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Automatic Level Control of LPG Leakage

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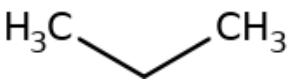
Abstract : *Liquified Petroleum Gas is major fuel for cooking in India.It is a mixture of two gases; Propane and Butane. Even a miniscule leakage in LPG gas cylinders in unventilated area over a significant amount of time can create hazardous conditions to anyone comes in contact.In this paper, a feedback system has been devised that will sense the level of LPG and when the level is beyond a permissible limit, it will switch -on the exhaust fan for proper ventilation. System also consist of transmitter and receiver system to send warning to the local office .This is an energy efficient system as controlling of exhaust fan will be based on the Sensor signal . When the level of above mentioned gas will be more than 530 ppm, it will be switched ON.*
Keywords: *LPG monitoring, MQ-06 Sensor, Automatic level Control.*

I. Introduction

Liquified Petroleum Gas(LPG) is a major fuel for cooking across the world. India has a total of 24.9 crore gas connections that is the 80% of total households. LPG is generally a combination of Propane and Butane whose proportion varies depending upon the temperature and weather condition of country. In India, Propane and Butane is mixed in ratioof 40:60 under pressurized condition as LPG[1].It is filled in 85% of cylinder volume.

Propane: Propane is highly inflammable gas an its leakage over a long period of time can cause explosion in case of even a small spark[2].



Propane

Butane

Butane : Butane is a odorless,highly inflammable natural gas which is not soluble in water. Exposure to butane in high concentrations can cause damage in Central Nervous System and cause cardiac issues. Immediate side effects can be Sedation,loss of consciousness, Short term memory loss,Indistinct speech, Coordination problem,Confusion**,** convulsion and fits of laughter**,** hallucination. Long or repetitive exposure may cause problems like Ataxia, Sinusitis, Breathing problem , Depression and Nervousness. Its exposure affects the Central Nervous system of body, hence, it causes psychological problems more than physical problems in body[3].

Cardiac condition that occurs due to excessive exposure to butane is the irregular pattern of Heart beat that may also cause Sudden Sniffing Death Syndrome where heart fails to pump blood. Although , the exposure to these gases may not be fatal but can surely cause damage to Heart and Central Nervous System of human body.To prevent the sudden exposure from these gases in enclosed area like a Godown, a monitoring and automatic level control system can be installed. This system consist of sensor and microcontroller which is connected with exhaust fan. This system can be installed in godowns or close area where LPG cylinders are stored.Whenever sensor detects the level of these gases beyond permissible limits that 530 ppm , it will send signal to microcontroller that will turn on the exhaust fan . As soon as the excess gas is expelled , it will switch off the exhaust fan. Thisis anEnergy efficient system. Section II of the paper describes the working of configured module. Section III will feature the component Description. Section IV is the conclusion.

II. System Design

LPG monitoring system contains a MQ-06 sensor. This sensor is connected with a PIC microcontroller that can enable an exhaust to switched ON whenever level of LPG are higher than permissible limits that cause damage or could be fatal. Main components that are used in the assembly are: MQ-6 is a gasoline sensor which senses the gases specifically LPG(Propane & Butane),PIC Micro-controller 16f877A,a liquid crystal display display(sixteen*2),Buzzer,Exhaust Fan,RF ,Module of frequency 433 MHz,Encoder IC(HT12E) and Decoder IC(HT12D)[4-6].This system works on 5V Dc supply. It can be connected with 230V supply and with voltage regulator IC 7805, voltage can be stepped down at 5V.

Configuration of system is shown in the Figure 1,

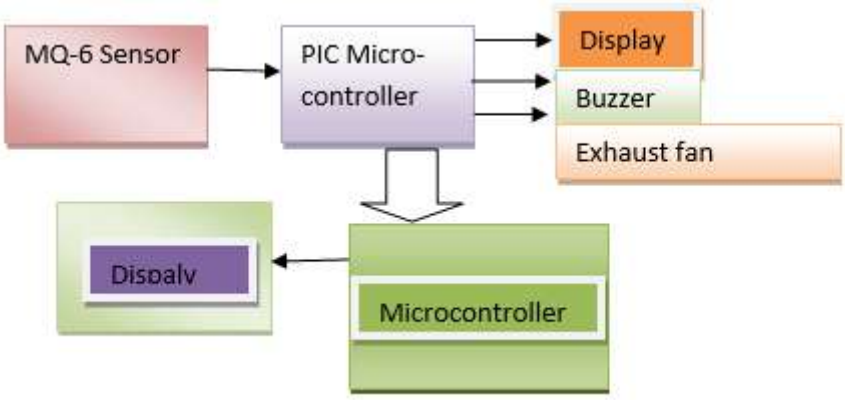


Figure 1. Block Diagram of Energy efficient monitoring of LPG leakage.

