Gas Leakage monitoring & Alerting system for Industries

PNT2022TMID20041

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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.

a 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 intelligentsystem 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 peruser 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.

b 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 :

a Existing problem

Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT This project proposed the most common problem experienced in our dayto- day lives that is regarding GAS container going empty. We bring this paper to create awareness about the reducing weight of the gas in the container, and to place a gas order using IOT. The gas booking/order is being done with the help IOT and that the continuous weight measurement is done using a load cell which is interfaced with a Microcontroller (to compare with an ideal value). For ease it is even has been added with an RF TX & Rx module which will give the same information. When it comes it to security of the kit as well as gas container, we have an MQ-2(gas sensor), LM 35(temperature sensor), which will detect the surrounding environment for any chance of error. Whenever any change is subjected in any of the sensors (load cell, LM35, Mq-2) a siren (60db) is triggered.

A. LM 35 (temp. sensor) For the sensors, if any fire is to be happened then the temperature sensor will sense a high change (positive change) in temperature and will send an pulse to microcontroller which intern will send an update to the internet through IoT, and as well it will trigger an siren alarm in the RF Rx kit (sub board).

B. MQ-2 (Gas Sensor) MQ 2 sensor is basically an LPG (liquefied petroleum gas) which is composed of propane & butane, so when a gas leakage is sensed by the sensor it will send a high pulse to the Mc which will update it in the IoT, and even a buzzer is heard in the RF Rx kit. And the problem can be sorted & solved. Thus, the overall components & sensors play role in the paper as explained above.

2. Cloud Connected Smart Gas Leakage Detection and Safety Precaution System The project design and develop a cloud connected smart LPG gas cylinder platform, acting as a safety device for detecting LPG gas leak at low levels to avoid any possible accidents. It is also capable of sensing fire breakout in the area and weight of the gas in order to provide real time monitoring and alert over Internet. If an abnormal condition is detected, the device sends an alert to the smartphone app of the user and generates an alert e-mail to other authorities. In addition to this upon detecting a gas leakage or a fire breakout, the device automatically takes safety precautionary measures, like gas valve closing, ventilation opening, fire sprinkler activation and home electrical power supply cutoff. The device connects to the internet via Wi-Fi and thus increasing the mobility of the platform within the premises of the house. A Wi-Fi capable ARM Cortex-M4 microcontroller is used to implement the system. This device offers a complete, low cost, powerful and userfriendly way of real-time monitoring and remote control of gas leakages and prevention mechanisms in household and industrial areas.

b References

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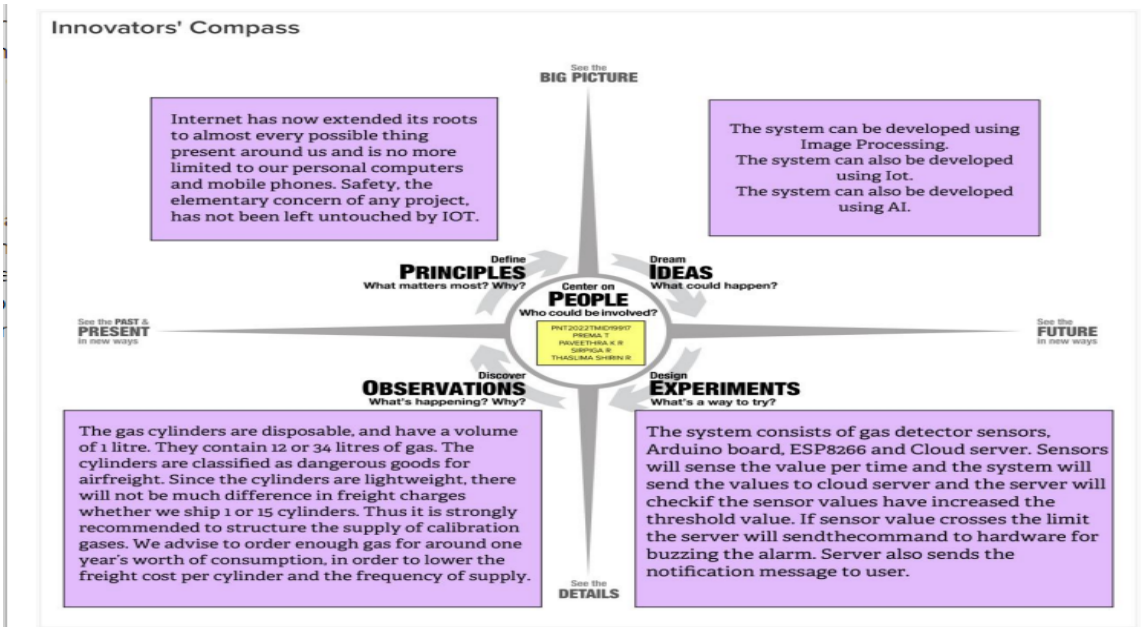
c Problem Statement Definition

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 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. 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 to prevent the issue.

