

Embedded Based LPG Gas Monitoring & Automatic Cylinder Booking with Alert System

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ABSTRACT

The main objective of this research is automatic protection from the LPG (Liquefied Petroleum Gas) leakage or reduction of the hazards that can be caused due to unawareness of the user about the gas leakage and also providing an automatic gas booking facility by applying advance communication technology. If there is any gas leakage from storage tank, service station or from the automobile then a buzzer will turn ON and an alert message will be sent to a pre-set mobile number by using GSM(Global System for Mobile communication) technology. Proposed model notifies alert to people before any leakage from the gas cylinder and also automatically books for refilling of gas from the gas booking center before the cylinder gets empty. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using load sensor and if the gas level reaches below the threshold limit of gas around 2kg so that the user can replace the old cylinder with new in time and automatically books the cylinder using a GSM module.

Keywords: Microcontroller, Gas sensor, GSM (Global System for Mobile communication), LPG (Liquefied Petroleum Gas), Load cell, LCD(Liquid Crystal Display).

I. INTRODUCTION

There are several standards have been implemented for gas leakage detection system .The existing systems provides an alert system, which detect a Gas leakage in the house and commercial premises. The objective of this proposed system is to continuously measure the weight of the LPG cylinder and as it reaches the minimum threshold value, it automatically sends an SMS alert to the user as well as Authorized LPG agent. Leakage detection is used in household safety. The main causes of accidents in gas pipeline are corrosion, external interference, construction defects, ground movement and material failure. Transport, through the pipes is the safest but it does not mean that pipes are risk-free. Leakage detection like are hearing, smelling and seeing or looking.

The threshold level of weight of the LPG cylinder is used for automatic cylinder booking. This system

detects the LPG leakage by using gas sensor and alerts the consumer about the gas leakage by sending alert SMS. The GSM Modem to alert the user about the gas leakage by sending alert SMS and status of automatic cylinder booking.

II. PROBLEM STATEMENT

During illegal filling of gas cylinder consumers are unaware about their safety. Problems arise when LPG consumers worn out regulators, use old valves. Risks are added when there is lack of awareness of using gas cylinders (11, 12).Again in day to day life people having a busy schedule don not get time to check the gas available in the cylinder or usually forget to book for new cylinder(or refilling of gas).

III. LITERATURE SURVEY

In the year 2011, A. MAHALINGAM, R. T. NAAYAGI,1, N. E. MASTORAKIS, “Design and Implementation of an Economic Gas Leakage Detector”, This project developed system to detect the gas leakage and providing immediate alarm or intimation to the user. Later in 2013, few people developed the design proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by buzzer. This project was developed using microcontroller ARM version 7 processor and simulated using Keil software.

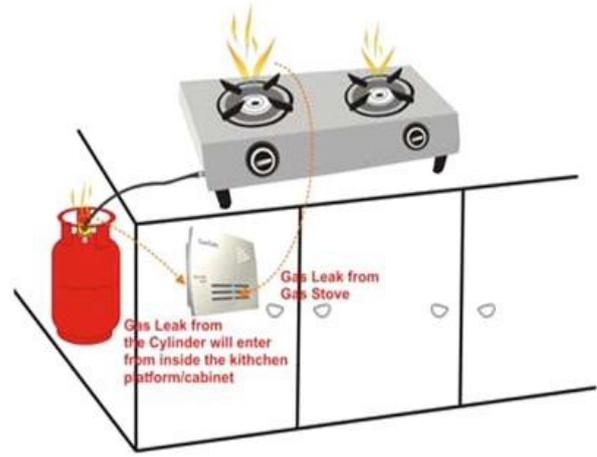


Fig 1. Practical Installation

In the year 2014, Hitendra Rawat, Ashish Kushwah, Khyati Asthana, Akanksha Shivhare, designed a system, They provided security issues against thieves, leakage and fire accidents. In those cases their system sends SMS to the emergency number provided to it. In the proposed system we have designed “LPG gas monitoring and automatic cylinder booking with alert system”. These report focus on detection of economic fuels like petroleum, liquid petroleum gas, alcohol.etc., and alert the surrounding people about the leakage through SMS. It also sense surrounding temperature, so that no fire accidents occurs. The one more important feature is automatic cylinder booking by noticing the current expenditure of LPG gas in our daily life. These projects alert the user by sending message to mobile through SMS in three conditions. They are

- When LPG gas weight reaches to maximum threshold value.
- When the LPG gas exceed its peak value.
- When the temperature exceed more than room temperature.

