

## LPG Gas Leakage Detection and Alert System

**Dr. G. Annapurna**

*Professor, Electrical & Electronics Engineering Department  
G. Narayanamma Institute of Technology and Science, Hyderabad, India  
email: gootyanu@gmail.com*

**A. Lasya Priya, B. L. Malvika, Sofia Tahreem, V. Juhitha and B. Neha**

*Students, Electrical & Electronics Engineering Department  
G. Narayanamma Institute of Technology and Science, Hyderabad, India  
email: lasya24007@gmail.com malvikaboyini@gmail.com  
sofiatahreem14@gmail.com juhithavemula7@gmail.com  
nehabandari05@gmail.com*

### Abstract

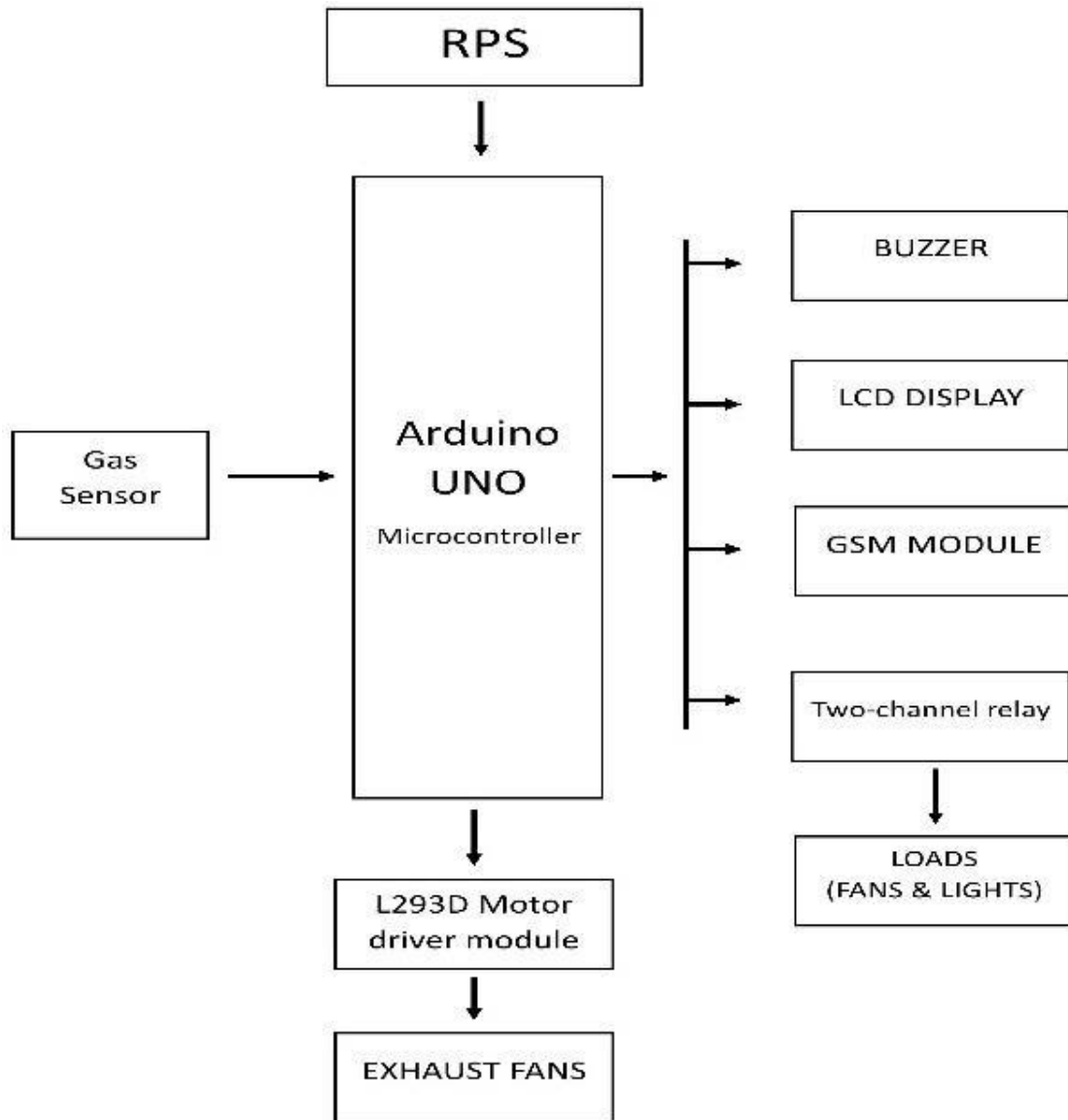
This project aims to develop a system which is capable of detecting LPG gas leaks. This proposed gas detection system detects various gases such as propane, butane, propene, and butene, which are very harmful to the surroundings. After the sensor detects a gas leak, it sends the signal to the Arduino NANO for further processing. The Arduino NANO sends the signal to the buzzer, which then turns on to warn people in the area. It also cuts off the power to the equipment via a relay and simultaneously turns on the exhaust fans to remove harmful gases from the environment. The system also displays the gas concentration on the LCD and sends a warning notification to the user via the GSM module.

