and it uses LabVIEW as the GUI (graphical user interface).
A detailed sensor list for flammable toxic and combustible gases and their possible advantages and disadvantages has been compared. One such example is the SB-95 sensor, which detects sequentially the variation on the methane and carbon monoxide gas concentration and modifies its resistance accordingly. The variation in the filament resistivity is transmitted as a voltage variation on the load resistor. At the same time, metal oxide sensors have a long response time and even longer recovery time. These sensors need to extract the gas by making a hole into the pipe for the gas concentration measurement. Making holes can cause danger such as leakage or explosion of the toxic gas.

On the other hand, ultrasonic sensors are free from the above disadvantages for the measurement of gas concentration with fast response time and the device is

compact and inexpensive too.

A detailed study of health issues related to gases like hydrogen sulphide, Carbon monoxide and methane has been done. Activation of optical alarms and buzzers when the sensed values of SB-95 sensor goes above the threshold along with the working of the sensor is explained in detail.

2.1 Existing problem:

The fire and gas system is generally required to be independent of the control system. This is consistent with the fire and gas system normally having a higher integrity requirement than the control system. Some fire and gas systems have been integrated with emergency shut-down systems. This remains a contentious point. As already mentioned, no single company can supply all the 'best in show' products for all the items described in this paper. There are therefore normally interfaces between different suppliers. Minimizing interfaces, document sets and inspections can be achieved by procuring all products from one source at the cost of reducing choice of initiating devices and possibly increasing the initial purchase cost.

2.2 References:

1.Somov, A. Baranov, A. Savkin, M.Ivanov, L. Calliari, R. Passerone, E. Karpov and A. Suchkov, "Energy-Aware Gas Sensing Using Wireless Sensor Networks", EWSN 2012, LNCS 7158, pp. 245–260.

2. Bhattacharjee,P. Bhatnagar, S. choudhury, "Design and Development of a Flexible Reliable Smart Gas Detection System", IJCA, 31(2011) 1-8.

3.L.Z. Ya, W.Z. Dong and C. Rong, "Intelligent Residential Security Alarm and Remote Control System Based on Single Chip Computer" 3rd International conference on (ICIEA- 2008), June 3-5,159-161.

4. Peijiang and J. Xuehhua, "Design and implementation of remote monitoring system based on GSM", PACIIA-2008, 19-20 Dec. 678-681

5.Lita, I.B. Cioc and D. A. Visan, "A New Approach of Automatic Localization System Using GPS and GSM/GPRS Transmission", 29th International Spring Seminar on (ISSE-2006), 10-14 May, 115-119.

2.3 Problem Statement Definition:

Gas leakage is a major problem in industries, residential premises and gas powered vehicles. The leakage if not detected may lead to explosion and cause severe damages life and environment. The Conventional leakage system uses onsite alarms for warning. In this project, we propose a leakage detection method in which the leakage information is also sent to first response team through wireless media. This ensures, the detection system used FPGA (Field Programmable Gate Array) to detect the leakage and automatically initiate a warning call through a GSM. A prototype of the gas leakage detection system will be developed and test with the LPG. This can be used across many industries and canteens to avoid explosion.

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:
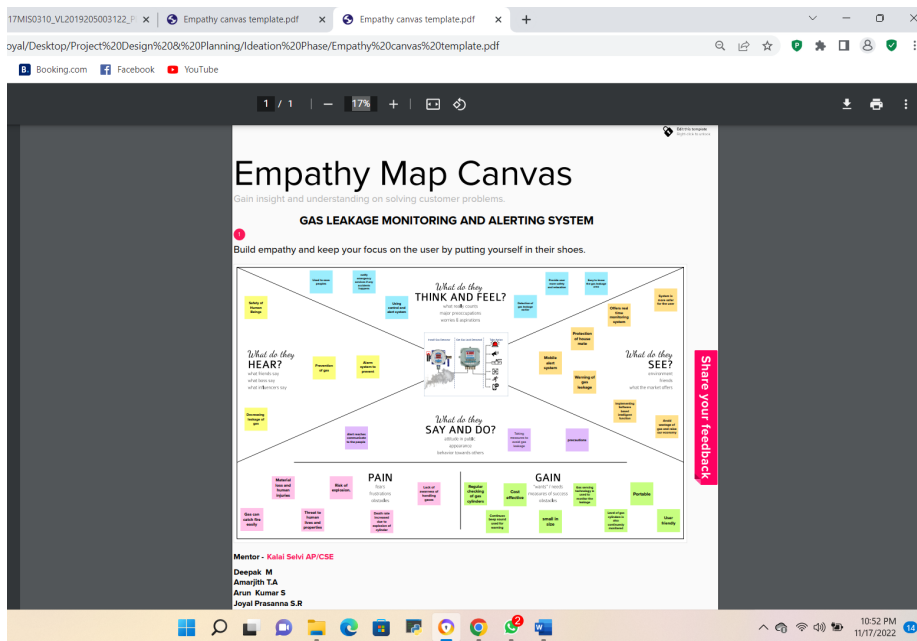
3.2 Ideation & Brainstorming.