Project Description: The MQ-6 gas sensor senses the gases and sends a signal to the PIC Microcontroller. There is an LCD Display of16*2 next to the microcontroller. There is a SET and RESET buttons also there. We can set the values according to our choice. Threshold Value chosen for thisproject are 530 ppm. If the value of the input gases is greater than the value stored in the microcontroller then automatically the signal is sent to buzzer and fan. The buzzer would get activated and the fan automatically starts working.

If the value of input gases is less than the value stored in the microcontroller, then one signal is sent to RF module of frequency 433 MHz and an Encoder IC (HT12E) is also attached to it. LCD sends one signal to and to the buzzer. If the buzzer does not get activated then also it gives signal to Microcontroller IC. Buzzer would activate only when the input value of a gas is greater than its threshold value. Encoder generates code and send it over the wire attached to it which acts like antenna which in turn would get release into air.

On the other hand, the receiver has a signal decoder (HT12D) which would decode the coded signal and send the decoded signal to micro-controller. The micro-controller would read the signal and display the signal with the help of LCD.

III. Components Description

MQ 06 Sensor: MQ -6 Gas sensor is highly sensitive and it is used in project based on cost and availability.As shown is Fig 2, it has total of six pins; one for analog input which is TTL driven and works on 5V.Outer membrane of this sensor is coated with SnO_2.This membrane converts the measured level of gas into voltage level. This sensor can be easily interfaced with PIC Micro-controller 16f877A.

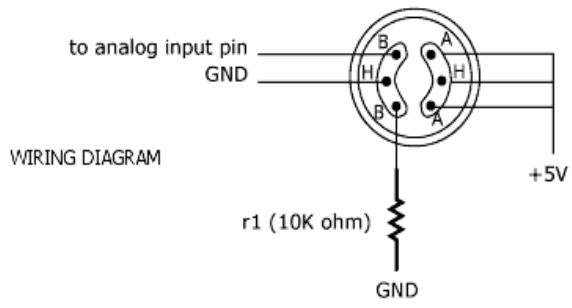


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Figure 2: Internal Diagram of MQ 06 Sensor **Figure 3:** MQ 06 Sensor

Datasheet of Sensor is attached below.Graph is plotted between (Rs/Ro) Vs PPM in given Datasheet. Based on this Datasheet , PPM is measured based on sensor output. Ro is the value of resistance in pure air and Rs is the value of the resistance base on level of gas or gas concentration in the atmosphere[7]. Value of Rs can be calculated with given formula:

Ro: sensor resistance at 100ppm of gas in the clean air

Rs: Value of sensor resistance at various gas concentration.

$R_L = 20K\Omega$ Vc =Circuit voltage

$Resistance\ of\ sensor: R_s = (V_c/V_{out} - 1) * R_L$ .....(1)

Vout = Voltage corresponding to Analog Value provided by sensor.

