

# Automation of LPG Cylinder Booking and Leakage Monitoring system

Abhishek B N V<sup>#1</sup>, Bharath P<sup>#1</sup>, Gunasheel B C<sup>#1</sup>, Vinodh Kumar G S<sup>#1</sup>, Veeresh H<sup>#2</sup>

#1 Students of B.E, Dept. of Electronics and communication, The Oxford College Of Engineering, Bengaluru, Karnataka

#2 Asst. Professor Department of ECE, The Oxford College Of Engineering, Bengaluru, Karnataka

**Abstract**— A Cost effective, automatic liquefied petroleum gas (LPG) booking, leakage detection and real time gas leakage detection system is proposed in the paper. In this system, the LPG leakage is detected through the sensor and information is sent to the user by short message service (SMS) and simultaneously alerts the customer using GSM module. If these gases exceed normal level then alarm is generated immediately. In this system MQ-5 gas sensor used to sense poisonous gas and has high sensitivity to LPG and also response to natural gas. This work modifies the existing safety model installed in industries. It offers quick response time and accurate detection. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using weight sensor. **keywords**-LPG booking, MQ5 sensor, Loadcell

## I. INTRODUCTION

LPG, first produced in 1910 by Dr. Walter Snelling is a mixture of Commercial Propane and Butane having saturated as well as unsaturated hydrocarbons. Because of the versatile nature of LPG it is used for many needs such as domestic fuel, industrial fuel, automobile fuel, heating, illumination etc and the demand for LPG is on an exponential raise day by day. The leaked gases when ignited may lead to severe explosion. The number of deaths due to the explosion of gas cylinders has been increasing in recent years. Thus there is a need for a system to detect and also prevent leakage of LPG.

Poisonous gases are one that causes serious environmental pollution. Polluted air acts as serious aspects as the soil and water pollution can be detected visually and by taste but polluted air cannot be detected as it can be odorless, tasteless and colorless. The poisonous gases causes serious health impacts so they have to be monitored. The Liquefied Petroleum Gas and Natural Gas burn to produce clean energy. however, there is a serious threat about their leakage. The gases may lead to suffocation and may lead to explosion. However, there are still some shortcomings on real time monitoring and on data transmission and accurate location of leakage point when accident happens. These problems can be solved with help of developing embedded system using wireless sensor network. It can give real time detection of

potential risk area, collect the data of leak accident and locate leakage point. The system is affordable and can be easily implement in the chemical industries and in residential area which is surrounded by the chemical industries or plants, to avoid threat to human lives. The system also supports to provide real-time monitoring of concentration of the gases present in air. As this method is automatic the information can be given in real time such that the threat to human lives can be avoided.

It also provides a feature to measure the weight of LPG cylinder with its value displayed on LCD display. A gas quantity of less or equal to threshold value of the empty cylinder is automatically detected by sending text message to a dealer. Also when cylinder weighs less than or equal to 1Kg, it informs the family members by sending a message to refill the cylinder.

## II. LITERATURE SURVEY

B.D. Jodhe, P.A. Potdukhe and N.S Gawai <sup>[1]</sup> describes a microcontroller based system where a gas sensor, MQ6 is used to detect dangerous gas leaks. If leakage is detected, message to the authorized person member using cellular network called GSM is sent automatically. It consisted of microcontroller (ATmega16A), gas sensor (MQ6), Load cell (L6D).GSM module (SIMCOM 300), and 16\*2 LCD display. S. Rajitha and T.Swapna <sup>[2]</sup> presented paper on security alert system using GSM for gas leakage, which uses the MQ5 sensor to detect gas leakage and GSM to provide the SMS to the user. It consisted of LPC2148 based on 32 bit ARM7TDMI-S cup. Hrushikesh Keluskar, Pooja chavan, Sonali Kudale, G.D. salunke and Satish pawar <sup>[3]</sup> describes GSM based home safety. They also used the MQ6 sensor as gas sensor, but they have used LPC2138 microcontroller. In addition to the above papers they have added XBEE.XBEE is used form a control room in building, with the help of XBEE we can transmit the data from sensor to computer.

