



# LPG Gas Detector with Automatic Shut Off

Priyanka Yalgodkar<sup>1</sup>, Shruti Kaule<sup>2</sup>, Pranav Khijinkar<sup>3</sup>

Electronic and Telecommunication Department, Pune District Educational Associations College of Engineering,  
Manjari(BK), Pune<sup>1-3</sup>

**Abstract:** Gas leakage poses a significant threat in residential and industrial environments, often leading to hazardous situations like fires and explosions. This paper presents a Smart IoT-based Gas Leakage Detection and Auto Shut-off System that enhances safety by integrating real-time monitoring with an automated response mechanism. The system detects gas leaks using an MQ-6 sensor and promptly shuts off the gas supply through a servo motor-based valve control. Additionally, an alert notification is sent to users via an LCD display and buzzer to ensure immediate awareness. This paper discusses the half implemented version of the system, focusing on gas detection and auto shut-off functionalities. The proposed system improves upon existing gas detection techniques by offering a cost-effective, highly responsive, and automated approach to preventing gas-related accidents.

## I. INTRODUCTION

Gas leaks pose a serious threat to residential, commercial, and industrial areas as well as gas-powered transit vehicles in Nigeria and several other developing countries [1]. The havoc wrecked by gas leakage has not ceased to be common news on media, and a serious threat to lives and properties [2]. Therefore, it is essential to device measures to intelligently detect and control gas leakage, thereby controlling fire outbreak in homes and industries. Gas leakage has been said to be the most prominent cause of fire outbreak in homes and industries leading to non-redeemable loss of several lives and valuable properties [3, 4]. Recently, fire outreach has gone beyond control claiming lives and properties from 2 This paper presents the design and construction of a GSM-based gas leakage detector with audio-visual alert and automatic shut off control , built around an ATmega 328P microcontroller. The microcontroller is programmed to intelligently handle the whole operation of the gas detection and control system. This design provides an intelligent solution to solve the identified problems of increasing events of fire outbreak due to gas leakage, by providing quick alerting means on the occurrence of gas leakage detection and stopping further leakage by an automatic homes to industries to petroleum and filling stations in the nations of the world [5, 6]. Bhopal gas accident in India was reported to have been the worst gas leakage industrial accident ever experienced in the world [7]. The cases of fire outbreaks in houses are on the increase resulting from different sources ranging from burning bush, unprotected campfire, and electrical fire outbreak to gas leakages resulting into fire having the highest cause of such fire outbreak [8, 9]. Research posits that fire outbreaks claim several lives and cause loss of very valuable properties, which are non-redeemable in some cases [10]. This paper presents the design and construction of a GSM-based gas leakage detector with audio-visual alert and automatic shut off control, built around an ESP 32 microcontroller The microcontroller is programmed to intelligently handle the whole operation of the gas detection and control system. This design provides an intelligent solution to solve the identified problems of increasing events of fire outbreak due to gas leakage, by providing quick alerting means on the occurrence of gas leakage This paper presents the design and construction of a GSM-based gas leakage detector with audio-visual alert and automatic shut off control, built around an ESP32 microcontroller. The microcontroller is programmed to intelligently handle the whole operation of the gas detection and control system. This design provides an intelligent solution to solve the identified problems of increasing events of fire outbreak due to gas leakage, by providing quick alerting means on the occurrence of gas leakage detection and stopping further leakage by an automatic shut off of the gas main source. This paper also offers a very accurate and reasonably cost efficient method for detecting gas leaks, promptly alerting the user within the immediate environment of the appliance through an audio sound (beeps) and a Light Emitting Diode (LED), turn off the gas supply and notify someone off-site (or user) about the incident so that emergency services can be called in case any further action is needed. The system has been constructed to guarantee that the occurrence of gas leakage is intelligently detected, instantly notified, interactively monitored, and automatically regulated, unlike traditional unintelligent ring-ring fire alarm systems. This will reduce occurrence of fire outbreak and all forms of associated losses This study significantly seeks to extend the human ability to monitor, control and secure. It ultimately seeks to ensure the security of human lives and properties by possibly reducing to minimum or eliminating fire outbreak in residential houses, industries and gas stations in extension. Section II of this paper presents a review of related literatures, section III outlined the system design approach, while construction and testing, and conclusion and recommendations are presented in section IV and section V respectively



## II. PROBLEM STATEMENT

Domestic LPG leakage incidents continue to cause accidents because leaks often remain unnoticed until gas concentration becomes dangerously high. Existing household setups generally lack an integrated system that can detect LPG leaks at an early stage, alert users locally and remotely, and automatically isolate the gas source. The problem addressed in this work is the absence of a compact, cost-effective, and user-friendly smart device that can continuously monitor LPG concentration, provide timely multi-channel alerts, and perform automatic safety actions to minimize the risk of fire, explosion, and suffocation in domestic environments.