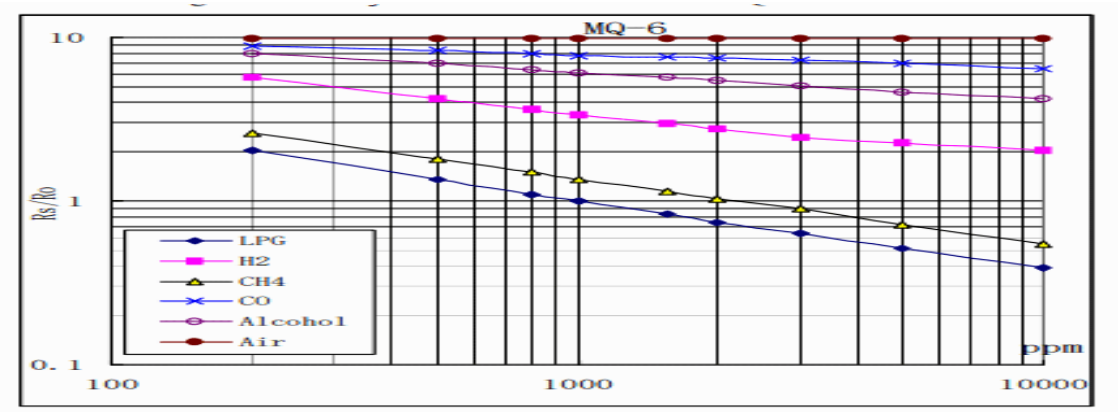

Fig 4: Data sheet of MQ06 Sensor to find the ratio of R_s/R_0

If the detectedvalue of Butane is more than 530 ppm , then actuation signal is generated to switch on exhaust fan and Buzzer. Alert signal is shown on LCD display mounted at remote location through a wireless module.

PIC16f877 Microcontroller: PIC16f877 Microcontroller is a 40 pin IC , largely used in automation systems like home automation system. 33 pin s of 40 pins can be used as input and output. It has EEPROM where information can be save permanently. It has a small instruction set of 35 instructions so can be easily programmed for interfacing .It can be reprogrammed as many times as required due to the advantage of Flash memory. It operates on 20MHz frequency.Its input an output port can source or sink current upto 10mA. Operating voltage is between 4.2Volts to 5.5 Volts[8].

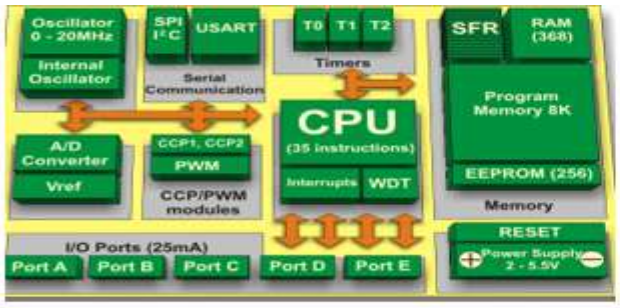

Figure 5: Block Diagram of PIC16f877 Microcontroller

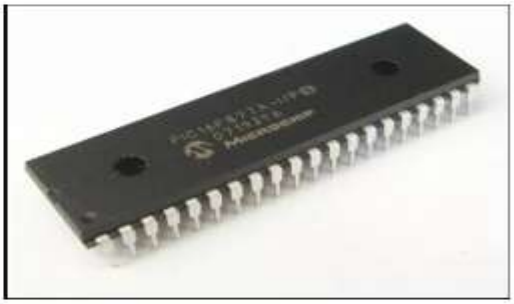

Figure 6: PIC16f877 Microcontroller

Input/ OutportPorts : It has 5 I/o Ports namely Port A, Port B, Port C, Port D & Port E. Port A is 6 pins wide, Port B, Port C, Port D are all 8 pins wide and Port E is just 3pins wide. All these ports are Bidirectional having their directions controlled by TRIX(X) Flag. If the status of TRIX(X) falg is '1', then corresponding port will act as input port and output otherwise. Each port has a corresponding TRIS flag.

An RF module working on 433 MHz is used along with Encoder IC HT12E to transmit the signal sent by Sensor. It encodes the parallel measurements into sequential for transmission by means of a RF transmitter At receiving end, IC HT12D is connected at receiving end with the LCD to show the alarm.A buzzer is connected that will be start an alarm as soon as measured concentration exceeds threshold concentration . A dc motor is used in the project as a prototype for exhaust fan connected at window for ventilation.

IV. Result and Discussions

A prototype for the detection of increasing level of LPG in an closed indoor environment has been eveloped. This module is fully equipped with buzzer and feedback system that can actuate an exhaust fan installed at window to increase the ventilation.It also consists of a RF module to send alarm signal at remote location .

