The Ciência & Engenharia - Science & Engineering Journal
ISSN: 0103-944X
Volume 11 Issue 1, 2023
pp: 81 - 88

High Sensitive Gas Leakage Detector With Automatic Dialer System

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Abstract

Now-a-days due to the increase in number of automobiles there has been an extensive use of automobiles in day-to-day life. Usage of vehicles reduces the journey time but at the same time it increases the harmful gases like Butane, propane, CO, LPG etc levels which has a severe effect on human health. For example Carbon monoxide is a toxic gas, but, being colorless, odorless, tasteless, and initially non-irritating, it is very difficult for people to detect. Carbon monoxide is a product of incomplete combustion of organic matter due to insufficient oxygen supply to enable complete oxidation to carbon dioxide (CO_2). It is often produced in domestic or industrial settings by older motor vehicles and other gasoline-powered tools, heaters, and cooking equipment. Symptoms of mild acute poisoning include light headedness, confusion, headaches, vertigo, and flu-like effects; larger exposures can lead to significant toxicity of the central nervous system and heart, and even deathThis project eliminates the above problems. The proposed projects detects the level of Carbon Monoxide and whenever it reaches threshold (harmful) limit the engine of the vehicle will be turn off and the buzzer will be switched on. It also gives a visual display on LED. Thus, saving the environment and human lives from the dangerous, life threatening effects of several hazardous gases like butane, propane, CO and LPG etc

This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer

Introduction

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles like Compressed Natural Gas (CNG), buses, cars, etc. It is noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, and vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and meager harm to the environment. Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The risks of explosion, fire,

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suffocation are based on their physical properties such toxicity, flammability, etc. The number of deaths due to the explosion of gas cylinders has been increasing in recent years. The Bhopal gas tragedy is an example of accidents due to gas leakage.

The reason for such explosions is due to substandard cylinders, old valves, no regular checking of gas cylinders, worn out regulators and a lack of awareness of handling gas cylinders. Therefore, the gas leakage should be detected and controlled to protect people from danger. An odorant such as ethane thiol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mzechanism. A gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. A number of research papers have been published on gas leakage detection techniques [1–8]. K. Padmapriya et al. proposed the design of a wireless LPG monitoring system. In this paper, the user is alerted about the gas leakage through SMS and the power supply is turned off [6]. Meenakshi Vidya et al. proposed the leakage detection and real time gas monitoring system. In this system, the gas leakage is detected and controlled by means of an exhaust fan. The level of LPG in cylinder is also continuously monitored [7]. Selvapriya et al. proposed the system in which the leakage is detected by the gas sensor and produce the results in the audio and visual forms. It provides a design approach on software as well as hardware [8]. In the existing method, different gas sensing technology is used.

In this paper a low-cost advanced sensor-based gas leakage detector, alert and control system is proposed and discussed. The system is very efficient, user friendly, portable, small in size and cost effective. It will cost only 917 Bangladeshi taka which is equivalent to ten USD.

literature Review

Literature Review This section present the review of some studies that are related to gas leakages detection. 2.1. Liquid Problem Gas Detection Liquid problem gas is a flammable mixture of hydrocarbon gases used as fuel in heating appliances, cooking equipment, and specifically as a vehicle fuel (it is often referred to as autogas). It is an odorless gas due to ethyl mercaptan is added as an odorant to be easily detected when leakage occurs for safety precaution. LPG is made by refining petroleum or wet natural gas and is almost entirely derived from fossil fuels sources being manufactured during the refining of crude oil as theory emerged from the natural state. It was classified as a hazardous material because of its explosive potentials when under pressure, due to this hazardous property leading to fire explosion. The gas detection process was made by the chemically infused paper that change its color when it’s been exposed to gas before the development of the electronics gas detector. The electronics leakage detector was an active approach to initial fault detection in other to achieve the utmost safety of humanity and properties as a whole they introduced an android base automatic gas detection).different approaches have been used alongside several research in the detection of leakage and were also implemented alongside some incident toward some decades. The existing leakage detection is optical sensor method, cable sensor, negative pressure, vapor sampling, signal processing, mass volume, and pressure point analysis, in which have been implemented using a different framework. Some groups of researchers have classified the technology as two fitting categories, which are software and hardware method but research continues and to technical nature research effort which led them to three group methods [4]. 2.2. Classification of Leakages Detection There are different classes of leakage detection which have been used to monitor the leakage, several

