

A smart management system for LPG cylinder booking and leakage detection

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Abstract:

Liquefied Petroleum Gas (LPG) is basic need of each and every house hold person. Always the person working in kitchen worried about the level of LPG Cylinder and leakage of the gas as well. In the present research paper , a smart management system has been proposed for handling such kind of problems. A smart device has been design and fabricated that can help to detect the level and leakage of the LPG cylinder. The proposed system is based on smart management of various equipments for enhancing the safety while using the LPG Cylinder. The center of the system is depends on a microcontroller. This microcontroller unit getting inputs from weight sensor. Now a days there are many cases related to gas leakage which cause innocent people lives and property damage. The developed system will be very useful to avoid the hazardous.

1. INTRODUCTION

Safe working environment is the basic thing which everyone deserve, the place of working can be shop floor of any industry or can be a kitchen of a small house. There are so many case studies related to accident occurs due to the gas leakage from LPG Cylinder. A case report presented by Millo et al., in 2009, In this report a case study of two deaths occurs due to LPG cylinder blast has been represented. Few researchers also worked on safety related to LPG and automatic gas booking system (Kumar et al., 2016; Kasar et al., 2016; Tauseef et al., 2010). Beheshti et al., (2018) worked on Modeling of fire, Explosion and LPG Leakage for house hold cylinder.

Today, booking an LPG cylinder is now just a text SMS away. Petroleum companies have launched the Customer-friendly service called as IVRS (*Interactive voice Response*) technique for their customers. Our system provides security from the gas leakage; it detects leakage and takes control action over it. It is helpful for us to avoid explosion it also have provision for automatic gas booking. Keshamoni, and Hemanth in 2017 worked on monitoring of gas level using smart system. The authors also worked on detection of gas leakage. Amsaveni, et al., (2015) designed a system for detecting the gas leakage. The designed system was based on GSM mobile based system. Fraiwan et al., (2011) fabricated a system for detecting the leakage of LPG, but the designed system was wireless mobile based.

2. CURRENT SYSTEM

Various methods for gas booking are there in current system. This system shows that there is more time required to deliver LPG after booking. There is no such facility of continuous gas level monitoring system. There are so many researchers who worked on the same concept of gas leakage detection or for the monitoring of the gas leakage (Raj, et al., 2015; Jagtap, et al., 2016; Leavline, et al., 2017;). Mathesh et al., (2017) represented a smart gas management system, similarly, Khan and Abbasi in 1999 worked on the same concept, the

authors also considered industrial accident along with this.

2.1 Current System in Villages

The people book gas cylinder when it gets empty by calling gas agency and agency will gives us booking number, with this booking number the person got receipt from agency office. Then one has to go in store room for taking cylinder.

2.2 Current System in City

In current system there is facility of booking gas by calling agency and automatically registered of mobile number and address of owner. So the agency delivers the cylinder on that address. But there is also problem occur if gas will finish within that days then we have to wait for delivery of LPG

2.3 Smart Gas Booking System

Our proposed design can help us to avoid such kind of problem in our daily life. Our design is based on ARM controller, it continuously monitor level of the gas. If the gas level is reaches to the threshold level, then automatically SMS send to the agency and cylinder is booked. It also has provision to detect gas leakage and controlling, the regulator knob is turn off automatically if the gas leakage is takes place.

3. PROPOSED WORK

In the current research paper, A model has been proposed for sensing , displacing and monitoring of the cylinder gas.

The basic block diagram of proposed system smart gas booking, leakage detection and controlling using ARM controller has been demonstrated figure 1. The basic essential blocks in the system are as:

- Power Supply unit
- ARM Controller
- Gas Sensor circuit
- LPG sensor
- Gas leakage Alarm sensor
- LCD Display
- Load Cell
- GSM Module
- DC motor