Mr. Sagar Shinde, Mr.S.B.Patil and Dr.A.J.Patil <sup>[4]</sup> presented paper on Development of Movable Gas Tanker Leakage Detection Using Wireless Sensor Network Based on Embedded System.They used ARM 7 microcontroller,GPS

and Zigbee for communication purpose, they included protection circuitry like buzzer and exhaust fan.

V.Ramya, B.Palaniappan [5] describes Embedded system for Hazardous Gas detection and Alerting. They designed using PIC 16F877 microcontroller, it consists of 2 sensors propane gas sensor and LPG sensor MQ5 and MQ2 and GSM module.

several similar papers are shown in literature [6] -[7]

### III. SYSTEM OVERVIEW

The system block diagram comprises of parts as shown in figure 1. It consists of microcontroller (LPC2148), gas sensor (MQ5), weight sensor (Load Cell-L6D), GSM module (SIMCOM 300), and Exhaust fan.

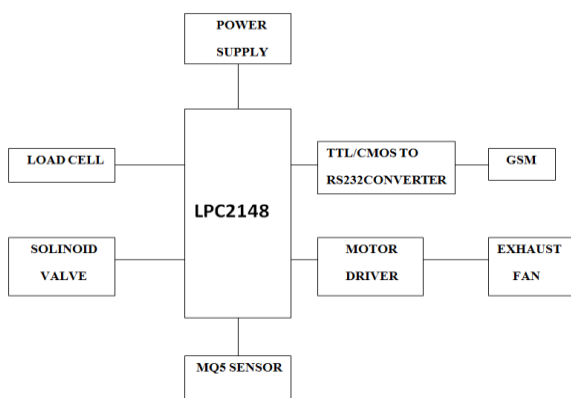


Fig 1. System block diagram

Design of system is based on ARM7 microcontroller. It consists of three major modules namely **leakage detection module**, **ARM7 interfaced with GSM module**, and **Protection circuitry**. Leakage detection Module will detect the leak with the help of MQ5 sensor. ARM7 interfaced with GSM module is used for giving alert messages. Protection circuitry consists of exhaust fan, Buzzer and motor with handle module. Motor will automatically close the knob of gas cylinder, when there is a leak. Controller is interfaced with Load cell to implement additional functionality of displaying the percentage of weight on an LCD display. If found empty an indication SMS is sent to the consumer and to the booking office.

**Leakage detection Module** - consists of MQ5 gas sensor and associated circuitry to detect the amount of combustible gas present in the surroundings. MQ5 Gas Sensor is used which has lower conductivity in clean air and its sensitivity increases with the concentration of gas, also it avoids gases like cooking fumes. It requires a voltage of 0-5 volts which is low and safe as per as the gaseous environment is considered. Output of sensor module is connected to one of ADC channel of the controller. Based on output voltage from ADC we can determine whether the gas level is within safe limits or not. If not, the controller will immediately activate alarm and LED,

along with that it sends alert messages to stored numbers via GSM.

**ARM7 interfaced with GSM module** - In case of a leak of LPG gas, GSM module is activated and alert messages are transmitted to user, Fire station etc. We will use SIM300 or SIM 900 GSM module. Communication to GSM module is done with the help of UART(Universal Asynchronous Receive Transmitter) and AT commands. Gas sensor detects the presence of gas, weight sensor gives the gas level in cylinder, and microcontroller will take corrective or necessary actions. The status of all these happening has to be conveyed to the owner of system or housemates. The technology making it very easy to send and receive messages using 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.

**Protection circuitry** - It consists of Exhaust fan, buzzer and motor. Upon leakage detection fan will be switched ON along with that buzzer will beep to give an indication to neighbors. Motor along with handle will automatically close the knob of cylinder. Servo motors are used for closing the knob.

