



## LPG Leakage Detection Using Arduino and GSM Module

<sup>1</sup>Kiran Kamble, <sup>2</sup>Mohanish Apturkar, <sup>3</sup>Nihar Tijare, <sup>4</sup>Vikrant Bhagwat, <sup>5</sup>Prof. Ekeshwari A. Rangari

<sup>1,2,3,4,5</sup>Students, Department of Electrical Engineering, Jagadambha College of Engineering and Technology, Yavatmal, Maharashtra, India

<sup>5</sup>Assistant Professor. Department of Electrical Engineering, Jagadambha College of Engineering and Technology, Yavatmal, Maharashtra, India

<sup>1</sup>kiran1999kamble@gmail.com, <sup>2</sup>apturkarmohnish@gmail.com, <sup>3</sup>nihartijare2@gmail.com,

<sup>4</sup>vikrantbhagwat421@gmail.com, <sup>5</sup>ekeshwari.rangari@gmail.com

### Article History

Received on: 09 April 2022

Revised on: 10 April 2022

Accepted on: 27 May 2022

**Keywords:** Arduino Uno, GSM Module, LCD, MQ-135 gas sensor, Buzzer etc.

**e-ISSN:** 2455-6491

**Production and hosted  
by**

[www.garph.org](http://www.garph.org)

©2021|All right reserved.

### ABSTRACT

Gas Leakage in open or closed areas can prove to be dangerous and lethal. The traditional Gas Leakage Detector Systems though have great precision, fail to acknowledge a few factors in the field of alerting the people about the leakage. Therefore, for the sake of lives safety and fulfillment of social duties, and keeping in focus the life-threatening instances of blasts and injuries due to leakage of gas in industries, vehicles, and houses, a gas leakage system has been designed whereby the application of embedded systems is involved in it. The proposed low-cost project uses an MQ-135 gas sensor which can be calibrated to detect gas leakage levels based on ambience. MQ-135 gas sensors are generally used to detect or measure the presence of gases like LPG and butane. An Arduino is used to control all the components. Once the proposed gas leakage system is installed, it generates an identifiable buzzing sound alert using a buzzer after detecting the gas leakage. Also, an alert message is sent to authorize person through the SMS with the help of the GSM module. Along with this LCD will display the message of leak detected. The requirement of a gas detection system is not only to monitor continuously but also to prevent gas leakage hence minimizing the chances of fire and damage.

### 1. INTRODUCTION

LPG is additionally referred to as propane, is a combustible mixture of hydrocarbon gases that may be used as fuel in many areas like domestic areas, industries, factories, vehicles, and also in heating appliances, as LPG has various advantages like high energy value, clean-burning and minimum environmental effect. LPG is created of highly flammable compounds of chemical propane and butane. It's most

ordinarily utilized in houses for cooking purposes in India because it's easily available and at a less expensive rate.

1. With the rise in the number of usages, the risk of gas leakage has also been increasing. Gas leakage causes various accidents which end up in property loss and human injuries and even result in death. the number of deaths by gas cylinder leakage has increased more in recent years. Gas leakage is caused because of irregular checking of

gas cylinders, leakage in gas pipes, and lack of awareness of handling cylinders. Therefore, a proper method or technique is required to detect the leakage and alert people to stop accidents. Keeping this in mind we've designed a gas leakage detector system by using Arduino and GSM modules to alert the user via SMS and alarm.

## 2. LITERATURE REVIEW

Marchel Thimoty Tombeng proposed the system to detect gas leakage which is cost-effective, provides a quick response, is easy to use, and has low maintenance. During this system, the sensor generates the parameter and sends it to the microcontroller. Then the microcontroller processes the information and if the leak occurs, it sends the alert message through SMS Gateway and the alarm will start to grant warnings to users. [1]

For instance, the role of Liquefied Petroleum Gas (LPG) is critical to human life, both within the home and in industry. This, however, can have a negative effect, particularly if there's no known leaky hole that may cause explosions and smoke. He proposed a system that uses an MQ6 sensor. When the MQ-6 system senses LPG above 100 ppm, the sensor sends information to the controller on the Arduino Uno, which can react as an alarm, a loudspeaker as a warning sound, and data by means of SMS to the house owner. The test results show that this warning system can indicate whether there's any leakage on the concentration of gas of 117 to 457 ppm and also the duration of SMS sending between 3 and 182 seconds from five tests performed in three different locations. [2]