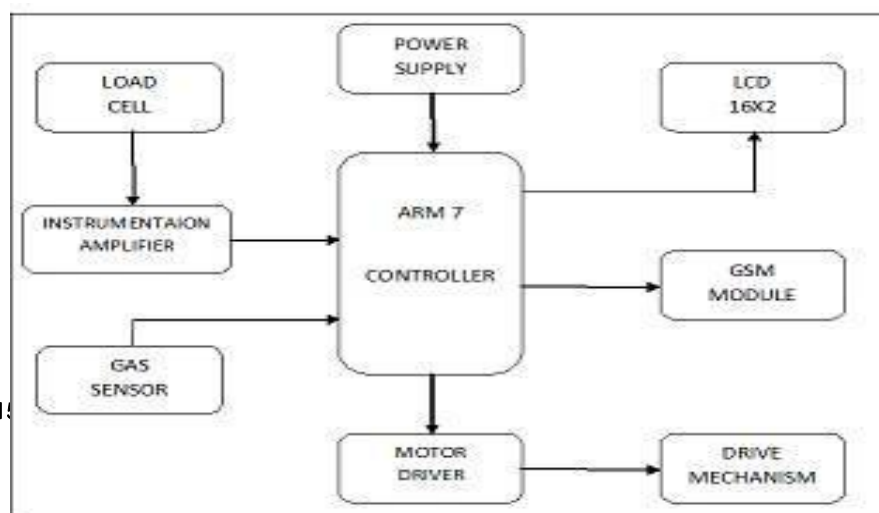


Figure 1: Circuit diagram of the proposed model

3.1 Power Supply Unit

Linear regulated power supply, all the electronic circuit needs a dc voltage is derived from the single ac phase main supply. For this purpose the person have to use a regulated dc power supply. Figure 2 shows ARM controller block diagram.

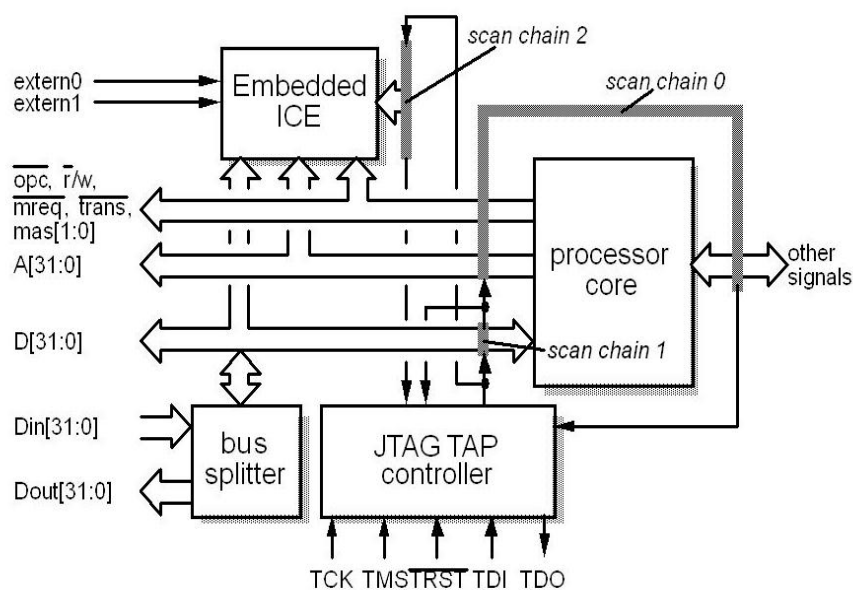


Figure 2 ARM controller block diagram

3.2. LPG sensor

There is requirement a sensor for sensing the gas leakage. Figure 3 demonstrates a LPG leakage sensor. It will send the signal to the buzzer. The buzzer will produce sound after getting output from the sensor. Figure 4 shows MQ-6 gas sensor circuit.



