



GAS LEAKAGE DETECTION AND CONTROLLING USING IoT SENSOR

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Abstract: Liquefied Petroleum Gas LPG is the most common cooking fuel through out country. Nowadays, leakages are frequently occurred in home appliances and small scale factories. It is very life threatening if you will not distinguish and modified right away. The main aim of the project is to carry out the literature review on IoT based gas detection techniques to ensure the safety of people and surroundings. Here, we have developed a Arduino based LPG gas leakage detector that detects the gas leakage and control the fire accidents. If gas leakage occurs ,this system detects it makes an alert through buzzer sound. Next, it power offs the regulator and open up the windows automatically by using DC gared motors.

Keywords: LPG (liquefied petroleum gas); gas sensors MQ-2(detected butane) MQ-6(detected methane); buzzer (alarm); LED (light)

1. 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, 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. Gas leakage occurs mainly due to poor maintenance of equipments and inadequate awareness of the people. This system which help in our security and make our home and kitchen safe. While LPG is an essential need of every household, its leakage could lead to a disaster. Here, I have developed an Aurdino based LPG gas leakage Detector. If gas leakage occurs, this system detects it and makes an alert. Along with this by using the AURDINO UNO it passes data to the L29 3D DRIVER. This microcontroller passes the input to the 5 Volts DC Gared Motor and then it senses gas through the gas sensors i.e, MQ2(Detects butane),MQ6(detected methane)

2. 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 has a low cost 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.

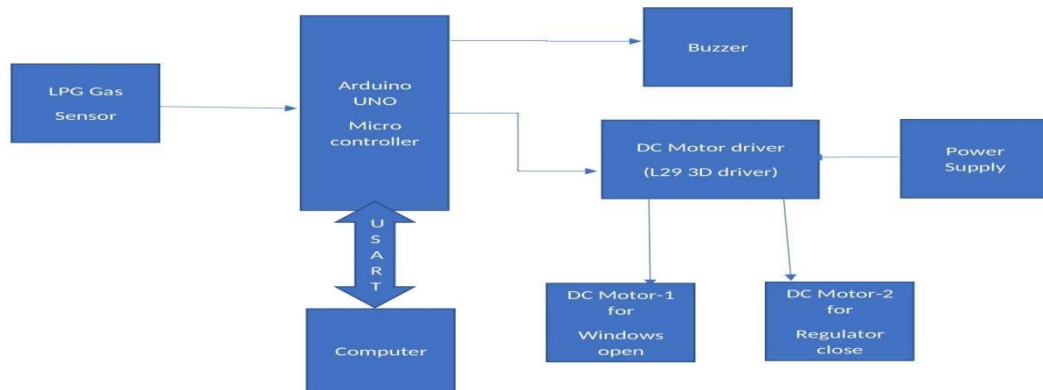


Figure 1. Block diagram of gas leakage detection and controlling using IoT sensor.

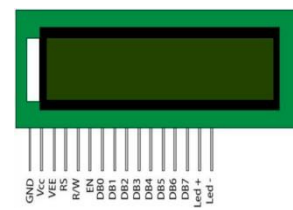
This system is based on the Arduino UNO R3 and MQ-6 gas sensor. When the sensor detects gas in the atmosphere, it will give digital output 1 and if gas is not detected the sensor will give digital output 0. Arduino will receive the sensor output as digital input. If the sensor output is high, then the 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 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 components, quantity and price in Bangladeshi Taka. The gas detector system is very cheap and it will cost only 917 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 alert system are presented.

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

	<u>Equipment Quantity</u>	
	<u>Price (BDT)</u>	
Arduino Uno R3	1	420/-
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-3500/-



Arduino UNO
MQ-6 Gas sensor LCD Pin Configuration



Buzzer

DC Gared Motor

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

3. 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. 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, 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.

