Microcontroller Based LPG Gas Leakage Alert System

Manas Halder, Sumanta Chatterjee

Abstract— **The main focus of this paper is to discuss how gas sensors are made using Arduino microcontroller. Arduino is a microcontroller by which many instruments can be made; from these we have made "Gas sensor". In this authentic model a gas sensor model i.e. mq-6 gas sensor is used for sensing LPG gas from environment and allows user to be aware of the leakage of that. For being aware a buzzer is used to be aware of and interrupt the user to the hazards of the consumption of the destruction of gas leaking. This module will effective to detect LPG leakage in domestic purpose, factory, petrol pump etc.**

Index Terms— **Gas sensor, Microcontroller**

I. INTRODUCTION

In this article, we are going to discuss how to implement the LPG gas sensor and alarming system by using Arduino. LPG gas is essential for day to day's life. Without LPG gases the 20th century will have been become the darkest area on earth. At one side it is good to use but at another side it has many harmful sides. When it leaks out and came to contact with flame-able things it can cause burning. This system detects any LPG gas from environment when it came contact within its sensing range. It senses and gives the message of leaking in the LCD display and also gives the alarm to alert people or user of current place.

When the LPG controller exceeds the range of the gas sensor module, it can detect the concentration of leaking the gas in the air.

II. LITERATURE REVIEW

A gas detector is a device that detects the presence of gas in an area, often as a part of safety system. This type of equipment is used to detect gas leak or other emissions and can interface with a control system so a process can automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them opportunity to alert. These types of devices are important because there are many harmful gases that can be harmful to organic life such as humans and animals.

Gas detectors can be used to detect flame- able, combustible and toxic gases and oxygen depletion. This type of device is widely used in industry and can be found in locations such as oil rings, to monitor manufacture process and emerging technologies such as photovoltaic. Gas leak detection methods become concern after the affects of harmful gases on human health is discovered. Before modern electronic sensors early detection methods relied on less precise detectors. Though the 19 and 20th centuries coal miners would bring canaries down to the tunnels with them as an early detection system against life –threatening gases such as carbon dioxide, carbon monoxide and methane.. The first gas detector in industrial age was the safety lamp or day lamp was invented by Hunpohry Davy (of England) in 1815 to detect the presence of methane gas in the underground coal mines. The flame safety lamp consisted of an oil flame adjusted to specific height in the fresh sir. To prevent ignition with the lamps flame was contained within a glass sleeve with a mess flame arrestor. The flames height varied depending on the presence of methane or the lack of the oxygen. To this day in certain parts of the world flame safety lamp are still in service. The modern era of gas detection started in 1926-1927 with the development of catalytic combustion (LEL) sensor by Dr. Oliver Johnson. Dr. Johnson was an employee of standard oil company in California (now chevron), he begun to research and development on a method to detect combustible mixtures in air to help prevent explosions in fuel storage tanks. A demonstration model was developed in 1926 and denoted as model A. The first practical "electric vapour indicator" meter begun production in 1927 with the release of model B. The world's first gas detection company Johnson-williams instruments (or JW instruments) was formed in 1928 palo atlo, CA by Dr. Oliver Johnson, Phil Williams. A J-W instrument was first recognized as the first electrical company in Silicon-valley. Over the next 40 years J-W instruments pioneered many "firsts" in the modern age of gas detection, including making instruments smaller and more portable, development of portable oxygen detector as well as the first combination instrument that could detect combustible gases as well as oxygen. Before the development of electronic house-hold carbon monoxide detectors in 1980s and 1990s, carbon monoxide detectors presense was detected with a chemically infused paper that turned brown when exposed to the gas. Since then many electronic technologies and devices has been developed to detect, monitor and alert the leak of a wide array of gases. As the cost and performance of electronic gas sensors was improved, they have been incorporated into wider range of system. Their use in automobiles was initially for engine emission control, but now gas sensors may also be used ensure passenger comfort and safety. Carbon dioxide sensors are being installed into buildings as part of demand control ventilation systems. Sophisticated gas sensor systems are being researched for use in medical diagnostic, monitoring and treatment system, well beyond their initial use in operating rooms. Gas monitors and alarms for carbon monoxide and other harmful gases are increasingly available for office and domestic use, and are becoming legally required in some jurisdictions.