Figure 3 LPG Gas Sensor

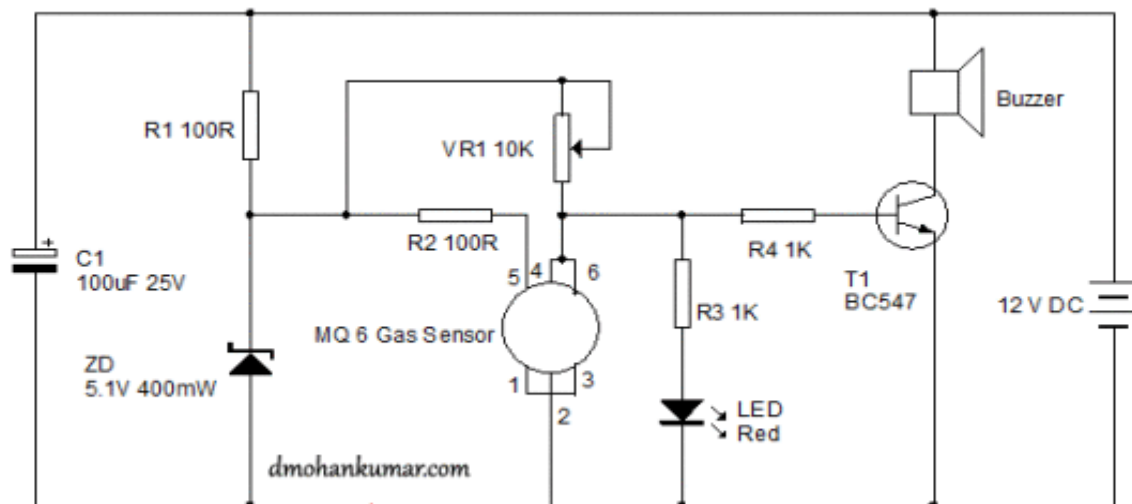


Figure 4 MQ-6 gas sensor circuit

3.3 LCD Display

The status of the LPG has to be displayed on a LCD screen. The display size of the LCD can be 16 x 2 or depending on the requirement of the consumer. The remaining quantity of the gas has to be shown on the LCD in Kgs.

3.4 GSM Module

GSM Module has been attached to send the SMS to the submitted number. In the proposed model more than 1 mobile number can be submitted. This module helps to get the gas booking before empty of the cylinder. Figure 5 shows block diagram of the proposed GSM-GPRS module. The displayed SMS sample has been demonstrated in figure 6.

