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GAS LEAKAGE DETECTION AND ALERTING SYSTEM FOR HOME AND INDUSTRY

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Abstract

One of the main issue faced by industries and domestic premises is accident due to gas leakage. Some of the harmful gases like propane, LPG, Ammonia, methane is highly combustible and the chance of dangerous explosion is more if confined in a closed space. In the present study the system can detect and notify hazardous gas present in hazardous and non- hazardous area. The system uses gas sensors such as MQ2, MQ3, etc. The information of gas detection is send to the Arduino which act as the controller to analyze the presence of gas. This controller triggers the buzzer and LED is used for visual communication of danger. The buzzer gets activated when controller detects gas in the dangerous level. The system can detect Propane, CNG, LPG, methane etc. This system is user friendly, compact and economical which can be used in houses as well as in industries.

Keywords: Hazardous gas, Sensors, Arduino, detection system, LPG

Introduction

In urban areas the main fuel used is Liquefied Petroleum Gas (LPG) for cooking, heating etc. Even in industries, commercial and non-commercial business LPG has become unavoidable. Gas leakage has become a threat and the security issue has to be considered with due importance. It not only cause death and injury but also destroys property and create economical imbalance. Many of the vehicles are running in LPG and CNG. Gas leakage create anxiety and preventive measures is the main requirement to stop the associated accidents.

The Bhopal Gas Tragedy shocked India and it was one of the major Process Safety Management failure. The gas leakage in Polymer Plant of Andhra Pradesh led to 8 deaths and 40 injuries. Explosion in Neyveli Lignite Corporation Power Plant led to 20 deaths. According to Indian Statistical department nearly 54 people are killed due to fire accident. The major cause of fire is Gas Leakage.

Many accidents occurred locally leading to leakage of hazardous gases or explosion. For instance, Explosion in Shopping complex of Ayala Center Makati in 2007. In 2011 investigation team found that blast was due to methane gas. The accident was reported by Janelle and it was explosion happened in LPG refilling station of Pasig City on 11 January 2017. The cause of accident was LPG gas leakage. Injured victims were taken for emergency treatment in Pasig and Mandaluyong. Similar LPG gas leakage occurred in city of Bonifacio Global on 13 May 2013 was due to gas explosion. Another fire outbreak at Phoenix Petro terminal Industrial Park was due to gas leakage. Four LPG storage tank exploded leading to huge outbreak of fire.

Raw field gases like hydrogen sulphide, Benzene, Carbon dioxide, LPG etc. have least explosive limit of 0.5% and higher explosive limit of 40% in air. But for methane lower explosive limit of 3.6 to 5% and upper explosive limit of 15% in air with lower vapor density.

Different types of gases are used in industries, household premises as well as in automobiles for transportation. Gas leakage will result in explosion leading to damage of people and properties. LPG and propane are highly inflammable containing hydrocarbon gases which is an efficient fuel for various applications that includes houses, cafeterias, all industries, hospitals because properties which include less smoke during combustion, good calorific value etc.

In most of the houses LPG is commonly used for cooking purposes. When there is leakage of gas the chance of explosion and fire outbreak is more. The main cause of explosion are substandard cylinders, damaged valves, no regular or proper checking of health of gas cylinders, damaged or worn out or low quality regulators etc. Hence the gas leakage has to be detected at the earliest to protect men and material from danger.

Various types of gas sensors are available to detect leakage of various hazardous and nonhazardous gases. The MQ5 can detect gas of methane, MQ2 can sense gas of propane/butane and MQ8 is used sense hydrogen gas. Capacitor of variable type is used to adjust the sensitivity of sensor. These type of sensors are usually kept in the vicinity of gas source for detecting leakage of gases. This signal is then fed to the Arduino.

Here cost effective sensor is used to for gas leakage detection which can be also connected to IOT devices for monitoring, recording and control. It is a highly efficient system, ease in handling, compact, portable and cost effective. Whenever leakage occurs, the buzzer will be activated there by giving alert for urgent action. The proposed system is an effective combination of a sensor microcontroller and buzzer which are manufactured in a cost-effective way.

Material and Methods

The Gas Leakage uses Gas sensor, Arduino board, Indicator (LED), Buzzer for alert etc. The block diagram of recommended gas detection system is shown in figure 1.

