



GAS LEAKAGE DETECTOR SYSTEM WITH SMS ALERT

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ABSTRACT

Liquefied Petroleum Gas (LPG) is a main source of cooking fuel, especially in metro areas because it's clean compared to firewood and charcoal. Gas leakage is a major problem both in industrial sector and residential premises. Presently, home security has become a major concern due to increasing gas leakage. Gas leakage is a source of great anxiety in industrial, residential areas and vehicles like Compressed Natural Gas (CNG), buses, and cars which are run on gaspower. One of the precautionary approaches to stop accidents associated with the gas leakage is to put in place a gas leakage detection device at vulnerable places. This paper is to implement and discuss a design of a gas leakage detector system with SMS alert that can automatically detect and alert gas leakage. This proposed system also includes a notifying system for the users. This is a sensor based device that easily detects a LPG leakage.

I. INTRODUCTION

This journal is an implementation of gas detection system using GSM network. This unit gas detection system with SMS alert is a newly advent gas detector device using MQ-9 gas sensor and microcontroller. It's a sophisticated gas sensing method different from the existing systems due to its unique features. LPG gas is a mixture of propane and butane which are highly flammable chemicals. It's an odourless gas in its natural state to which Ethyl Mercaptan is added as powerful smelling agent, so that leakage can be easily detected. LPG leakage can be detected in the cars, industrial sectors and residential areas using an Ideal Gas Sensor. This LPG gas leakage detector unit can easily be implemented into a unit that can sound an alarm or send a notification of the LPG concentration via GSM network. The sensor used in this research has both admirable sensitivity and rapid response time. This device can be used as well to sense other gases like isobutane, propane, LNG and even cigarette smoke. The output of sensor goes LOW as soon as the LPG sensor senses any gas leakage. This is sensed by the microcontroller and the LED & buzzer are turned ON. With a delay of about few milliseconds, the exhaust fan is also turned ON for throwing the gas out and a "GAS LEAKAGE" message is sent to a predefined mobile number using GSM Module.

1. Statement of problem

Gas leakages are a common problem in homes and industries. If not detected and corrected at the right time, it can cause lost of lives and properties. Potentially deadly carbon monoxide is also very dangerous to life. A leakage of natural gas can be dangerous because it increases the risk of fire or explosion. Local gas companies work hard to provide adequate warning in the event of a gas leak. Because methane—and therefore, natural gas—does not have any odour, the gas company adds a warning "rotten-egg" smell (mercaptan or a similar sulfur-based compound) that can be easily detected by most people. However, people who have a dimi-

nished sense of smell may not be able to rely upon this safety mechanism. Also the leak might occur at a time when no one is in the vicinity which increases the risk of an explosion.

2. Significance of the Project

This research work can be used to checked gas leakages at home, in a car, storage tank area or in a pump station. This can be easily implemented to industrial level by upgrading its ranges. This research work is important in every home, office and industries because there are many gases that can be harmful to organic life. This work helps people to upgrade their safety standards, comply statutory even though it has small sensitivity to detect alcohol, it can be used as liquor tester. The system has excellent sensitivity combined with a quick response time. The most important and basic function is to prevent accidents and protect life and property from fire outbreak. It provides along lasting safety means for detecting the leakage of gas into the area of an appliance when the appliance is in a shutdown condition or not in use. It provide a novel gas detection and monitoring system which is economical to manufacture and which may be readily installed in conventional trailers, boats or the like which are usually dependent upon a stored supply of pressurized gas.

II. METHODOLOGY

The block diagram of GSM-based gas leakage detection and alert system is illustrated in Fig. 1. The system design is achieved by using top-down approach. The hardware module is designed first as indicated in the block diagram of fig.1. The software module is developed using C-language. The design focuses mainly on module integration and interfacing of the system. The system architecture has different five functional units and each unit requires input to generates desired output.



Figure 1: The Block Diagram of the GSM Based Gas Leakage Security Alert System

A. GAS SENSOR:

MQ-9 Sensor unit: The most common gas leakage at homes/industries are carbon monoxide and liquefied petroleum gas (flammable gases), MQ-9 gas sensor as shown in fig.2. is deployed to detect any gas leakages and report to the control unit of the system.



Fig.2: MQ-9 Gas Sensor

MQ-9 is a Sensor designed to detect carbon monoxide/Combustible gas and it does detection by the method of cycle high and low temperature. It can sense carbon monoxide when low temperature heated by 1.5V is supplied. The sensor's conductivity is higher along with the gas concentration rising at high temperature (heated by 5.0V). It detects Methane, Propane combustible gas and

cleans other gases adsorbed under low temperature. The sensor could be used to detect any gases containing carbon monoxide and combustible gases, at low cost and suitable for different applications.

