**GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES**

**PROJECT REPORT**

| PROJECT NAME | GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES |
|---|---|
| TEAM ID | **PNT2022TMID27405** |
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| BRANCH | **INFORMATION TECHNOLOGY** |

# 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

its effectiveness toward saving a significant portion of the wasted gas in domestic.

# 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.

# OBJECTIVE :

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.

# PROBLEM FORMUALTION:-

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 to prevent the issue.

# LIST OF COMPONENTS :

| S. No | Name of the Component | Quantity |
|-------|----------------------|----------|
| 1. | Arduino UNO R3 | 1 |
| 2. | Breadboard | 1 |
| 3. | LED | 2 |
| 4. | Resistor | 5 |
| 5. | Piezo | 1 |
| 6. | Gas Sensor | 1 |
| 7. | LCD 16*2 | 1 |

## ARDUINO UNO R3 :-



Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The term Uno means "one" in the language of "Italian" and was selected for marking the release of Arduino's IDE 1.0 software. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the reference versions of Arduino and currently progressed to new releases. The Uno-board is the primary in a sequence of USB-Arduino Board, & the reference model designed for the Arduino platform.

# BREADBOARD :



A breadboard is a widely used tool to design and test circuit. You do not need to solder wires and components to make a circuit while using a bread board. It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle. It consist of an array of conductive metal clips encased in a box made of white ABS plastic, where each clip is insulated with another clips. There are a number of holes on the plastic box, arranged in a particular fashion. A typical bread board layout consists of two types of region also called strips. Bus strips and socket strips. Bus strips are usually used to provide power supply to the circuit. It consists of two columns, one for power voltage and other for ground. Socket strips are used to hold most of the components in a circuit. Generally it consists of two sections each with 5 rows and 64 columns. Every column is electrically connected from inside.

**LED :**



LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electro-luminance. Electro-luminance is the property of the material to convert electrical energy into light energy and later it radiates this light energy. In the same way, the semiconductor in LED emits light under the influence of electric field. The symbol of LED is formed by merging the symbol of P-N Junction diode and outward arrows. These outward arrows symbolise the light radiated by the light emitting diode.

## RESISITOR :



A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

## PIEZO :



A piezo is a device that generates a voltage when force is applied or becomes deformed when voltage is supplied.

## GAS SENSOR :



A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.
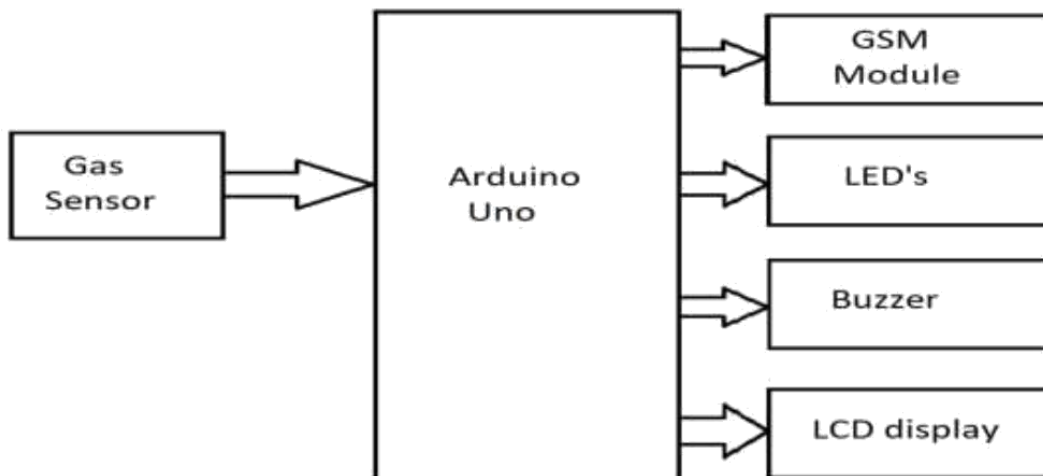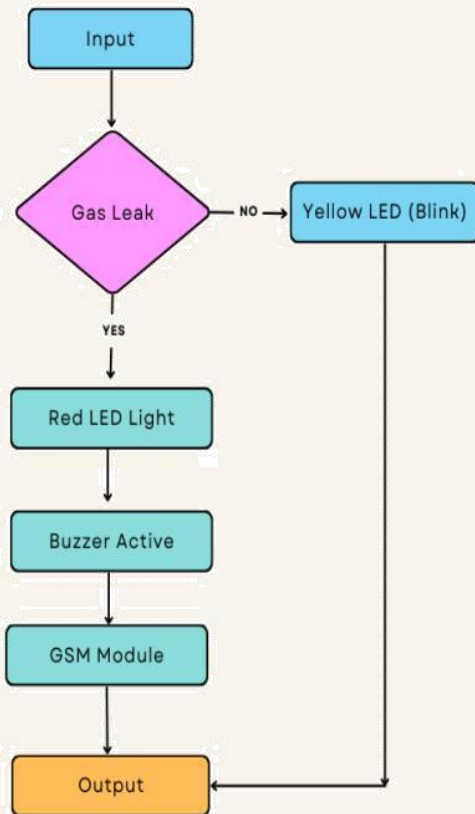
**LCD 16*2:**
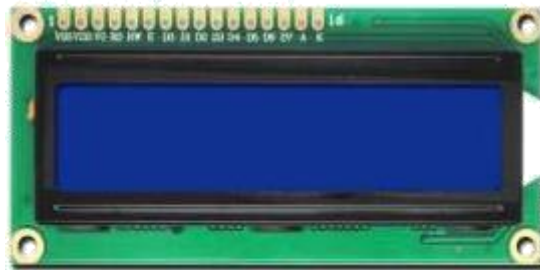