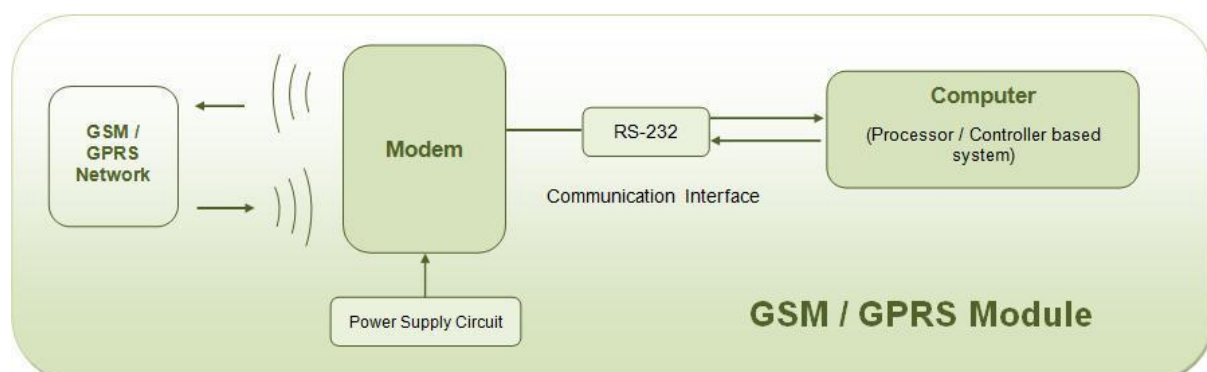


Figure 5 Block diagram of GSM-GPRS module

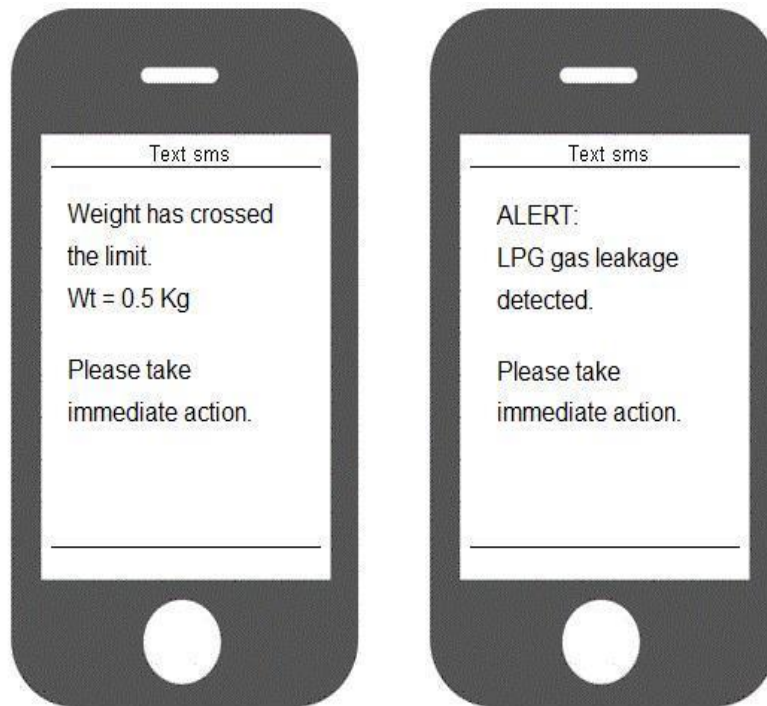


Figure 6 Text SMS after alert

3.5 Pro, drawback and applications of the proposed system

Following are few pros related to the proposed system:

- It insures the security from the gas leakage and hazards.
- It is very less time consuming and cylinder replace in time.
- Easy implementation.
- It is fully automated system; errors due to human are control.
- The person can turn off the room power supply when gas leak.
- System can be battery operated.
- The person can drive the regulator by dc motor

Some disadvantages of the system as :

- Gas sensor should be high enough sensitive to detect gas leakage.
- If the person can use another sensor then cost will be high.
- It should be real time.

This system can be used in different parking area like

- House hold purpose
- Gas agency
- Chemical factory
- Companies

- Hospitals etc.

4. PROPOSED SYSTEM INSTALLATION

Installation is the most important part of all the systems, following are the steps needs to follow for the installation purpose :

- Installation Step 1 Collect all the required inputs and output of device
- Installation Step 2 Initialize all input and output ports
- Installation Step 3 Initialize LCD display, GAS sensor, GSM module.
- Installation Step 4 Display the level of Gas on LCD.
- Installation Step 5 If the level of gas is 2 kg then send SMS to the agency.
- Installation Step 6 If gas leakage takes place then sound the alarm and send SMS to the customer.
- Installation Step 7 Then turn off the main gas valve.
- Installation Step 8 Go to step 4.

Various input and output of the proposed system has been shown in figure 7 on the other hand line diagram is displayed in figure 8.

