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Microcontroller Based Gas Leakage Detection and Automatic Shut off System

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ABSTRACT:
"Prevention is better than cure". Gas leakage is a major problem associated with industries, factories or even in household also. The leakage of gases which can be flammable or non-flammable can be detected using gas sensor .The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable places. The sensitivity and response time of gas sensor for gases like propane (C3H8) and butane (C4H10) is very high. As soon as the gas sensor senses the gas the output of the gas sensor goes low .This low output signal is received by the microcontroller which activates other components and devices attached to it. The other components include exhaust fan which throws gases out of premises to reduce the concentration of gases, servomotor which works on the principle of servo mechanism, rotate (almost 180 degree) the motor driver to turn off the gas supply regulator, buzzer which sound an alarm, LCD (generally in case of factories and industries),GSM (Global System for Mobile Communication) which warns authorized authority by sending a warning SMS.

KEYWORDS: Gas sensor (MQ-6), GSM, LCD, Servo motor, Pic16f877A microcontroller, Buzzer.

1. INTRODUCTION:

Liquefied petroleum is a major discovery to mankind. LPG is also referred as propane or butane. It is a mixture of flammable hydrocarbons. It is mainly used in homes for cooking, heating and also used in vehicles. Its density is more than natural air so it is heavier than it .Due to this reason it settles down in the premises by displacing the air that can result into explosion. To prevent such an accident we require a system that can detect the gas and alerts the concerned authorities.

For detection of gases, gas sensor named MQ-6 sensor is used having high sensitivity and response towards gases such as propane and butane. The key material of MQ-6 sensor is tin oxide (SnO2) which is sensitive to flammable gases. As the concentration of gases increases conductivity of sensor also increases. LPG has no odour so odorant is used but sometimes it becomes difficult to be detected by human sense organ, so for this purpose we need a sensor that can detect the gas accurately and precisely.

The main objective of this project is to detect the leakage of LPG, to alert the concerned authorities and to automatically turn off the main gas supply using servomotor so that hazardous event can be prevented.

The world's worst gas leakage industrial accident was 'Bhopal gas tragedy'. We can avoid such type of serious damages by installing gas leakage detection system in industries and household premises [1].

2. SYSTEM OVERVIEW:

The system overview contain the block diagram fig[1] which contain microcontroller (PIC16F877A), gas sensor (MQ-6), display unit, GSM modem (SIM900), relay, exhaust fan, buzzer and servomotor which is used to switch off the main gas supply. Microcontroller is the heart of the whole system. All devices are connected to the microcontroller; it acts as the central unit for the system. The output of the gas sensor

acts as the input for the microcontroller and the output of microcontroller acts as the input for servo-motor, relay connected with exhaust fan, buzzer and GSM modem.

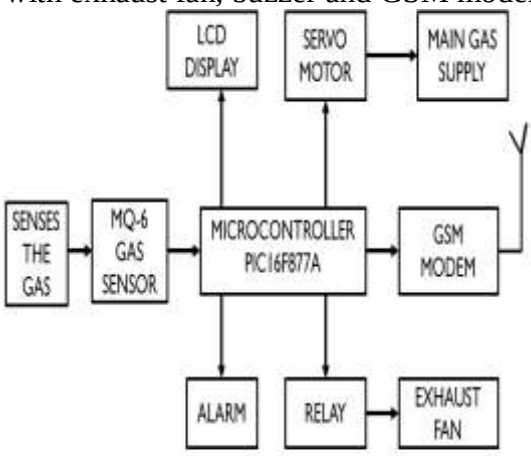

Fig 1 Block Diagram

2.1 MICROCONTROLLER:

Microcontroller is an integrated circuit which is capable of performing various tasks like a computer in a very fast and efficient manner. It is like a small computer. It contains processor core, memory and programmable input/output peripherals. These are basically used in automatically controlled products and devices. In this system we have used PIC16F877A microcontroller designed by microchip. It is 8 bit microcontroller having 40 pins [2]. It is based on CMOS technologies which consume low power and provides high speed. Due to flash memory technology it can be written and erased as many times as possible. It contains five I/O ports (A, B, C, Dand E) and 33 I/O pins. It supports external oscillator up to 20 MHz. It contains two timer of 8 bit and one timer of 16 bit. It also features 256 bytes EEPROM data memory,8192 bytes(8k) flash program memory,368 bytes data memory,10 bit 8 channels of analog to digital converter, two comparator, two capture/compare/PWM function,15 interrupts, 1-UART, 1-A/E/USART, 1-SPI. Its operating voltage range is 2 to 5.5 V.