Zainal H.C. Soh along with others proposed the method that uses a gas sensor to detect and monitor gas levels, and so transfer the information to Ubidots over the web of Things. This project measures the gas level inside a house or an industrial building and uploads the information to Ubidots' dashboard to stay it safe. Ubidots analyze the gas level data to trace the gas level during the day and week. The system was successfully developed by employing a gas sensor connected to an Intel Edison, which sent gas level data to Ubidots Cloud through IoT and sent a telegram to the owner in the event of a gas leak. [3]

## 3. SYSTEM OVERVIEW

In this paper, we have designed a Gas Leakage Detector system using GSM & Arduino with SMS Alert. We will interface SIM800 GSM Module as well as MQ135 Gas Sensor with Arduino. The gas level value will be displayed on the 16x2 LCD Display. Whenever the excess gas is detected, an SMS will be sent to a particular phone number.

Smoke and gas leakage detectors are very useful in detecting smoke or fire in buildings, and so are the important safety parameters in order to prevent disasters. Bursting cylinders and accidental fires have caused lots of harm to the economies in the past. This circuit triggers the alert system when smoke or gas leakage is detected. The circuit mainly uses the MQ135 Smoke/Gas sensor and Arduino to detect smoke and gas leaks. This MQ135 gas sensor is sensitive to LPG, Alcohol, Methane, etc. It detects the presence of a dangerous LPG leak in your car or in a service station, or storage tank environment. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG, and cigarette smoke. If the LPG sensor senses any gas leakage from storage the output of this sensor goes low. This low signal is monitored by the microcontroller and sends the signal to the GSM module to send messages as "Gas Leakage" to a mobile number written in code.

## 4. HARDWARE REQUIREMENT

### A. Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced with various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), and 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo.

The Arduino Uno has a number of facilities for communicating with a computer, another

Arduino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an information file is required. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows serial communication on any of the Uno's digital pins.

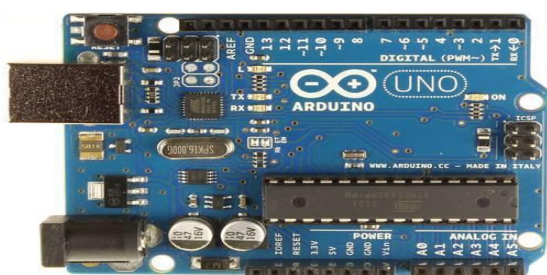


Figure 1: Arduino UNO

#### B. SIM800 GSM Module

SIM800 is a quad-band GSM/GPRS module designed for the global market. It works on frequencies GSM 850 MHz, 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 24x24mm, SIM800 can meet almost all the space requirements in users' applications, such as M2M, smartphones, PDA, and other mobile devices. SIM800 is a quad-band GSM/GPRS module designed for the global market. It works on frequencies GSM 850 MHz, 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 24x24mm, SIM800 can meet almost all the space requirements in users' applications, such as M2M, smartphones, PDA and other mobile devices.



Figure 2: SIM800 GSM Module

#### A. MQ-135 Gas 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 the gas sensor increases as the concentration of polluting gas increases. MQ-135 gas sensor can be implemented to detect smoke, benzene, steam, and other harmful gases. It has the potential to detect different harmful gases. It is 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.



Figure 3: MQ-135 Gas Sensor

#### A. LCD Display

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These

displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc. The main advantages of this LCD device include power consumption is less and low cost. The main disadvantages of this LCD device include it occupies a large area, slow devices, and also lifespan of these devices will be reduced due to direct current. So these LCDs use AC supply with less than 500Hz frequency.



Figure 4: LCD display

### 5. CIRCUIT DIAGRAM

The circuit diagram for the gas leakage detector using Arduino and GSM Module is shown below.

Supply MQ135 Sensor with 5V Power Supply. Connect its Analog pin A0 to Analog pin A0 of Arduino. Similarly, Connect the GSM Module with 9V/12V external Power Supply. Only the Tx, Rx and GND pin of Sim800 Modem is connected to Arduino. So, connect Tx & Rx to Pin No. 9 & 10 of Arduino respectively. Connect the LCD to pin no 7,6,5,4,3,2 of Arduino. Supply it with 5V Power Supply. Use a 10K POT to adjust the contrast.

