

## LPG Leakage Detection and Automatic Gas Cylinder Booking System

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### ABSTRACT:

The paper deals with LPG leakage Monitoring and gas booking system. This system focuses on saving of time and home safety. The system will detect the leakage and inform the consumer about the gas leakage by SMS. Audio output is also generated on speaker. As a part of emergency the system will immediately turn off the regulator valve with the help of stepper motor to avoid any mishap. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using load cell and display the weight continuously. If the gas level reaches below the threshold limit of 18 kilogram (including empty weight of cylinder), it will automatically book new gas cylinder using a GSM module. The device helps for safety and avoid chances of explosion due to leakage.

### I. INTRODUCTION:

In early days food, clothes and shelter were considered as basic needs. Preparing food or boiling water was done using Chulha, using coal or wood, but these methods are not suitable as it generates smoke. Smoke is very dangerous for our health. In 1910, Dr Walter Snelling has first developed LPG [1]. It is a mixture of commercial propane and commercial Butane, with saturated or unsaturated hydrocarbons [1]. LPG has very versatile nature and because of its properties it is used to fulfill daily needs. LPG is used in domestic applications, Industrial applications as fuel. With development of technology now a day's automobiles are also developed which uses LPG as fuel. Demand of LPG is increasing day by day. So in addition to food, cloth and shelter now LPG is also becoming basic need. Safety plays a major role in today's world and it is necessary that good safety systems must be implemented in domestic and industrial places. In general, leakage refers to presence of natural gas or other containment into a living area. The leakage is always harmful as it may lead to explosion. The explosion may create damage or even death also. Due to gas leakage and explosion the numbers of death cases are increasing day by day. So with the word prevention is better than cure, need comes to detect gas leakage at very low level and to take corrective action to avoid mishap. Another issue is related to domestic gas booking system. Presently no any system gives us the idea about how much LPG is remaining in cylinder and when the cylinder is about to become empty. After booking it takes around three to four days to get filled cylinder from Petroleum Company. Most of the petroleum industries have launched their IVRS system for booking gas cylinder [2]. Some people find it difficult to use this technology [2, 3]. Also some people have very busy schedule and they may forget to book the cylinder. With this aspect we have proposed system in which automatic booking of cylinder will take place when total weight of cylinder goes below 18 kilogram. In this paper we have primary object as gas leakage detection and if leakage is observed immediately turn off the regulator. The secondary objective defined is the automatic gas cylinder booking system. Truly this technique will lead to a smart home automation system [4].

**KEYWORDS:** LPG, Gas leakage, GSM, Load Cell, Gas regulator.

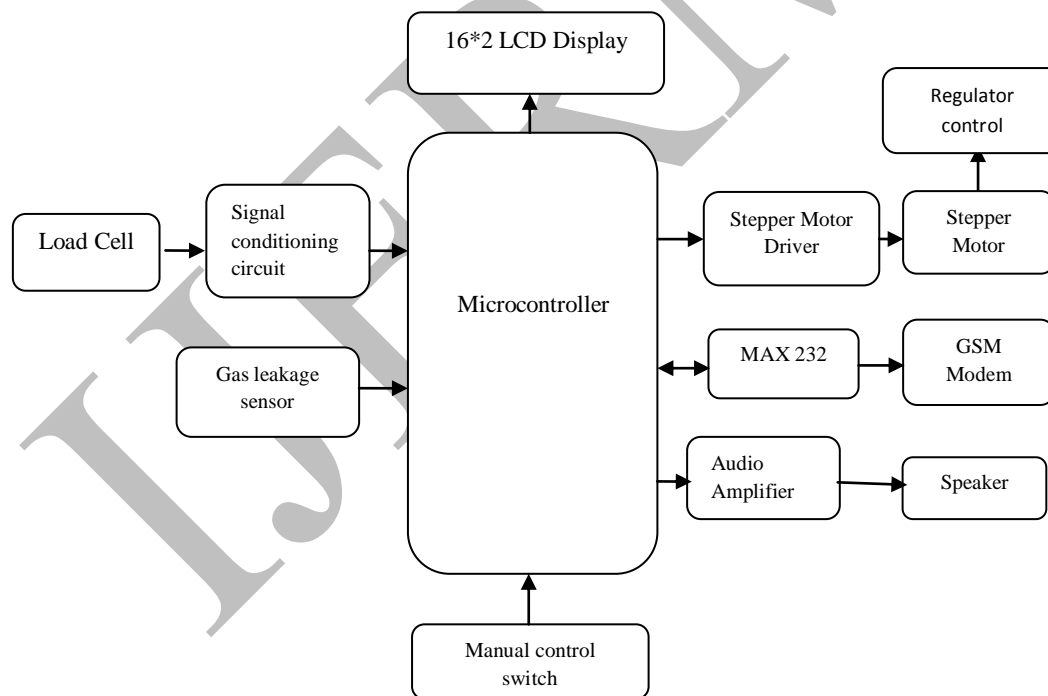
## II. PROPOSED SYSTEM:

Proposed system consists of gas leakage detection sensor which is interfaced with microcontroller. If leakage is detected microcontroller immediately start the stepper motor to turn off the gas regulator. Totally external coupling is made to turn off gas regulator. Message will be also displayed on LCD display. Microcontroller will run an audio file when leakage is detected. Load cell is used to monitor the weight of cylinder. GSM module is interfaced with controller which will automatically book the cylinder when weight of cylinder goes below the threshold. It is also used to SMS gas leakage to specified mobile number. Proposed system specifications are as follows:

- Real time gas weight measurement between 0 to 29.7 kilogram
- Gas cylinder booking when weight goes below 18 kilogram.
- Gas leakage detection, sending SMS and announcing using speaker.
- Turn off regulator when gas leakage observed.

## III. HARDWARE DETAILS and SYSTEM DESCRIPTION:

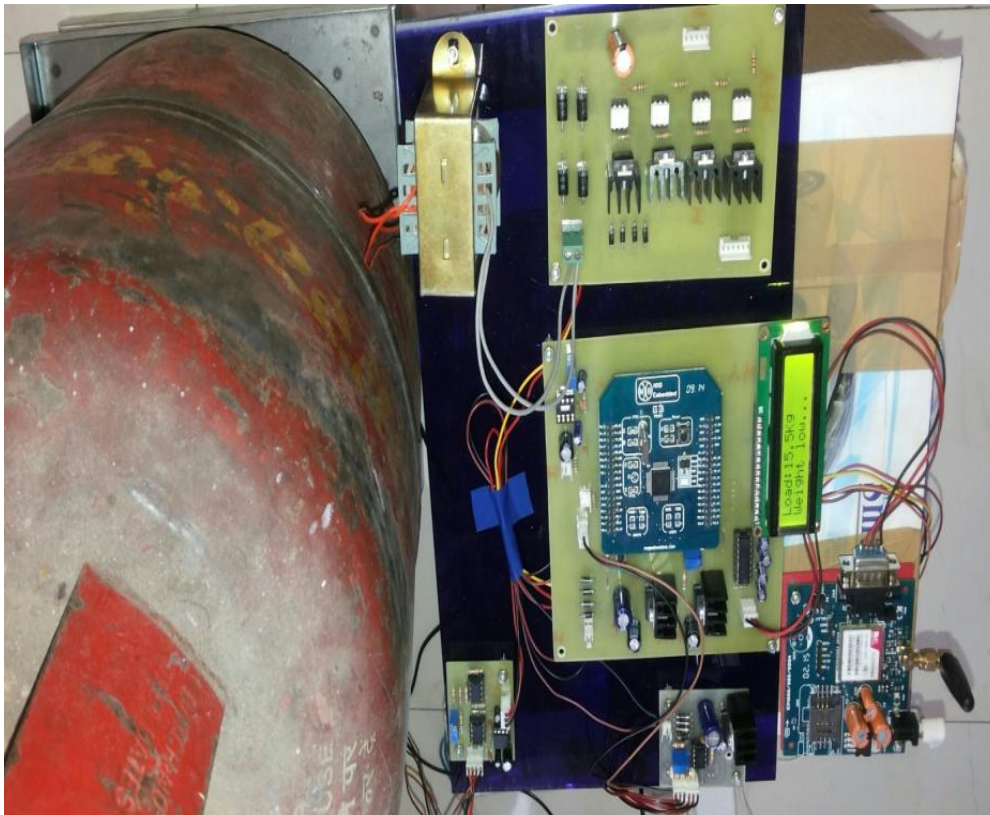
Figure 1 shows the block diagram of proposed system.



