

R.F.L. Safety Kit for Domestic LPG

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Abstract: Home fires have been taking place frequently and the threat to human lives and properties has grown in recent years. Liquefied Petroleum Gas (LPG) is extremely combustible and may burn even at a long way from the supply of escape. Most fire accidents are caused because of a poor-quality rubber tube or the regulator is not turned off when not in use. Therefore, developing the system which includes gas leakage alert, fire alarm, refill reminder is very essential. Hence, this paper presents a gas leakage alert system to detect the gas leakage, Fire alarm in case of fire, Automated ventilation in case of gas leakage and to alarm the people onboard and automated refill SMS generation. The Abbreviations in the title represents functionality of the kit: **R**-Refill Reminder, **F**-Fire Alert, **L**-Leakage Alert

Keywords: Arduino UNO, Fire sensor, Gas sensor, Load cell, DC motor, GSM modem

I. INTRODUCTION

Gas leak results in varied accidents leading to both material loss and human injuries. The risk of explosion, firing, suffocation are based on their physical properties such as toxicity, flammability, etc. The number of deaths because of explosion of gas cylinders has been increasing in recent years. The reason for such explosion is because of substandard cylinders, old valves, worn out regulators and lack of awareness in handling gas cylinders. The LPG or propane is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, restaurants, hotels, automobiles, vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and major harm to the environment. Natural gas is another wide used fuel in homes. Both gases burn to produce clean energy, however there is a serious problem of their leakage. Being heavier than air, these gases do not disperse easily. It may lead to suffocation when inhaled and may lead to explosion [1].

II. LITERATURE REVIEW

Due to the explosion of LPG, the number of deaths has been increased in recent years. To avoid this problem there is a need for a system to detect the leakage of LPG. Gas leak detection is the process of identifying potentially hazardous gas leaks by means of various sensors [2]. Several designs of LPG detection and alert system have been proposed in the literature. Apeh et al. designed kitchen gas leakage detection and automatic gas shut off system [3]. T.Soundarya et al. presented the cylinder LPG gas leakage detection system [4]. Wireless and GSM technology [5] based gas detectors have also been proposed. This paper presents a LPG leakage detection and alert system to avoid fire accidents and to provide house safety. The rest of the paper is organized as follows. Section 2 presents the LPG leakage detection and alert system and Section 3 concludes the paper.

III. BLOCK DIAGRAM AND DESCRIPTION

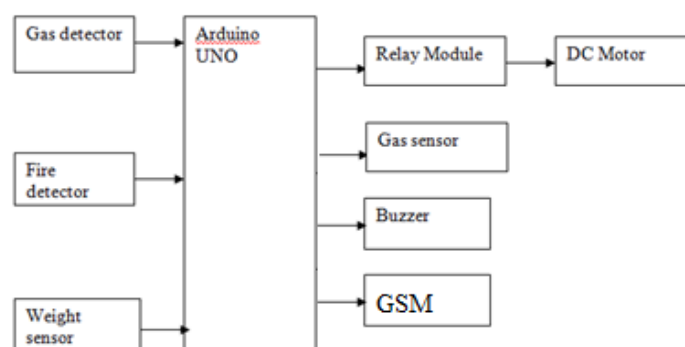


Fig. 1 Block Diagram

The LPG outflow detection and alert system conferred during this section could be seen in Figure one. It is battery operated and hence portable. It is designed in such a way that it can also be operated with ac power supply. To notice the LPG, MQ-6 gas sensing element is utilized. This sensor can be operated at +5V. The sensitivity of this sensor is very high and it has quick response time. It can detect the LPG concentration in the range of 200-10000ppm. Weight sensor is added to check the weight of the cylinder. Fire sensor is added in case of fire detection. GSM modem will send an alert via SMS. DC motor is used for ventilation mechanism, to open the windows in case of gas leakage.

