International Journal of Research Publication and Reviews

LPG GAS LEAKAGE DETECTION SYSTEM

Anant Suryavanshi[1], Atharva Gawande[2], Atharva Gumte[3], Shreeyash Gawade[4], Ishwari Ghaysundar[5], Aditya Gite[6], Mrunal Gorghate[7]

Department of Engineering, Sciences and Humanities (DESH)
Vishwakarma Institute of Technology, Pune, 411037, Maharashtra, India

ABSTRACT:

This research focuses on making homes and workplaces safer by using a smart system to detect gas leaks. We know that traditional systems sometimes don't warn us quickly enough, so we've designed a new system using Arduino. .

Our system has special sensors placed in key areas that can quickly detect if there's a gas leak. These sensors are connected to a central control system. This means we can monitor and control the system remotely.

We've made sure that the sensors are really good at accurately finding gas leaks by calibrating them properly. We've also added features to the system, like sending alerts or sounding alarms, so you know immediately if there's a problem and we have also added the feature of turning the main supply off.

Our tests show that the system works well in quickly and accurately detecting gas leaks. This means it can help keep you and your surroundings safer. In the future, we hope to make the system even better based on what we've learned.

Keywords: Arduino, LPG, Fire detection, Gas leakage detection, GSM Module, Gas Leakage Prevention).

INTRODUCTION :

Liquefied petroleum gas (LPG or LP gas), is a combination of flammable hydrocarbon gases which is utilized as fuel for cooking, and transportation purposes. It is a combination of 48% propane, half butane, and 2% of pentane. LPG is set up by refining petroleum or wet flammable gas and it is essentially obtained from petroleum product sources, being made during the refining of petrol such as crude oil, or extricated from petrol or flammable gas streams as they rise out of the ground. It was first invented by Dr. Walter Snelling in 1910, and it was first commercialized in 1912.

The use of this cylinder LPG (Liquefied Petroleum Gas) in day-to-day lives is part of the modern lifestyle, particularly as far as cooking, in light of the fact that the fire delivered from LPG gas itself is a spotless fire. Due to high availability and sustainable price range, LPG is used by almost every range of people. Among the user's majority of the people are unaware of the deadlines of this very dangerous useful product, they don't have any proper knowledge about how to prevent any accident or danger which may be caused by this gas.

Most of the accidents or blast is because of irregular maintenance of the gas line, cylinder or other accessories which are used to transfer or use the gas. If anyone inhales it by mistake it can cause suffocation because it is heavier than air. LPG is very highly flammable by its nature so we have to make sure that gas shouldn't occur but the issue of LPG leakage and fire is frequently experienced in our everyday life. So, LPG is a profoundly combustible gas used mainly for cooking in the kitchen. Leakage of this LPG gas increases the danger of suffocation, building fire even a blast. Consequently, there are a lot of things we need to include when utilizing LPG gas in our daily lives. This outcome is an unpredictable gas leakage that is emerging, which is probably going to be the reason for a fire. Extra measures should be taken in case any gas leakage occurs, the situation should be taken before any fire/blast could happen because of its highly sensitive and flammable nature it can cause great disaster if any fire source is exposed to the gas so special countermeasures should be taken for the gas leakage.

The greatest gas mishap on the planet is the Bhopal gas tragedy in India in 1984 which executed a huge number of lives [Sharif, Amina. (2020). Case study for Bhopal Gas Tragedy. 10.13140/RG.2.2.16473.75364.]. In the last two years, some major gas blasts have taken place in Bangladesh. Among them, the Chawkbazar blast which caused the death of 70 lives, and recently a blast in a mosque at Narayanganj Caused 24 deaths.

In this paper, we built an Arduino-based framework that helps to prevent accidents related to LPG leakage and also, along these lines keep the user informed through a smart application. The device is an intelligent piece of home computerization framework, as at the point whenever gas spillage is detected it alarms the customer through a GSM signal (SMS). All the while, it sounds the buzzers to alert nearby people. The framework is planned to such an extent that it very well may be utilized as a LPG chamber stand. The device is capable of identifying the gas and send accurate information

directly to the user via GSM module as quickly as possible. The algorithm is designed to detect and produce results as quickly as accurately possible to prevent any accident/blast from happening. The device is also environment friendly and comparatively cheap to obtain than other available products in the market.

Methodology/Experimental

The proposed system "LPD Gas Leakage Detection System." is able to deal with gas leakage detection, & alerting its owner to take precautions. Here, Gas sensor (MQ5) is interfaced with the Arduino UNO, which contains the ATMEGA328 microcontroller. The given sensor is collecting the environment data as Input. The interface GSM module SIM800l is able to connect with a cellular network. GAS sensor (MQ5) detects gas leakage by counting threshold (ppm). As soon as it detects the high concentration of LPG gas, the Owner should be notified by SMS and the buzzer will turn on as an alerting system so that he/she can take the necessary step. The responses of all sensors are also visible in LCD16*2-Display. Figure.01 is showing the working method of the entire system.
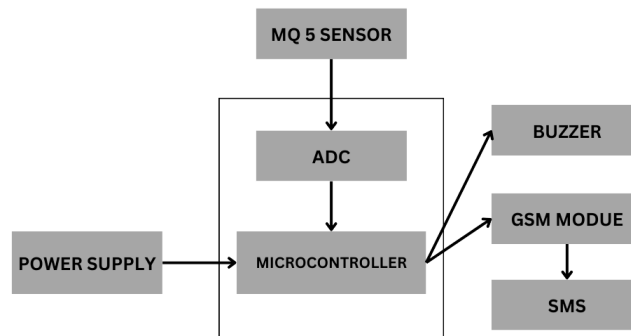

