

Hazardous Gas Detection using ARDUINO

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Abstract

This paper is based on a system which is used to detect various hazardous gases with the help of arduino. This work changes the presently available systems that are set industrial areas and this system can also be used in houses and at work place. The primary aim of the work is to design arduino based hazardous gas detecting system using gas sensors. The toxic gases like butane (also known as LPG), methane and carbon monoxide are sensed and displayed on the LCD display. The concentration of the gasses will be shown in the form of percentage by LCD display.

Keywords: Arduino, Carbon Monoxide, Gas Sensors, LCD Display, LPG, Methane

I. INTRODUCTION

The technology is growing day by day. With this rise in technology we have not succeeded to take care of our environment in which we live... Thus we have polluted the surrounding, thereby decreasing the quality of the environment we live.

Even though there are many types of pollution such as water, soil and air pollution, out of these air pollution acts as the major problem as the other can be detected visually and by taste, but the toxic air cannot be detected as it can be colourless, odourless and tasteless. Hence there is an increasing demand for the environmental pollution control and monitoring systems.

In the view of the ever-rising pollution sources with hazardous chemicals, these systems should have the provisions to detect the sources quickly. Hazardous gases are one that causes health problems, but are also used in industries in large quantities. These gases have to be monitored such that rise in the normal level of them could be detected and suitable safety measures can be taken. But the present systems available are not so handy, are expensive and hard to implement. So an embedded system is designed using ATmega 328 Microcontroller, for the purpose of detection of toxic gas leakage, which in turn neglects the dangers that have adverse effects on human lives.

The toxic gases like carbon monoxide, methane and LPG are mentioned here. The system is reasonable and can be easily implemented in the chemical factories and in localities which is surrounded by the chemical industries or plants. The system also has the provision to provide real-time monitoring of concentration of the gases which is present in the atmosphere. As this method is automatic the information can be given rapidly. such that human lives can be saved in time.

II. METHODOLOGY USED

The functionality of system is divided into three main steps. In the initial step, the gas leakage is detected by the gas sensor. This detects the gas leakage and gives the signal to the microcontroller. After that in second step the microcontroller receives the signal, which sends by gas sensor. It sends activation signal to other external devices attached such as LCD display .The LCD display will show which gas is actually detected.

A. Block Diagram of The System:

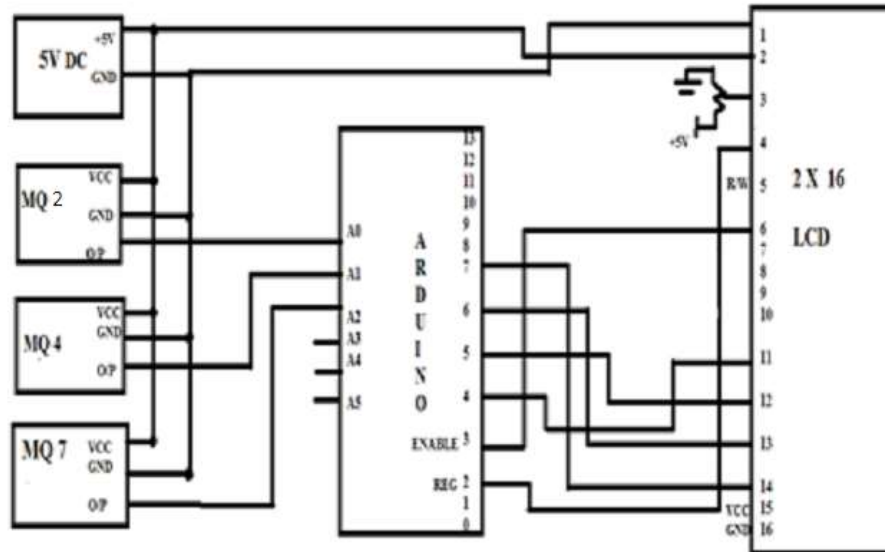


Fig. 1: Basic Block Diagram Of the Gas Detection System

The input which are the gas es are sensed through the particular gas sensors. In this system sensors for detecting Methane, LPG and carbon monoxide are used. Then this sensed value is passed to the Programmable Interface Controller. The signals that are sensed are analog in nature and are converted into digital form by the analog to digital convertor which is built inside the PIC. The names of the gases which have been sensed are then displayed on the LCD and the concentration in percentage will be displayed on LCD according to the conditions present in programming.

B. MQ-2 LPG Sensor:

This is an ideal sensor which is used for the detection of the harmful LPG leakages at homes or in a work place, storage equipments as well as in vehicles in which the fuel used is LPG. This section is very easy to incorporate into a circuit with alarms, to start an alarm tone or even to show a visual view of the concentration of the gas. This sensor provides a good sensitivity along with with the good response time. Whenever input gas is present, the conductivity of the sensor is higher and the concentration also rises.



Fig. 2 : MQ-2 Sensor

MQ-2 gas sensor senses the toxic gases but give accurate values for LPG. It can also sense the natural gas available. It is economical and handy.

