

Smart Gas Cylinder: Leakage Alert and Automatic Booking

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Abstract— Now a days, world is very fast and automate due to change in technologies. Internet of things is one of the important technologies which operate hardware resources remotely. This project deals with automatic booking of gas Cylinder and also detects leakage of gas. In our home, we observe whenever the LPG cylinder is get empty, we need to give request to the gas cylinder provider for new cylinder. However, many times it happens that because of the rush or due to the shortage of the cylinder, there is a delay in providing the gas cylinder. The main reason behind this is the delay in informing to the gas provider or we inform the gas provider at the last moment when the gas is empty. This project also detects the leakage of gas from LPG cylinder using gas sensor which is very sensitive to detect presence of LPG (composed of mostly butane and propane). To avoid all such situations, we have proposed solution through this paper.

Keywords— MQ-6 Gas Sensor; Load Cell Sensor; 16*2LCD Circuit, Arduino UNO R3 AT MEGA32

I. INTRODUCTION

Natural gas is widely used as fuel in homes. The gases being heavier than air do not disperse easily and leaked gases may lead to explosion [1][2]. The number of deaths due to the explosion of gas cylinders has been increasing in recent years[4][5]. There is a need for a system to detect leakage of gas. The proposed system will indicate to user by electric buzzer and sending SMS if there is leakage of gas from the gas cylinder.

The proposed system reduces the customer's burden. Now-a-days, big problem in our houses is to refill the cylinder. Most of the time people book the cylinder without knowing the exact quantity of gas left in it[3][6][7]. This system will monitor the quantity of gas level in the cylinder, when gas level reaches below the threshold limit of around 2kg it sends SMS to user by sending SMS on registered mobile number.

This system helps to upgrade safety standards and most important and basic function will prevent accidents and protect life. This application will be used by anyone who uses gas in his/her home. It provides detection of gas leakage from a gas cylinder which will be useful especially for older persons who live at home lonely for their security.

II. SYSTEM OVERVIEW

This proposed system consists of gas leakage detection system, weight measurement module, microcontroller, GSM module and alert system.

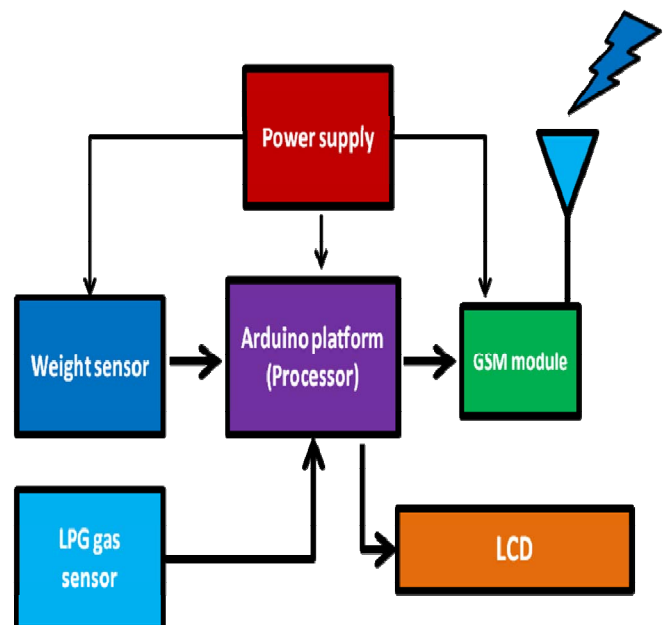


Fig. 1. Block Diagram of Proposed System

Fig.1 shows the block diagram of system. The theme is to sense weight of gas cylinder using weight sensor. If the measured weight is found to be near empty then alert message is sent to the user using GSM module. Similarly LPG gas sensor is used to sense gas leakage and user alert is sent in that case too. A digital processor forms the brain of the system. The processor remains interfaced with a weight sensor and LPG gas sensor. Thus the two inputs to a processor are the current weight of gas cylinder and LPG gas leakage level indicator. Thresholds are defined for both weights of gas cylinder and gas leakage level. The threshold for weight is chosen such that it is a value near emptiness and not completely empty. The average weight of the household gas cylinder in India is 14Kg in full condition. Hence, any value between 1 – 2Kg can work as threshold value. This will provide sufficient time between user alert and next refill. In the case of LPG gas leakage similar threshold level is estimated and any crossing of this value indicates the alert condition. GSM module is interfaced with a processor which is used to generate alert condition in the form of SMS. The alert SMS is sent to the pre-defined mobile number.