16×2 LCD is one kind of electronic device used to display the message and data. The term LCD full form is Liquid Crystal Display. The display is named 16×2 LCD because it has 16 Columns and 2 Rows. it can be displayed (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots. These displays are mainly based on multi-segment light emitting diodes. There are a lot of combinations of display available in the market like 8×1, 8×2, 10×2, 16×1, etc. but the 16×2 LCD is widely used. These LCD modules are low cost, and programmer-friendly, therefore, is used in various DIY circuits, devices, and embedded projects.

# PROPOSED METHOD :

Arduino UNO is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. The detection results displayed on LCD. Indicates the people of danger in work place, factory, home. Buzzer activity with beep(siren) sound is made. Also send alert SMS to the in charge of the plant whose number is saved in SIM card by using GSM modem. The SMS received depends upon the leak of gas in the detection area of the sensor.

# FLOWCHART : GAS LEAKAGE MONITORING AND ALERTING SYSTEM

```
                    ┌──────────┐
                    │  Input   │
                    └────┬─────┘
                         │
                         ▼
                    ◆ Gas Leak ◆ ──NO──► ┌──────────────────┐
                         │                │ Yellow LED (Blink)│
                        YES               └─────────┬────────┘
                         │                          │
                         ▼                          │
               ┌──────────────┐                     │
               │ Red LED Light │                    │
               └──────┬───────┘                     │
                      │                              │
                      ▼                              │
               ┌──────────────┐                     │
               │ Buzzer Active │                    │
               └──────┬───────┘                     │
                      │                              │
                      ▼                              │
               ┌──────────────┐                     │
               │  GSM Module  │                      │
               └──────┬───────┘                     │
                      │                              │
                      ▼                              │
               ┌──────────────┐ ◄───────────────────┘
               │   Output     │
               └──────────────┘
```

```
┌──────────┐          ┌──────────────┐          ┌──────────────┐
│   Gas    │  ═══►     │              │  ═══►     │     GSM      │
│  Sensor  │          │   Arduino    │          │    Module    │
└──────────┘          │     Uno      │          └──────────────┘
                      │              │  ═══►     ┌──────────────┐
                      │              │          │    LED's     │
                      │              │          └──────────────┘
                      │              │  ═══►     ┌──────────────┐
                      │              │          │    Buzzer    │
                      │              │          └──────────────┘
                      │              │  ═══►     ┌──────────────┐
                      │              │          │  LCD display │
                      └──────────────┘          └──────────────┘
```