Manas Halder is a second year UG student of Computer Science and Engineering from JIS College of Engineering, Kalyani, Nadia, West Bengal. India

Mr. Sumanta Chatterjee is presently working as an Assistant Professor of JIS College of Engineering, Kalyani, Nadia, West Bengal

III. TYPES OF GAS DETECTOR

Electrochemical: Electrochemical gas detectors work by allowing gases to diffuse through a porous membrane to an electrode where it is either chemically oxidized or reduced. The amount of current produced is determined by how much is oxidized at the electrode, indicating the concentration of the gas. Manufactures customized electrochemical gas detectors by changing the porous barrier to allow for the detection of certain concentration range. Also since the diffusion barrier is a physical/mechanical barrier, the detector tended to more stable and reliable over the sensor's duration and thus required less maintenance than other early detector technologies.

Catalytic bead: Catalytic bead sensors are commonly used to measure combustible gases that present in explosion hazards when concentrations are in lower explosion limit (LEL) and upper explosion limit (UEL).

Photo-ionization: Photo- ionizations detectors (PIDS) use a high-photon-energy UV lamp to ionize chemicals in simple gas. If the compound has ionization energy below that of the lamp photons an electron will be ejected and the resulting current will be proportional to the concentration of the compound.

Infrared point: Iinfrared (IR) point sensors use radiation passing through a known volume of gas; energy from the sensor beam is absorbed at certain wavelengths, depending on the properties of the specific gas. For example, carbon monoxide absorbs wavelengths of about 4.2-4.5 μm. The energy in this wavelength is compared to a wavelength outside of the absorption range; the difference in energy between these two wavelengths is proportional to the concentration of gas present.

Infrared imaging: Infrared image sensors include active and passive systems. For active sensing, IR imaging sensors typically scan a laser across the field of view of a scene and look for backscattered light at the absorption line wavelength of a specific target gas.

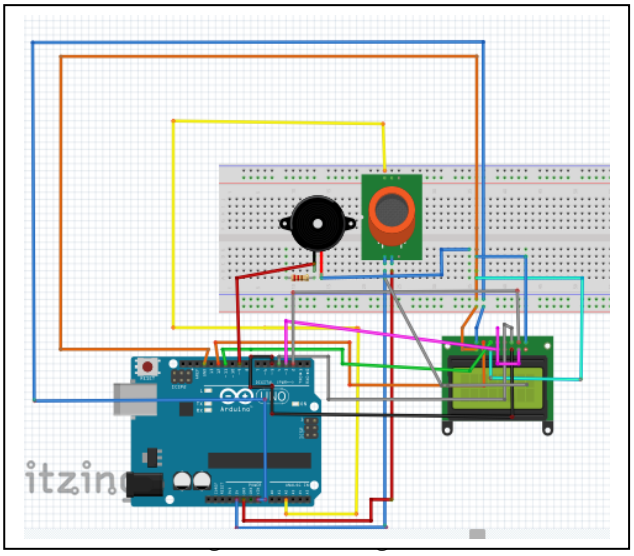
Semiconductor: Semiconductor sensors detect gases by a chemical reaction that takes place when the gas comes in direct contact with the sensor. Tin dioxide is the most common material used in semiconductor sensors, and the electrical resistance in the sensor is decreased when it comes in contact with the monitored gas. The resistance of the tin dioxide is typically around 50 kΩ in air but can drop to around 3.5 kΩ in the presence of 1% methane. This change in resistance is used to calculate the gas concentration.

Ultrasonic: Ultrasonic gas leak detectors are not gas detectors. It detects the acoustic emission created when a pressured gas expands in a low pressure area through a small orifice (the leak).