3.3 Proposed Solution:

Project team shall fill the following information in proposed solution template

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	In the previous existing project, the cost is high, There is a little bit of lag in performance. And also not that efficient in warning the people at a right time. Rather than a buzzer, there is no facility like sending messages to workers to warn.
2.	Idea / Solution description	The idea is to reduce the cost of the project and increase its performance efficiency to the best level. And the lag is solved.
3.	Novelty / Uniqueness	The uniqueness of our project is that we provide a wi-fi module to alert the workers in an industry in the organization about gas leakage via a message using a wifi module also easy installation.
4.	Social Impact / Customer Satisfaction	t is more safe than the previous ones and also affordable so any type of customer can buy. And the safety of our product is tested in a realworld environment so there is no problem or error in it
5.	Business Model (Revenue Model)	This model can be used by anyone. because it is low cost and budget for everyone.
6.	Scalability of the Solution	The Scalability of the solution Can Be Used for Pipeline Gas Leakage , Filling Gas Interface Leakage Detection

3.4 Problem Solution fit:

Project Design Phase-I - Solution Fit Template

Project Title: Gas Leakage Monitoring & Alerting System For Industries   **Team ID:** PNT2022TMID39853

1. CUSTOMER SEGMENT(S)

The technology of the Internet of Things has resulted in the development of innovative solutions for multiple industry verticals. Whether these gases are used for manufacturing or are byproducts of any process in a facility, it becomes very important to monitor and control them

Our customers are most industry verticals where IoT powered gas monitoring and detection systems are a must. like Semiconductor Manufacturing Industries, Wastewater Treatment Plants, Chemical Industry and also it's can be used in House, School and Hospitals.

6. CUSTOMER CONSTRAINTS

Customer constraints are something that limits or controls our customers before buying the project some of the customer constraints are
- Budget
- Quality
- Availability
- Satisfaction
- Risks

5. AVAILABLE SOLUTIONS

As a solution for the problem, a monitoring system of gas detector by wireless system needs to be developed in order to solve the problem. By monitoring system wirelessly, user can remotely view the condition of the home without them being there themselves.

Define CS, fit into CC

Explore AS, differentiate

2. JOBS-TO-BE-DONE / PROBLEMS

Environmental commitments and most importantly the basic function being prevented by accidents and protect life and property from disasters. Thus it takes nearly 60 min to detect when 1% of gas leak occurs.

9. PROBLEM ROOT CAUSE

However, sometimes problems can appear out of the blue causing unforeseen costs and problems like
- Sensor Placement
- Sensor drift
- Sensor Failure
- Communications failure

7. BEHAVIOUR

Customer can address their problems and get the job done in below steps
- Social Media
- Feedback
- Mail Survey
- Official website

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

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

4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

Following are the functional requirements of the proposed solution.

| FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Location	1.Heavier Target Gas-Detector at lower level 2.Lighter Target Gas-Detector at Higher level
FR-2	Flow of Gas	Sensor
FR-3	Alarm Management	Indicators 1.Auditory alarm 2.light 3.CMMS
FR-4	Calibrating gas detectors	Bump Tests
FR-5	Ingress Protection Rating	1.IP 66 2.IP 77
FR-6	Non-corrosive Gases	1.IP 54

4.2 Non-Functional requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	can detect leakage at homes, commercial premises or factories. Two highly important safety factors are considered in this system including: time and control. GLDS detects the leakage soon after it happened and sends users an immediate alarm on the incident.

FR No.	Non-Functional Requirement	Description
NFR-2	Security	The security of gas leakage product is very secure, because it can produce alarm if any fault occurs
NFR-3	Reliability	1.UEI gas leak combustible detector 2.Amprobe gas leak detector 3.Ridgid combustible gas detector
NFR-4	Performance	Gas detectors utilize a sensor to gauge the grouping of specific gases in the air. The sensor fills in as a kind of perspective point and scale, creating a quantifiable electric flow when a compound response brought about by a particular gas happens
NFR-5	Availability	The Techamor Y301 is a methane, propane, and combustible natural gas leak detector that has a voice alarm and a digital display. It detects gas leaks in your home for 24 hours a day from your kitchen.
NFR-6	Scalability	The most scalability of this gas leakage detector usually utilized size is 14 kilogram.