These project gives alert message by buzzing the buzzer and trough SMS to the house holders. We also provide automatic doors and windows opening, so that the compressed gas can spread in to air freely. Hence a fire accident does not occurs.

IV. METHODOLOGY USED

The below fig 2 indicates the basic building blocks of the whole system. The microcontroller plays the most important role to carry out all the required processes very smoothly with correct timing.

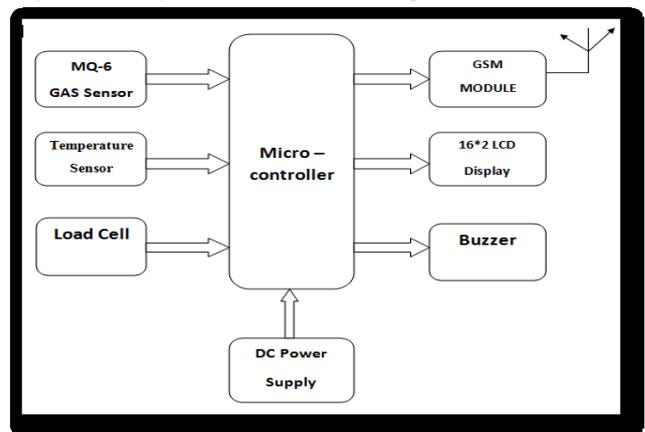


Fig2 . Block Diagram

1) Microcontroller ATMEGA16:-

In this proposed system Arduino Mega is used as a controller. Arduino is a well-equipped Open-Source Prototype Platform based on easy-to-use hardware and software. The ATMEGA16 is a 8-bit CMOS microprocessor with 16Kbytes of Flash programmable and erasable read only memory (EPROM).It exhibits high-performance with low-power consumption. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel ATMEGA16 provides a highly-flexible and cost-effective solution to many embedded control applications.

2) GSM:-

GSM network is divided like Operation and support system (OSS), Switching system (SS) and Base station system (BSS) . Microcontroller sends a signal when there is a leakage of gas. That signal will come to the GSM module first. It consists one sim card and it has a unique identity number The GSM module used is SIMCOM 300 which uses SIM memory to store the number of required members.

3)LPG Gas Sensor

MQ-4 is a Sensor for Natural Gases Sensitive material. MQ-4 gas sensor is SnO₂, which has lower conductivity in clear air. When the target combined gas exist, the sensor's conductivity is heavier with the gas concentration rising. we used simple circuit to convert respective output signal according to concentration level. MQ-4 gas sensor has high sensitive to Methane, Propane and Butane. The sensor can be used to detect different combustible gas, especially Methane; it is with cost effective and useful for so many applications.

4) LM-35 Temperature sensor

LM-35 is a integrated circuit sensor that can be used to measure the temperature with an electrical output proportional to the temperature (in centigrades).LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. Its output voltage is proportional to Celsius temperature, Scale factor is .01v/centigrade It consumes approximately 60 micro amps from its supply which is very low and possesses a low self-heating capability.

5) LCD Display

A 16X2 LCD (Liquid Crystal Display) display is used as the visual indicator. The reason behind using this LCD display is its cost effectiveness and easy programmability. It displays various messages such as leakage of gas, alert message for booking of cylinder etc. It also displays the actions carried out by the microcontroller.

6) Load Cell

As per dictionary, 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. Load cell is a passive transducer or sensor which converts applied force into electrical signals. They are also referred to as "Load transducers".

7) Piezoelectric Buzzer

Buzzer is an audio signalling device. The typical uses of buzzers are for alarms, timers and confirmation of user input such as a mouse click or keystroke. The project used an electronic type of buzzer which is a piezoelectric element that driven by an micro-controller signals. Peizo buzzer is based on the inverse principle of peizo electricity discover in 1880 by Jacques and Pierre Curie. It is the phenomenon of generating electricity when mechanical pressure is applied to the certain materials and the vice versa. Such materials called Piezo electric material.

V. WORKING OPERATION

1) Leakage Detection:-

SnO₂ is the sensing material used as gas sensor. When SnO₂ is heated at a certain high temperature in air, oxygen is adsorbed on the crystal surface with a negative charge. Then donor electrons in the crystal surface are transferred to the adsorbed oxygen, resulting in leaving positive charges in a space charge layer. Thus, surface potential is formed to serve as a potential barrier against electron flow. Electric current flows through the conjunction parts (grain boundary) of SnO₂ micro crystals. At grain boundaries, adsorbed oxygen forms a potential barrier which prevents carriers from moving freely. The electrical resistance of the sensor is attributed to this potential barrier. In the presence of a deoxidizing gas, the surface density of the negatively charged oxygen decreases, so the barrier height in the grain boundary is reduced. The reduced barrier height decreases sensor resistance. Hence the corresponding pulse can reach the microcontroller as an interrupt signal and

also can be fed to the buzzer and the exhaust fan so that they will be turned „ON“.