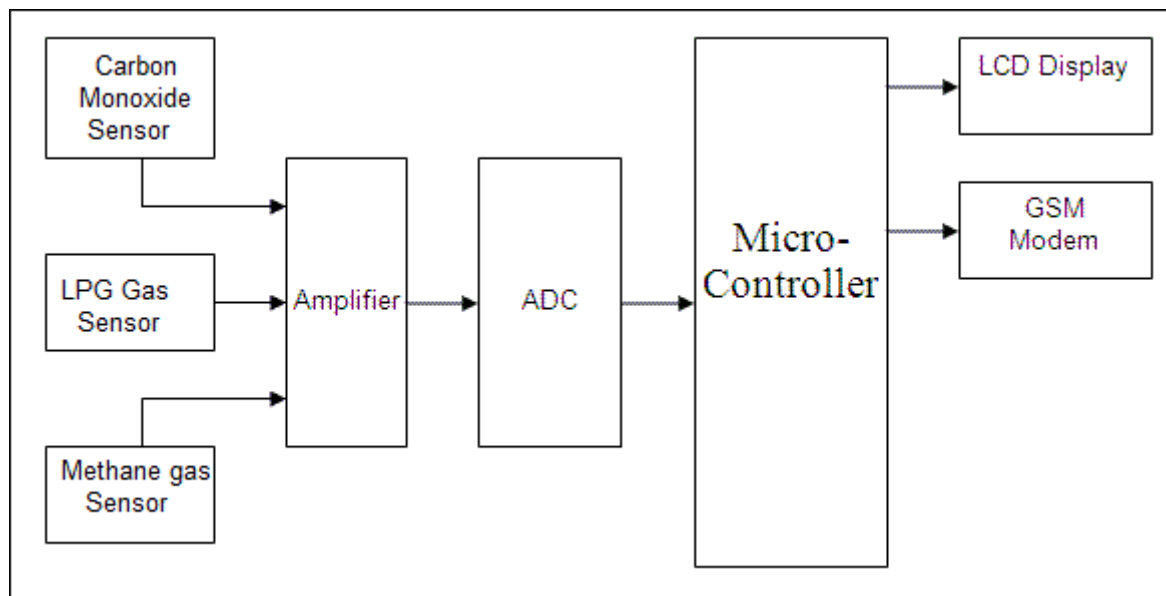


Figure 7- Various Input and Output for Microcontroller

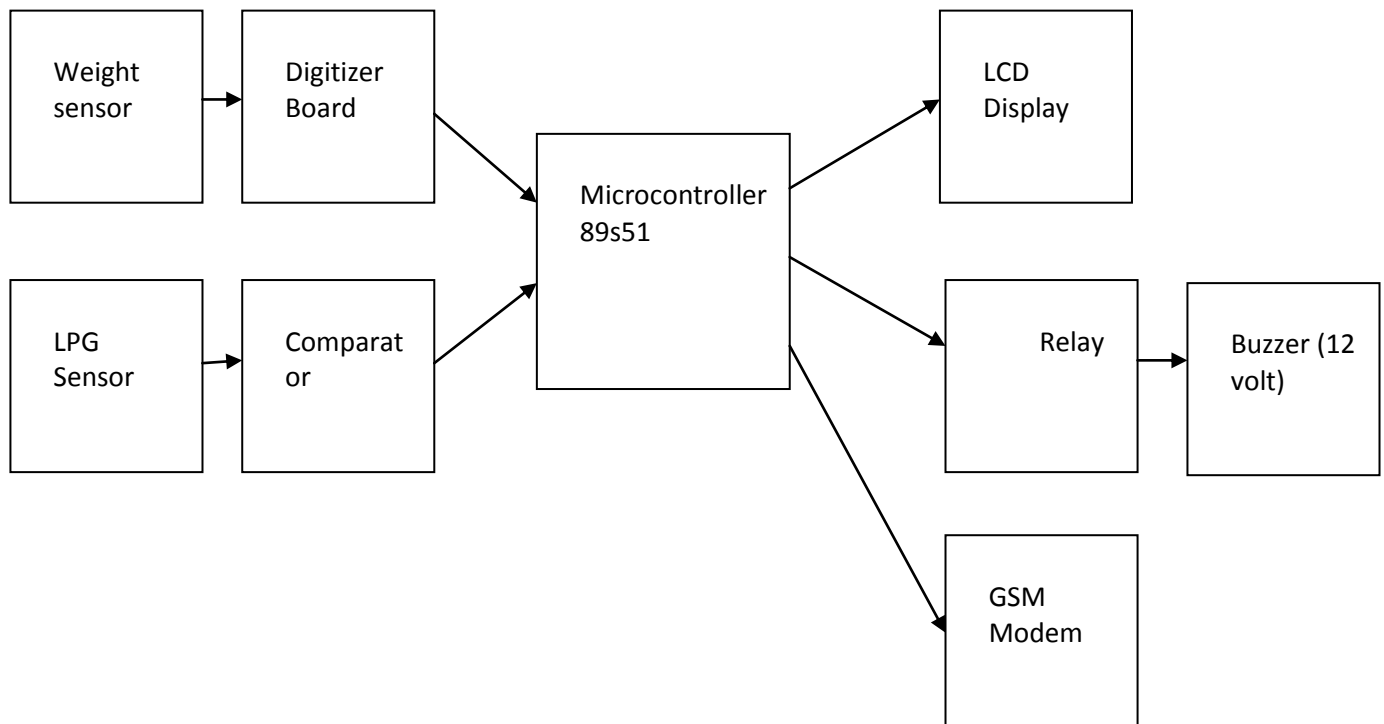


Figure 8 Line diagram of the proposed smart system

5. SCOPE OF THE STUDY

Due to the increased cost of the fuel, most of them prefer in hiring the gas cars instead of petrol/diesel vehicles. Using gas in the cars is highly a risk issue, which will cause major accidents due to the leakage of LPG Gas. In order to overcome this problem LPG gas leakage is protected by using a protection system. The authors designed and developed such type of system, in order to prevent the number of accidents in gas cars; this project is not only for cars it can be used for homes too.

In this way implement our system. It is help in gas booking automatically when gas level (i.e. 2 kg) reaches to the threshold level SMS will be send to the agency i.e. "REGISTER THIS NUMBER". It will also continuously displays the level or the weight of the gas in the LPG cylinder.

It is also useful in gas leakage detection and alert by SMS to the owner. It will turn off the solenoid pressure valve automatically. SMS "GAS DETECTED" is send to the owner mobile number. It will avoid dangerous explosion and save human life. It is very fast in response. Figure 9 shows embedded system for hazardous gas detection