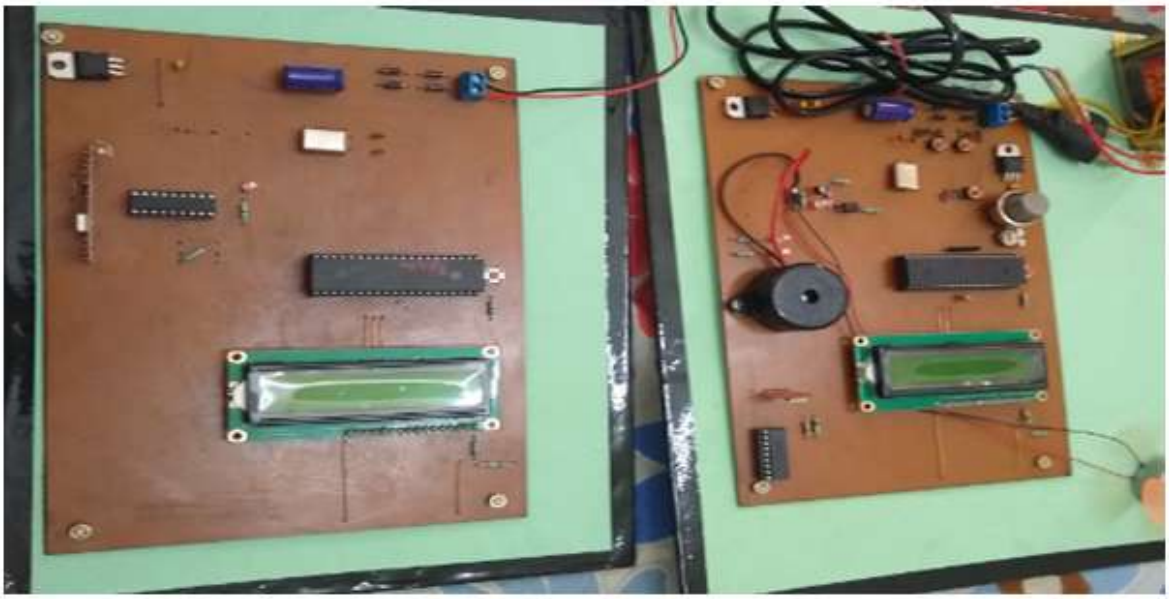

Figure 7: Feedback base LPG monitoring system to be installed in closed environment

V. Conclusion

Empty LPG cylinders are not completely out of gas and when they are stored in closed environment then small leakage over a long period may accumulate hazardous amount of gas in enclosed area . This can prove to be fatal for anyone entering inside the go down. This system proves to be useful for such situation as it will automatically turn on the exhaust fan for ventilation and sends signal to remote locations thus preventing any major tragedy occurring due to LPG leakage.

References

[1]. Shruthi Unnikrishnan et. al.,'LPG Monitoring and Leakage Detection System',IEEE WiSPNET 2017 conference,22-24 March, Chennai, India,2017.
[2]. Zbigniew Krzysiak et al,' Analysis of tank safety with propane-butane on LPG distribution station', ,Polish Journal of Chemical Technology , Vol -19, Iss.4,pp 99-102,2017
[3]. https://nj.gov/health/eoh/rtkweb/documents/fs/1118.pdf.
[4]. Tamil Selvi a/p Sitan et al,'Liquefied Petroleum Gas (LPG) Leakage Detection and Monitoring System',Journal of Science and Technology, Vol. 10 No. 3 ,2018, p. 46-53.
[5]. G. B. C. V. K. G. S. V. H., B. N. V. Abhishek, P. Bharath, "Automation of lpg cylinder booking and leakge monitoring system," International Journal of Combined Research and Development (IJCRD), pp. 693–695, 2016.
[6]. A. Raj, A. Viswanathan, and T. Athul, "Lpg gas monitoring system," IJITR, vol. 3, no. 2, pp. 1957–1960, 2015
[7]. S. S. S. S. K. K. Pankaj C. Warule and Shivam Upadhyay, "Lpg detection, metering and control system using microcontroller," International Journal of Advance Research and Innovative Ideas in Education, 2016
[8]. Technical data mq-6 gas sensor. [Online]. Available: https://www. sparkfun.com/datasheets/Sensors/Biometric/MQ-6.pdf.
[9]. Pic16f87xa data sheet. [Online]. Available: http://ww1.microchip.com/ downloads/en/DeviceDoc/39582b.pdf.