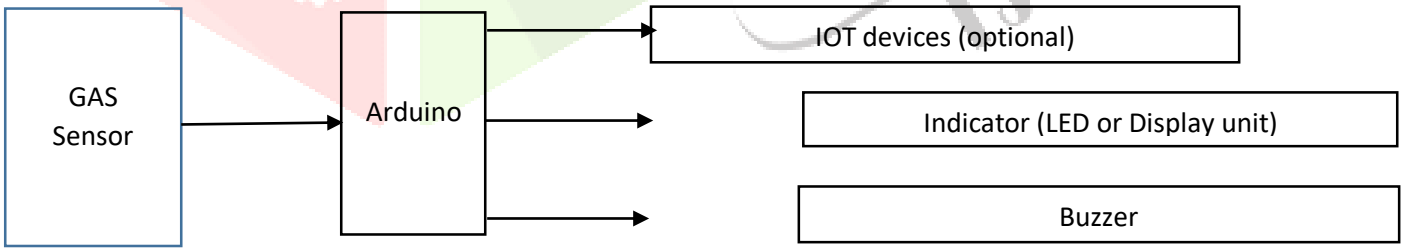

Fig.1: Gas detection system

Here semiconductor sensor detects gas leakage. The MQ6 (figure 4) gas sensor contains sensitive material SnO2 which is having less conductivity in clean air. If the ppm of gas increases to preset value (leakage) the conductivity of sensor increases which is directly proportional to gas concentration. The MQ6 sensor is sensitive to Propane, LPG, Natural Gas and Butane. This sensor can sense Methane and other combustible gas hence suitable for different applications. Moreover, it is of low cost and compact. The concentration that MQ6 can detect ranges from 200 to 10000 ppm.

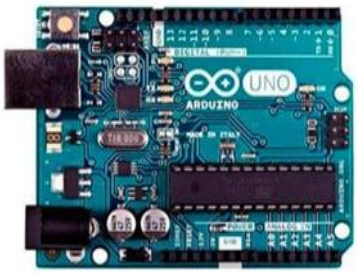

Figure 2: Arduino Board

Figure 3: Buzzer

Figure 4: Gas Detector MQ6

The Arduino (figure 2) here serves as controller. It triggers led and buzzer (figure 3) based on signal received from gas sensor. The sensor has different set points to detect different concentration of gas in ppm. The Arduino recognizes gas concentration regardless of types of gases present. It analyzes presence of ppm of gas above tolerance level. Here tolerance level or safe level is set as 220ppm. The dangerous level is set as above 350 ppm.

The system uses 12V buzzer for voice alert. The circuit diagram of the proposed system is shown in figure 5. This circuit is designed in Tinker CAD software. Provision is made for connecting to IOT devices for monitoring and control of system.

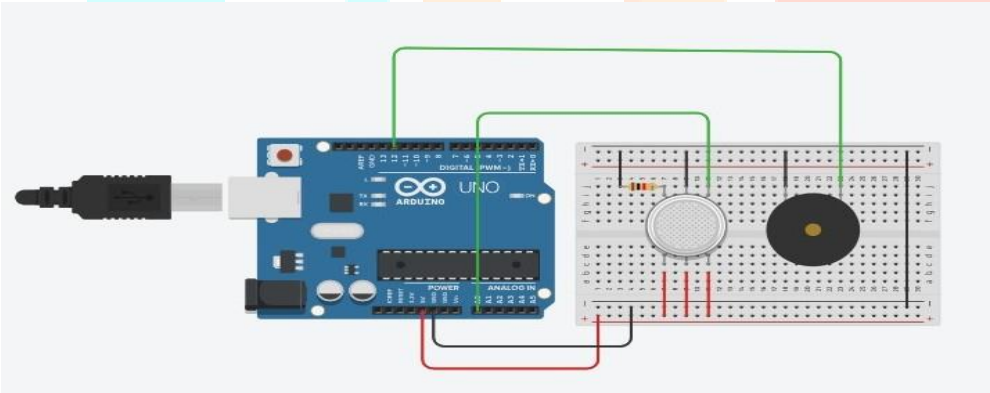

Figure 5: Circuit diagram of Gas detection system.

Result and Discussions

The Tinker cad is one of the software tool for design of electronic automation. This Tinker cad software is commonly used by Engineers to prepare design or schematic as well as for printing of circuit boards. In figure 5, circuit diagram designed using Tinker cad libraries was shown. The system uses Arduino for controlling and MQ6 for gas sensing. When gas leakage is detected, it will give a digital output one as shown in the diagram (figure 6).

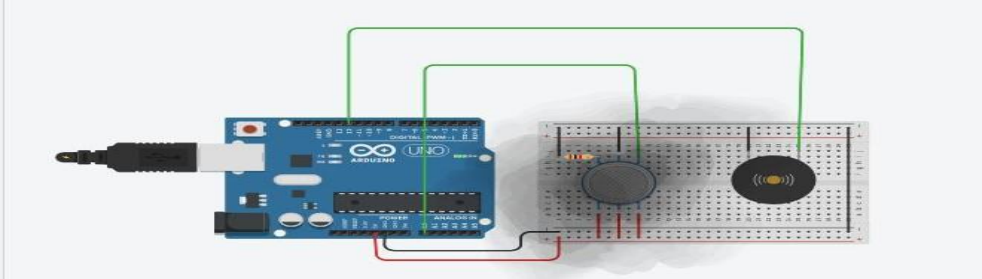

Figure 6: output of Gas detection unit

If no gas detected the sensor gives output of zero. Arduino takes the output from sensor. If sensor output goes above recommended level, then the buzzer will start beeping. Measuring range of the MQ6 sensor is 200 to 10000 ppm. Less than 299 ppm is considered as safe and the concentration above 351 ppm is unsafe/dangerous and it leads to harm.