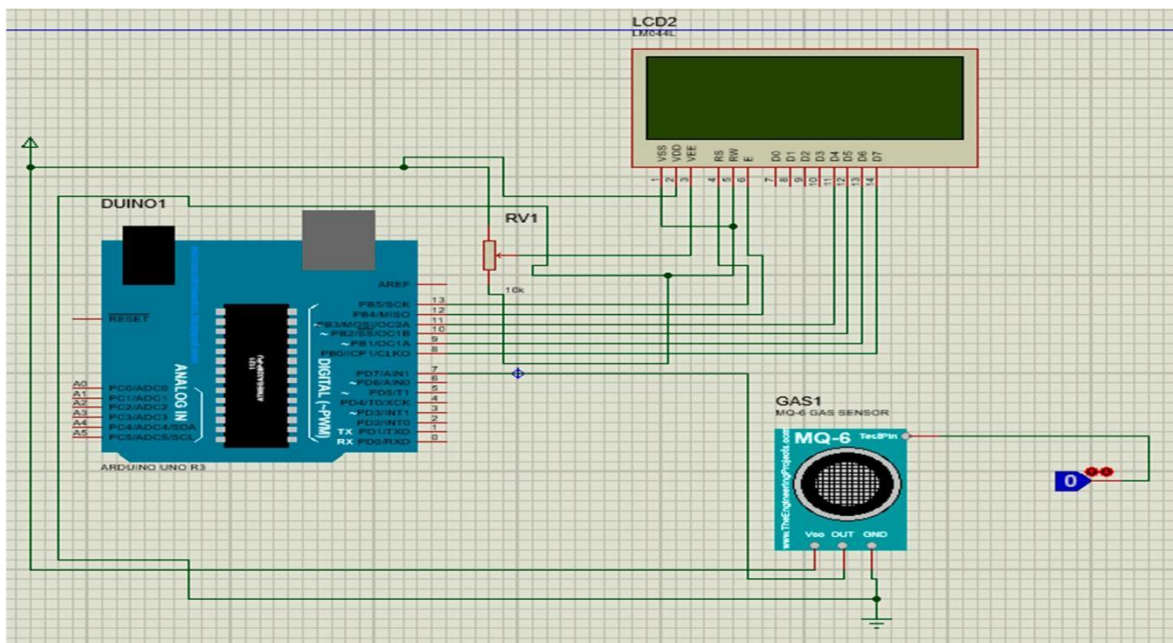


Figure 3. Circuit diagram that was designed using Proteus libraries.



Figure 4 shows the circuit diagram of the MQ-6 gas sensor connected with Arduino.

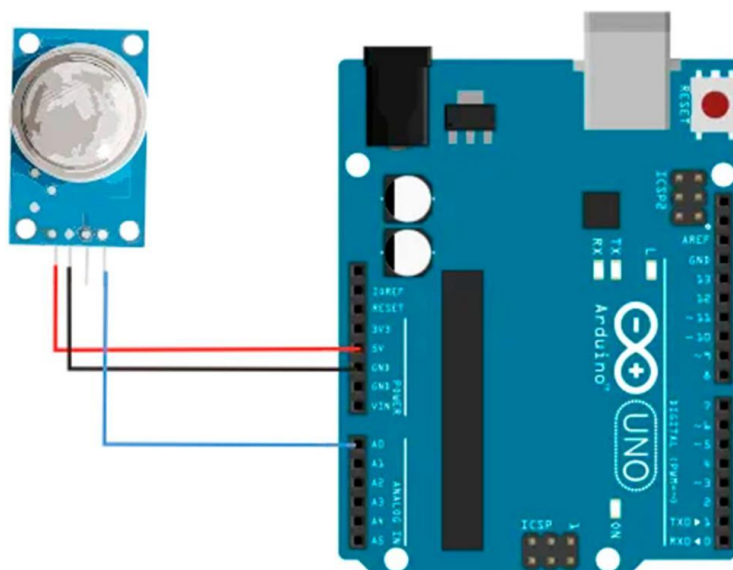


Figure 4. Circuit diagram of MQ-6 gas sensor connected with Arduino.

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 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.

4. 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 detection system. In future this system will have a feature where it can notify the emergency services if any accidents happen. Further, rather than the household it may be useful in large LPG gas companies by connecting the CO₂ extinguisher. It may help to degrade the injuries and fire accidents and predicts simultaneously. 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 it to 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.

5. CONCLUSIONS

The design of a sensor-based automatic gas leakage detector with an alert and control 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. In this project Further, rather than the household it may be useful in large LPG gas company by connecting the CO₂ extinguisher. It may help to degrade the injuries and fire



accidents and predicts simultaneously. Liquefied Petroleum Gas (LPG) is the most common cooking fuel throughout our country. Nowadays, leakages are frequently occurred in home appliances and small scale factories. It is very life threatening if you will not distinguish and modified right away. The main aim of the project is to carry out the literature review on IOT based gas detection techniques to ensure the safety of people and surroundings. Here we have developed a Arduino based LPG gas leakage detector that detects the gas leakage and control the fire accidents. If gas leakage occurs, this system detects it makes an alert through buzzer sound. Next, it power cuts the regulator and open ups the windows automatically by using DC geared motors. Gas leakage leads to severe accidents resulting in material losses and human injuries. It occurs mainly due to poor maintenance of equipment and inadequate awareness of the people. Therefore, we conclude that this Leakage Detector using Arduino will helps to sounds a buzzer in preventing from danger which are caused by gas leakage. And we came with an idea to develop more rather than a buzzer sound. So, in that process here along with buzzer we implemented to power cut the regulator and open up the windows automatically to avoid injuries. The proposed system will cost only USD 10 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.

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