5. PROJECT DESIGN:

5.1 Data Flow Diagrams:
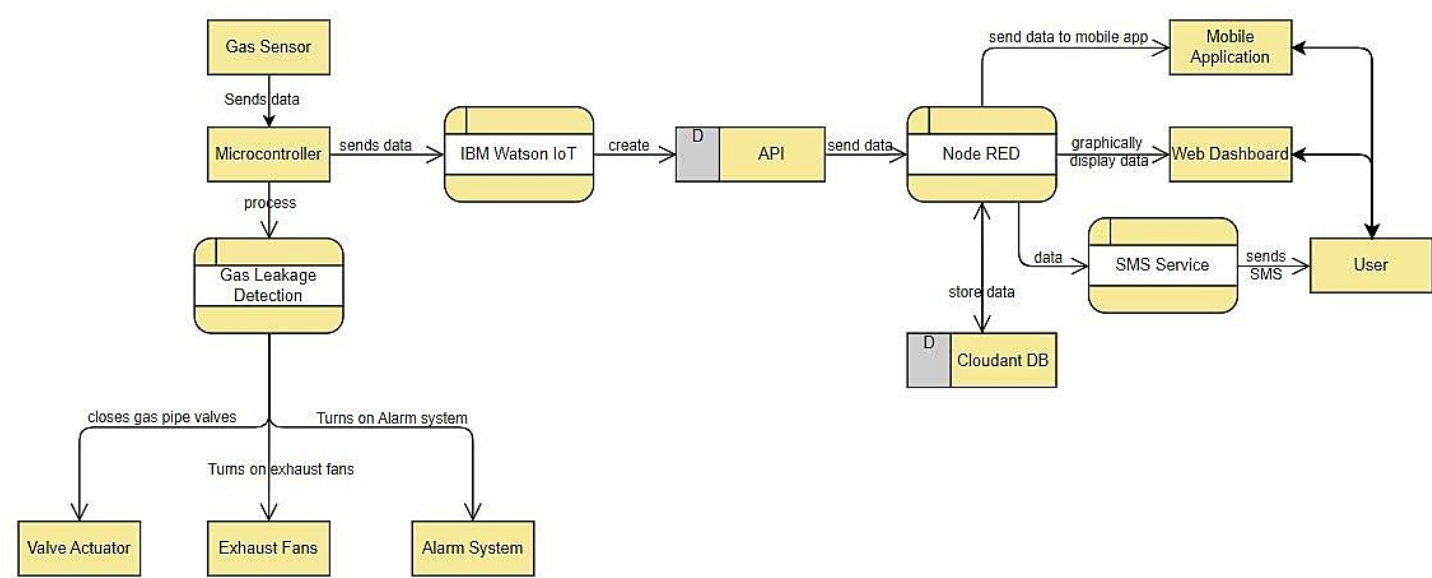
5.2 Solution & Technical Architecture:

   The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

  Guidelines:

  1. Include all the processes(As an application logic /Technology block)
  2. Provide infrastructural demarcation(local)
  3.Indicate external interfaces (third party sensor etc..)
  4.Indicate AC and DC sources/Power supply)
  5.Indicate interfaces to maintain machine learning models if applicabl
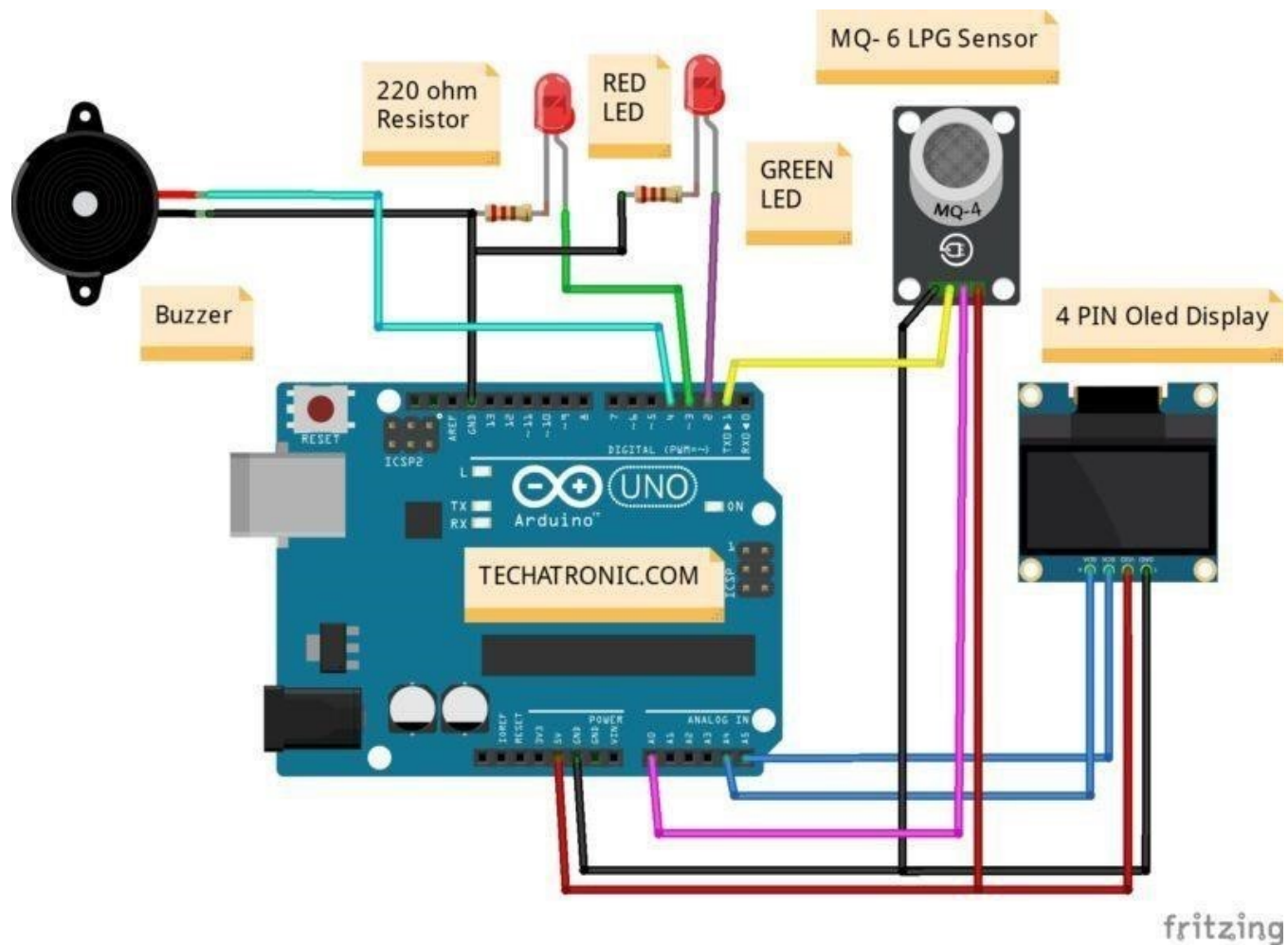
5.3 User Stories:

Use the below template to list all the user stories for the product

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release

Customer (Industry owner)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
Customer (Industry Owner)	Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1

Customer (Industry Owner)	Authorize	USN-3	As a user, I will enable the supervisor to monitor the gas leakage system status.	I can provide access to supervisor.	High	Sprint-1
Customer (Supervisor)	Login	USN-4	As a user, I can log into the application by entering email & password.	I can get access to dashboard.	High	Sprint-1
Customer (Supervisor)	Monitor	USN-5	As a user, I can monitor the status of the gas leakage system.	I can view the status of gas leakage system.	High	Sprint-1
Customer (Line Workers)	Notification	USN-6	As a user, I can get (alarm system) alert about gas leakage.	I can get alert about gas leak.	Medium	Sprint-2
Customer (Supervisor)	Notification	USN-7	As a user, I can get SMS notification & alarming alert about gas leakage.	I can get alert about gas leakage.	Medium	Sprint-2
Customer (Industry Owner)	Notification	USN-8	As a user, I can get SMS notification about gas leakage.	I can get alert about gas leakage.	Medium	Sprint-2
Customer (Industry Owner)	Sign-Up	USN-9	As a user, I can sign-up using Facebook login.	I can sign-up with the application using Facebook.	Low	Sprint-3
Customer (Supervisor)	Sign-Up	USN-10	As a user, I can sign-up using Facebook login.	I can sign-up with the application using Facebook.	Low	Sprint-3
Administrator	Service Request	USN-11	As a user, I can request for service in case of any issue with gas leakage monitoring system	I can get service from provider	Low	Sprint-3
Administrator	Increased service	USN-12	As a user, I can request for scaling up the gas leakage monitoring system.	I can get service from the provider.	Low	Sprint-4

