

MODERN GAS LEAKAGE DETECTION SYSTEM

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II. METHODOLOGY USED

Abstract—Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses, cars. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places. The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane (C_3H_8) and butane (C_4H_{10}). Gas leakage system consists of GSM (Global System for mobile communications) module, which warns by sending SMS. However, the former gas leakage system cannot react in time. This paper provides the design approach on both software and hardware.

Keywords: GSM (Global System for mobile communications), CNG (compressed natural gas), LPG (Liquefied petroleum gas), Gas sensor MQ-6, stepper motor Driver IC (ULN2003A),

I. INTRODUCTION

LPG consists of mixture of propane and butane which is highly flammable chemical. It is odorless gas due to which Ethanethiol is added as powerful odorant, so that leakage can be easily detected. There are other international standards like EN589, amyl mercaptane and tetrahydrothiophene which are most commonly used as odorants. LPG is one of the alternate fuels used now days. Sometimes liquefied petroleum gas is also known as LPG, LP gas, Auto gas etc. This gas is commonly used for heating appliances, hot water, cooking, and various other purposes also. LPG is also used as an alternate fuel in vehicles due to soaring in the prices of petrol and diesel.

Some people have low sense of smell, may or may not respond on low concentration of gas leakage. In such a case, gas leakage security systems become an essential and help to protect from gas leakage accidents. A number of research papers have been published on gas leakage security system. Embedded system for Hazardous gas detection and Alerting has been proposed in literature. Where the alarm is activated immediately, if the gas concentration exceeds normal level.

Bhopal gas tragedy was an example of gas leakage accident in India. This was world's worst gas leakage industrial accident. This paper provides a cost effective and highly accurate system, which not only detect gas leakage but also alert (Beep) and turn off main power and gas supplies, and send an SMS. GSM module is used which alert the user by sending an SMS. In order to provide high accuracy gas sensor MQ-5 has been used.

The functionality of system is divided into three main steps. The fig. 1 shows the block diagram of gas leakage security system. The important components used in this system are

- Micro Controller
- GSM Module
- Gas Leakage sensor
- Analog to digital converter
- Crystal Oscillator
- Liquid crystal display
- Stepper Motor
- Weight sensor,
- Buffer

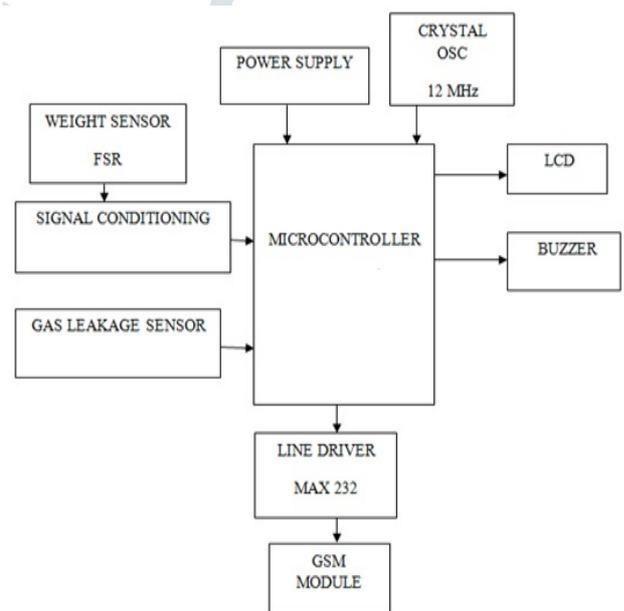


Fig.1 Block diagram of gas leakage security system

The following steps are used in the implementation

- In the initial step, the gas leakage is detected by the gas sensor MQ-5.
- This detects the gas leakage and gives the signal to the microcontroller with the help of ADC
- The microcontroller receives the signal, send by gas sensor. It sends activation signal to other external devices attached with it.
- Next buzzer activation and simultaneously message display on liquid crystal display screen takes place
- GSM module activated, which send warning SMS to the user.
- Stepper motor IC (ULN 2003A) to drives the stepper motor attached it, as a result main power and gas supplies turn off.

- At the end, when the gas leakage is successfully stopped then with the help of reset button the whole system reached to the initial stage.

MQ-5 Gas Sensor

MQ5 is a semiconductor type gas sensor which detects the gas leakage. The sensitive material of MQ-5 is tin dioxide (SnO_2). It has very low conductivity in clean air. This Gas sensor not only has sensitivity to propane and butane but also to other natural gases, low sensitivity to cigarette smoke and alcohol. The MQ-5 gas sensor is shown in fig. 2. This sensor can also be used for detection of other combustible gas such as methane.

The concentration range of MQ-5 gas sensor is 300-1000 ppm. This sensor is available in 6 pins package, out of which 4 pins are used for fetching the signals and other 2 pins are used for providing heating current. This sensor has fast response time. The power needed by the sensor is 5V. This sensor has different resistance value in different concentration. For an example, if we calibrate the MQ-5 gas sensor to the 1000ppm of propane concentration in air, then the resistance value would be approximately 20k Ω .

For the Configuration of MQ5., sensor composed by micro Al_2O_3 ceramic tube, Tin Dioxide (SnO_2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-5 have 6 pin ,4 of them are used to fetch signals, and other 2 are used for providing heating current.



Fig. 2 MQ-5 Gas sensor

B. GSM

GSM module is used to send SMS to the user cell phone. When the gas leakage is detected by the gas sensor, microcontroller sends a signal to GSM module, in which one of the tasks is to send the text SMS. GSM module requires one SIM card. This module is capable to accept any network SIM card. Fig. 3 shows a GSM module IC (Integrated circuit). This module has a unique identity number like mobile phones have. This module works on 12V DC supply.

We can send SMS and also send a voice message. These SMS or voice messages are saved in the microcontroller memory. Multiple SMSs can also be sent to user, police and fire station etc. This module is designed in a way so that user can connect this module without Serial cable, this module can be connected to any of Serial to USB converter module or cable.



Fig. 3 GSM Module

III. RESULT

This system has been tested by taking a small amount of LPG gas near to the sensor. MQ-5 gas sensor detects the LPG gas and sends a signal to the microcontroller. After that microcontroller sends an active signal to other externally connected devices. As a result a buzzer rings and a message is display on LCD screen. Simultaneously main power and gas supply turns off with the help of stepper motor and GSM module sends an SMS. When reset button is pressed, the system refreshes itself and whole system regains its initial position.

IV. CONCLUSION

In this system, we have described a new approach for gas leakage detection system at a low concentration. The leakage is detected with the help of MQ-5 gas sensor. Sensor sends a signal to microcontroller. In the next step, microcontroller sends an active signal to other externally connected devices. The efficiency and memory of the microcontroller can be increased if Philips microcontroller is used in place of ATmega328. Multiple SMS can be sent by changing programming GSM module.

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