# CIRCUIT DIAGRAM :
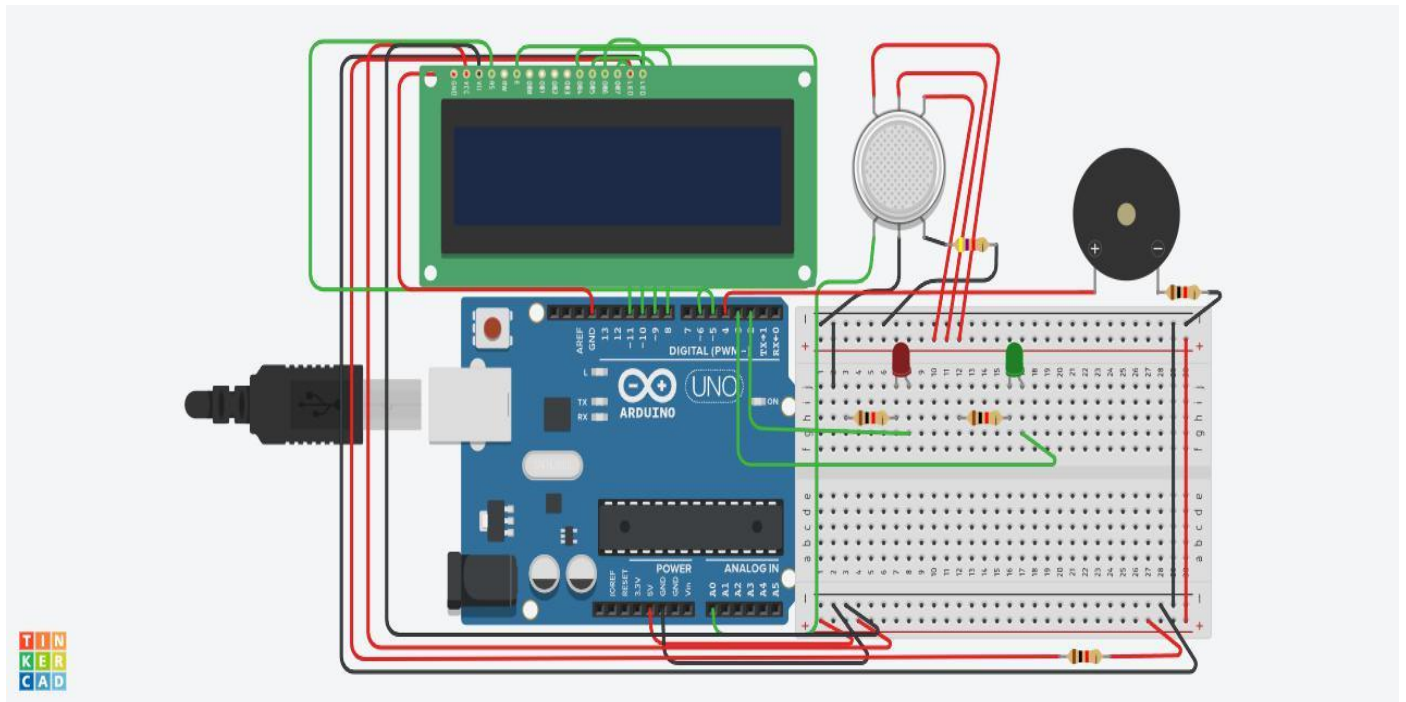


# SOLUTION STATEMENT :

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.

# 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.

# LITERATURE REVIEW

## 2.1 INTRODUCTION

This will provide a review about the previous research and existing project that have been made by using reference sources and guidelines as journals, internet, article writing, blog and scientific studies to get an idea about the project design, conception and any information that related to improve the project. With a differences concept and design, there are other creation and innovation of projects done by the other people. The research that is related to this project also covered in this chapter.

## 2.2 WHAT IS GAS LEAKAGE MONITORING AND ALERTING SYSTEM?

The literature review of the papers that were referenced and those that serves as base paper and supporting paper provides a detailed description about the state of the implementation of Gas leakage monitoring and alerting system. This literature review outlines the impact of Gas leakage monitoring and alerting system for the industries to prevent the leakage of gas. The inflammable gas such as Liquidized petroleum gas (LPG), which is excessively used in the house and at work places. The leakage of the gas causes destructible impact to the lives and as well as to the heritage of the people. So, by keeping it in the concept of the project we have determined to develop an examining system which finds the leak of LPG gas and protects the work places by taken correct precaution at correct time.