If any unsafe level of gas is detected in the air (predefined or set value of safety level) alarm will be activated which has the buzzer to alert about abnormal condition so that necessary action can be taken at the earliest. If there is presence of carbon monoxide above safe limit (leak), there will be some physical discomfort. The leakage is detected within micro seconds after the leakage starts. This system also detects leakage of gas. This is the most efficient way of detecting gas leakage. The fire accidents caused due to gas leakage can be reduced by switching off the power. The gas detection as well as control can be incorporated at a large scale by many industries. The system can be incorporated in kitchen, hotel, malls, cafeteria, hospitals etc. where there is high chance of safety issues.

Conclusion

In the present study automatic type gas leakage detector system using sensor which gives alert was designed which can be connected to IOT device for controlling from remote. It is a cos effective, low power, compact, portable, lightweight, friendly for user, efficient and simple monitoring unit for detecting gas. The gas leakage not only leads to pollution but also create safety issues to men and material there by affecting economy of the country as well as wastage of gas. Gas detection devices can help to overcome such issues.

The proposed system is affordable for common people. In future, this system can be connected with IOT devices for ease of monitoring and control. The compact device helped in developments in smart gas sensors, finds application in gas detection in industries as well as non-industries. The need of safety in workplaces is one of the key factor which has to be taken into account with due importance in the coming years.

Findings of the study shows that the system can effectively detect and monitor the amount of concentration of various gases like methane, CNG, propane, LPG and hydrogen gases in a confined space or room or building or place within a few meter. The buzzer gives alert to people that there is a leakage of harmful gas and the exhaust fan helps to reduce the concentration or warn for emergency service.

If the system is connected to GSM module and IOT devices, the person who is in remote can know about the danger so that necessary action can be taken without further delay. Also using IOT devices the gas leakage can be controlled or information can be given to safety department to take urgent emergency action to stop the leakage or threat.

References

1]. Akship Agarwal, Lalit Kumar, Pavneet Kumar, Vikas Kumar Jha, *"IOT based hazardous gas detection system using AVR microcontroller"*, International Research Journal of Engineering and Technology, Vol 4, Issue 3, March 2017.

2]. Apeh S T, Erameh K B, Iruansi U, "Design and development of kitchen gas leakage detection and automatic gas shut down system", Journal of Emerging Trends in Engineering Application, vol 5, p 222-228, 2014.

3]. Anurupa A, Gunasegaram M, Amsaveni M, "Efficient Gas Leakage Detection and Control System using GSM Module", International Journal of Engineering Research and Technology, vol 3, p 1-4, 2015.

4]. Attia H A, Halah Y A, "Electronic Design of Liquified Petroleum Gas Leakage Monitoring, Alarm and Protection System based on Discrete Components", International Journal of Applied Engineering Research, Vol 11, 2016.

5]. Dr. Mohammad Monirujjaman Khan, "Sensor based Gas Leakage Detection System", Proceedings of 7th International Electronic conference on Sensors and applications, 2020.

6]. Kulothungan S, Gukan A, Arunprabhu K B, "Automatic Gas Leakage Detection and Prevention System" International Journal of Engineering Development and Research, Vol 7, Issue 2, p 10-12, 2019.

7]. K Manichandana, Simrah Ummen Ruman, Harshavardhini Biderkota, Anisha P, B. V Krishnamurthy, Kishor Kumar C, "Gas Leakage Detection and Smart Alerting System", Global Journal of Engineering Science and Researches, p 24-30, 2018.

8]. P Kanaka Laha Lakshmi, P S G Aruna Sri, P Gopi Krishna, "An IOT based LPG Leakage Sensing and Alerting System", International Journal of Innovative Technology and Exploring Engineering, Vol 8, Issue 6, April 2019.

9]. Maribelle Jualayba, Kristian Regio, Harold Quiozon, Adrian Destreza, "Hazardous Gas Detection and Notification System", IEEE 10th International Conference on Humanoid, Nanotechnology, Information Technology, communication and Control, Environment and Management, 2018.

10]. Suresh Kumar Nataranjan, Parth Deshpande, Pranali Gole and Poonam Bhosale, "LPG Gas Detection and Prevention", International Journal of Current Research, Vol 9, Issue 10, Oct 2017.

11]. V Ramya, B Palaniappan, "Embedded System for Hazardous Gas Detection and Alerting", International Journal of Distributed and Parallel Systems, Vol 3, Issue 3, May 2012.