## III. OBJECTIVE

The primary objective of this project is to design and develop a smart gas leakage detection system with an automatic shut-off mechanism. Specific objectives include:

- **Real-time monitoring of gas concentration using the MQ-6 sensor:** The system continuously monitors the surrounding environment for gas leaks using an MQ-6 gas sensor. The sensor detects even minor leaks, ensuring early detection before the situation escalates. The real-time data is processed by the microcontroller to determine if gas levels exceed a predefined threshold.
- **Automatic shut-off of the gas supply when a leak is detected:** If the sensor detects a gas concentration above the safe limit, the microcontroller immediately activates a servo motor. The servo motor turns the gas valve off, stopping further leakage and preventing hazardous incidents such as explosions or fires. This automatic intervention eliminates the need for manual action, reducing the risk of human error.
- **Providing immediate local alerts via a buzzer and LCD display:** When a leak is detected, the system activates an alarm using a buzzer to alert nearby individuals. An LCD display provides real-time updates about the gas concentration and system status, ensuring users are informed. This feature is particularly useful in households, kitchens, and industrial environments where quick response is necessary.
- **Enhancing safety by reducing human intervention in emergency situations:** Traditional gas safety measures often rely on human intervention, which may be delayed or ineffective in emergencies. The proposed system automatically detects and mitigates leaks, ensuring a proactive approach to gas safety. By minimizing the need for manual responses, the system increases efficiency and reliability in handling gas-related hazards.
- **Developing a scalable system that can be expanded with GSM and IoT features in future iterations:** The current implementation is a standalone system but is designed with scalability in mind. Future enhancements may include GSM-based alerts, where users can receive SMS notifications regarding gas leaks. IoT integration can further enable remote monitoring via mobile applications or cloud-based systems, accessibility and control.

## IV. DEVELOPMENT AND TESTING

### SMART LPG CYLINDER MONITORING SYSTEM

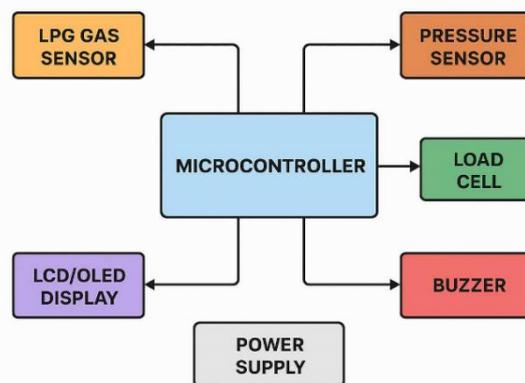


Fig. 1 A sample graph



The construction demonstrates how the design's objectives were achieved by converting the paper work into a finished hardware design. The design was implemented by soldering and connecting all the different pieces in construction on a Printed Circuit Board (PCB) as shown in Fig. 5, and then tested to verify correct functionality. This was done after carrying out all software development and hardware design. To guarantee the system's proper functionality as described, it was built in three stages: the use of a breadboard, a solderless experiment board, before final implementation. Additionally, circuits were soldered on PCB, and connection of everything together was done, and the system was enclosed in a case.



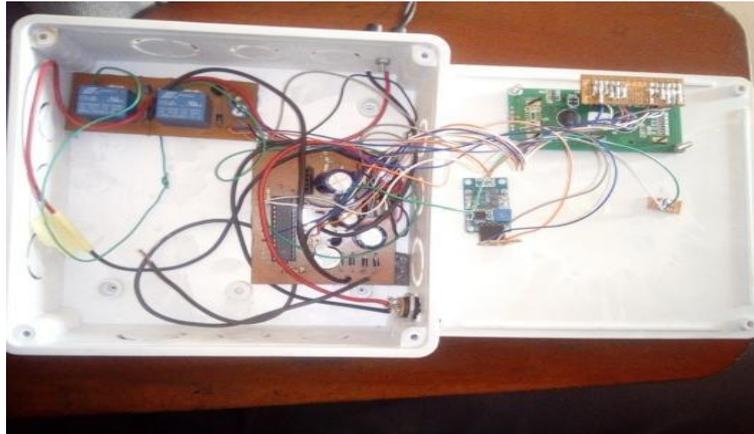
## V. IMPLEMENTATION

The concept was successfully implemented for the first time on a breadboard, meeting all of the goals and objectives and operating as predicted at every level. In addition, the PCB was designed as shown in Fig. 5. Then, the power supply was soldered. Also, the electric valve controller was connected to hose on both sides as shown.



## VI. SOLDERING

Several circuits and components of this system design were soldered in tandem to meet desired functionality of the design. The power supply stage was first soldered before the microcontroller, lcd display and transistor-relay stages were done. The soldering of the system was done on pcb the pcb contains the power supply stage, the microcontroller stage with the transistor-relay stage and other five outputs, which are lcd, led, buzzer, gsm module and valve controller. All the components mentioned were connected with soldered power supply board in a casing as shown.