IV. HARDWARE REQUIREMENT

1. Arduino UNO Microcontroller
2. Gas sensor module (MQ-6)
3. 16*2 LCD display
4. Jumping wires
5. 9v battery
6. BC 547 Transistor
7. Buzzer
8. 1k resistor
9. Bread-board

V. CIRCUIT DIAGRAM



VI. WORKING PROCEDURE

(i)**Ar** Arduino is a single board microcontroller meant to make the application more accessible which are interactive objects and surroundings. The hardware features with an open-source hardware board designed around an 8-bit Atmel AVR microcontroller or a 32 bit Atmel ARM. Current models consists an usb interface, 6 analog input pins and 14 digital I/O pins that allows the user to attach various extension boards. The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller. In order to get started, they are simply connected to a computer with a USB cable or with a AC-to-DC adapter or battery. Arduino Uno Board varies from all other boards and they will not use the FTDI USB-to-serial driver chip in them. It is featured by the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

LCD DISPLAY: We come across LCD displays everywhere around us. Computers, laptops, calculator are made of these kind of LCD display. The 16*2 LCD display has widely used in DIYS circuits. The 16*2 LCD display translates 16 characters in 2 such lines.

VII. PIN DIAGRAM

Gas sensor(MQ-6)	Arduino
1.Vcc	1.Vcc
2.Gnd	2.Gnd
3.D0	3.------
4.A0	4.A2

Table 1: Connection between gas sensor and Arduino

LCD display	Arduino
1.Gnd	1.Gnd
2.Vcc	2.Vin
3.VEE	3.-------
4.RS	4.12 no.Pin
5.R/W	5.Gnd
6.EN	6.11 no.Pin
7.DB0	7.-------
8.DB1	8.-------
9.DB2	9.-------
10.DB3	10.-------
11.DB4	11. 5 no. Pin
12.DB5	12. 4 no. Pin
13.DB6	13. 3 no. Pin
14.DB7	14. 2 no. Pin
15.Led+	15. 5V
16.Led-	16.Gnd

Table 2: Connection between LCD display and Arduino

VIII. RESULTS

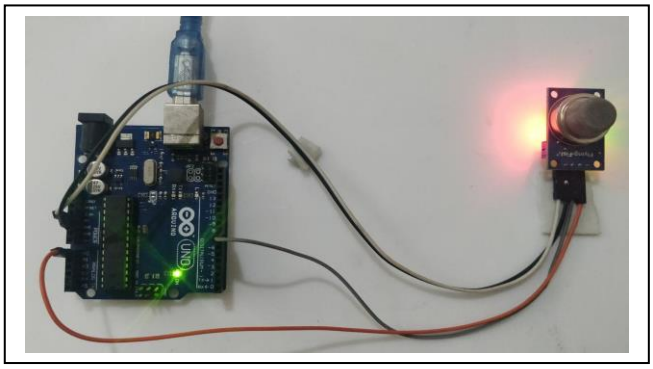


Fig: 2: Circuit using microcontroller

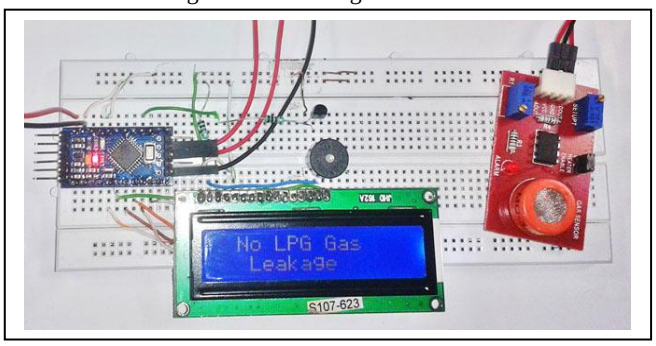


Fig: 3 Display of sensing gas

IX. ANALYSIS AND DISCUSSION

The LPG gas sensor is also used to detect cigarette smoke, toxic gases, combustible, propane, ISO-butane and LNG. This gas sensor works after 15 minutes of sensing the leaking gas. This circuit is so easy to make and its market value is cheaper in today's market.

