

# LPG DETECTION, METERING AND CONTROL SYSTEM USING MICROCONTROLLER

Prof. Pankaj C. Warule<sup>1</sup>, Shivam Upadhyay<sup>2</sup>, Snehal S. Shelke<sup>3</sup>, Sumitra K. Khandade<sup>4</sup>

<sup>1</sup> Associate Professor, Department of Electronics and Telecommunication, Pravara Rural Engineering College, Loni, Savitribai Phule Pune University, Pune, Maharashtra, India.

<sup>2</sup> BE Scholar, Department of Electronics and Telecommunication, Pravara Rural Engineering College, Loni, Savitribai Phule Pune University, Pune, Maharashtra, India.

<sup>3</sup> BE Scholar, Department of Electronics and Telecommunication, Pravara Rural Engineering College, Loni, Savitribai Phule Pune University, Pune, Maharashtra, India.

<sup>4</sup> BE Scholar, Department of Electronics and Telecommunication, Pravara Rural Engineering College, Loni, Savitribai Phule Pune University, Pune, Maharashtra, India.

## ABSTRACT:

The conventional system of transportation and storing of LPG gas cylinders is a very complex process. This system has many disadvantages like lengthy process, time consuming, quite costly. Accidents while transportation is yet another aspect. To overcome above problem we can implement prepaid LPG gas metering and control system. In this system the gas will be supplied to the consumer through pipelines with a unit mounted over it for measurement and control of LPG gas. A prepaid gas card will be issued to every consumer with a unique customer code. The amount of gas needed to consumer will be written in the memory i.e. prepaid gas card. The unit will continuously measure the gas flow through it and stop the supply when units (in kgs) of gas in the card become zero.

In this system there will be two modes charging and consuming. In charging mode for a typical amount (Rs) typical units of gas will be charged and in the consumption mode measuring and controlling of gas is done. Solenoid valve is used as final element. The system can be made more and more fail-safe and reliable by using more safety features. No doubt the implementation cost will be high

**Keywords**-Prepaid card, gas sensors, gas detector, GSM.

## I. Introduction

LPG has very importance in our lives. According to the surveys that are conducted we could literally feel that to make the system fully secure and leak proof using distributed control system. By changing the units in EEPROM IC i.e. AT24C64, only that much of gas product, liquid is passed [1-2], [4]. By inserting the card in the unit, the unit continuously monitors the gas consumption and stops when the charged unit of gas becomes zero. The charge for carrying the empty cylinder back to agency is same as that of filled one, thus it's not possible to reduce the cost of transportation of empty cylinder. By using this system, we have the option of using the desired amount of the LPG gas.

Suppliers change the new cylinder with used one or partially filled one. So we face a big loss at such incidents [3], [7], [10]. For above all problems there is vital solution, the supply of gas to every house, shop or office via pipelines. This is where a unit just like an energy meter at every house, which measures the gas and control the gas flow. The amount of gas needed can be charged every month/everyday/every year as per the customer wish. By just inserting a card in the unit, the unit continuously monitors the consumption and stops when the charged unit (kg) of gas becomes zero.

A buzzer will alarm the user when the gas unit will come to the edge of end. The user can see the unit (kg) of gas remained for use on the LCD display, to prevent the accidents due to LPG gas the system is very useful [1-4]. As the leakage occurs the detection of the leakage is done by the sensor. The consumer will be notified in such a case using GSM module [1-2], [4].

## II. System Overview

The system block diagram comprises of parts as shown in figure 1. It consists of microcontroller, gas sensor, display, relay, control knob and buzzer.

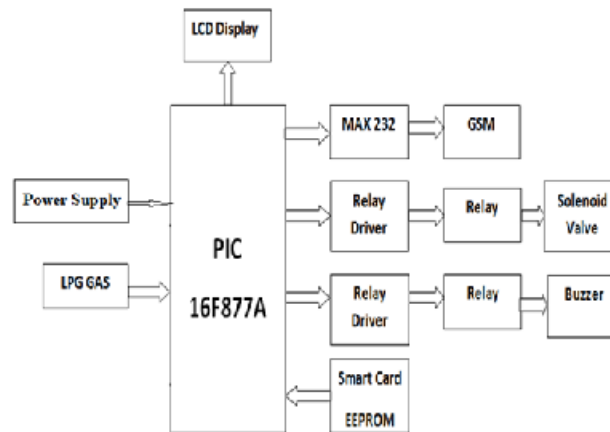


Figure 1. Block Schematic

### 2.1 PIC 16F877A

This CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC architecture into a 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F877A features 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I<sup>2</sup>C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications .

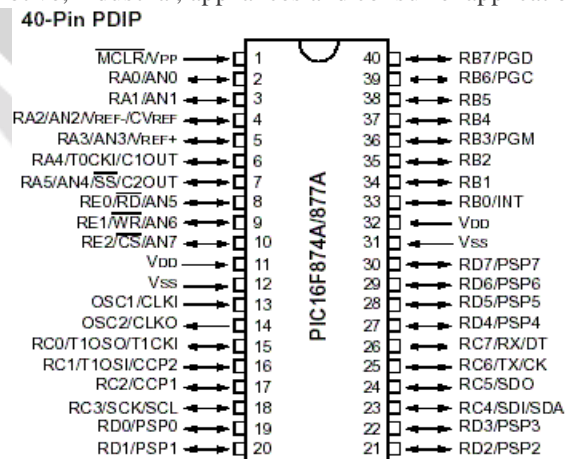


Figure 2: Pin diagram of PIC 16F877A microcontroller.

## 2.2 Gas Sensor

The isobutene, propane, methane, etc. are the contents of LPG gas. This gas sensor is preferably used for LPG gas instead of smokes due to another fire or fire causes. SnO<sub>2</sub> is the sensitive material of MQ-6 gas sensor. It has lower conductivity in natural and pure air. When the target burns gas exist the sensor's conductivity is higher along with the gas concentration rising. MQ-6 gas sensor is highly sensitive to Propane, Butane and LPG. This sensor can be used to detect different combustible gas, especially Methane with low cost and applicable for different application. The alert signal is given to the microcontroller when the sensor senses the leakage of LPG gas. The buzzer will be on at the time of occurrence of extreme conditions.



**Figure 3: The configuration of MQ6 gas sensor**

## 2.3 Display

It is necessary to know about the availability of the gas or the remaining amount of the gas. This need can be completed by using the display. To monitor the system and to control the performance the display is used. It shows the messages as well as the leakage detection. The payment for the system also displayed. The system also, displays the actions carried out in the microcontroller.

## 2.4 GSM

The GSM module may be connected to CPU using serial interface MAX 232. It helps to transmit and receive the SMS with UART. The tri-band sim300 based GSM modem is highly flexible plug and play modem. In much real-time application Sim300 can fit almost all the space requirements. It has become very easy for mobile communication technology to receive and send the messages by using this global system. The AT commands can be implemented by interfacing to the receiver and transmitter pins of microcontroller. MQ6 gas sensor detects the leakage of gas, weight sensor provides the level in cylinder, and microcontroller will take the protective and necessary action. All these notable information /status occurring has to be conveyed to the user. The mobile number of user and distributors is stored in simcom300. It requires less memory to store and receive the messages.

## 2.5 Prepaid card/Smart card

The prepaid gas card is called as smart card are the new generation gas metrological flow-rate instrument for the gas companies consumers have computerized gas supply with scientific, automatic and regular gas management. Through the smart card the prepaid gas can realize the function of payment ahead of gas consumption, and from the LCD of prepaid gas meter the purchased volume, the surplus volume and other information can be displayed. We supply the prepaid gas to gas companies and consumer as stock of line gas meters with more modernization, safety, reliable performance and modern management.

## 2.6 Solenoid Valve

This valve is operated by relay and it is having +12 V supply. A solenoid valve is an electro-mechanical valve for use with liquid or gas controlled by running or stopping an electrical current through a solenoid, which is a coil of wire, thus changing the state of the valve. The operation of a solenoid valve is similar to that of a light switch, but typically controls the flow of air or water, whereas a light switch typically controls the flow of electricity.

Solenoid valves may have two or more ports; in the case of a two-port valve the flow is switched ON or OFF; in the case of a three port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

### III. Result

The proposed the block schematic of the working system will be as shown in the figure 1. The smart card stores the amount with which is recharged, when the card is inserted into the home unit the system continuously monitors the amount of gas consumed and the remaining balance is automatically updated. The proposed working of the system can also be explained as when the system attribute is designed, when a small amount of LPG gas is brought near the sensor, it detects the leakage and the buzzer is activated and then supply of gas is stopped. The consumer as well as the central agency are alerted by the system when the LPG gas storage reaches at critical position. By using the smart or the prepaid card the LPG gas distribution system can become the easier.

### IV. Conclusion

Whenever the leakage of gas will occur within a short span of time the alert will be given to the user as well as the message will be send to the distributor. The supply will be turned off automatically immediately. The efforts of rebooking of the gas cylinder have been dropped out via this system. The user become the smart user by using the smart prepaid card. The accidents occur due to gas leakage can be avoided by this system. Transportation as well as the efforts of distributors can be minimized and the cost of the system will be reduce.