**Keywords:** Arduino nano, exhaust fans, GSM module, Relay.

### INTRODUCTION

Gas leakage is one of the major problems and in recent days, it is observed in many places including residences, industries, and gas-operating vehicles like CNG buses, cars, etc. Dangerous mishaps are observed to occur as a result of gas leaks. Since LPG is extremely flammable, it can burn even at a considerable distance from the site of the leak. This energy source principally consists of the extremely combustible chemical molecules propane and butane. In homes, LPG is primarily used for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Accidents caused by gas leaks result in both material loss and human injuries. The threat of home fires has

been on the rise in recent years, resulting in an increased risk of human death and property damage. In order to prevent harm to the public, gas leaks should be detected and controlled. Hence gas leakage detectors are essential for detecting leaks and protecting people from danger. In this paper, a low-cost advanced sensor-based gas leakage detector and alert system is proposed.



**Figure 1:** Block Diagram

### OBJECTIVES

1. The system should detect gas outflows like LPG leaks or any such petroleum centred on a gaseous substance that should be discovered using a sensor.

2. The system should send the user an alert message and display the concentration on the screen.
3. The system should turn on the exhaust fans i.e it must let the fresh air in using the inlet fan and the gas should be sent out using the outlet fan and also the power supply to home appliances like lights and fans should be cut off.

### **LITERATURE SURVEY**

1. In the year 2015, Arun Raj, Athira Viswanathan and Athults developed a system which uses a gas sensor to detect leakage of LPG and alert the owner via SMS. It also monitors the level of LPG in the cylinder and informs the owner via SMS and LCD if it is below the threshold limit. Additionally, an automatic reservation of the gas bottle is made with the help of a GSM module.
2. Later in the year 2020, M. Hima Jyothi, K. Devika, K. Krishna Tulasi, G. Ramya and CH. Vijay Kumar designed a project to implement leak detection safety measures. Residents receive alert messages when there is a leak, and if the strength of the leakage rises, alert messages are also sent to the fire station and nearby neighbours, and a buzzer and LCD display are activated for emergency rescue.
3. In the year 2021, K Gavaskar, D Malathi, G Ravivarma, and A Arulmurugan, developed an LPG Leakage Detection Alert and Auto Exhaust System using IoT. This research project uses a solenoid valve, fumes fan, LCD, IoT, and fixed load cell to identify gas spills and control it. It offers speedy response times and precise crisis identification, and booking of LPG may be made through the application.