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6. PROJECT PLANNING& SCHEDULING:

6.1 Sprint Planning & Estimation:

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	Low	S.R.Joyal prasanna
Sprint-1	Registration	USN-2	As a user, I will receive confirmation email once I have registered for the application	3	Medium	M.Deepak
Sprint-1	Registration	USN-3	As a user, I can log into the application by entering email & password.	5	Medium	T.A.Amarjith
Sprint-1	Monitoring	USN-4	As a user, I will enable the supervisor to monitor the gas leakage system status.	10	High	S.Arun kumar
Sprint-2	Notification	USN-5	As a user, I can get SMS notification.	10	High	S.Arun kumar
Sprint-2	Notification	USN-6	As a user, I can get alarming alert about gas leakage.	10	High	T.A.Amarjith
Sprint-3	Login	USN-7	As a user, I can sign up using Facebook login	2	Low	S.R.Joyal prasanna
Sprint-3	Login	USN-8	As a user, I can sign up using Google Login.	2	Low	S.R.Joyal prasanna

Sprint	Functional Requirement	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Service Request	USN-9	As a user, I can request for service in case of any issue with the gas leakage monitoring system.	8	Medium	M.Deepak
Sprint-3	Service Request	USN-10	As a user, I can request for scaling up the gas leakage monitoring system.	8	Medium	T.A.Amarjith
Sprint-4	Monitoring	USN-11	As a user, I can have mobile application for gas leakage monitoring and alerting system.	10	High	S.Arun kumar

| | Monitoring | USN-12 | As a user, I must be able to send control commands to initiate measures in case of gas leakage. | 10 | High | T.A.Amarji th |
| Sprin t-4 | | | | | | |

6.2 Sprint Delivery Schedule:

Sprint	Total Story Points	Durati on	Sprint Start Date	Sprint End Date (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

6.3 Reports from JIRA:

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	NOV					NOV							NOV								
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
GLMS-1 Registration																					
GLMS-2 confirmation																					
GLMS-3 authorize																					
GLMS-4 login																					
GLMS-5 moniter	███	███	███	███	███																
GLMS-6 notification	███	███	███	███	███																
GLMS-7 customizaion						███	███	███	███	███	███	███									
GLMS-8 increased service													███	███	███	███	███	███	███		

7. CODING & SOLUTIONING:

7.1 Feature 1:

SIM800 GSM Module:

SIM800 is a quad-band GSM/GPRS module designed for the global market. It works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz, and PCS 1900MHz. SIM800 features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 24243mm, SIM800 can meet almost all the space requirements in users' applications, such as M2M, smartphone, PDA and other mobile devices.

SIM800 has 68 SMT pads and provides all hardware interfaces between the module and customers' boards. SIM800 is designed with power-saving technique so that the current consumption is as low as 1.2mA in sleep mode. SIM800 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications.

Features:

• Support up to 552 Keypads.

• One full function UART port, and can be configured to two independent serial ports.

• One USB port can be used as debugging and firmware upgrading.

• Audio channels which include a microphone input and a receiver output.

• Programmable general-purpose input and output.

• One SIM card interface.

• Support Bluetooth function.

• Support one PWM.

• PCM/SPI/SD card interface, only one function can be accessed synchronously.

• Power supply 3.4V ~ 4.4V

• Typical power consumption in sleep mode is 1.2mA

• Frequency bands GPRS multi-slot class 12

• Support SIM card: 1.8V, 3V

• Serial Port: Can be used for AT commands for data stream

• USB Port: Can be used as debugging and firmware upgrading

7.2 Feature 2:

MQ135 Gas/Smoke Sensor:

The **MQ-135** gas sensor senses the gases like **ammonia nitrogen, oxygen, alcohols, aromatic compounds, sulfide, and smoke**. The MQ-3 gas sensor has a lower conductivity to clean the air as a gas sensing material. In the atmosphere we can find polluting gases, but the conductivity of gas sensor increases as the concentration of polluting gas increases. MQ-135 gas sensor can be implemented to detect the **smoke, benzene, steam and other harmful gases**. It has the potential to detect different harmful gases. It is with low cost and particularly suitable for Air quality monitoring applications.
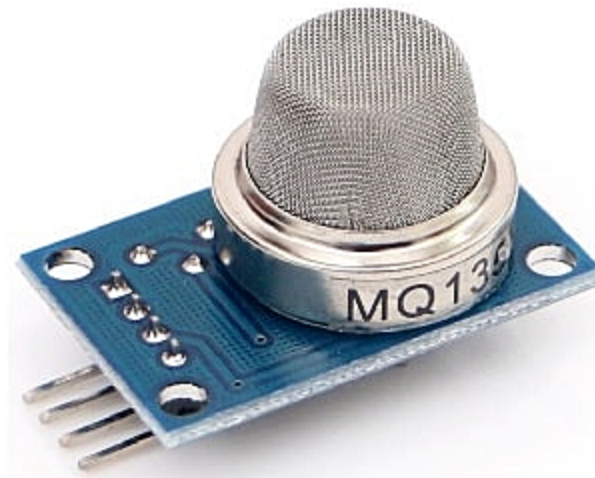
The **MQ135 sensor** is a signal output indicator instruction. It has two outputs: analog output and TTL output. The **TTL output** is low signal light which can be accessed through the IO ports on the Microcontroller. The **analog output** is a concentration, i.e. increasing voltage is directly proportional to increasing concentration. This sensor has a long life and reliable stability as well.