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criteria are classified into their classification, some of which are critical principles and abilities needed from humans. The detection is classified into three, which are automated detection, manual detection, and semiautomated detection. Automated Detection involves monitoring of detecting leakage without the help of the operator, once the detector device is installed and been connected to the display of the personnel in charge and can be automatically shut down from the display unit. (SCADA); Manual Detection - These are methods in which the device can only be operated by humans. Like thermal imager or light detection and ranging (Lidar) devices; Semi-automated detection – solutions that necessitate a certain amount of input or assistance in carrying out certain tasks (e.g. statistical or digital signal processing methods) (Batzias et al., 2011). The technology used in leakages detection can be classified into two categories which are, Direct method and the Indirect method The direct method is making use of a handheld detector by the patrol team along the pipeline and in the aspect of the very long pipeline, the airplane mounted optical imaging device is used along the pipeline for measuring gas emanation for fast result

Method and Materials

In this paper, semiconductor sensors are used to detect LPG gas. An MQ6 semiconductor sensor is used. Sensitive material of the MQ-6 gas sensor is SnO2, which has lower conductivity in clean air. When the target combustible gas exists, the sensor conductivity increases along with the rising gas concentration. The MQ6 gas sensor has a high sensitivity to Propane, Butane and LPG, and response to Natural gas. The sensor could be used to detect different combustible gasses, especially Methane; it hasalowcost and is suitable for different applications. The MQ-6 can detect gas concentrations anywhere from 200 to 10,000 ppm. The sensor's output is an analog resistance. Figure 1 shows the block diagram of the gas leakage detection and alert system.

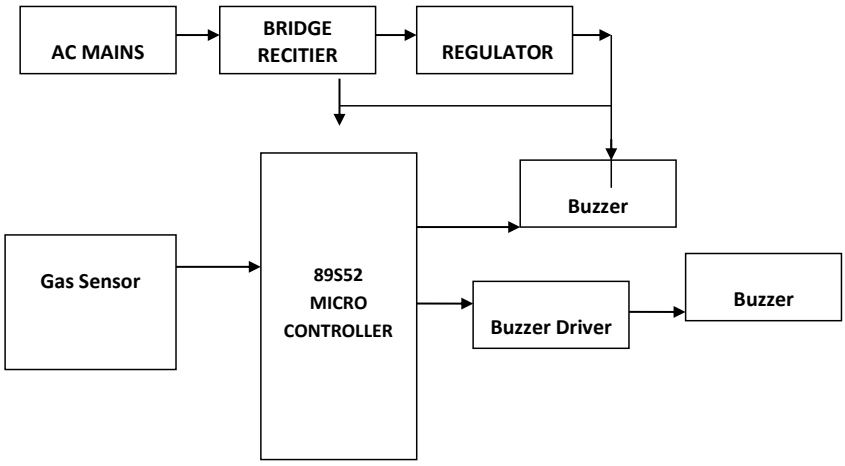

Figure 1. Block diagram of gas leakage detection and dialer system.

This system is based on the 8052 microcontroller and MQ-6 gas sensor. When the sensor detects gas in the atmosphere, it will give digital output 1 and if gas in not detected the sensor will give digital output 0. microcontroller will receive the sensor output as digital input. If the sensor output is high, then the buzzer will start tuning along with the LCD that will show that "Gas detected: Yes". If the sensor output is low then buzzer will not be tuning, and the LCD will show that "Gas detected: No". The buzzer most commonly consists of a number of switches or sensors connected to control unit that determines which button was pushed or

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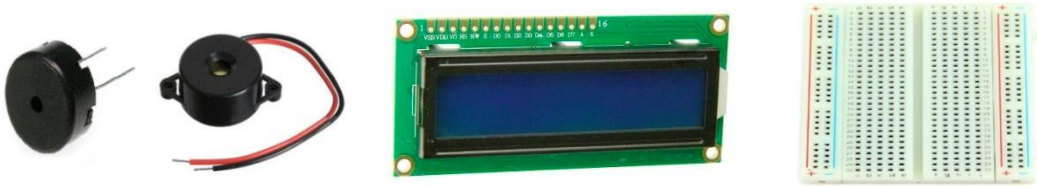
whether a preset time has lapsed, and usually illuminates a light on the appreciate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

For the design of a sensor-based gas leakage detector and alarm system the following hardware components are required. Table 1 lists the list of required hardware opponents, quantity and price in Bangladeshi Taka. The gas detector system is very cheap and it will cost only 577 BD Taka. The device is portable, light weight, user friendly and efficient with multi-functional features. In Figure 2, some important components that are needed to design the gas leakage detection and dialer system are presented.

