

Automatic Gas Leakage Detection and Booking System

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Abstract - Gas leakage is a major problem with the usage of the LPG in various sectors such as residential, industrial, automobile, etc. One of the preventive methods related to accidents associated with the gas leakage is to use gas leakage detection kit which can detect leakage of gas and alert the user about the same. Most fire accidents are either due to the improper use of LPG or carelessness which leads to serious injuries caused by gas leakage and explosion. This project focuses on protection from the LPG leakage or reduction of the hazards that can be caused due to unawareness of the user about the gas leak and also to provide an automatic gas booking facility via NodeMCU by monitoring the level of LPG using load cell, MQ-2 gas sensor, and Arduino UNO R3. Our system also detects smoke and controls the exhaust fan accordingly and in case of fire accidents, the fire brigade gets alerted immediately. This system activates the indicators if the amount of LPG detected near the gas sensor is more than the threshold value. Also, when the level of gas falls below some predefined value it automatically alerts the user and sends a message to the gas agency for booking a refill. This system is reliable and cost-effective when compared to other systems.

Key Words: MQ-2 gas sensor, Arduino UNO R3, NodeMCU, LCD (Liquid Crystal Display), LPG (Liquefied Petroleum Gas).

1. INTRODUCTION

LPG plays a significant role in our day to day life as there are various ways to use LPG like cooking, vehicle fuel, etc. Gas leakage results in various accidents leading to both material loss and human injuries. The danger of explosion, firing, and suffocation is predicated on their physical properties like toxicity, flammability, etc. The number of deaths because of the explosion of gas cylinders has been increasing in recent years. The LPG or propane is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, etc. thanks to its desirable properties which include high calorific value, less smoke, less soot, and meager harm to the environment. One of the preventive methods to forestall such accidents is to install a gas leakage detection kit at vulnerable places. Sometimes the users find it difficult to book a refill because they are not aware of the remaining amount of LPG within the cylinder as they forget the date of installation of the cylinder because of their busy lives and end up booking the cylinder either too early or too late. One of the main drawbacks of the present system is safety. This project aims

to present such a design which will automatically detect gas leakage in vulnerable areas and forestall dangerous situations. The proposed system continuously monitors the amount of the LPG within the cylinder using load cell which is connected to the Arduino UNO R3 which successively displays the amount of the remaining gas through an LCD module and also automatically alert the user to refill the gas, if the gas level reaches below the threshold value it immediately alerts the user about the status of the gas level within the cylinder. The MQ-6 gas sensor is employed to detect any gas leakage, when there is a leakage and the amount of the propane and butane (LPG components) are over the threshold value then it alerts the user about the gas leakage through the buzzer, and NodeMCU, also it turns off the main power supply of the house, and the main supply of the gas is turned off to prevent explosion and fire accidents. Aside from leakage detection our system also detects smoke and automatically activates the fan and in case of fire accidents, the system detects fire and reports to the fire brigade through an alert message. This paper presents an LPG leakage detection and alert system to avoid fire accidents and to provide safety.

2. LITERATURE SURVEY

This paper [1] explains the major problems with gas leakage within the industrial sector, residential area and gas-powered vehicles like buses, cars, etc. which might cause dangerous situations if ignored as LPG is extremely inflammable even a tiny low electric spark or a flame is enough to cause a fire when the LPG is mixed with the air because of gas leakage. It suggests a decent way to control the system using ATmega328 microcontroller, load cell, and MQ-6 gas sensor to observe the amount of LPG through the load cell and display the amount continuously and to book a refill automatically when the gas level reaches below the edge value. The gas sensor detects the gas leakage and alerts the user through a buzzer and turns off the gas supply by turning off the regulator knob. This paper [2] explains Common causes of LPG (Liquefied petroleum gas) accidents as LPG (Liquefied petroleum gas) is a flammable gas, which has the potential to form a blast. To stop this a system is proposed which make use of MQ-6 gas sensor, AT89C51 microcontroller, stepper motor, LCD module, and GSM module to make the gas leakage detection system. The gas leakage is detected by the MQ-6 gas sensor and it sends the signal to the microcontroller with the assistance of ADC, the microcontroller receives the signal and alerts the user via a buzzer and displays the message on the LCD and also drives the stepper motor to turn off the regulator knob. The main

disadvantage of this technique is that they just put off the gas regulator knob during the gas leak but not the power supply which might result in fire accidents and explosion.