**VII. COUPLING AND PACKAGING**



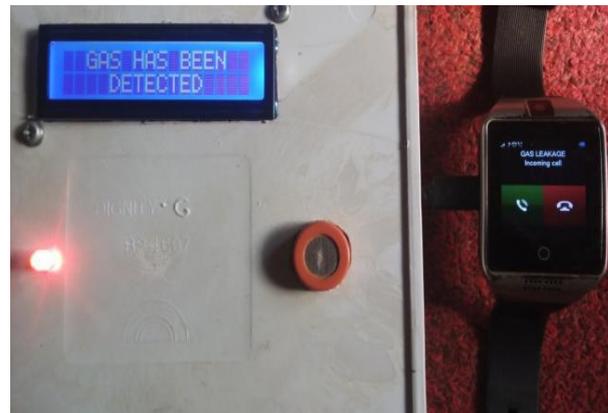
**TESTING**

Some testing and measuring equipment such as bench power supply, oscilloscope, and digital multi-meter were used in the testing and implementation stage. The setting up of the system is displayed in while shows the initial state of the system. shows the system set up when no gas leakage is detected, and shows the system with wrist wash displaying the state of the off-premises device





The LED gives no light, the buzzer gives no sound and the GSM module did not dial any number when no gas leakage was detected. Immediately gas was detected, the LED turns on red light, buzzer started making loud sound, the GSM module dialled the pre-determined number as captured in Fig. 13 and The audio-visual features functioned accurately.



## VIII. CONCLUSION

Finally, few factors such as components availability, compatibility, durability, research materials, economic application, efficiency, portability and cost were put into consideration in this system design. Additionally, the design specification for electronic device was not compromised in this design. Soldering and positioning of the components on the PCB were well done to ensure proper operation of the system, while the testing was properly carried out to ensure accurate functionality. Nevertheless, the overall workability of the design, and its performance is dependent on the user who is prone to human error. Performance may also be impacted by handling, usage, ventilation, packaging, and transportation.

Conclusively, the design and construction were done in such a way that maintenance and repairs are easy and affordable for the user in case of any breakdown. In general, the research gives good exposure to practical digital electronics, which is one of the main obstacles in the field of electronics as of today. Despite all the challenges involved, the design is eventually a significant contribution to the security of human lives and properties.

### B. Recommendations

This system design can be improved upon in case of future project work. Also, there is a room for improvement in this design work due to some limitations such as: the unstable nature of power supply in Nigeria and inability to detect the exact point of gas leakage on the appliance. Therefore, further research can be carried out to improve on this design, while reducing the size and cost considerably through the use of solar power system to power the design, the use of GPS to detect the exact point of gas leakage as used by [16] and the use of ICs with higher scale of integration (smaller ICs) can result in significant reduction in the circuit size.

The heading of the Acknowledgment section and the References section must not be numbered. Causal Productions wishes to acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template.



## REFERENCES

- [1]. R. Abu, K. Patchigolla and N. Simms, "A Review on Qualitative Assessment of Natural Gas Utilisation Options for Eliminating Routine Nigerian Gas Flaring," *Gases*, vol. 3, no. 1, pp. 1-24, 2023.
- [2]. A. O. Oke, O. M. Olaniyi, O. T. Arulogun and O. M. Olaniyan, "Development of a Microcontroller-controlled Security Door System," *The Pacific Journal of Science and Technology*, vol. 10, no. 2, pp. 398-403, 2009.
- [3]. A. O. Oke, A. S. Falohun and A. B. Adetunji, "Development of A GSM - Based Fire Detector System," in *Proceedings of the World Congress on Engineering 2015 (WCE 2015)*, London, U.K., 2015.
- [4]. A. K. Idowu, O. Ijarotimi and O. J. B. Babatunde, "Development of a Robust Microcontroller Based Gas Leakage Detector for Nigeria Homes," *Imperial Journal of Interdisciplinary Research (IJIR)*, vol. 3, no. 9, 2017.
- [5]. G. K. Adewuyi, "Assessment of Fire Service Station Response to Filling Stations Fire Outbreak and Vulnerable Healthcare Centers to Filling Stations in Urban Settlement," *International Journal of Research and Review*, vol. 7, no. 3, pp. 10-30, 2020.
- [6]. S. Adenubi, D. Appah, E. Okafor and V. Aimikhe, "A Review of Leak Detection Systems for Natural Gas Pipelines and Facilities," *International Journal of Energy Technology and Policy*, vol. 13, no. 2, pp. 9-19, 2023.
- [7]. A. Sharif, "Case study for Bhopal Gas Tragedy," in *P P Savani University Conference*, India, 2020.
- [8]. V. Ramya and B. Palaniappan, "Embedded system for hazardous gas detection and Alerting," *International Journal of Distributed and Parallel System (IJDPS)*, vol. 3, no. 3, p. 287, 2012.
- [9]. A. S. Falohun, A. O. Oke, B. M. Abolaji and O. E. Oladejo, "Dangerous Gas Detection using an Integrated Circuit and MQ-9," *International Journal of Computer Applications (0975 – 8887)*, vol. 35, no. 7, pp. 30-34, 2016.
- [10]. K. PadmaPriya, M. Surekha and R. Preethi, "Automatic Refill Booking Using," *International Journal of Key Scientific Research for Industrial Engineering and Technology*, vol. 1, no. 1, pp. 01--5, 2014.