III. SYSTEM OPERATIONS

Following two flowcharts for leakage detection and automatic LPG cylinder booking which describes the flow of the operations as follows:

A. Leakage Detection

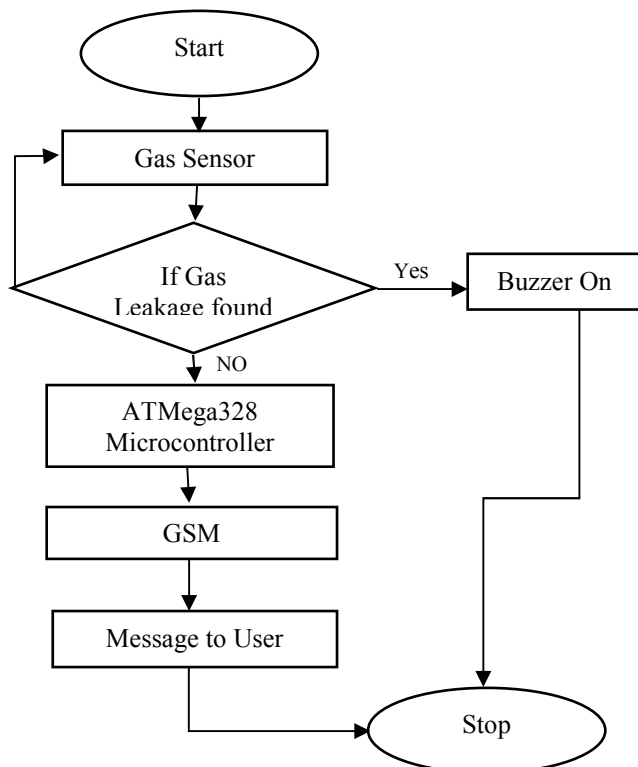


Fig. 2. Flow chart of Leakage Detection

If gas leakage is detected by gas sensor, then the output of the sensor goes high which is given to the microcontroller. Simultaneously, microcontroller switches on the buzzer and sends message about leakage found to person via GSM module. This working is as shown in Fig. 3.1.

B. Automatic Booking System

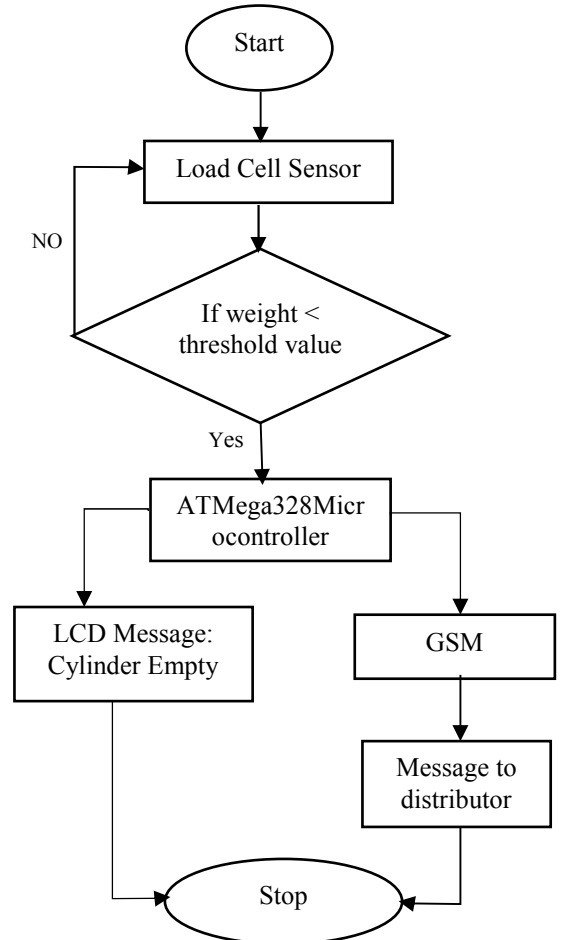


Fig. 3. Flow chart of Automatic Booking System

Here the amount of gas is continuously measured by load cells (weight sensor) with displaying the same on the LCD. When the sensor's output reaches below the specified threshold value, then the message will be sent regarding booking of LPG cylinder along with displaying messages on the LCD.