This method [3] employs ARM microcontroller, solenoid valve, weight cell, and buzzer, MQ-6 gas sensor, LCD (Liquefied Crystal Display), and GSM module. The gas sensor detects the gas leakage and sends an indication to the ARM microcontroller which then activates the fan and turns off the regulator valve employing a solenoid then turns off the main power supply. This technique also monitors the gas level using weight cell and displays the gas level within the LCD and if the gas level reaches below 2kg i.e. the set threshold value then the system automatically books the refill for the gas from the agency. This paper [4] shows several systems are proposed and implemented to resolve the matter of identifying and rectifying the gas leakages. a number of the systems have identified in several ways like DC motors, micro-controller, etc. By the observations made, we still feel that the present system can still be improved for detection and supply better solutions which use a sensor, signal conditioning circuit, Analog to Digital converter (ADC), FPGA and a GSM module to create the gas detection system. The MQ-6 gas sensor detects the gas leakage and sends the data to the FPGA which then compares the received information with the threshold value and if the received data is bigger than the threshold value, then the leakage is detected and so a warning sign is sent to the user through the GSM module. This system [5] employs ARM microcontroller, MQ-5 gas sensor, stepper motor, Weight sensor, and GSM module to create the system. The gas sensor detects the gas leakage and therefore the information is sent to an ARM microcontroller which then activates the stepper motor to turn off the regulator knob. The load of the cylinder is monitored by the load cell and is displayed within the LCD module when the load of the cylinder reaches below the threshold value the microcontroller books a refill through the GSM module.

This paper [6] proposed a leakage detection and real-time gas monitoring system where the leakage is detected and controlled utilizing an exhaust fan. The amount of LPG in the cylinder is also continuously monitored. This paper [7] proposes a system of LPG monitoring using wireless sensors, within which the user is alerted through SMS about the gas leakage and the power supply is turned off. This paper [8] proposes a system in which the gas leakage detected by the sensor is represented in the audio and visual forms. This paper [9] proposed smart sensor technology. In this, a versatile, reliable smart gas detection system is developed and again the leakage is detected and controlled by using an exhaust fan. The above-mentioned methods are already in use to detect and control the LPG system, but they are either costly or not efficient, which is why there is a requirement for a system which is affordable and efficient.