B. PIC MICROCONTROLLER:

PIC microcontrollers are popular processor developed by microchip technology with built-in RAM, memory, internal bus and peripherals that is used for many applications. PIC originally stood for Programmable Intelligent Computer but is now generally known as a Peripheral Interface Controller. The PIC microcontroller consists of inbuilt ADC in it. The analog output from the gas sensor is converted to digital signal. The programmed instructions are fed into the microcontroller. It's connected to relay, GSM module, buzzer and exhaust fan. When the gas leakage is detected, the exhaust fan is switched on. The buzzer produces an alarm to indicate leakage. Through the GSM module, an SMS is send to the user for alerting. The PIC microcontroller performs the controlling operation. PIC16F877A was used in the implementation of this project work. It has totally 40 pins. Its memory size is 16 bits.

C. GSM MODULE:

SIM900 GSM Modem Unit: SIM 900 is for frequency GPRS/GSM modem and an ultra- compact and reliable wireless modem. It is a breakout board and sim900 quad band GPRS/GSM modem as shown in fig.3. It can communicate with microcontroller via MAX232 driver, activated using AT commands. This module supports software power on and reset. The GPRS is configured and controlled via its universal asynchronous receiver transmitter, UART using simple AT commands.



Fig.3: Sim900 GSM Modem

PRINCIPLE OF OPERATION

When the system is switched ON, the default inbuilt LED on the board blinks that indicates power has been supplied to the board. The system initializes the sensor, security alarm and GSM modem through the uploaded sequence of written codes. The MQ-9 sensor keeps monitoring gas leakage and when it detects, it sends signal to the PIC16F877A microcontroller which processes the signal, activate the security alarm and send SMS alert to the owner through the SIM900 GSM modem. The alarming and monitoring continues until action is taken.

System Flow Chart

The system program is written using the flow chart shown in Fig.:4. The system first initialized, and reads input sensor. If the gas is leaking, the sensor detects and sends signal to control unit which then activate alarm and sends sms to the user. If the gas is not leaking, the system continues to check the sensor until it senses gas leakage.

Fig.4: Gas leakage and alarm system flow chart

Results & Discussion

Testing was carried out by releasing LPG into the atmosphere around the sensor. The gas detector and response unit are there to detect it. The results of test carried out on the device at different times and days for concentration of gas in the air around the sensor. The last four values is the case of an endless loop due to high gas concentration. The device was tested placing the LPG device at different distances from the gas source. It was observed that when the LPG device was test by placing it at different distances from the gas source, the response time of the LPG system decreased as the distance from the gas source increased. Also it was observed that the sensitivity of the gas sensor was very high in clean air. The gas sensor sensitivity varied with temperature while the reference voltage remained constant over time. At constant gas concentration, the sensed voltage will always be constant. The gas sensor has a very fast response to gas since the time difference between test results with same concentration is very small while the difference between the sensed voltages is very high.

Conclusion

A gas leakage detection and alert system has been developed in this work. The developed system will not only detect LPG leakage but go further to prevent further leakage if the cause of the leakage is due to accidental or deliberate opening of the head. Simultaneously, a short SMS is sent to a pre-defined phone number using GSM infrastructures to alert the concern people of the incident of gas leakage. Going by the results of the tests carried out after implementation of the design of this work, it is concluded that the developed system is suitable for use in homes and restaurants to forestall and check incidence of LPG leakage and disaster that may follow such leakage. All that is required is to place the developed device on or beside the LPG cylinder head.

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References

- [1] [1]Evalina, N. and Azis, H. A., "Implementation and design gas leakage detection system using ATmega8 microcontroller", in *Materials Science and Engineering Conference Series*, 2020, vol. 821, no. 1, p. 012049. doi:10.1088/1757-899X/821/1/012049.
- [2] Mahalingam, A.; Naayagi, R.T.; Mastorakis, N.E. Design and implementation of an economic gas leakage detector. In *Proceedings of 6th International Conference on Circuits, Systems and Signals*, Athens, Greece, 7–9 March 2012; pp. 20–24.
- [3] Meenakshi, A.A.; Meghana, R.B.N.; Krishna, P.R. LPG Gas Leakage Detection and Prevention System. *Int. J. Future Revolut. Comput. Sci. Commun. Eng.* 2017, 3, 1–4.
- [4] A. Banik, B. Aich and S. Ghosh, "Microcontroller based low cost gas leakage detector with SMS alert," *2018 Emerging Trends in Electronic Devices and Computational Techniques (EDCT)*, 2018, pp. 1-3, doi: 10.1109/EDCT.2018.8405094.
- [5] Onengiye M. Georgewill, Chukwunazo J. Ezeofor "Design and Implementation of SMS-Based Industrial/Homes Gas Leakage Monitoring & Detection Alarm System", *International Journal of Engineering Trends and Technology (IJETT)*, V35(9),410-416 May 2016. ISSN:2231-5381. www.ijettjournal.org. published by seventh sense research group