Features:

• High Sensitivity

• High sensitivity to Ammonia, Sulfide, and Benze

• Stable and Long Life

• Detection Range: 10 – 300 ppm NH3, 10 – 1000 ppm Benzene, 10 – 300 Alcohol

• Heater Voltage: 5.0V

• Dimensions: 18mm Diameter, 17mm High excluding pins, Pins – 6mm High

• Long life and low cost

7.3 Database Schema:
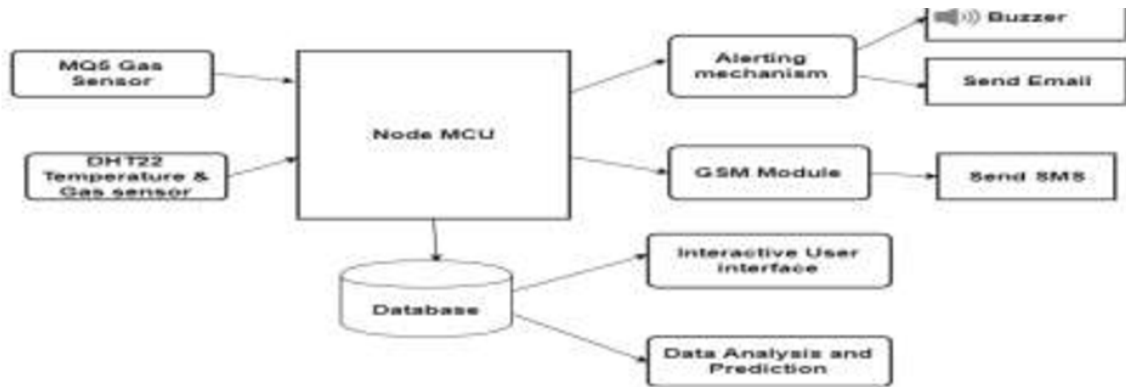
Detection of Gas Leakage in Dangerous Condition
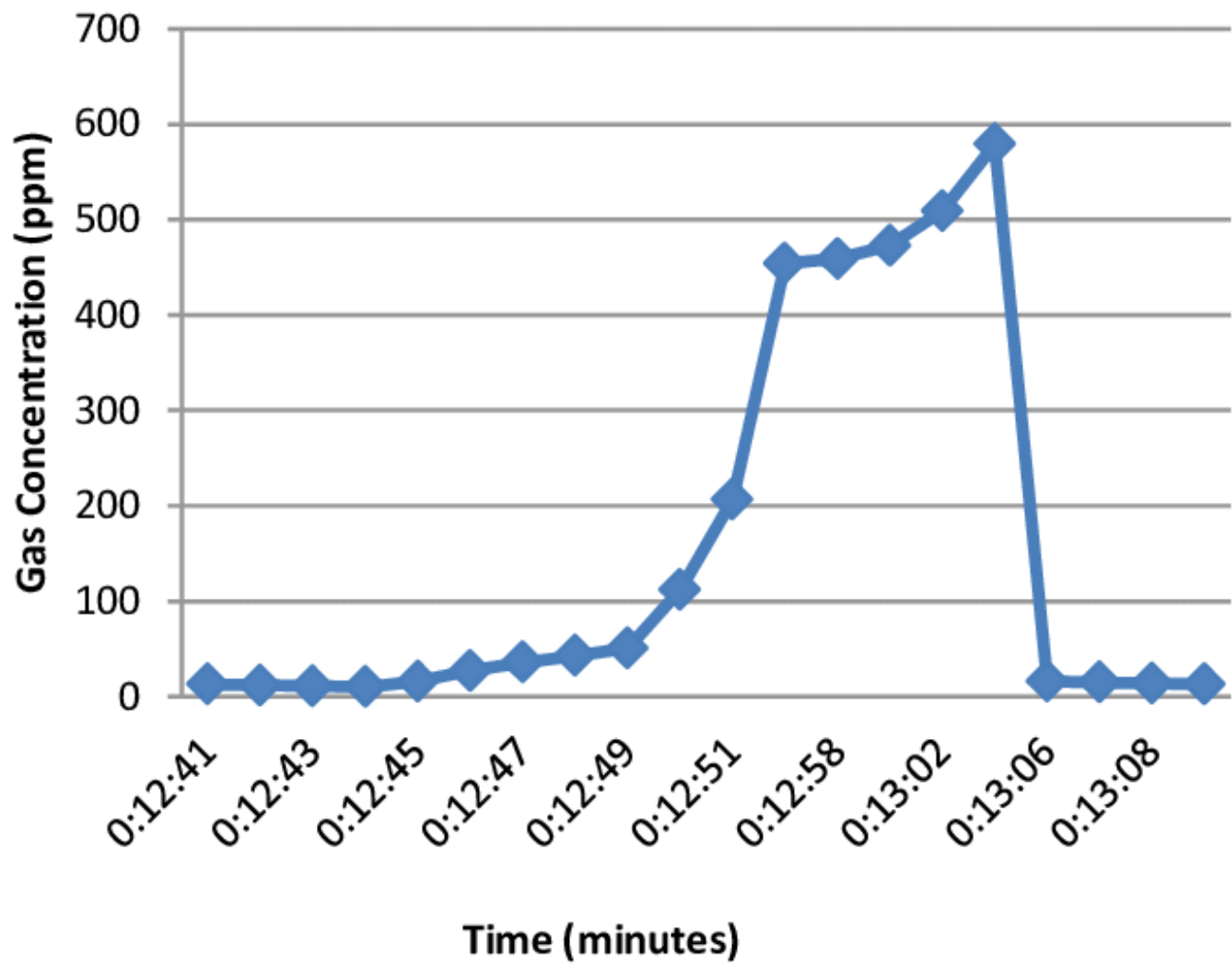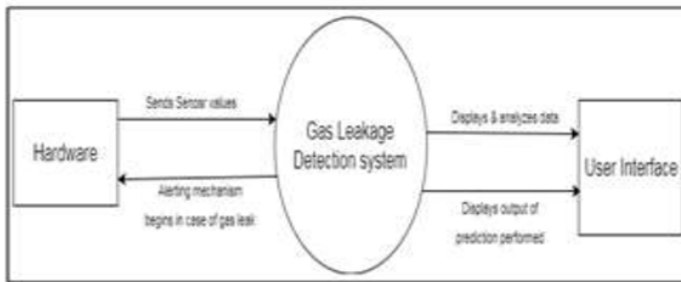
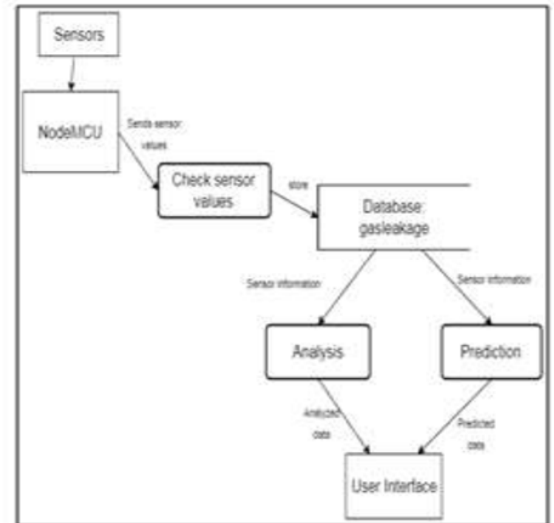**Figure 1:** Block Diagram

4. Flow Diagrams

Figure 2: Level 0 DFD

Figure 3: Level 1 DFD

8. TESTING:

8.1 Test Cases:

Table 1. Testing Black Boxes

NO	Scenario	Test Result	Security	Conclusion
1	Provides a power source	Provides a power source	Read automatically the value of gas content in the room	VALID
2	Bring the gas source closer to the MQ-6 sensor	Bring the gas source closer to the MQ-6 sensor	The LED and Fan Lights up as a warning and sends a message that there is a gas leak	VALID

Table 2. Testing of the gas leak detection system algorithm

Analog data	Red Led	Fan	SMS	explanation
<=199>=400	Off	Off	There is no message sended	Secure
>=200 &<=400	On	On	"Gas content increases, Warning !!!"	Standby
>=400	On	On	"Indicated Gas Leaks !! Danger !! "	Danger

8.2 User Acceptance Testing:

At Industries, all toxic gas cylinders will be tested for leaks prior to removing cylinders from the delivery vehicle, if possible. Also, non-toxic gas cylinders such as flammables should be tested for leaks before acceptance. Leaking gas cylinders will not be accepted. Similarly, all compressed gas experimental apparatus should be leak tested periodically per the applicable experimental protocol. Only individuals trained in the use of leak detection methods should perform this leak test procedure.