## 2.3 AUTHORS AND THEIR PROPOSAL

### A. LIU zhen-ya, WANG Zhen-dong and CHEN Rong

In the year of 2008, LIU zhen-ya, WANG Zhen-dong and CHEN Rong, "Intelligent Residential Security Alarm and Remote Control System Based On Single Chip Computer", the paper focuses on, Intelligent residential burglar alarm, emergency alarm, fire alarm, toxic gas leakage remote automatic sound alarm and remote control system, which is based on 89c51 single chipcomputer. The system can perform an automatic alarm, which calls the police hotline number automatically. It can also be a voice alarm and shows alarm occurred address. This intelligent security system can be used control the electrical power remotely through telephone.

### B. Chen Peijiang and Jiang Xuehhua

In the year of 2008, Chen Peijiang and Jiang Xuehhua, "Design and implementation of Remote Monitoring System Based on GSM", this paper focuses on the wireless monitoring system, because the wireless remote monitoring system has more applications a remote monitoring system based on SMS through GSM.

### C. K.Galatsis, W.Wlodarsla, K.Kalantar-Zadeh and A.Trinchi

In the year of 2002, K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A.Trinchi,"Investigation of gas sensors for vehicle cabin air quality monitoring", this paper focuses on, car cabin air quality monitoring can be effectively analyzed using metal oxide semiconducting (MOS) gas sensors. In this paper, commercially available gas sensors are compared with fabricated Moo3 based sensors possessed comparable gas sensing properties. The sensor has response 74% higher relative to the hest commercial sensor tested.

### D. Somashekhar Malipatil, Shilpa, Jayasudha

In the past, There are lot of authors came up with ideas to prevent and detect gas leakage such as, The authors Somashekhar Malipatil, Shilpa, Jayasudha proposed LPG Gas Measurement Detection using GPS. They used components like Arduino, LPG, GPS, MQ6 sensor, Load cell,Signal amplifier. This system monitors the level of gas cylinder. If threshold level comes below 2kgs the alert SMS will be sent to the user and also it detects the leakage level.

### E. Siddharth, Rameswari, Keerthana Gayathri, Kavin Sanjaya

Siddharth, Rameswari, Keerthana Gayathri, Kavin Sanjaya proposed Smart gas assistant for a perfect kitchen. In this paper they used Arudino, Wi-Fi, GSM Module, Internet of Things, Online Tool, Mobile Application. This system measures the amount of LPG present in the cylinder. It automatically books the cylinder from registered number. And a alert message sent to the customer also about volume of gas available in cylinder.

**F. Anusha, Nagesh, Venkata Sai, Srikanth, Rupalin Nanda**

Anusha, Nagesh, Venkata Sai, Srikanth, Rupalin Nanda designed IoT Based LPG Leakage Detection and Booking System with Customer SMS Alerts. In this paper they used GSM Modem, MQ2 Gas Sensor, Load Cell, AWS server. This system automatically detect the fuel leak and alert the user by sending the sms. If user is busy somewhere and fails to respond on time it automatically reserves the characteristics of LPG gasoline and replaces the data of reservation on the server robotically by using AWS server.

## PROPOSED SYSTEMS

This proposed system provides a way to detect leaks using a gas sensor MQ6 the detection system, Arduino, ESP8266 and alert system. Below diagram shows architecture of gas leakage detection in which Arduino has used to get input from gas sensor then give signal to stepper motor to turn off the valve of cylinder. And alert neighbour by turning buzzer and exhaust fan on. Also, sms the owner including images using Esp8266.
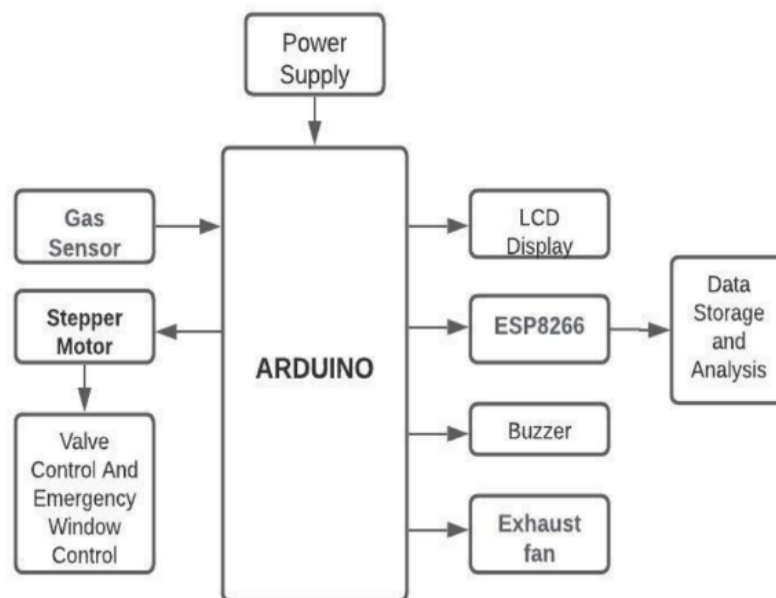
**IMPLEMENTATION**

