

Microcontroller Based LPG Gas Detector & Monitoring System

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Abstract— Gas leaks represent the cause of many accidents both in the industry sector and domestic environments. Due to the deployment of complex supervisory control and data acquisition systems, accident rates have decreased in the industry sector but they are still high in domestic environments. Here, we propose a gas leak detection system based on redundant sensing units and investigate ways of integrating it in the distributor's system. We also look at some off-the-shelf gas leak detection devices for home usage and present results of the study made on them. The performance of each studied device is analyzed in comparison to our solution. Results of this analysis show that the proposed implementation is suitable for a more reliable detection of gas leaks.

Key words: Microcontroller PIC 16F877A, GSM Module, Load Cell, Gas Sensor, LCD

I. INTRODUCTION

The use of liquefied petroleum Gas (LPG) is mostly increasing in countries like Nigeria, India, Bangladesh, Nepal, South Africa as It produces low smoke and less soot. The LPG is a flammable mixture of hydrocarbon gases like propane and but Gas pipelines are safe but they are prone to gas leakage due to mishandling, accidents and over filling of the gas cylinder. Explosions resulting from domestic cooking gas leakage can be fatal causing loss of property and injuries or even deaths. The design of microcontroller based LPG Gas detector monitoring system is proposed for home safety and industrial safety. This system detects the leakage of the LPG Gas and alerts the consumer about the leak by SMS and activating the buzzer. The LCD is display the LPG Gas is detected. At that moment exhaust fan will be start. Load cell is measure the weight of Gas and when the gas is leaked the overall weight of LPG Gas reduced which is displayed on LCD, these system are provide these information to the consumer by sending the SMS by using GSM module to the consumer of home and industries phone number . The display and audio able buzzer will be used to provide the attention. Liquid petroleum gas is generally used in houses and industries. In homes, LPG Gas is used mainly for cooking. This energy source is primarily composed of propane and butane which are mostly flammable chemical compounds. Leakage of this gas is dangerous as it enhances the risk of explosion. An odorant such as ethanol is added to LPG GAS, so that leaks can be detected easily by most people. Our paper aims at the designing of a system that detects LPG Gas leakage and alerts the subscriber through buzzer, sending SMS on consumer mobile phone and turning off the gas supply valve as a primary safety measure. In industries there will be a same problem of gas leakage due to that condition system will detects the leakage gas and alert the industries by activating buzzer . In homes load cell are measure the LPG gas and if the weight of the Gas is reduced then booking of the LPG Gas cylinders is done by sending SMS to the LPG Gas distributor agent. In this system the GSM module which

automatically books the LPG Gas cylinder by SMS to the LPG Gas distributor agent booking phone number. This will help the owner of the house to get the new LPG Gas cylinders in short time without any failure.

II. PROBLEM STATEMENT

In recent years we see many times in our country Gas leakage leads to various causality resulting into both financial loss as well as human life. The number of deaths figures due to explosion of LPG gas cylinders has been increasing in recent years main reason for such explosion is due to substandard cylinders, worn out regulators, old valves and lack of awareness using gas cylinders add to risks. These same problem is obtained in to the industries, in industries the people are also unaware about LPG Gas safety measures. . As a solution for the problem, our system is proposed.

III. BLOCK DIAGRAM

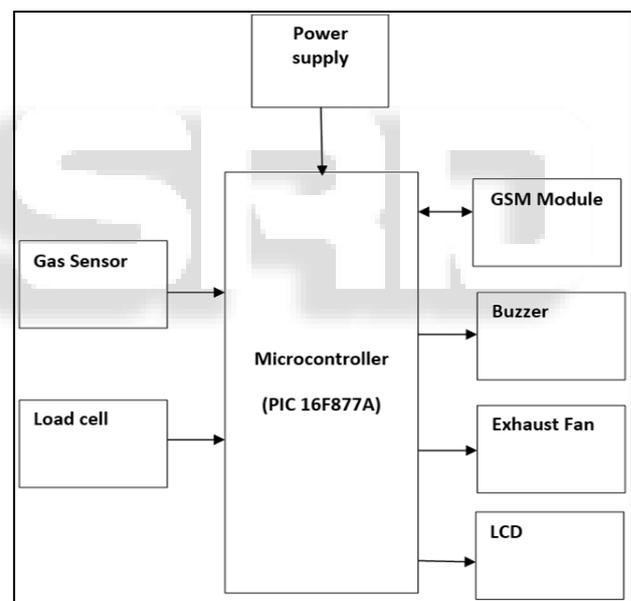


Fig. 1: Basic Block Diagram

IV. DESCRIPTION

A. Display

It is necessary requirement to put a display about system monitoring and controlling performance, which displays the various messages such as leakage of gas detection. Additionally the system also, displays the actions carried out in the microcontroller. For the work of displaying the alert messages Liquid crystal display (LCD) of 16*2 characters operating on +5 volt supply and operated 4-bit mode is implemented.