2.2 MQ-6 Gas Sensors

MQ-6 is a semiconductor type gas sensor which is used for the detection of gas leakage.LPG is a mixture of flammable hydrocarbons like propane and butane so we used a sensor which is highly sensitive to LPG and less sensitive to other gases. MQ-6 sensor contains a sensitive material tin oxide (SnO2) which has lower conductivity in air. As gas comes in contact with the sensor its conductivity increases. Its conductivity increases as the concentration of combustible gas (LPG) increases. This sensor can also be used to detect other combustible gases like methane but it has good sensitivity to propane and less sensitivity to cigarette smoke and alcohol. It operates on 5V.It has 6 pins,4 of them are used to fetch signal and other two are used for providing heating current.

MQ-6 sensor senses the gases and generates an output. This output is fed to the microcontroller as an input which alerts the servomotor, GSM modem, buzzer and relay connected with exhaust fan according to the output of the sensor [3].

2.3 SERVO MOTOR:

A servo motor is basically a DC motor with some other components which makes it servo. It is used to rotate shaft

at desired position. Simple DC motor does not provide efficient torque that can be used practically so gears are used in servo motor. A servo motor consist of a DC motor, gear arrangement, a potentiometer and a control circuitry.

A servo motor is controlled by electrical signal or PWM (Pulse Width Modulation). When the motor rotates, the knob of potentiometer changes its position and generates an electrical reference signal [4].This reference signal is given to control circuitry and command signal (PWM) is also provided to

control circuitry. By comparing both signals a feedback signal is generated which is responsible to operate motor in desired position[4]. When there is no difference between reference signal and command signal, it means motor has reached its desired position. It does not consume power to lock and hold its position so it is better than stepper motor. We have used Futaba S3003 servo motor in this system to shut off the regulator when gas leakage detected.

2.4 GSM MODEM:

GSM modem is used to send messages to user. It is just like a mobile phone with unique number. It works on AT commands. By this we can send SMS, read SMS, connect to internet via GPRS through simple AT commands. We have used Sim 900-RS232 GSM/GPRS modem which can be interfaced with computer using RS232 serial port. It can also be interfaced with microcontroller using MAX232 [5]. When gas leakage detected microcontroller alerts the GSM/GPRS modem to send message to the user.

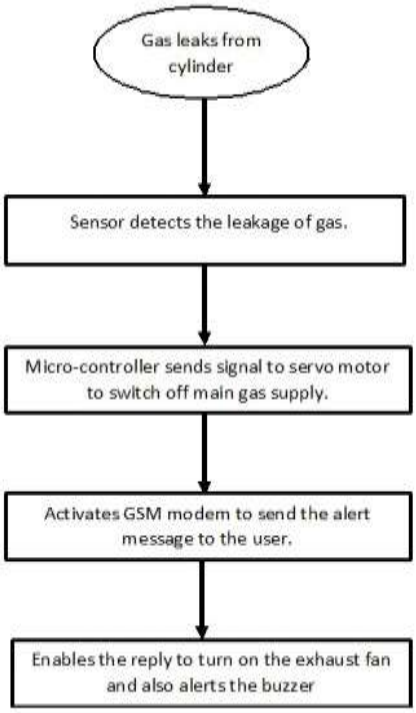

Fig 2Flow chart

2.5 **RELAY:**

Relay is an electromagnetic device which is used to isolate two electrical circuits and connects them magnetically [6].These devices allow one circuit to switch another one while they are completely separate. In this system exhaust fan is connected to relay. When gas leakage detected microcontroller alerts the relay to switch on exhaust fan. By using relay spark can be avoided and concentration of gas is reduced by using exhaust fan.