IV. DESIGN AND IMPLEMENTATION

An efficient and fast working controller is required to continuously sense the presence of LPG and LPG cylinder's weight. These operations require a very fast, single cycle execution rate microcontroller like ATMega328. Hence ATMega328 is used as the main component of the system.

Fig. 4 shows the complete connection diagram for the system. The system draws power from a 12V/2A adaptor. This is used to directly power the GSM module. The on board +5V

regulator on Arduino helps to down convert this 12V to +5V which is used by Arduino itself, LPG gas sensor, load cell - weight sensor and LCD. The individual interfaces are illustrated below in greater details.

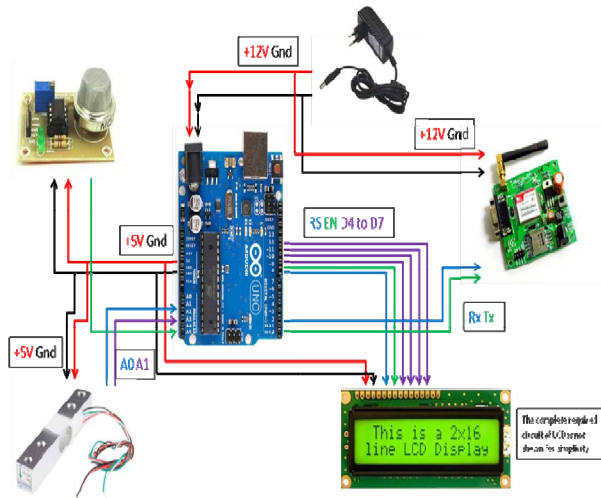


Fig. 4. Hardware Design

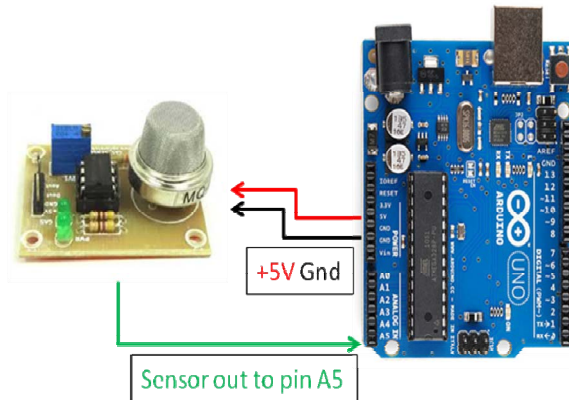


Fig. 5. LPG Sensor Circuit

As shown in Fig. 5 MQ2 is used as LPG gas sensors. This comes as a ready to use module requiring +5V supply and provides analog values as output. These values are proportional to sensed level of LPG gas. Thus, this sensor output is interfaced with analog pin A5 of Arduino. Required +5V is taken from the Arduino board itself.

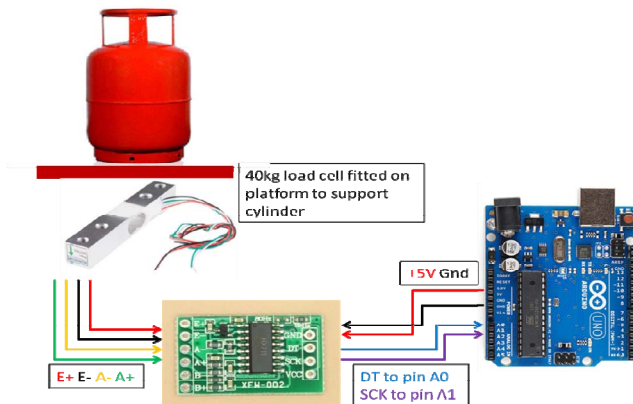


Fig. 6. Load Cell Sensor Circuit

Fig. 6 shows Load Cell Sensor Circuit. 40kg load cell is used as weight sensor. This load cell requires high resolution ADC converter board based on HX711 to be interfaced with Arduino. This interface requires pins A0 and A1. The HX711 based module uses +5V supply from Arduino.