**Fig.1 Block Diagram of proposed system**

### A. MICROCONTROLLER:

LPC 2138 microcontroller is selected for this system. The main task of microcontroller is to execute all the processes being involved. Low power consumption and tiny size are the key features to select the microcontroller. Input signal from load cell and of gas sensor is connected to microcontroller. Figure 2 shows the implementation of system using microcontroller.



**Fig. 2 Hardware Implementation of system**

#### **B. LOAD CELL:**

Transducer is a device which converts any physical quantity to electrical signal. Load cell converts applied force in terms of weight to electrical signal. Gas cylinder is placed on Load cell arrangement [3]. Cantilever or bending type of load cell is used. Load cell is actually four strain gauges connected in Wheatstone bridge circuit. Use of full bridge circuit i.e. using four strain gauges in bridge helps to obtain temperature compensation also. Output of bridge circuit is only because of applied force. The output of load cell is applied to signal conditioning circuit which will condition the millivolt signal to be interfaced to controller.

#### **C. GAS SENSOR:**

Gas sensor MQ-6 is highly sensitive to LPG, iso butane and propane. This sensor is used in gas leakage detecting equipments in domestic and industrial applications. It is suitable for LPG detection and important thing is, it avoids the noise signal of alcohol, cooking fumes and smoke. In clean air it has lower conductivity. If combustible gas is detected, the sensor conductivity increases with increase in gas concentration. Higher sensitivity to LPG, low cost and long life are the main features to select this gas sensor. Voltage variation obtained is from 0.5 volts in clean air to 0.9 volts when leakage detected. Hence 0.7 volts is considered as threshold level indication of gas leakage. If output voltage of 0.7 volts is detected, gas leakage system will be operated.

#### **D. LCD DISPLAY:**

16\*2 LCD display is used which is interfaced with microcontroller. When gas leakage is detected it will be displayed on LCD It also displays weight of cylinder continuously.

**E. AUDIO AMPLIFIER:**

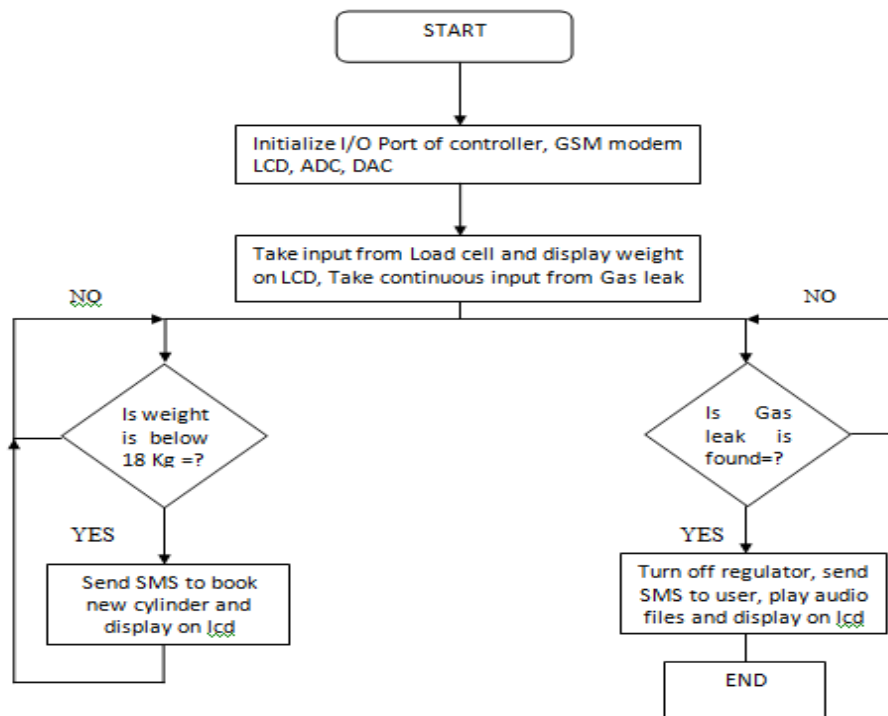
Audio amplifier is used to play audio recorded file using speaker. The audio file, “Gas Leakage Detected” or “Gas weight is low” is played in three different languages as English, Marathi, and Hindi.