3. SYSTEM OPERATION:

MQ-6 gas sensor is responsible for sensing the gas. When it senses the leaking gas (LPG) it generates an electrical signal as an output. This output of MQ-6 gas sensor is provided to microcontroller as an input[7]. According to the MQ-6 gas sensor output signal microcontroller alerts the servo motor to turn off the regulator. Simultaneously, it alerts the GSM modem to send the message to the user and it also alerts the relay and buzzer. Relay switches on the exhaust fan when microcontroller alerts it and buzzer makes an alarming sound.

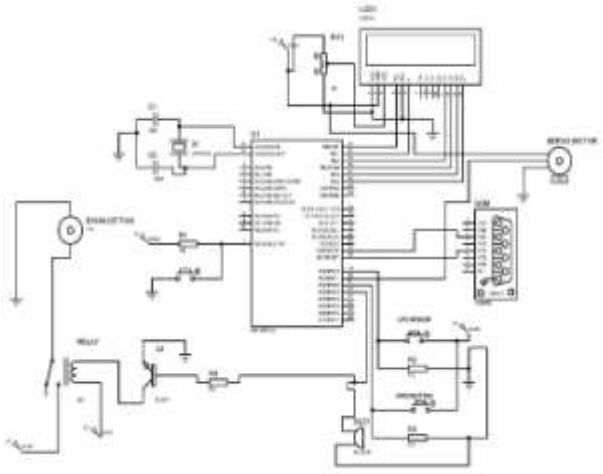

Fig 3 Proposed Circuit Diagram

4. RESULT:

The proposed circuit of gas leakage detection system is provided in fig [3]. The system was tested by introducing a small amount of gas near MQ-6 gas sensor. Sensor sends the signal to microcontroller when gas is leaked. After that microcontroller commands the servo motor to turn off regulator, GSM modem to send the message; relay to switch on the exhaust fan and buzzer to make an alarming sound

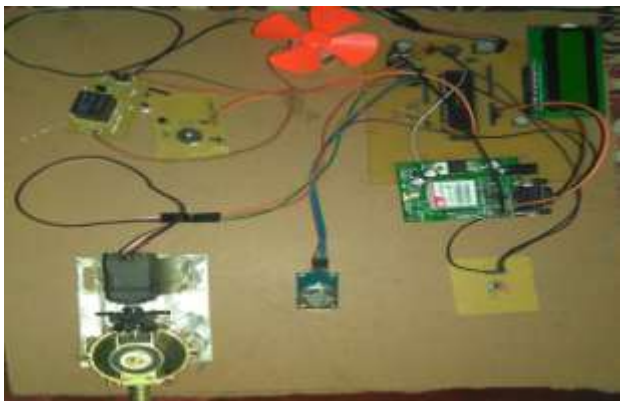

Fig 4 Proposed Prototype Model

5. CONCLUSION:

Nowadays LPG is too common in our houses, industries etc. Consequently, gas leakage is a major concern. By installing this system we can avoid the explosion, suffocation and other serious damages due to gas leakage. This system automatically turns off the main gas supply, alerts the user by sending messages and by buzzer when gas leakage detected so that preventive measures can be taken.

6. REFERENCES:

1. Broughton E (10 May 2005). "The Bhopal disaster and its aftermath: a review". Environmental Health 4 (1): 6 pages, doi: 10.1186/1476-069X-4-6.
2. Muhammad Ali Mazidi, Rolin D.McKinlay and Danny Causey “PIC Microcontroller and Embedded Systems Using Assembly and C for PIC18”, Pearson Education, 2008.
3. Hanwei Electronics Co. Ltd, MQ-6 Gas Sensor Technical Data.
4. Riazollah Firoozian “Servo Motors and Industrial Control Theory”, Springer; 2nd ed. 2014 edition.
5. Rappaport T.S, “Wireless Communications: Principles and Practice”, 2nd edition, Pearson education.
6. Nakano S, Goto Y, Yokosawa K, Tsukada K, “Hydrogen Gas Detection System Prototype with Wireless Sensor Networks”,Proc. of IEEE Conference on Sensors, pp. 1-4, 2005.
7. S Rajitha, T Swapna, “Security Alert System Using GSM for Gas Leakage”, International Journal of VLSI and Embedded Systems-IJVES, Vol. 03, pp. 173-175, 2012.