### V. ACKNOWLEDGMENT





The authors gratefully acknowledge to Department of Electronics and Telecommunications at Pravara Rural Engineering College, Loni for all the support and allowing us to conduct our research using all the facilities in the laboratories. We are also grateful to Prof S M Turkane for his support, guidance and help at all the times.

### REFERENCES

- [1]. Sunithaa.J, Sushmitha.D, “Embedded control system for LPG leakage detection and prevention” International Conference on Computing and Control Engineering (ICCCCE 2012), 12 & 13 April, 2012, Vol. 4 pp.120-141.
- [2]. V.Ramya, B. Palaniappan, “Embedded system for hazardous gas detection and alerting” International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.3, May 2012.
- [3]. Mr.Sagar Shinde, Mr.S.B.Patil, Dr.A.J.Patil, “Development of movable gas tanker leakage detection using wireless sensor network based on embedded system”, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 6, November- December 2012, pp.1180-1183.
- [4]. M. B. Fish, R.T. Wainer, “Standoff Gas Leakage detectors based on tunable diodes laser absorption spectroscopy”
- [5]. A. Mahalingam, R. T. Naayagi, N. E. Mastorakis, “Design and Implementation of an Economic Gas Leakage Detector”, Recent Researches in Applications of Electrical and Computer Engineering, proceedings of the 11<sup>th</sup> international conference on applications of electrical and computer engineering, pp.20-24, may 2012.
- [6]. S. Rajitha, T. Swapna, “Security alert system using GSM for gas leakage” International Journal of VLSI and Embedded Systems-IJVES, vol.3 issue.4, sept-oct 2012.
- [7]. Taufiq Noor Machmuda, “LPG Gas Detector and leak prevention based microcontroller”, 5th national conference on VLSI, embedded systems. 2012.
- [8]. A. CheSoh, M.Sc.; M.K. Hassan, M.Eng. ; And A.J. Ishak, M.Sc. “Vehicle gas leakage detector” IJITR, vol.3, issue.2, 2015.
- [9]. National Institute of Health. (2004). “What you need to know about natural gas detectors”. <http://www.nidcd.nih.gov/health/smelltaste/gas>, may 2012.
- [10]. Fraiwan, L.; Lweesy, K.; Bani-Salma, A.Mani, N, “A wireless home safety gas leakage detection system”, Proc. of 1st Middle East, Conference on Biomedical Engineering, pp.11-14, 2011.

- [11]. Nasaruddin, N.M.B.; Elamvazuthi, I.; Hanif, N.H.H.B.M, "Overcoming gas detector fault alarm due to moisture", Proc. of IEEE Student Conference on Research and Development, pp. 426-429, 2009.
- [12]. 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.
- [13]. Hanwei Electronics Co. Ltd (2002), MQ-6 Gas Sensor Technical Data.
- [14]. ATmega 128 Datasheet; www.atmel.com
- [15]. Kelvin R. Sullivan, "Understanding Relays", A tutorial on relays.
- [16]. SIMCOM Ltd, 27th Dec, 2005, "SIM 300 Hardware Specification Manual"
- [17]. Display Elektronik GmbH Datasheet; LCD Module, DEM 16216 SYH-PY
- [18]. Technical Data MQ6 Gas Sensors, www.hwsensors.com
- [19]. Aluminum Single-Point Load Cell Datasheet, model 1004, www.vpgrtransducers.com Sunithaa.J, Sushmitha.D, "Embedded control system for LPG leakage detection and prevention", International Conference on Computing and Control Engineering (ICCCE 2012), 12 & 13 April, 2012
- [20] Sharma S, Mishra V.N, Dwivedi R, Das R. "Classification of Gases/odours using Dynamic Responses of Thick Film Gas Sensor Array," in IEEE Conference on Sensors Journal, 2013.
- [21] M.L.Ali, M.I.H.B.Asad, and M.S.Islam, "Contactless Smart Card Based Prepaid Gas Metering System", proceedings of the 2014 International Conference On Industrial Engineering And Operations Management (IEOM 2014), Jan/7-9, 2014.

#### AUTHORS

	<p><b>Asst Prof. Pankaj C Warule</b> Associate Professor (Electronics and Telecommunication) Pravara Rural Engineering College, Loni . Saipankaj.warule@gmail.com</p>
	<p><b>Mr. Shivam Upadhyay</b> BE Scholar (Electronics and Telecommunication) Pravara Rural Engineering College, Loni . pratyushiva10@gmail.com</p>
	<p><b>Ms. Snehal S Shelke</b> BE Scholar (Electronics and Telecommunication) Pravara Rural Engineering College, Loni. Snhalsshelke178@gmail.com</p>
	<p><b>Ms. Sumitra K khandade</b> BE Scholar (Electronics and Telecommunication) Pravara Rural Engineering College, Loni . Sumitra.khandade44@gmail.com</p>