Table 1. List of required hardware opponents, quantity and price in Bangladeshi Taka.

Equipment	Quantity	Price (BDT)
8052 microcontroller	1	70/-
MQ-6 LPG gas sensor	1	160/-
16*2 LCD	1	124/-
Buzzer	1	15/-
Male to male/female wire	40	60/-
9 V Battery	1	40/-
Gas Lighter	1	35/-
10 K Variable Resistor	1	8/-
Mini Breadboard	1	55/-
		Total Taka-577/-

Gas sensor8052 microcontroller chip



Buzzer 16*2 LCD Breadboard

Figure 2. Some important components that are needed to design the gas leakage detection and alert system.

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Results and Analysis

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. Figure 3 shows the circuit diagram that was designed using Proteus libraries. This system is based on Arduino UNO R3 and MQ-6 gas sensor. When the sensor detects gas in atmosphere, it will give a digital output of 1 and if gas is not detected the sensor will give a digital output of 0. Arduino will take the sensor output as the digital input. If sensor output is high, then the buzzer will start tuning and the LCD will show that “Gas detected: Yes”. If sensor output is low then the buzzer will not be tuning, LCD will show that “Gas detected: No”. The detector incorporates a MQ-6 sensor (with gas detection range of 300–10,000 ppm) as the LPG gas sensor, PIC16F690 microcontroller as the control unit, LCD for displaying gas concentration, a buzzer as an alarm and a number of LEDs to indicate the gas leakage status. The microcontroller senses the presence of a gas when the voltages signal from the MQ-6 sensor goes beyond a certain level and gives an audiovisual alarm.