2) GSM Module:-

The GSM module works on simple AT commands which can be implemented by interfacing it to the microcontroller Rx and Tx pins. The GSM module used is SIMCOM 300 which uses SIM memory to store the number of system owner or housemates and distributor or to whoever the messages have to be forwarded. It requires very less memory to send and receive text messages and operates on simple 12 Volt adapter.

3) Automatic Gas Booking:-

The automatic Gas booking system continuously monitors the weight of the gas in cylinder and displays it on seven segment display. When the weight of the gas falls below the threshold value i.e. 10k.g., a logic high pulse is fed to a port pin of microcontroller. As this pin goes high, microcontroller will send a booking message to distributor. At the same time, the message will be displayed on LCD as “Booking Cylinder”. When the weight of the gas goes below 0.5 kg another logic high pulse is fed to another port of microcontroller through a relay circuit as discussed in truth table. As this port pin goes high, microcontroller will send an alert message through a GSM module to cell numbers of the required members and also an alert message is displayed on the LCD screen.

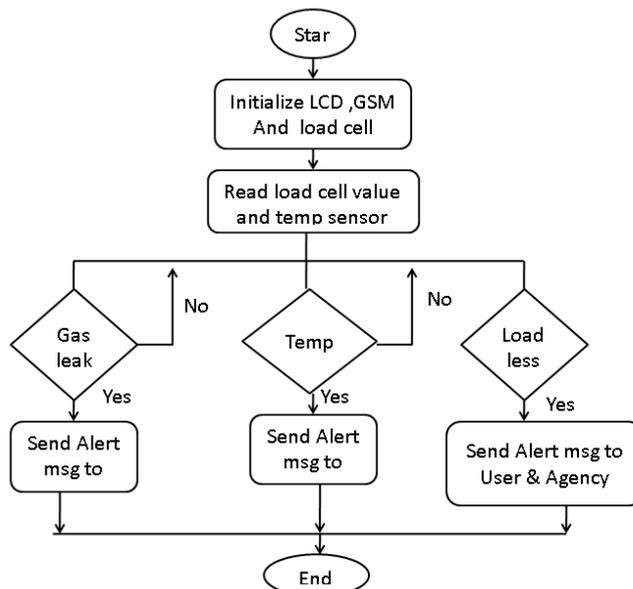


Fig 3. Flow Chart

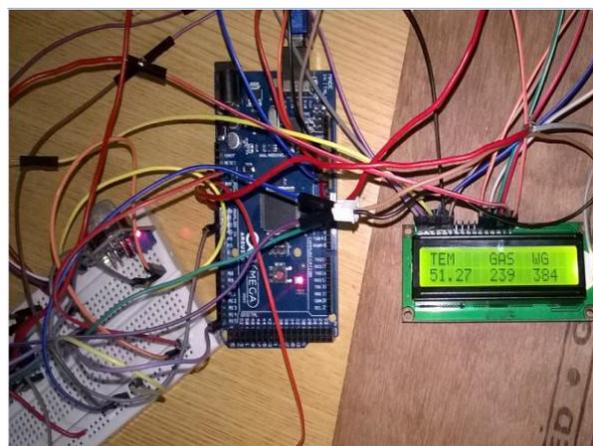


Fig 4. Design Assemble circuit



Fig 5. Prototype Model for Detection and Protection

VI. RESULT

By testing the system prototype model it is found that when a small amount of LPG is introduced near the gas sensor the system detects the leakage and sends an

alert message to the consumer by using the GSM module. Simultaneously the audio-visual indicator is activated and the exhaust fan is switched ON. The system prototype also monitors the gas level of the cylinder, books the new cylinder automatically and also sends an alert message to the consumer to remind about the refilling of the cylinder before the cylinder becomes empty.

VII. CONCLUSION

As we shorted out the problems faced by LPG gas consumers so we come up with some solutions to meet the few requirements of them, act in accordingly with minimum requirements on environmental issues and mostly the basic function being prevented by major disasters and protect life and property from reputed Accidents. The primary objective of our project is to measure the gas present in the cylinder when weight of the cylinder is below the fixed load, this can be done using the weight sensors. The gas retailer gets the order for a new cylinder and the house owner (consumer) receives the message regarding the status and the secondary objective is to provide any malfunction in gas servicing system in order to prevent damage or explosion of LPG.

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