Figure 01. Conceptual Diagram

Materials/Components:

Arduino UNO

Figure 02. Arduino Uno Board

The Arduino UNO is based on the Microchip ATmega328P microprocessor in the Microcontroller Board. This board has 14 digital pins & 6 analog pins. Out of 14 digital pins, 6 pins supported PWM. By using a Type B USB port, it is programmable along with the connection of other sensors. Its required voltage is between 7V to 12V. It's an open-source microcontroller board and its hardware reference design is available on the Arduino website.

MQ-5 Sensor

Figure 03. MQ5 Sensor

Gas Sensor(MQ5) module is useful for gas leakage detection (in home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible.

SIM800L GSM Module

Figure 04. GSM SIM800L Module

SIM800L module is a small cellular module that performs GPRS/GSM transmission, sending, and receiving SMS. It also can make voice calls and receive voice calls. This module is usually used for small ideal projects. This module is also cost-efficient. This module supports quad-band frequency which makes this module a perfect solution for any project such as needs as long-range connectivity. The GSM SIM800L module works at a 2Amps peak current. The low power consumption feature is available in this module that consumes only 1mA current when it's in sleep mode. The power supply of this module is very specific, it needs 3.7v-4.2v as per the datasheet. If the power supply is higher than 4.7v, it will damage the module. Also, the buck converter is used to achieve this voltage range.

Buzzer

Figure 05. Buzzer

A buzzer is a small and efficient component to add sound or alarm features to any project or system. It can create mechanical, electromechanical, or piezoelectric sound. There are two types of buzzers available. The first one is very simple which can make a continuous beeping sound and another is a ready-made buzzer that can make a Beep. Beep. Beep. Sound. In this project, we are using the second one which can make a Beep. Beep. Beep. Sound and increasing with time.

Lipo Battery

Figure 06. Lithium-ion Battery 3.7V

A 3.7v lithium polymer battery is known as a lipo battery. This battery is rechargeable. This battery is commonly used in various types of small projects or drones. The benefit of using this battery is that this battery is thin, light, and powerful.

Flowchart

When the system is turned on, the sensor Gas (MQ5) will enable it to detect and check the environment. The MQ25 sensor will read the value of concentration and if it detects the value of the GAS threshold, the next step should be Alert! the owner Via SMS and the buzzer will start beeping for Alert. Fig 07. shows how the system works.
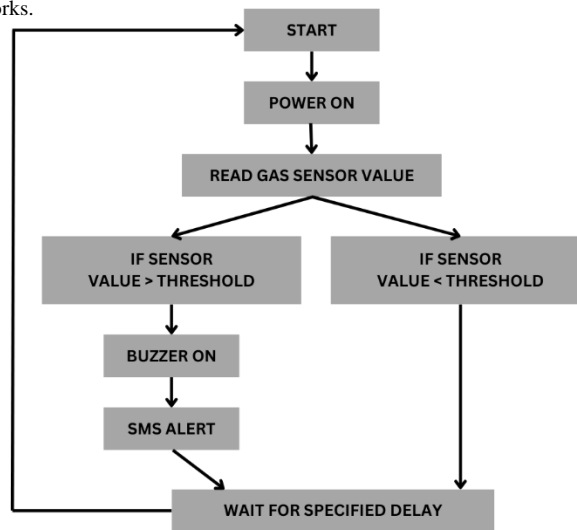

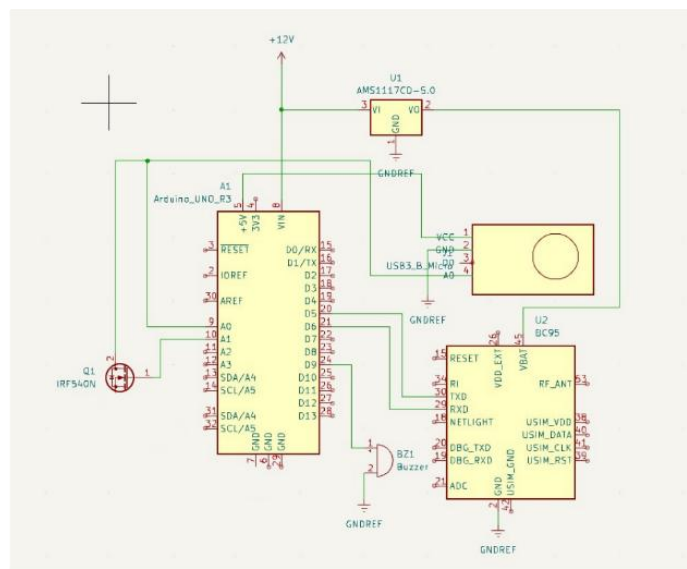
Fig 07. Flowchart

Block Diagram

Figure 08. System Diagram.