SET VOLTAGE	POINT SENSED VOLTAGE	GAS LEAKAGE DETECTED?	TIME
111	97	No	4.19 p.m
111	111	Yes	4.20 p.m
110	78	No	11.41 a.m
110	78	No	5.52 p.m
110	78	No	5.54 p.m

9. RESULTS:

9.1 Performance Metrics:

The performance issues are generally taken to be sensitivity (the size leak that can be detected), specificity (the certainty that a detected event of some kind is actually a leak), and the detection time (the time between the occurrence of the leak and annunciation). Similar issues are involved with the peripheral matters: leak location and size.

The physics of detection:

Detection speed begins with two basic issues from classical physics: the speed at which sound travels through a medium, and Newton's observation that along with mass and energy, momentum is conserved. Pressure events, such as the decrease precipitated by escaping fluid, travels at the speed of sound in the elastic medium (the fluid, pipe wall, backfill, or whatever it encounters along the way).

Key to process control: observation

Observation is fundamental in all process control work. You cannot detect or act on something you can't see. There is usually some set of parameters involved with discerning the operating conditions of a pipeline. These parameters are what must be observed to implement the procedure on which the detection system is based. How well they are observed has a lot to do with the confidence one can have regarding whether they are noise or data.

Most detection algorithms are based in science and, when properly implemented, result in performance within the capability of the equipment and methodology

employed. That does not infer that everyone experiencing a particular noise problem either knows how, or is motivated to, solve it. Put another way, not all implementations of the same technology are equal.

10. ADVANTAGES & DISADVANTAGES:

10.1 ADVANTAGES:

1. Get real-time alerts about the gaseous presence in the atmosphere

2. Prevent fire hazards and explosions

3. Supervise gas concentration levels

4. Ensure worker's health

5. Real-time updates about leakages

6. Cost-effective installation

7. Data analytics for improved decisions

8. Measure oxygen level accuracy

9. Get immediate gas leak alerts

10.2 Disadvantages:

1.Only one gas can be measured with each instrument.
2.When heavy dust, steam or fog blocks the laser beam, the system will not
    be able to take measurements.

3.This is also the case when a person or vehicle blocks the path

11. CONCLUSION:

"Gas monitoring system using Arduino" is developed to enhance man and machine safety in a kitchen, gas. The main objective of the project was early detection of gas leakage around the plant area. With the detection of a gas leak the sensor present in the plant area as well as with the plant area workers alerts the control room personnel. Therefore with this system even the human density in the plant area was determined. We have also analyzed various wireless technologies and various hardware and software approaches that can be implemented. After implementing this system in CPCL, Manali it was found out to be more efficient than the previously existing system. And with the introduction of Arduino the whole project cost was also reduced and human safety level was also increased.

12. FUTURE SCOPE:

The conduct of the gases is reliant on the Temperature and Humidity of the air around. A gas at certain focus probably won't be combustible at low temperature yet may have touchy nature at high temperature.

Therefore expansion of a Temperature and Humidity Sensor will be exceptionally useful. The other alteration which can be actualized in this gas spill locator is utilizing a tripped circuit which will trip off the principle supply once the gas spill is distinguished. During a gas spill it is unsafe to switch any apparatuses as it might start and this tripper circuit helps to reduce the electrical risks that can be caused because of a gas release.

Alongside the stumbling off of the primary supply it is especially important to kill the gas controller so no further spillage of the gas happens. A robot has been utilized in trading human for taking care of different errands in a risky and perilous working environment where human life may in danger. A portable gas detecting robot can be built to detect the spillage of gas through pipelines as the robot can proceed onward a track which is arranged along the length of pipeline.

13. APPENDIX:

13.1 SourceCode:

```
#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);
 }

}
```

13.2 GitHub& Project DemoLink

Github Link:

https://github.com/IBM-EPBL/IBM-Project-49635-1660830917

Project DemoLink :

https://drive.google.com/file/d/1PLPre_NqGTzxclqnAfIM9KOA3T
-6kxL8/view?usp=share_link