Fig. 2: LCD Display

B. GSM

The GSM modem is highly flexible plug and play modem based on tri-band Sim300 can fit almost all the space requirements in much real-time application. This global system for mobile communication technology making it very easy to send and receive the messages support the AT commands. These 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 happening has to be conveyed to the user.

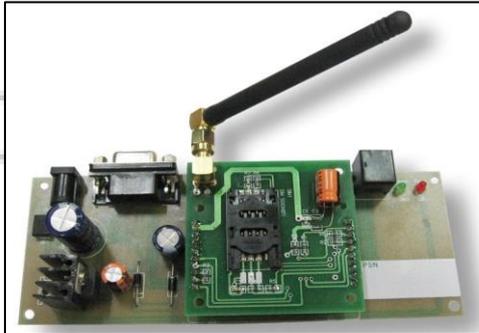


Fig. 3: GSM Module

C. MQ 6 Gas Sensor

MQ-6 gas sensor composed by micro AL₂O₃ ceramic tube, Tin Dioxide (SnO₂) 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 LPG sensitive components. The enveloped MQ-6 has 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current.



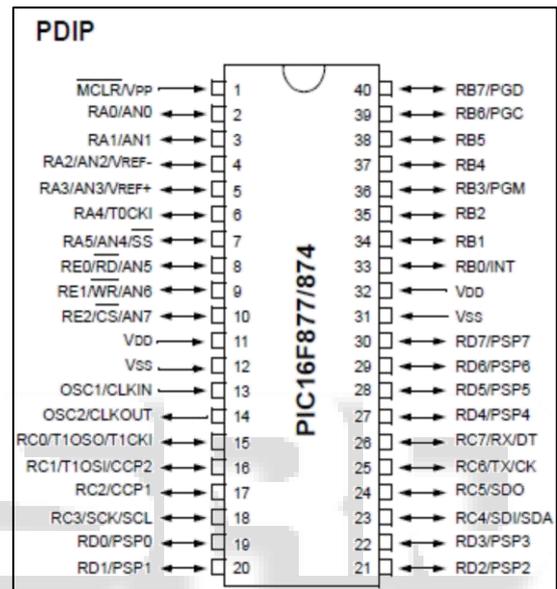
Fig. 4: MQ 6 Gas Sensor

D. Microcontroller

To monitor the LPG, an efficient and fast working microcontroller is required. The microcontroller also controls

the working of the gas sensor and load sensor output. The microcontroller used in this is PIC 16F877A. If the sensor sense a leakage then the microcontroller must make a fast response. The microcontroller is the central part of the system. It has an operating frequency of 20 MHz. it also have 3 timers and 5 input output ports. An efficient and fast working controller is needed to continuously sense the LPG gas and its level (weight) sensor's output. Also a fast reply is desired when leakage is found. Along with this a system must possess capacity to store some information which can be used for further processing. Above operations require a very fast, single cycle execution rate microcontroller like PIC 16F877A are used.

E. Pin diagram of PIC16F877A



F. Buzzer

When buzzer is blowing, this indicates the leakage of LPG gas. It is 12 V DC operated buzzer.

G. Exhaust Fan

When buzzer is blowing, this indicates the leakage of LPG gas. It is 12 V DC operated buzzer.

H. Load Cell

The weight sensor we used is the load cell module. A load cell is described as a "weight measurement device necessary for electronic scales that display weights in digits." However, load cell is not restricted to weight measurement in electronic scales. The strain gauge measures the deformation (strain) as an electrical signal, because the strain changes the effective electrical resistance of the wire. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. Load cells of one strain gauge (Quarter Bridge) or two strain gauges (half bridge) are also available. The electrical signal output is typically in the order of a few mill volts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer can be scaled to calculate the force applied to the transducer. The various types of load cells that exist include Hydraulic load cells, Pneumatic load cells and Strain gauge load cells. In our case the cylinder is put on to the load cell and load cell module is measure the

weight of cylinder in case the weight of cylinder is reduce then load cell informs to microcontroller..



Fig. 5: Load Cell

V. ADVANTAGES

- It has fast response.
- The sensor has excellent sensitivity combined with a quick response time.
- It also used in house as LPG gas leakage detection.
- It has stable performance and long life.

VI. DISADVANTAGES

- It work only when at 5V power supply is given.
- Its sensitivity depends on Humidity and temperature.
- Failure Indication Facility.

VII. APPLICATIONS

- Domestic gas leakage detector
- Industrial Combustible gas detector
- Portable gas detector
- Homes
- Factories
- LPG storage
- Gas cars
- Hotels

VIII. CONCLUSION

A cost-effective microcontroller based LPG Gas detector and monitoring system is proposed, designed and successfully implemented in this paper. Along with LPG Gas leakage detector, this system gives a fully automated approach towards the LPG Gas cylinder booking by sending the SMS using GSM module. Real time weight measurement of the gas and its display on LCD makes it an efficient home security system and also can be used in industries. The cost involved in developing the system is significantly low and is much lower than the cost of gas detectors commercially available in the market.

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