3 IDEATION & PROPOSED SOLUTION

a Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user’s behaviours and attitudes. It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user’s perspective along with his or her goals and challenges.



b Ideation & Brainstorming

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions. Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room

c Proposed Solution

Problem Statement (Problem to be solved)

Workers who are engaged with a busy industry packed with gas either harmful or harmless needs a way to monitor their gas pipelines continuously and detect early if there is any leakage of gas in their surroundings so that they can work efficiently on major crises rather than worrying about monitoring or leakage of gas, this will indeed reduce the manpower of that industry and create a peaceful environment.

Idea / Solution description

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 data are continuously transferred to the local server. The accuracy of MQ sensors is 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. Thus, the system at this stage can only be used as a primary indicator of leakage inside a plant.

Novelty / Uniqueness

This problem they failed to satisfy the needs of customer. Some of the solutions are only detecting some gases where some others failed to alert the main department and other solutions are with some delays. Our solution not only notify the industry person but also notify the fire fighters so that can take control over the situation and our solution will alert the workers even there is a small leak of gases.

Social Impact / Customer Satisfaction

Our solution will be very helpful for the workers and the society which is associated or located nearby the industries. Our solution will prevent great disasters like Bhopal Gas Tragedy so that so many lives can be saved. Through this project the workers mental pressure will be reduced so that they can concentrate on other works or by relaxing them.

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 and use it.

Scalability of the Solution

Our solution can be integrated for further future use because the solution we have provided will be lay on the basic or initial stage of any upgraded version.

d Problem Solution fit

4 REQUIREMENT ANALYSIS

a Functional requirement

Following are the functional requirements of the proposed solution.

Project Design Phase-I
Proposed Solution

Date	09 October 2022
Team ID	PNT2022TMID20041
Project Name	Project - GAS LEAKAGE MONITORING AND ALERTING SYSTEM
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	House fire accidents had taken growing lives and property in recent years. Most of the fire accidents occurred because of the poor quality of rubber tube in gas cylinders. The gas supply from regulator to the burner may be on even the regulator is in off condition.
2.	Idea / Solution description	For this leaking of gas there is a solution available i.e., Gas leakage monitoring And Alerting System which makes alarm sound, opening windows automatically and send notification to the user.
3.	Novelty / Uniqueness	Providing SMS to the authorized person and opening the windows automatically to send some amount of gas to outside and indicating danger with LEDs.
4.	Social Impact / Customer Satisfaction	This will impact in saving the lives of humans and their property from danger. This system makes people to feel safe and secured through SMS option and alarm sound for safe side it opens the windows.
5.	Business Model (Revenue Model)	This will help in live tracking the gas leakage by send the notifications and displaying in LCD display. This leads to low cost product and also more reliable.
6.	Scalability of the Solution	This is continuous tracking of gas safety and displaying the gas leakage in LCD display continuously. This system have better scope at present and future.