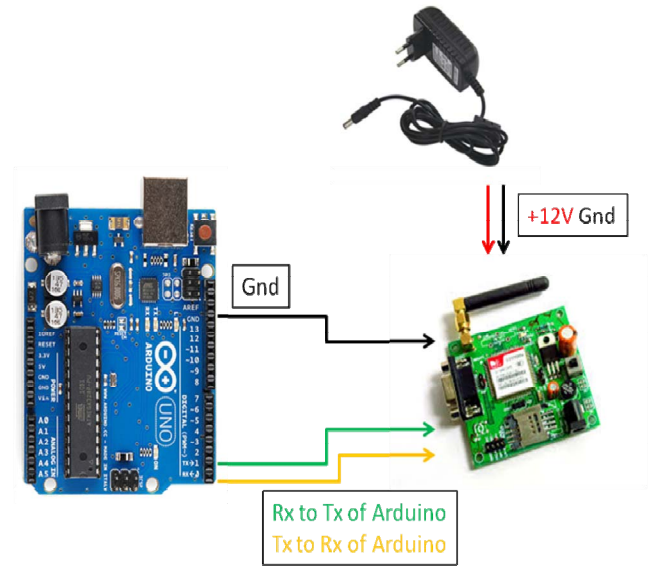


Fig. 7. GSM Modem Circuit

Fig. 7 shows GSM Modem Circuit. GSM 900 modem is used to connect the system with GSM network. It works on 12V and has TTL interface pins for connection with Arduino. Here the Rx on the modem is connected to the TX of Arduino and TX of modem is connected to Rx of Arduino UART port. Then grounds are combined to complete the circuit.

Fig. 8 shows LCD circuit. 16x2 LCD requires a minimum of 6 pin interfaces with the Arduino and is used likewise here. The connections are shown in the figure 8. RS and EN are 2 control pins connected with 13 and 12 of Arduino respectively. Then data pins D4 to D7 are connected to pins 11 through 8 of the Arduino. +5V and GND are used from the Arduino board itself to complete the power circuit. There is a 10k pot used to set display contrast.

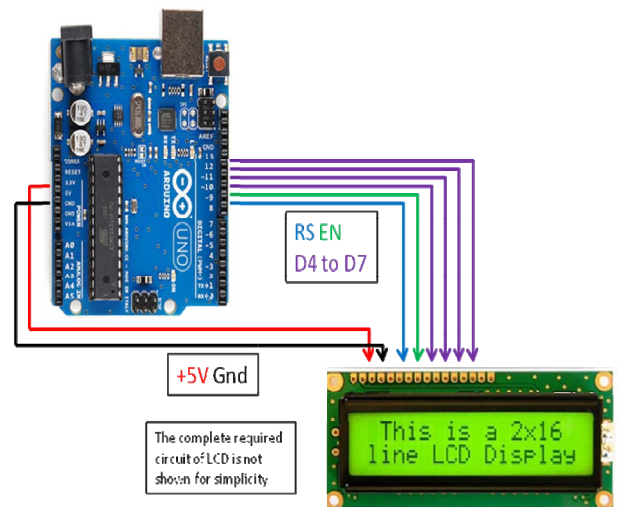


Fig. 8. 16X2 LCD Circuit

V. CONCLUSION

The system provides security to people by sensing leakage of gas. It is very useful for use in house as well as in industry. It helps the people to save their time by automatic booking system.

This system has lots of scope in future such as one can use exhaust fan to decrease density of spread gas from gas cylinder. One can also see level of gas in gas cylinder on mobile application. Also it is helpful for data analysis about how much gas consumes in certain period of time with respect to particular region

Acknowledgment

It is our foremost duty to express our deep sense of gratitude and respect to Dr. N. V. Dharwadkar (Head of Department of Computer Science & Engineering) for providing all necessary facilities to carry out the project work and whose encouraging part has been a perpetual source of information.

We are indebted to the library personnel's for offering all the help in completing the project work. Last but not only the least we are thankful to our colleagues and those helped us directly or indirectly throughout this project work.

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