### **COMPONENTS REQUIRED**

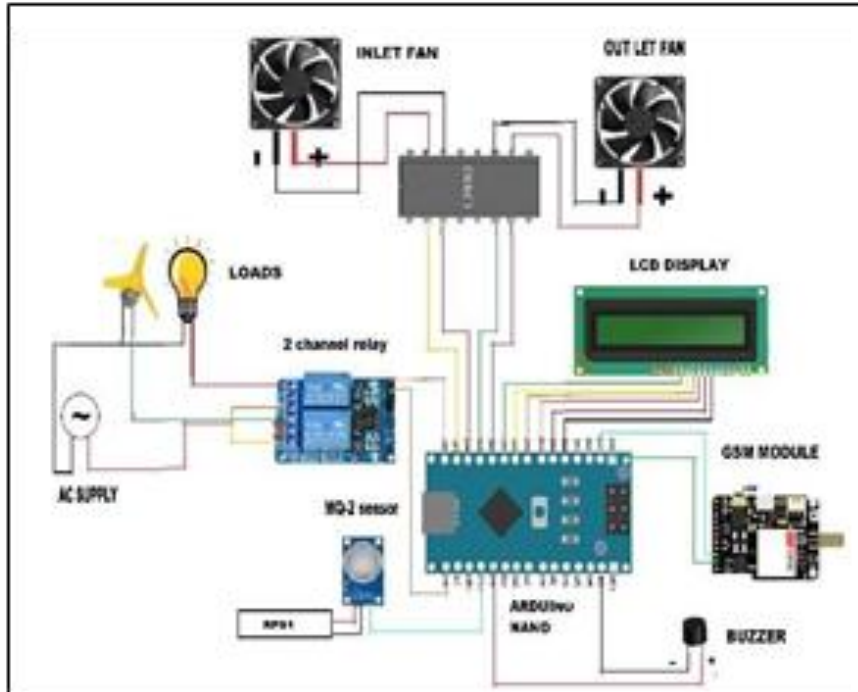
#### **Hardware Requirements:**

Arduino NANO Microcontroller, 16x2 LCD Display, 12v dc power supply, 5v Regulated CKT, Buzzer, LPG Gas sensor, GSM Module, GSM Sim.