3. PROPOSED BLOCK DIAGRAM

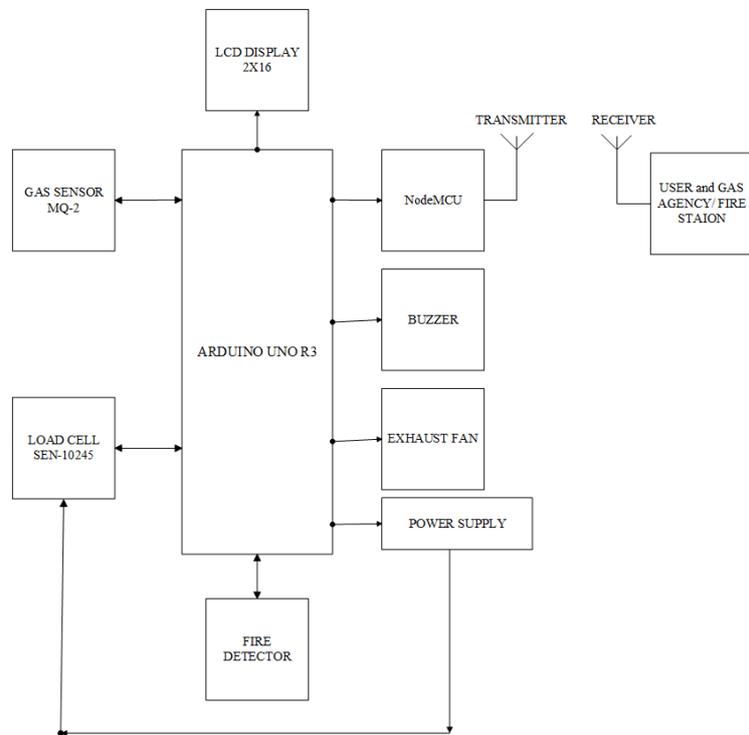


Fig -1: Block diagram of the proposed system

4. METHODOLOGY

The automatic LPG gas control system consists a load cell which is used to monitor the weight of the gas cylinder and display the level of gas remaining in the cylinder through LCD display, when the gas level reaches below a predefined value then the sensor sends the signal to the arduino which then alerts the user via buzzer and a message for booking a refill. The MQ-2 gas sensor is used to detect gas leakage, when the gas leak is detected the exhaust fan will be turned on and when the leakage increases more than a threshold value, then the whole power supply of the house is turned off and the system also shuts down completely. The fire detector is used to detect fire and when the sensor detects fire it sends a signal to the Arduino which in turn sends an alert message to the fire brigade and also alerts the user by the buzzer. The system can be restarted whenever the system shuts down due to fire, accident or the gas leakage and the system will start to work normally.

5. FLOW CHART

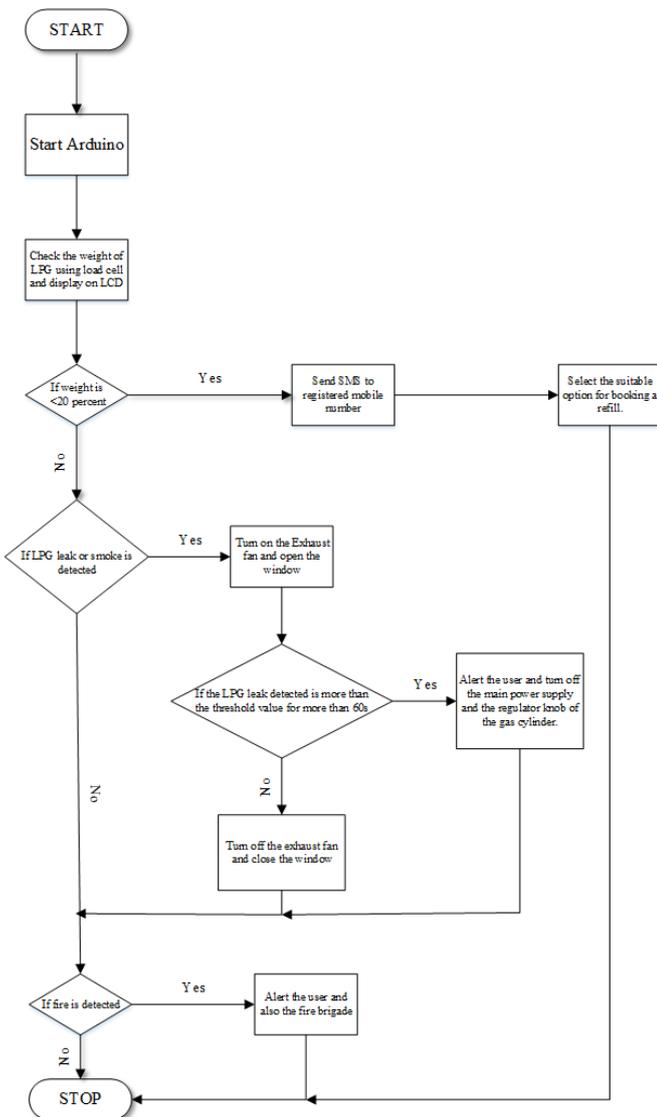


Chart -1: Flow chart of the proposed system

6. RESULT

- The user is alerted via message, buzzer, and message displayed on LCD when the amount of LPG reaches below the predefined value.
- The automatic refill of the LPG cylinder is booked by sending a message to the gas agency.
- The user is alerted if the LPG leakage is more than the threshold value and the main power supply and the regulator knob is turned off.
- The user and the fire brigade are alerted when the fire is detected by the flame sensor.

7. CONCLUSIONS

The main purpose here is to provide safety to the users of the LPG (Liquefied Petroleum Gas) in various fields like cooking, automobiles, industries, etc. Using this system we can easily monitor the amount of LPG present within the cylinder and also detect the LPG leakage and fire and alert the user and respective authorities immediately so that the assistance is provided as soon as possible. It uses various sensors such as MQ-2 sensor, Flame sensor and load cell to monitor the LPG being used completely to prevent accidents caused by carelessness or misuse of LPG. As the world is moving towards being smarter every day, we can integrate this system with other home automation systems for creating complete home automation and security systems which can be used in smart houses and smart cities, etc.

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