**F. REGULATOR CONTROL:**

Stepper motor is unique DC motor that rotates in fixed steps of certain number of degrees. Stepper motors are particularly useful in control applications because the controller can know the exact position of the motor shaft without the need of position sensors. With this consideration stepper motor is used to control the gas regulator. Shaft of stepper motor is mechanically coupled with gas regulator using flexible non metallic clips. If gas leakage is detected Microcontroller immediately sends the signal to stepper motor and the motor shaft rotates to switch off the regulator. Regulator is totally externally coupled with shaft of stepper motor and no any structural changes are made in regulator. Manual switch is provided with microcontroller. When corrective action on gas leakage is taken, manual switch will be pressed to switch on the regulator again.

**G. GSM MODULE:**

Load cell continuously monitors the weight of cylinder. When total weight of cylinder goes below 18 kilogram message will be send to the distributor and to system owners mobile number. GSM module SIMCOM 900 is used in this system. GSM module is interfaced with microcontroller and using AT commands sending of message is obtained through GSM module. System flow is indicated below.

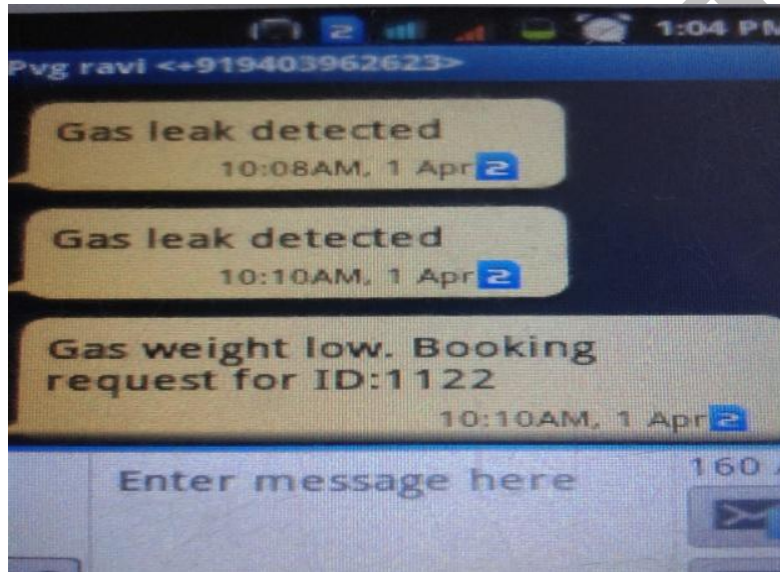


**Fig. 3 System signal flow**



**IV. RESULT:**

The system implementation is obtained as per the specifications. Gas leakage is detected by sensor properly and stepper motor operated to turn off regulator. When weight of cylinder decreases SMS is send on mobile numbers. Audio file played properly while gas leakage detected and weight of gas cylinder goes below threshold. Figure 4 shows the results obtained.



**Fig. 4 Result on LCD display**

**V.CONCLUSION:**

With human safety as first concern gas leakage detection is implemented effectively .Automatic gas booking system will really help to get rid of call waiting or dialing so many numbers while booking gas cylinder. Hence safety and time saving objectives are achieved.

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