IoT-based intelligent (LPG) leakage detector project is implemented using an ESP8266 chip. The circuit diagram shown below in image. MQ6 gas sensor has given input to Arduino which after detection of leakage action will be taken. The output will be displayed on IOT based display about the gas level shown in fig.4, which will show the percentage of gas level as per set value. If leakage is detected stepper motor will be informed to turn on the valve simultaneously buzzer will be turned on till user turns off after getting sms about the leakage.
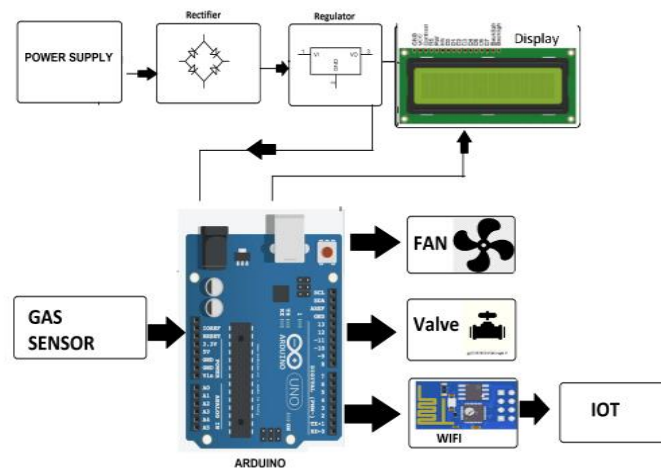


**FLOWCHART**

Below Flow chart shows how much gas present in the air. In starting if gas leaks it will be detected by the sensor and check the threshold value. As per result it turn on the motor and cylinder valve will be closed if still threshold is lower than gas value then alert message will be sent to the fire station and power will shut automatically. And even user will get the alert message immediately to act as per.
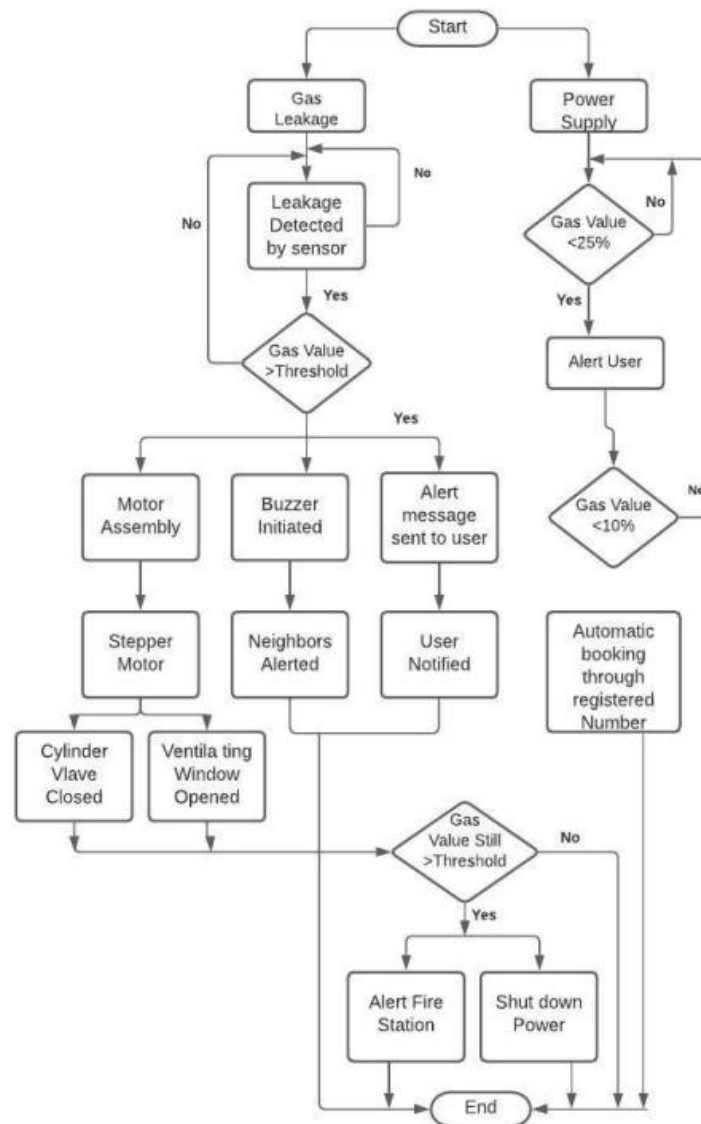
Fig. 3.  Flowchart of the gas leakage detection