IV. HARDWARE DESCRIPTION

- **Arduino UNO:**

Arduino is a component and computer code company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that may sense and control objects in the physical world. Arduino programs are also written in any programming language with a compiler that produces binary machine code. Atmel provides a development environment for their microcontrollers, AVR Studio and also the newer Atmel Studio, which might be used for programming Arduino. The Arduino project provides the Arduino integrated development surroundings (IDE) that may be a cross platform application written within the programming language Java. A program written with the IDE for Arduino is called a "sketch". Sketches are saved on the event pc as files with the file extension .ino. The Arduino IDE supports the languages C and C++ exploitation special rules to arrange code.



- **MQ2 GAS SENSOR:**

A gas sensor could be a device that detects the presence of gases in a region, typically as a part of a safety system. Gas sensing element (MQ2) module is helpful for gas run detection (in home and industry). It is appropriate for detection H₂, LPG, CH₄, CO, Alcohol, Smoke or gas. Due to its high sensitivity and quick reaction time, measurements are often taken as soon as possible. The sensitivity of the device are often adjusted by using the potentiometer.



- **Load cell:**

A load cell may be an electrical device that's used to produce an electrical signal whose magnitude is directly proportional to the force being measured. Strain gauge load cells are the most common in industry. These load cells are particularly stiff, have very good resonance values, and tend to have long life cycles in application. Strain gauge load cells work on the principle that the gauge (a planar resistor) deforms/stretches/contracts once the fabric of the load cells deforms appropriately. These values are very tiny and are relative to the stress and/or strain that the material load cell is undergoing at the time. The change in resistance of the gauge provides an electrical value modification that's calibrated to the load placed on the load cell.



- **GSM Modem**

GSM (Global system for mobile communication) is a globally accepted standard for digital cellular communications. The concept of GSM emerged from a cell-based mobile radio system at Bell Laboratories in the early 1970s. GSM is the name standardization group established in 1982 to create common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900MHz. GSM uses narrowband Time Division Multiple Access (TDMA) for providing voice and text based services over mobile phone networks. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world. In the US, GSM operates in the bands 850 MHz and 1900 MHz. GSM owns a market share of more than 70 percent of the world's digital cellular subscribers. GSM was developed using digital technology. It has an ability to carry 64 kbps to 120 Mbps of data rates.



- **Fire Detector**

Flame Detection Sensor Module is sensitive to the flame, but also can detect ordinary light. Usually used as a flame alarm. Detects a flame or a light source of a wavelength in the range of 760nm-1100 nm. Detection point of about 60 degrees, particularly sensitive to the flame spectrum. Sensitivity is adjustable, stable performance.



- **DC Motor**

Electrical DC Motors are continuous actuators that convert electrical energy into mechanical energy. The DC motor achieves this by producing a continuous angular rotation that can be used to rotate pumps, fans, compressors, wheels, etc. There are basically three types of conventional electrical motor available AC type Motors, DC type Motors and Stepper Motors. A DC motor consists of two parts, a “Stator” which is the stationary part and a “Rotor” which is the rotating part.



- **Relay Module**

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. This relay module has two channels (those blue cubes). There are other models with one, four and eight channels. This module should be powered with 5V, which is appropriate to use with an Arduino.

V. CONCLUSION

Nowadays LPG leakage is a major problem in industry, household appliances. Our approach is to monitor and detect the leakage of gas. We have design a system which can provide total control action on peripheral by using microcontroller Atmega328. This is an effective method for detecting automatically and controlling the LPG gas leakage. This system also provides controlled action by closing regulator valve by using solenoid. We are using new approach of ventilation via mechanical window control in case of LPG leakage. It works on electromagnetic locking principle and this window operates automatically in the pre-mentioned scenario. This system is easily affordable to middle class people due to low one time installation cost and low maintenance cost. This monitors the gas and detection of its leakage system to provide the safety for the consumer. The control system of the RFL kit can be integrated with the fire control system of the premises. Over and above these safety features, the kit notifies the consumer via SMS, when the cylinder is about to exhaust. The system is also capable of booking a new cylinder automatically through a notification to Gas Agency. Thus the RFL kit focuses on improving both safety and lifestyle of the consumer.

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