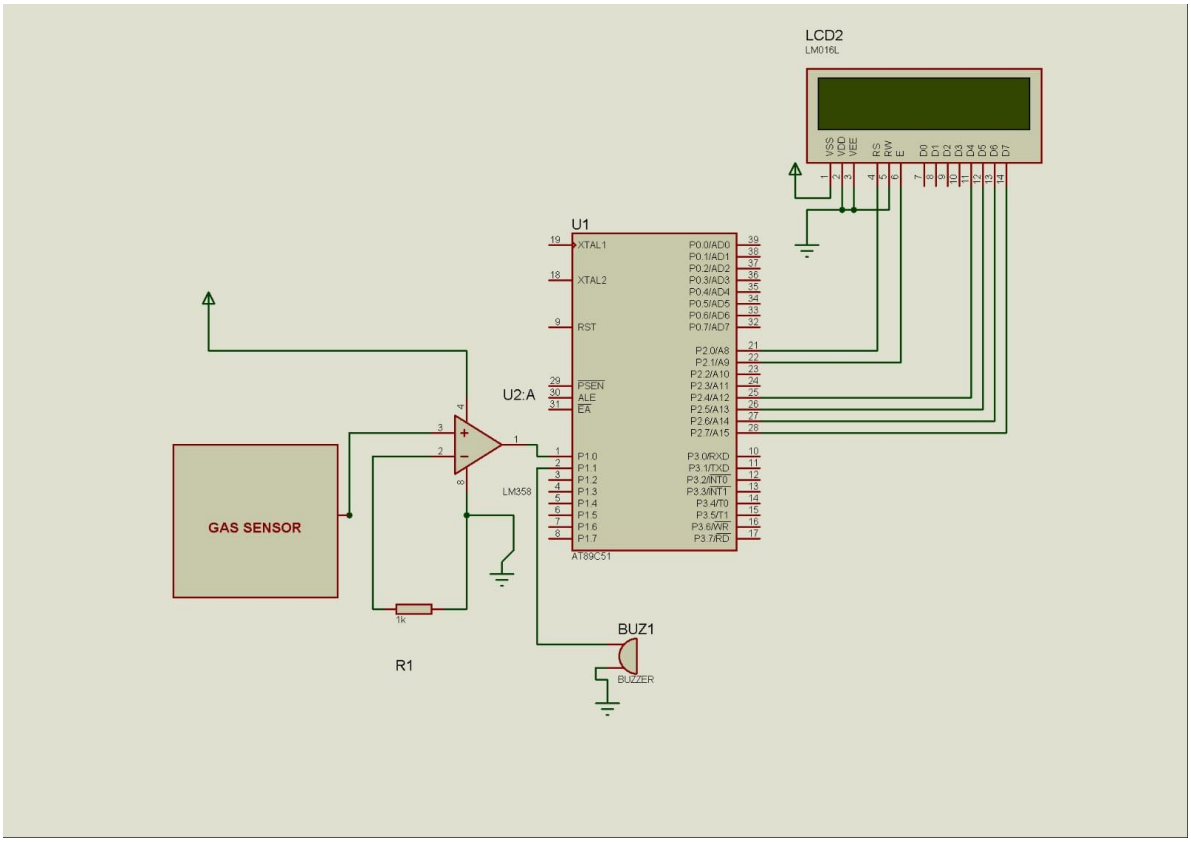

Figure 2. Circuit diagram that was designed using Proteus libraries.

If the system detects the level of gas in the air that exceeds the safety level it will activate the alarm which includes the buzzer to alert the users at home of the abnormal condition and to take any necessary action. The most tell-tale sign of a leak is the smell of gas in the home. However, in the case of a carbon monoxide leak, there are also particular physical symptoms you may suffer from if there is a leak. The output result of this paper is that the leakage will be detected and stopped within 2 s after the leakage starts. This system can even detect the level of gas leakage. This is an efficient method for automatically detecting and controlling

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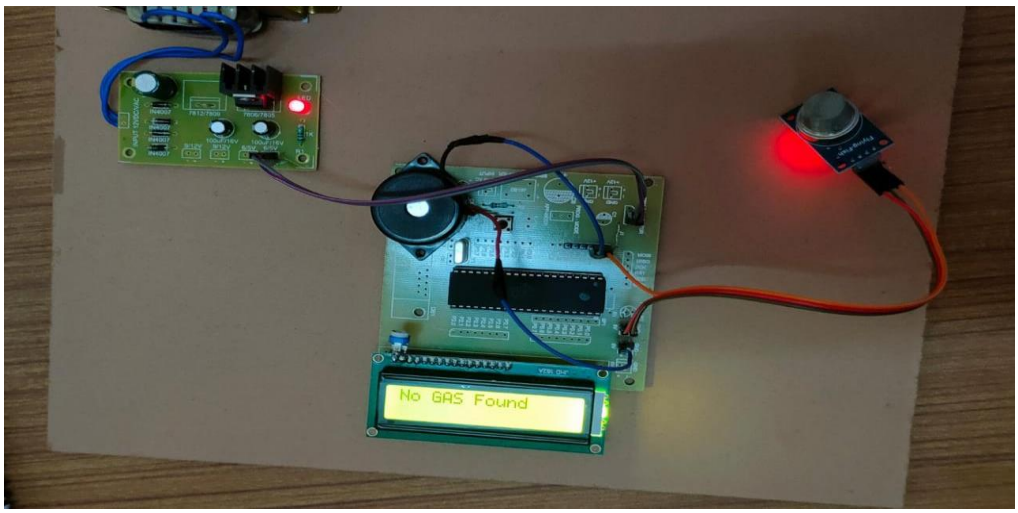
the gas leakage. Moreover, the fire accidents are also prevented by switching off the power supply. The idea for gas detection and control can be implemented at a large scale for various industries. This system can be installed in a kitchen, at a hostel cafeteria, and any other areas. This can be helpful in reducing accidents caused by gas leakage in household as well as in any similar commercial set up. In our country there are 180 million people, and due to its low cost this product is affordable and will preventmany accidents and save many properties and human lives.

Future Work

Overall, software and hardware parts of the systems have been developed and tested by introducing a small amount of LPG near gas sensor module. The authors of this paper are currently working to include multi functions with this device. One of the notable future functions of this system is to add a sub system where wastage of gas and the uses of gas can be monitored using this system. The system is flexible as a greater number of sensors and relays can be added to it according to the whole LPG supply setup in those premises. The author is adding more software based intelligent functions with this system. This is an automatic gas detection, control and alert system. In future this system will have a feature where it can notify the emergency services if any accidents happen. A mobile app and web-based app for real time monitoring also will be added. In the user app for this system many smart features will be added. The overall features will make the system more safe for the users. The system will be optimized for use in many places like the car, the home, industries and many other places. After designing the final prototype with smart multifunctional features, the system will be implemented in real life scenarios as a pilot project. A survey will be done soon before using the system and another one will be done after implementing the system to discover the KPI. Summarizing all the results, finding and analyzing a research article will be done and author has plans to submit itto the MDPI *sensors* journal for review. In the future paper the features of this final product will be compared with the available gas detector systems presented in other articles.