#### **Software Requirements:**

Arduino IDE, Language C++

## CIRCUIT DIAGRAM



**Figure 2:** Circuit Diagram

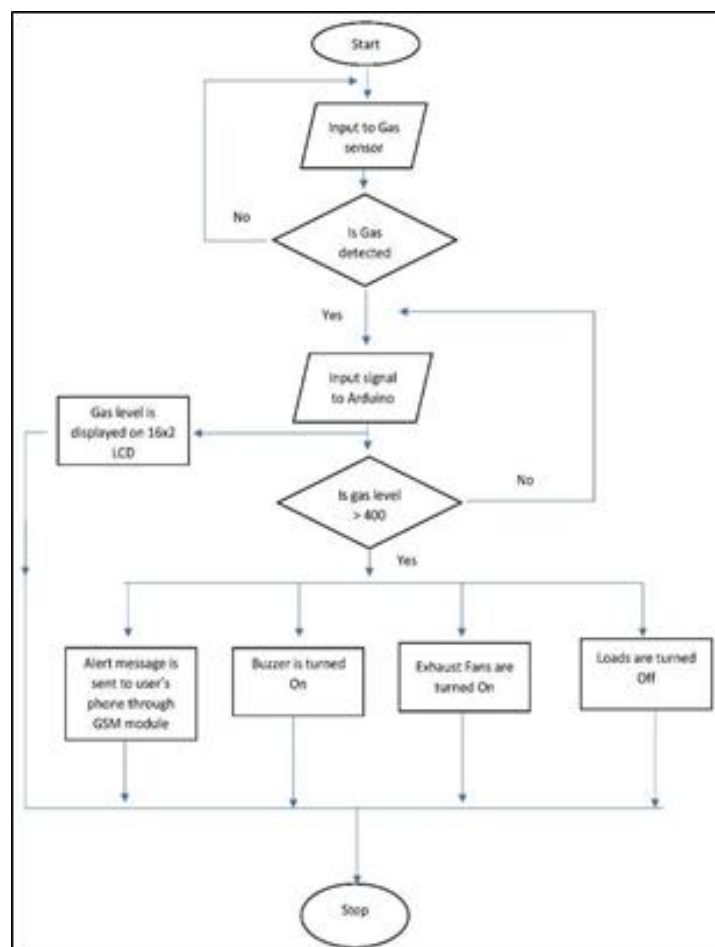
## WORKING

This LPG Gas Detection and Alert system consists of four main modules. In the first module, the MQ-2 gas sensor is used to determine the status of the LPG gas level in the surroundings. The sensor system consists of platinum wires and a tin dioxide (SnO<sub>2</sub>) coating, that works as the sensing element. Oxygen is adsorbed on the surface when the SnO<sub>2</sub> semiconductor layer is heated to a high temperature. An electron depletion layer forms just below the surface of the SnO<sub>2</sub> particles, when electrons from the conduction band of tin dioxide attract oxygen molecules in clean air. This results in the SnO<sub>2</sub> film becoming highly resistive and preventing electric current flow. Consequently, electrons are released into the tin dioxide, allowing current to flow. The second module consists of an Arduino Nano, a microcontroller that acts as the central system and communicates with the various connected systems. Here, the microcontroller takes input from the gas sensor in the form of voltage and performs the necessary calculations. When the LPG gas level rises above a set value, the microcontroller sends the signal to the prevention and alarm system. The gas level is displayed on the LCD screen. In this project, a threshold value of 400 ppm is considered. LPG gas can ignite in the presence of a flame when its concentration in the air is between 2-10 %, which corresponds to approximately 2000 ppm. Since the measurement of this value is prone to error, the detection sensor is calibrated to trigger at 20 % of the lower threshold. The third module is the prevention system. This part consists of an L293D motor driver, exhaust fans and

loads. The motor driver IC is an integrated circuit used to control the speed of the brushless DC motors in the exhaust fans. The motor driver ICs act as an interface between the motors in the exhaust fans and the microcontroller. When the gas level is above the threshold value, the microcontroller sends a low-current signal and outputs a proportionally higher current signal that can control and drive the motors.

When the motor rotates the exhaust fan blades, the LPG gas is expelled through the outlet fan while the fresh air is let in through the inlet fan. At the same time, the power supply to the loads is interrupted via a relay. The alert system is the fourth module which contains a GSM modem and buzzer. When the LPG level rises above the threshold value, the alert system starts working together with the prevention system. The GSM module and buzzer receive a signal from the microcontroller. Here the GSM modem sends an alert notification to the user via SMS while the buzzer sets off, giving a buzzing sound.

## FLOW CHART



**Figure 3:** Flow Chart

**RESULT****A. Analysis 1:**

When the gas level is less than 400ppm, the outputs are:

1. Loads are ON.
2. Value of the gas is displayed on the LCD screen.

**B. Analysis 2:**

When the gas level is greater than or equal to 400ppm, the outputs are:

1. Loads are OFF
2. Exhausts fans are turned ON
3. User receives alerts through GSM modules on their phones.
4. LCD displays the value of the gas.
5. Buzzer is turned ON

**ANALYSIS 1 OUTPUTS**

**Figure 4:** Loads ON



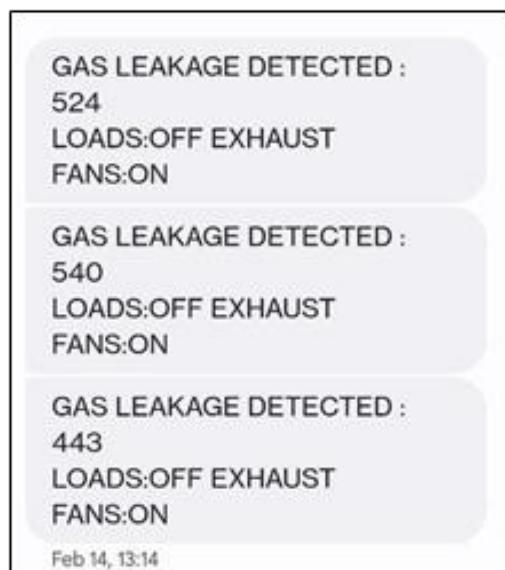
**Figure 5:** The gas level displayed on LCD before gas leakage