Table – 1
Specifications of MQ-2

Model No.	MQ-2
Type of the sensor	Semiconductor
Standard used	Bakelite material (Black Bakelite material)
Capability to Detect Gases	Isobutene, Butane, LPG
Concentration limits	200-5000ppm (Butane, Propane, LPG)

C. MQ – 4 Sensor:

MQ -4 sensors are used in systems with gas leakages detecting devices at small and in bigger levels. It is also able to detect CH₄, Natural gas. They have fast response. They have stable and long life. They consist of simple drive circuit.



Fig. 3: MQ-4 Sensor

Table – 2
Specifications of MQ-4

<i>Model No.</i>	<i>MQ-4</i>
<i>Type of Sensor</i>	<i>Semiconductor</i>
<i>Standard used</i>	<i>Bakelite material (Black Bakelite material)</i>
<i>Capability to Detect Gases</i>	<i>Methane, Natural gas</i>
<i>Concentration limits</i>	<i>200-1000ppm (Methane, Natural gas)</i>

D. MQ -7 Sensor:

MQ -7 sensors are used to detect carbon monoxide in devices that deals with this gas in factories and homes. They have stable and long life. They are very sensitive to the carbon monoxide.



Fig. 4: MQ-7 Sensor

Table – 3
Specifications of MQ-7

<i>Model No.</i>	<i>MQ-7</i>
<i>Type of Sensor</i>	<i>Semiconductor</i>
<i>Standard used</i>	<i>Bakelite material (Black Bakelite material)</i>
<i>Capability to Detect Gases</i>	<i>Carbon monoxide</i>
<i>Concentration limits</i>	<i>20-2000ppm (carbon monoxide)</i>

E. Arduino Microcontroller:

Arduino is a source with open electronics prototyping platform based on flexible, easy-to-use hardware and software. Arduino is capable to sense the environment by getting an input signal from a different sensors and can accordingly control different operations.



Fig. 5: Arduino Microcontroller

The Arduino programming language is used to program the microcontroller on the Arduino board and it also uses the Arduino development environment. Here this Arduino gets the sensed information from a gas sensor. An Arduino board consists of an Atmega microcontroller which is 8-bit along with complementary components in order to perform programming and its incorporation into other circuits. A boot loader is used to preprogram an Arduino microcontroller so that the programs to be uploaded on the on-chip flash memory is simplified to a great level in comparison with other devices that use an external programmer.

F. LCD Display:

The LCD (Liquid Crystal Display) screen is an electronic module used for displaying information. It has a large number of applications in day-to-day life. A 16x2 LCD display, which is a common module, is extremely used in various electronic circuits and devices. Mostly, LCD modules are preferred in comparison with seven-segment and other multi-segment displays. This is because the LCD is economical and can easily be programmed. It has no bounding of displaying special and custom characters, animations, and a lot more. The meaning of 16x2 LCD is that it can display 16 characters per line and there are 2 such lines. Here each character is displayed in a 5x7 pixel matrix size.

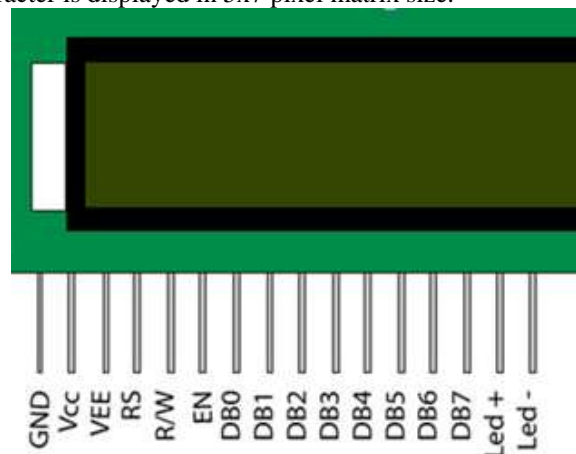


Fig. 6: Pin Diagram Of LCD Display

III. RESULTS

The prototype of the leakage system has been tested by sensing a small amount of LPG, Methane, and carbon monoxide gas near to the sensor.

MQ-4, MQ-2, and MQ-7 gas sensors detect Methane, LPG, and carbon monoxide gas and send a signal to the microcontroller. After that, the microcontroller sends an active signal to other externally connected devices.

As a result LCD display will show the names of detected gasses. When reset button is pressed, the system refreshes itself and whole system regains its initial position.



Fig. 7: Hardware Model Of The System

IV. CONCLUSION

Hazardous gas detection device which uses an embedded system has been implemented in this paper.

In this system we have describe a new approach for gas leakage detection system at a low concentration.

The leakage is detected with the help of MQ-4, MQ-2and MQ-7 gas sensors. Sensor sends a signal to microcontroller. In the next step microcontroller sends an active signal to other externally connected devices. A quick response rate is provided by this system.

With the help of this system the critical situations can be solved quickly over the manual methods which require large amount of time.

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