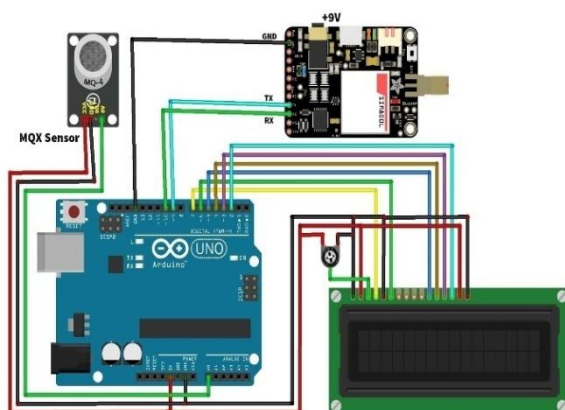


Figure 5: Circuit Diagram

When the circuit is powered on after uploading code, the LCD displays the Gas Level in some analog numbers. It will display the status of

whether the gas level is normal or excessive. When the gas level exceeds it will display SMS Sent status.

This circuit triggers the alert system when smoke or gas leakage is detected. The circuit mainly uses the MQ135 Smoke/Gas sensor and Arduino to detect smoke and gas leak. The sensor has excellent sensitivity combined with a quick response time. This low signal is monitored by the microcontroller and sends the signal to the GSM module Sim800 to send messages as "Excess Gas Detected. Open Windows" to a mobile number written in code.

### 6. RESULT & CONCLUSION

This system and tool work as expected, and is able to detect LPG gas leaks that occur. With this system and tool, the people who use it feel safe and comfortable. In other words, do not worry about the danger if there is an LPG gas leak that is unknown to the owner. Because this system and tool can send information to the owner if an unknown LPG gas leak occurs through an SMS message sent to the owner's mobile.

### REFERENCES

- [1] Tombeng, M. T. (2015). "Smarthome for Home Safety and Monitoring System Using Smartphone Application and Zigbee Wireless Communication", Konferensi Nasional Sistem dan Informatika. ISSN: 2460-8378, p. 402. Bali: STIKOM.
- [2] Novi Rahayu, "Early warning of Leaking LPG Gas through Short Message Service (SMS) and Loudspeaker Tool using Arduino Uno", Journal of Applied Engineering and Technological Science Vol 1(2) 2020: 91-102.
- [3] Zainal H. C. Soh, Syahrul A. C. Abdullah, Mohd A. Shafie and Mohammad N. Ibrahim, "Home and Industrial Safety IoT on LPG Gas Leakage Detection and Alert System", International Journal of Advance Software Computer Application, Vol. 11, No. 1, March 2019 ISSN 2074-8523.
- [4] Fraiwan, L., et al. A wireless home safety gas leakage detection system. in Biomedical Engineering (MECBME), 2011 1st Middle East Conference on. 2011. IEEE.
- [5] Mustafa, K. and H. Gitano-Briggs. Liquefied petroleum gas (LPG) as an alternative fuel in spark ignition engine: Performance and emission characteristics. in Energy and Environment, 2009. ICEE 2009. 3rd International Conference on. 2009. IEEE.
- [6] Fauadi, Muhammad HafidzFazli Md, Suriati Akmal, Mahasan Mat Ali, Nurul IzahAnuar, Samad Ramlan, Ahamad ZakiMohd Noor, and Nurfadzylah Awang. "Intelligent Vision-based Navigation System for Mobile Robot: A Technological Review." Periodicals of Engineering and Natural Sciences (PEN) 6, no. 2 (2018): 47-57.
- [7] Sabharwal, N., et al., A low-cost zigbee based automatic wireless weather station with GUI and web hosting facility. 2014, ICRTEDC.
- [8] Mahmood, S.N. and F.F. Hasan, Design of Weather Monitoring System Using Arduino Based Database Implementation. Journal of Multidisciplinary Engineering

Science and Technology (JMEST), ISSN, 2017: p. 2458-9403.

- [9] Andrade, P. B., Cruvinel, P. E., & Pe, E. A. (2018, January). Module for Virtual Calibration of Sensors of Agricultural Spraying Systems (Temperature, Pressure and flow) Using an Arduino-Based Architecture and a Controller Area Network Bus (CAN). In 2018 IEEE 12th International Conference on Semantic Computing (ICSC) (pp. 352-357). IEEE.