LPG Leakage Detecting and Alerting System

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Abstract— Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses, cars. Due to leakage of LPG, it produces hazardous and toxic impact for human beings and also for other living creatures. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit. The aim of this paper is to present such a design that can automatically detect and stop gas leakages. We speculate some solutions to detect the LPG gas leakage and make alert to the users who are using LPG gas. The host in our project is 8051 microcontroller. In this design we are using LPG gas sensor (MQ6) for sensing the leakage and produce the result in audio and visual formats also alerts human via short message service (SMS). This gas sensor has high sensitivity for propane and iso-butane and also can sense cigarette smoke.

Key words: GSM (Global System for mobile Communications), Microcontroller 8051, LPG Gas Sensor (MQ6)

I. INTRODUCTION

LPG is one of the alternate fuels used now days. LPG is also used as an alternate fuel in vehicles due to soaring in the prices of petrol and diesel. Now a day's, the accidents due to gas leakage in homes, cars, industries etc. have been increasing day by day. As this gas is heavier than air, when it leaks from the cylinder it flows along floor and tends to settle in low spots such as a basement. This can cause fire or suffocation if not dealt with. LPG consists of mixture of propane and butane which is highly flammable chemical. It is an odourless gas. Due to which Ethane oil is added as powerful odorant, so that leakage can be easily detected. We can detect the presence of dangerous LPG leakage in the cars, industrial sectors and residential premises using an ideal gas sensor. The sensor used in this project will have both admirable sensitivity and rapid response time. Gas leakage detection is not only important but stopping leakage is equally essential. We designed a system which sniffs LPG leakage and emphasis by the measures such as Spinning the Exhaust fan, SMS, Call, Beep sound, LED Blink. This paper provides a cost effective and highly accurate system.

II. PROPOSED SYSTEM

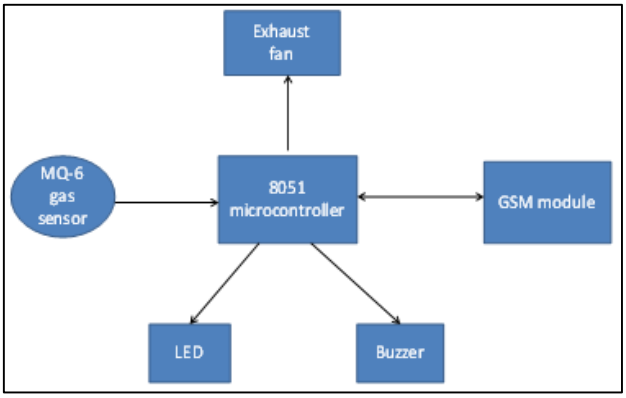

Fig. 1: Block Diagram

In This system we are using 8051 microcontroller as our host it is connected to five other modules: MQ6 gas sensor, GSM module, exhaust fan, buzzer, LED.3 pins on one side of the gas sensor are connected to the power supply. On the other side one of the pins is connected to analog input of microcontroller and the other two pins are connected the ground. The remaining modules are connected to the output pins of microcontroller.

A. MQ-6 Gas Sensor

This is a simple to use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and iso-butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200-10,000 PPM. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple all you need to do is power the heater coil with 5v, add a load resistance, and connect the output to an ADC. This sensor could be used to detect different combustible gas, especially methane; it is with low cost and suitable for different applications.

B. Applications

- Domestic gas leakage detector
- Industrial combustible gas detector
- Portable gas detector

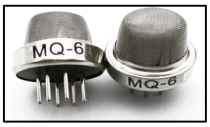

Fig. 2: MQ-6 Gas Sensor

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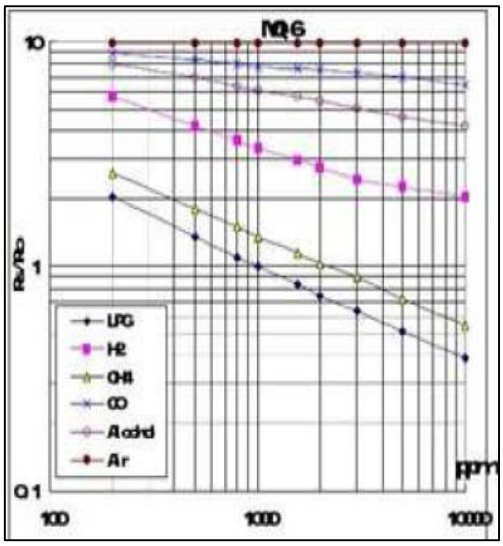