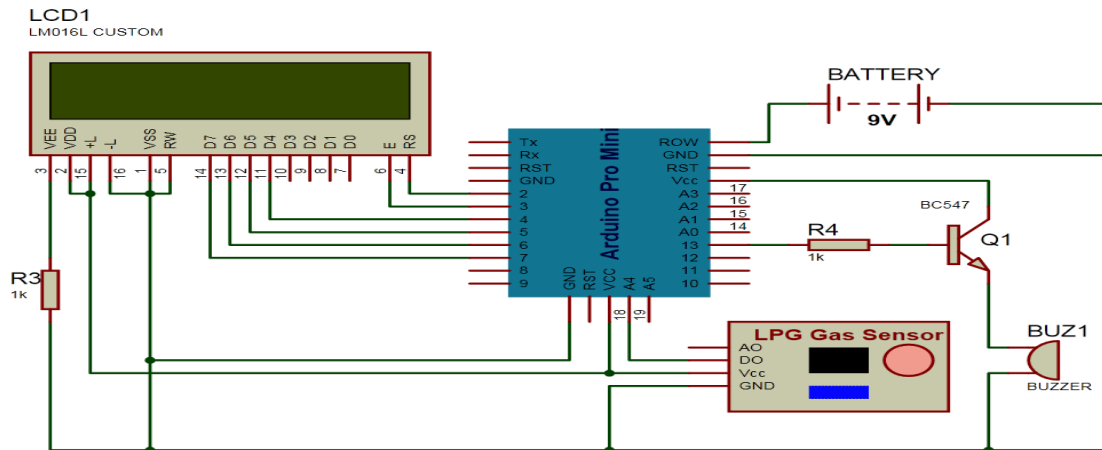


Figure 9 Embedded system for Hazardous Gas Detection

6. CONCLUSION

In the current research paper a system has been proposed. The proposed system is based on smart management of various equipments for enhancing the safety while using the LPG Cylinder. The center of the system is depends on a microcontroller. This microcontroller unit getting inputs from weight sensor. Weight sensor works as a unit for providing information related to weight of the gas and helps in booking the next cylinder. This helps in saving delivery time for the next cylinder. LPG Sensor also works as an input unit for the microcontroller. It helps to detect the leakage of gas. A buzzer will provide this information of leakage. Other output units are as LCD display for displaying the weight of the cylinder, and GSM Modem, this GSM modem will send the SMS to the consumer as well as there is option to send SMS for gas booking company.

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