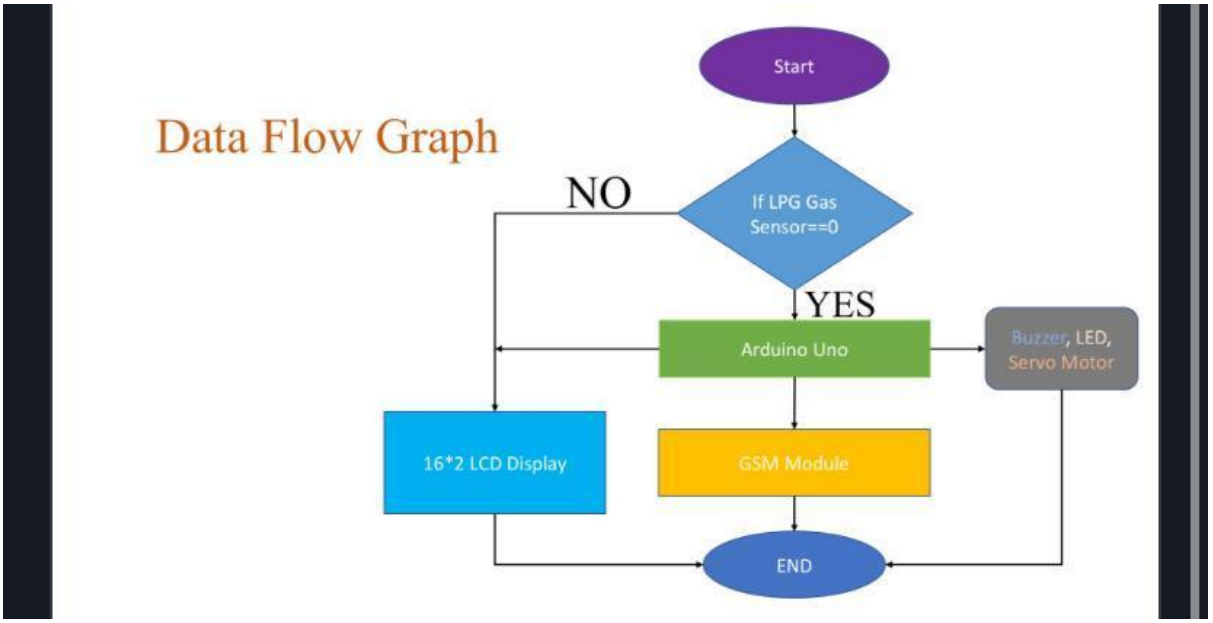
b Non-Functional requirements

Following are the non-functional requirements of the proposed solution

5 PROJECT DESIGN

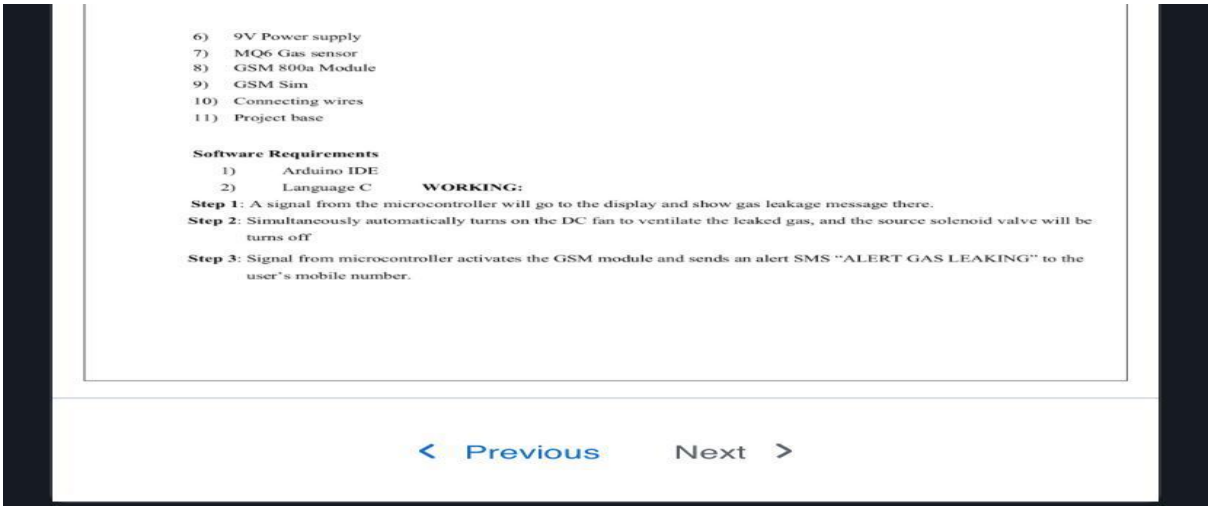
a Data Flow Diagrams

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



b Solution & Technical Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to: • Find the best tech solution to solve existing business problems. • Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders. • Define features, development phases, and solution requirements. • Provide specifications according to which the solution is defined, managed, and delivered



6) 9V Power supply
7) MQ6 Gas sensor
8) GSM 800a Module
9) GSM Sim
10) Connecting wires
11) Project base