Fig. 3: Sensitivity Characteristics of MQ-6 Gas Sensor

Model No.			MQ-6
Sensor Type			Semiconductor
Standard Encapsulation			Bakelite (Black Bakelite)
Detection Gas			Isobutane, Butane, LPG
Concentration			300-10000ppm (Butane, Propane, LPG)
Circuit	Loop Voltage	V_C	≤24V DC
	Heater Voltage	V_H	5.0V±0.2V ACorDC
	Load Resistance	R_L	Adjustable
Character	Heater Resistance	R_H	31Ω±3ΩRoom Tem.
	Heater consumption	P_H	≤900mW
	Sensing Resistance	R_S	2KΩ-20KΩ(in 2000ppm C_3H_8)
	Sensitivity	S	Rs(in air)/Rs(1000ppm C_4H_{10})≥5
	Slope	α	≤0.6($R_{2000ppm}/R_{1000ppm}$ LPG)
Condition	Tem. Humidity		20±2℃65%±5%RH
	Standard test circuit		Vc:5.0V±0.1V VH: 5.0V±0.1V
	Preheat time		Over 48 hours

Fig. 4: Specifications of MQ-6 gas sensor

C. GSM Module

Fig. 5: GSM Module

GSM module is used to establish communication between a computer and a GSM/GPRS system. A GSM module assembles a GSM modem with standard communication interfaces like RS-232 (serial port), USB etc., so that it can be easily interfaced with a computer or a microcontroller/ microprocessor based system. GSM SIM 900 Quad-band GSM/GPRS engine, works on frequencies 850MHz, 900MHz, 1800MHz. It is very compact in size and designed with RS 232 level converter circuitry, which allows you to directly interface PC Serial port. GSM uses a combination of Time Division Multiplexing and Frequency Division Multiplexing. The baud rate can be configurable from 9600-115200 through AT command. Initially Module is in Auto band mode. This GSM/GPRS RS232 Module is having internal TCP/IP stack to enable you to connect with internet via GPRS. Using this module, we will be able to send & read SMS, Connect to internet via GPRS through simple AT commands. The suitable operating voltage level is 5V-12V DC. 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 as well as call. GSM module requires one SIM card. This module is capable to accept any network SIM card.

D. 8051 Microcontroller

The Intel 8051 microcontroller is one of the most popular general purpose microcontrollers in use today. The success of the Intel 8051 spawned a number of clones which are collectively referred to as the MCS-51 family of microcontrollers, which includes chips from vendors such as Atmel, Philips, Infineon, and Texas Instruments.

The Intel 8051 is an 8-bit microcontroller which means that most available operations are limited to 8 bits. There are 3 basic "sizes" of the 8051: Short, Standard, and Extended. The Short and Standard chips are often available in DIP (dual in-line package) form, but the Extended 8051 models often have a different form factor, and are not "drop-in compatible". All these things are called 8051 because they can all be programmed using 8051 assembly language, and they all share certain features (although the different models all have their own special features).

Some of the features that have made the 8051 popular are:

- 4 KB on chip program memory.
- 128 bytes on chip data memory (RAM)
- [32 bank register + 16 bit addressable register + 80 general purpose register]
- 4 register banks.
- 128 user defined software flags.
- 8-bit data bus
- 16-bit address bus
- 16 bit timers (usually 2, but may have more, or less).
- 3 internal and 2 external interrupts.
- Bit as well as byte addressable RAM area of 16 bytes.
- Four 8-bit ports, (short models have two 8-bit ports).
- 16-bit program counter and data pointer.
- Microsecond instruction cycle with 12 MHz Crystal.

8051 models may also have a number of special, model specific features, such as UART, ADC, Op Amps, etc... It is a very powerful micro controller.

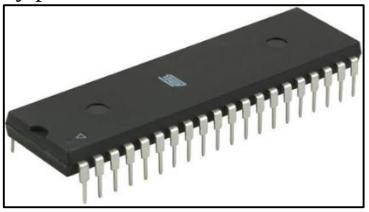

Fig. 6: 8051 Microcontroller

E. Algorithm

The functionality of system is divided into three main steps. In the initial step, the gas leakage is detected by the gas sensor

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MQ-6. This detects the gas leakage and gives the signal to the microcontroller. After that in second step the microcontroller receives the signal, sent by the gas sensor. It sends activation signal to other external devices attached with it such as Exhaust fan, Buzzer, LED (Light Emitting Diode), GSM module. In the last step, many tasks have been performed such as buzzer activates simultaneously Light emitting diode blinks, GPRS module activates, which sends warning SMS to the user through AT commands. Buzzer produces a long beep sound to help the visually impaired people and the LED is used for hearing impaired people to provide visual alerts.

F. Applications

- Safety from gas leakage in house appliances and in cars.
- In large industries which use gas for production.
- Safety from gas leakage in heating gas fired appliances like boilers, domestic water heaters etc.

III. Conclusion

In recent households, the use of LPG is taking a troll and cases of accidents due to LPG are on the rise. From the use of cylinders to using pipelines, biggest threat is security and cost. Our project will be a boon for many households as it is economical.

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