**INFERENCE OF LITERATURE SURVEY**

The literature review of the papers that were referenced and those that serve as base paper and supporting paper helped to narrow down the main challenges that the proposed application might face. Also, it has served as a guide for the development of the application in the right way, using the necessary tools. From the Table 2.2, the following were inferred from the literature survey.

# Table: Inference of the Literature Survey

| AUTHOR NAME | INFERENCE |
|---|---|
| LIU zhen-ya, WANG Zhen-dong and CHEN Rong | Intelligent Residential Security Alarm and Remote Control System Based On Single Chip Computer |
| Chen Peijiang and Jiang Xuehhua | Design and implementation of Remote Monitoring System Based on GSM |
| K.Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A.Trinchi | Investigation of gas sensors for vehicle cabin air quality monitoring |
| Somashekhar Malipatil, Shilpa, Jayasudha | LPG Gas Measurement Detection using GPS. They used components like Arduino, LPG, GPS, MQ6 sensor, Load cell,Signal amplifier. |
| Siddharth, Rameswari, Keerthana Gayathri, Kavin Sanjaya | Smart gas assistant for a perfect kitchen. In this paper they used Arduino, Wi-Fi, GSM Module, Internet of Things, Online Tool, Mobile application. |
| Anusha, Nagesh, Venkata Sai, Srikanth, Rupalin Nanda | IoT Based LPG Leakage Detection and Booking System with Customer SMS Alerts. In this paper they used GSM Modem, MQ2 Gas Sensor, Load Cell, AWS server. |

# PROBLEM STATEMENT

- Gas leakage leads to various accidents resulting into both financial loss as well as human injuries. In human's daily life, environment gives the most significant impact to their health issues. The risk of fires, explosion, suffocation, all are based on their physical properties such flammability, toxicity etc. The number of deaths due to the explosion of gas cylinders has been increasing in recent years. The reason for such explosion is due to sub- standard cylinders, old valves, worn out regulators and lack of awareness using gas cylinders add to risks.

- The leakage of gases only can be detected by human nearby and if there are no human nearby, it cannot be detected. But sometimes it cannot be detected by human that has a low sense of smell. Thus, the system will help to detect the presence of gas leakage.

- Being heavier than air, these gases do not disperse easily. It may lead to suffocation when inhaled and may lead to explosion.

- Furthermore, gas leakage can cause fire that will lead to serious injury or death and it also can destroy human properties. The system will give real-time response to the user.

- In order to minimize or eliminate the hazard of gas leakage there is a need for a system to detect and alert on such incidence leading to the development of this project.

| QUESTION | DESCRIPTION |
|---|---|
| What does the problem affect? | The gas leaked by a cylinder if inhaled can lead to suffocation, as well as cause difficulty in walking or speaking. |
| What are the boundaries of the problem? | Gas leakage is very harmful for human beings as well as for plants & animals. Also may cause fires. |
| What is the issue? | Gas leakage |
| When does the issue occur? | It occurs when a gas line, gas cylinder or any gas-burning appliance springs a leak. |
| Where is the issue occurring? | The reason for such gas leaks is due to sub-standard cylinders, old valves, worn out regulators and lack of awareness using gas cylinders add to risks. |
| Why is important that we fix the problem? | Gas leakage can cause fire that will lead to serious injury or death and it also can destroy human properties. In order to minimize or eliminate the hazard of gas leakage there is a need for a system to detect and alert. |