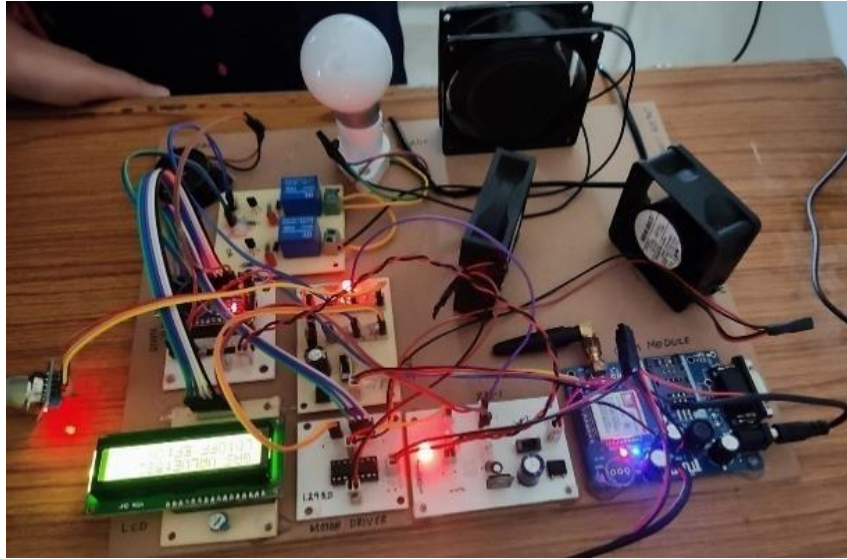
**Figure 6:** Exhausts Fans turned ON



**Figure 7:** Value of gas displayed in ppm



**Figure 8:** Alert message sent to the user



**Figure 9:** Loads off after gas detection

## CONCLUSION

Currently, LPG leakage is a major problem in enterprises and households. In this project, a system is developed to detect LPG leaks and raise the alarm. The gas sensor detects a gas leak while the Arduino Nano is used to transmit data and signals to the connected devices. The exhaust fans help to remove the gas, while the GSM module sends messages to the owner about the gas leak. In this way, the intensity of accidents is reduced. In addition, the power supply to the loads is interrupted. The system can be used for both industrial and domestic purposes. This system is effective and inexpensive, which makes it user-friendly and reliable.

## FUTURE SCOPE

For domestic purposes, the performance of the system can be further improved by interfacing a robot to turn off the cylinder regulator. The buzzer can be replaced with a speaker for a wider range of the alert system. It is possible to further enhance the monitoring system by sending alert messages to the user via Bluetooth instead of GSM, which would enable another real-time application to be supported. It is possible to develop mobile robots that are capable of detecting multiple gas concentrations in the vicinity for industrial purposes.

## REFERENCES

- [1] K Gavaskar, D Malathi, G Ravivarma, A Arulmurugan, "Development of LPG Leakage Detection Alert and Auto Exhaust System using IoT", IEEE, February 2021.



- [2] Alan M John, Bhavesh Purbia, Ankit Sharma, Mrs A.S Udupurkar, “LPG/CNG Gas Leakage Detection System with GSM Module”, IJARCCCE, Vol. 6, Issue 5, May 2017.
- [3] Sarika K Shinde, Priya R Khore, Ashwini T Hirave, Prof. Vipul R Kaushik, Prof. Sudhir N Divekar, Dr Vijay N Patil, “Automatic LPG cylinder booking and leakage detection using Arduino UNO”, IJSRSET,2020.
- [4] Mohammad Monirujjaman Khan,” Sensor-based Gas Leakage Detector System”, engineering proceedings, 14th November 2020.
- [5] Arun Raj, Athira Viswanathan, Athults,” LPG Gas Monitoring System”, IJITR, Feb-March 2015.
- [6] Preet S. Jadhvani, Sinchan R. Patil, Tejas S. Shinde, Mrs Sonal Patil,” LPG Gas Leakage Detection and Alert System using Arduino”, IJRASET, May 2021.