Software Requirements

1) Arduino IDE
2) Language C

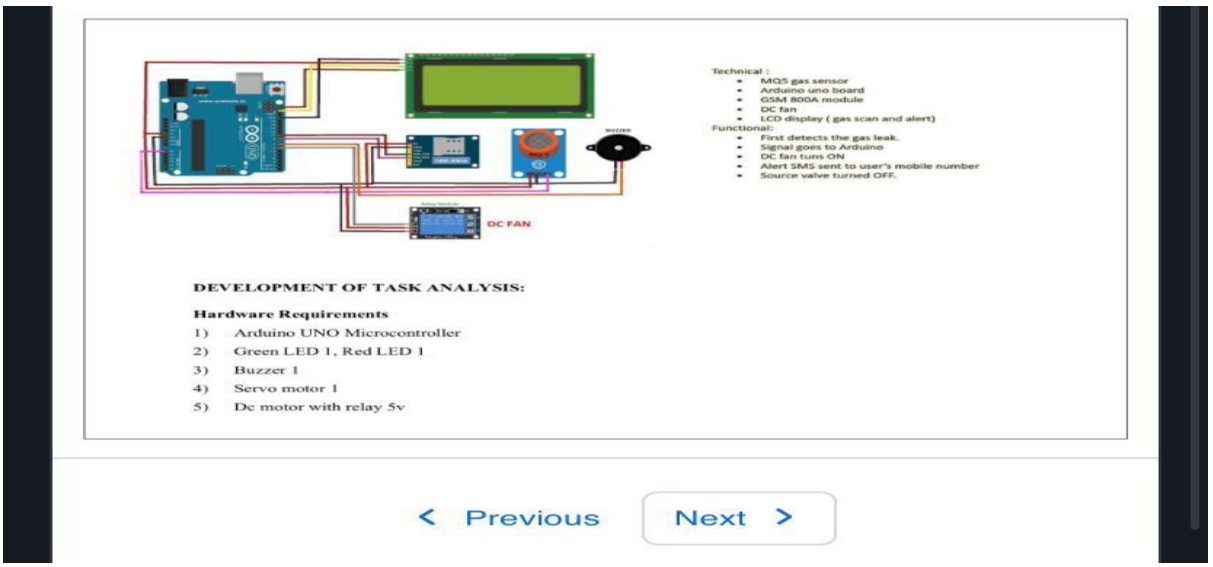
WORKING:

Step 1: A signal from the microcontroller will go to the display and show gas leakage message there.

Step 2: Simultaneously automatically turns on the DC fan to ventilate the leaked gas, and the source solenoid valve will be turns off

Step 3: Signal from microcontroller activates the GSM module and sends an alert SMS "ALERT GAS LEAKING" to the user's mobile number.

< Previous Next >



c User Stories

6 *PROJECT PLANNING & SCHEDULING*

***a* Sprint Planning & Estimation**

b Sprint Delivery Schedule

7 CODING & SOLUTIONING (Explain the features added in the project along with code)

a Feature 1

Stage 1 coding for GAS LEAKAGE MONITORING AND ALERTING SYSTEM

```
#include <LiquidCrystal_I2C.h>

// Set the LCD address to 0x3F for 16 chars and 2 line display
LiquidCrystal_I2C lcd (0x3F, 16, 2);

void setup()
{
 // initialize the LCD display
 lcd.init();

 // Turn on the blacklight and print a message.
 lcd.backlight();
 //lcd.print("Hello, world!");
}

void loop()
{

 lcd.clear();
 lcd.print("Hello World!");
 delay(1000);
 lcd.clear();
```

b Feature 2

c Database Schema (if Applicable)

8 TESTING

a TestCases
b User Acceptance Testing

9 RESULTS

a Performance Metrics

10 ADVANTAGES & DISADVANTAGES

Advantages

- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Supervise gas concentration levels
- Ensure worker's health
- Real-time updates about leakages
- Cost-effective installation
- Data analytics for improved decisions

Disadvantages

- Installation cost can be high.
- Poor stability and greater environmental impact

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 by the GSM module. 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 includes the upgradation of the system to a prediction level using Big Data analytics. This can also help in predicting the location of the leak with the analysed values, which in turn will be much useful to avoid hazards caused due to leaks. Further development can be made in the part of improving the accuracy of the gas sensing, speed control of the rover and can also give some control actions when detected with a leak, like automation of the plant's HVAC system.

13 APPENDIX

GitHub link : https://github.com/IBM-EPBL/IBM-Project-21517-1659782627