A Load cell is added to calculate the weight of the cylinder, if found empty, the system will automatically send a SMS to user and to booking office. The resistance of the sensor is given by equation(1)

$$R_s = (V_c / V_{RL} - 1) \times R_L \quad (1)$$

where  $R_s$  is the sensor resistance

$V_c$  is the supply voltage to load cell

$V_{RL}$  is the voltage across load resistance

$R_L$  is the load resistance

### IV. FLOW CHART

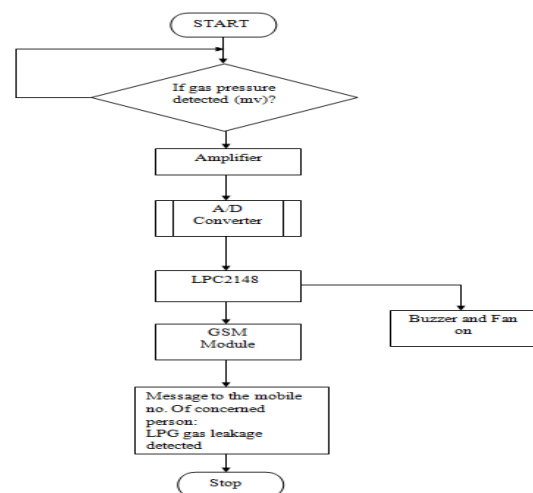


Fig 2. Gas leakage module

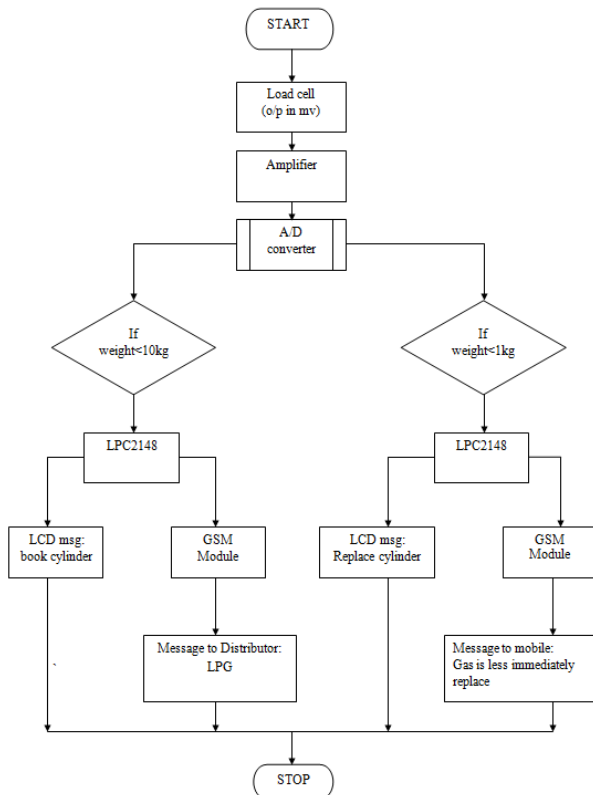


Fig 3. Gas booking module

## V. SOFTWARE DISCRPTION

Keil development tools, designed for ARM processor-based microcontroller devices, support every level of developer from the professional application engineer to the student just learning about embedded software development. The industry - standard Keil C/C++ Compilers, Macro Assemblers, Debuggers, Real-Time Kernels, and Single-board Computers support ALL ARM compatible derivatives.

The system prototype is constructed and when a Small amount of LPG is brought near the system, the system sensor detects the leakage and sends the SMS to housemates and activates the alarm and switches on the exhaust fan, turns off the power supply. Also system prototype continuously monitors the LPG level of the cylinder and books the cylinder automatically.

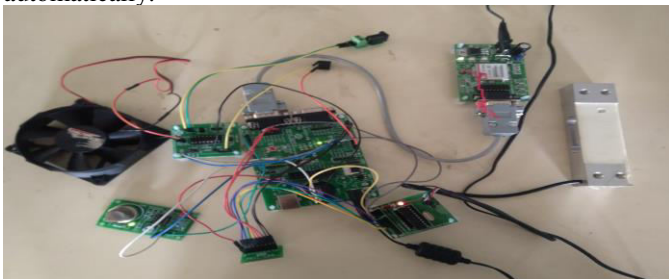


Fig 4. Prototype

## VI. CONCLUSION

The gas leakage detection system was proposed, designed and successfully implemented in this paper for home safety and industrial applications. This system detects the leakage of the LPG and alerts the consumer about the leak by SMS and as an emergency measure the system will turn off the power supply, while activating the alarm. Along with gas leakage detection, this system gives a fully automated approach towards the gas booking. 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 and other places to detect gas leaks. This project is implemented using the ARM 7processor and simulated using the Keil software. The cost involved in developing the system is significantly low and is much less than the cost of gas detectors commercially available in the market.

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