Result



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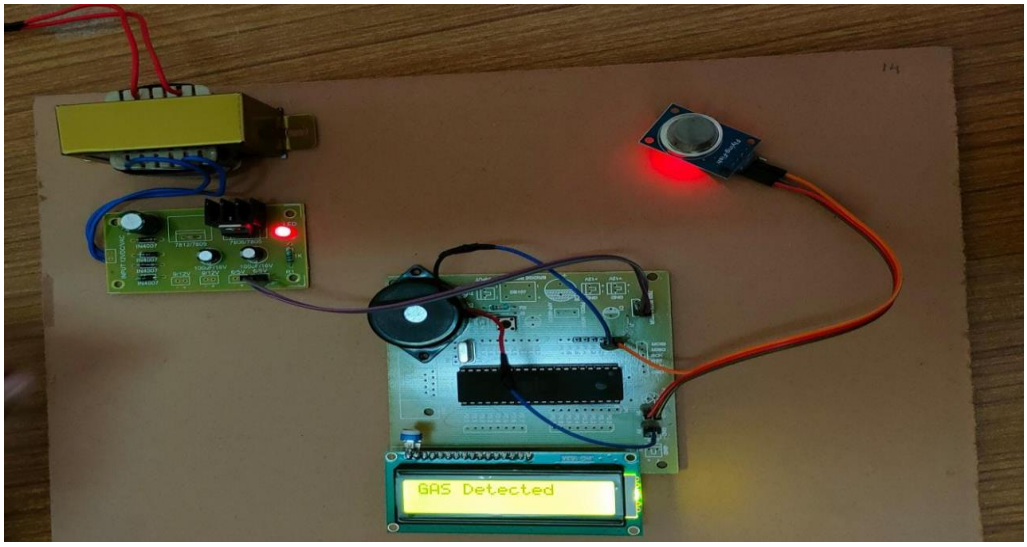

Conclusions

The design of a sensor-basedhigh sensitive automatic gas leakage detector with dailer system has been proposed and discussed in this paper. This is a low-cost, low power, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere but also wastage of gases will hurt our economy. The proposed system will cost only USD 8 which is easily affordable even for poor people. In the open literatures it is noticed that much work has not been done for a smart gas detection system. In future, more advanced features will be integrated with this system which will provide users with more safety and relaxation. The proliferation of handheld devices has led to developments in the field of smart gas sensors, which has considerably widened their scope of application. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.

References

[1] 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.

[2] Attia, H.A.; Halah, Y.A. Electronic Design of Liquefied Petroleum Gas Leakage Monitoring, Alarm, and Protection System Based on Discrete Components. *Int. J. Appl. Eng. Res.* **2016**, *11*, 9721–9726.

[3] Apeh, S.T.; Erameh, K.B.; Iruansi, U. Design and Development of Kitchen Gas Leakage Detection and Automatic Gas Shut off System. *J. Emerg. Trends Eng. Appl. Sci.* **2014**, *5*, 222–228.

[4] Soundarya, T.; Anchitaalagammai, J.V.; Priya, G.D.; Karthickkumar, S.S. C-Leakage: Cylinder LPG Gas Leakage Detection for Home Safety. *IOSR J. Electron. Commun. Eng.* **2014**, *9*, 53–58.

[5] Shrivastava, A.; Prabhaker, R.; Kumar, R.; Verma, R. GSM based gas leakage detection system. *Int. J. Emerg. Trends Electr. Electron.* **2013**, *3*, 42–45.

[6] Anurupa, A.; Gunasegaram, M.; Amsaveni, M. Efficient Gas Leakage Detection and Control System using GSM Module. *Int. J. Eng. Res. Technol.***2015**,*3*, 1–4.

The Ciência & Engenharia - Science & Engineering Journal
ISSN: 0103-944X
Volume 11 Issue 1, 2023
pp: 81 - 88

[7] Meenakshi, A.A.; Meghana, R.B.N.; Krishna, P.R. LPG Gas Leakage Detection and Prevention System. *Int.*
[8] *J. Future Revolut. Comput. Sci. Commun. Eng.* **2017**, *3*, 1–4.
[9] All Answers Ltd. GSM Based LPG Detection [Internet]. November 2018. Available online: https://ukdiss.com/examples/gsm-based-lpg-detection.php?vref=1 (accessed on 15 October 2020).