The proposed system connection is explained in Figure 11. Here Arduino UNO is the Brain of this system which is getting all the inputs and output from sensors.

Theory

Arduino IDE Program: An IDE is available on the official website of the Arduino microcontroller which is arduino.cc. From this website, we are able to download the software and program the microcontroller according to the system's needs. Here, in this system SIM800L module was used for the function to send a message which was accessed in the system by adding SIM800L Library in IDE programming.

System Prototype:

In this system prototype part, smart LPG GAS leakage and fire detection system consisting of a number of components connected that are explained below:

A. Arduino Uno is the main controller of all existing components that are connected to it.

B. Bread Board is used as a connector between one another components.

C. MQ5 sensors detect the intensity of the Gas, if the LPG cylinder is leaked or not.

D. SIM800L GSM module is used as an

interaction device for sending emergency SMS and Call for gas leaking and fire detection.

E. The buzzer will buzz up when any of the sensors detect any incidents.

F. Jumper cable used to connect all through components.

SMS & Call Delivery Scheme:

Whenever the input sensors detect a specific incident, it will send an analog signal to the microcontroller Arduino Uno. In Arduino, programming was done as expected to function the sensors. And the GSM Module is the gateway to send emergency SMS to the owner or the user for Alert! And the buzzer, will turn on for safety reasons. Here, for interfacing GSM SIM800L modules with Arduino, we used RX, TX pin and a Valid sim card must be present in the module.

Results and Discussions

Figure 09. SMS Alert System

When the leakage of LPG has detected the buzzer turns on, a message will be sent to the user contact number every 20 seconds as shown in Fig 09. All the while the exhaust fan also turned on for transferring the gas outside to prevent any accident or blast from happening. The alert system will continue until any action is taken to take control over gas leakage.

Conclusion

LPG is very sensitive to fire. Nowadays the usage of LPG gas is too much in various kinds of necessities. It is almost a part of the daily lifestyle. So, the risk of the leakage damages of gases is also increasing with a parallel speed. In this circumstance, a smart gas leakage detector is needed to detect leakages and fires. On the other hand, an alarm, SMS, or phone call will be sent to the owner so that the owner can control the situation in time before causing so much damage. The outcome of each module should be seen in the LCD 16*2 Display. Buzzer turns on and alerts if any leakages of LPG or fire have been identified. Above all, the damage that occurred by gas leakages can be reduced a lot by using this Smart LPG Gas Leakage Detection and Prevention System.

REFERENCES :

1. S. Shrestha, V. P. K. Anne and R. Chaitanya, "IoT Based Smart Gas Management System," 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI), Tirunelveli, India, 2019, pp. 550-555, doi: 10.1109/ICOEI.2019.8862639.
2. K. Keshamoni and S. Hemanth, "Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT," 2017 IEEE 7th International Advance Computing Conference (IACC), Hyderabad, India, 2017, pp. 330-332, doi: 10.1109/IACC.2017.0078.

3. Fatkiyah, E., Persada, D., & Andayati, D. (2019). Early Detection of Leaks on Gas Cylinders Using Arduino Based MQ-6 Sensors. Journal of Physics: Conference Series, 1413(1).

4. Tukkoji, Dr. Chetana, and Sanjeev Kumar A. N. 2020. "LPG GAS LEAKAGE DETECTION USING IOT." International Journal of Engineering Applied Sciences and Technology 04 (12). IJEAST: 603–9. doi:10.33564/ijeast.2020.v04i12.108.

5. Rahul Nalawade et.al (2018) "Iot Based Gas Leakage Detection and Alert Generation", a. International Journal of Future Revolution in computer science & communication engineering ISSN: 2454-4248, 2018, volume4, Issue-5, 175-176.

6. Hasibuan, M.S., Syafriwel, Idris, I., 2019. Intelligent LPG Gas Leak Detection Tool with SMS Notification, in: Journal of Physics: Conference Series. Institute of Physics Publishing. doi:10.1088/1742- 6596/1424/1/012020.

7. Srivastava, A.K., Thakur, S., ... Raj, A., 2019. IoT based LPG cylinder monitoring system, in: Proceedings - 2019 IEEE International Symposium on Smart Electronic Systems, ISES 2019. Institute Electronic copy available at: https://ssrn.com/abstract=3884477 of Electrical and Electronics Engineers Inc., pp. 268–271. doi:10.1109/iSES47678.2019.00066.

8. IoT-based LPG Gas Leakage Detection and Prevention System Pushpendra Kumar Pateriyaa*, Ali Azam Munnab , Arnob sahac , Harichad Biswasd , Aljami Ahammede , Abishek Shahf , Email: pushpendra.mnnit@gmail.com; mmunna0221@gmail.com; arnob.11719001@gmail.com; harichadbiswas24@gmail.com; aljamiador13@gmail.com; abishekshah670@gmail.com; School of Computer Science & Engineering Lovely Professional University, Phagwara, Punjab, India