X. CONCLUSION

Gas sensors using Arduino microcontroller is finally designed and implemented which is capable of detecting LPG leakage for home and industry safety purpose. The sensor also has a facility to detect other harmful gases in the air. An interesting future study might involve testing the LPG gases at different temperatures and using of GSM module for sending the gas leakage message to user's Smartphone.

REFERENCES

[1] Humidity Sensing of Zinc Oxide Nanorods Based Prototype Using Arduino Uno Microcontroller Platform, Date Added to IEEE *Xplore*: 27 December 2018 INSPEC Accession Number: 18381682DOI: 10.1109/ICSENS.2018.8589853

[2] Automated unified system for LPG using load sensor, 2017 International Conference on Power and Embedded Drive Control (ICPEDC)Date Added to IEEE *Xplore*: 26 October 2017INSPEC Accession Number: 17289854,DOI: 10.1109/ICPEDC.2017.8081133

[3] Smart gas cylinder: Leakage alert and automatic booking, 2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)Date of Conference: 1-2 Aug. 2017Date Added to IEEE *Xplore*: 21 June 2018INSPEC Accession Number: 17859626DOI: 10.1109/ICECDS.2017.8389616,Publisher: IEEE

[4] UAV environment monitoring system, Published in: 2017 International Conference on Electrical, Electronics and System Engineering (ICEESE)Date of Conference: 9-10 Nov. 2017,Date Added to IEEE *Xplore*: 22 February 2018,INSPEC Accession Number: 17598984,DOI: 10.1109/ICEESE.2017.8298395

[5] Microcontroller based low cost gas leakage detector with SMS alert, Published in: 2018 Emerging Trends in Electronic Devices and Computational Techniques (EDCT),Date of Conference: 8-9 March 2018,Date Added to IEEE *Xplore*: 09 July 2018,INSPEC Accession Number: 17932255,DOI: 10.1109/EDCT.2018.8405094,Publisher: I EEE

[6] Novel Sensing Approach for LPG Leakage Detection: Part I—Operating Mechanism and Preliminary Results, IEEE Sensors Journal (Volume: 16 , Issue: 4 , Feb.15, 2016),Page(s): 996 – 1003,Date of Publication: 30 October 2015 ,INSPEC Accession Number: 15722354,DOI: 10.1109/JSEN.2015.2496400,Publisher: IE EE

[7] .Smart gas cylinder: Leakage alert and automatic booking,2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS),Date Added to IEEE *Xplore*: 21 June 2018,INSPEC Accession Number: 17859626, DOI: 10.1109/ ICECDS.2017.8389616,Publisher: IEEE

[8] Design of Gas Sensor Setup and Study of Gas (LPG) Sensing Behavior of Conducting Polyaniline/Magnesium Chromate (MgCrO4) Composites, IEEE Sensors Journal (Volume: 10 , Issue: 4 , April 2010) Page(s): 807 – 813, Date of Publication: 08 March 2010 , INSPEC Accession Number: 1116864 DOI: 10.1109/JSEN.2009.2034627, Publisher: IEEE

[9] Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT,2017 IEEE 7th International Advance Computing Conference (IACC),Date of Conference: 5-7 Jan. 2017,Date Added to IEEE *Xplore*: 13 July 2017,Electronic ISSN: 2473-3571

Manas Halder is a second year UG student of Computer Science and Engineering from JIS College of Engineering, Kalyani, Nadia, West Bengal, India.

Mr. Sumanta Chatterjee is presently working as an Assistant Professor of JIS College of Engineering, Kalyani, Nadia, West Bengal. He has worked 2 years in the Industry and 7 years in the Academic Sector. He has completed his M.Tech degree in Computer Science and Engineering and B.Tech degree in Information Technology from West Bengal University of Technology. He is recently working on the emerging research field "E-Commerce" and "Embedded System". He has made significant contribution on the research field "Ecommerce" and "Embedded System". He is a member of International Association of Computer Science and Information Technology (IACSIT) and also a member of International Association for Engineers (IAENG).