

Smart LPG Leakage Detection and Control System

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Abstract

LPG leakage can lead to disastrous and fatal consequences. This paper presents Internet of things enabled LPG leakage detection and monitoring system. A cost effective kit was developed for the purpose. The kit can detect gas leakage, controls the stove knobs and regulator valves automatically. The leakage is notified with an SMS to the user and subsequently for maintenance measures. A gas sensor which is sensitive to gases such as butane and propane is used to detect the leakage. Stepper motors were used to control the stove knobs and regulator valve.

Keywords: *LPG leakage, Gas Sensors, Stepper motors, Internet of Things*

1.0 Introduction

In India, about 3525 accidents have been reported due to bursting of LPG cylinders in 2014. The number of accidents reported in Karnataka alone due to cooking gas barrel/stove burst in 2014 is about 627 incidents. Detection of gas leakage using sensors controlled by microcontrollers is reported. The microcontroller is connected to an audio-video alarm. Buzzer and LEDs are used for indication and alerting mechanism. The system uses microcontroller which detects the gas leakage and activates the alarm when permissible limit is crossed [1]. A framework that screens the gas spill continuously with the sensors is suggested. The information is accessible progressively through internet and IOT is used to provide ongoing sensor information. Preferred position of the proposed framework alongside gas spillage identification, constant information is accessible through ongoing feed over internet [2]. A machine which includes sensor, GSM module, microcontroller is proposed. The GSM module is connected to the microcontroller to stop the main supply. The system was found to be fairly reliable, tamper-evidence and user - friendly. On a longer run, the protection value is efficient [3]. A device with LPG sensors is developed to sense the leakage of gas through the variation in temperature and alerts the micro controller. GSM module was linked to the microcontroller to provide a command to stop the supply [4]. An automated email is sent to the owner. The signal is sent to the DC motor to shut off the regulator valve [5]. Works related to use of automatic control of stove knobs with stepper motor are scarcely reported.

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2.0 System Details

2.1 Specifications

ARDUINO is an open source laptop hardware, software, software program, employer undertaking, person community that designs and manufactures single-board microcontrollers and microcontroller kit. Arduino includes Hardware component inclusive of Arduino circuit and software component with instructions. It consists of programming to manipulate the assignment and hardware. It is a tool used for controlling the venture along with commands to the circuit. In addition, Arduino can be procured easily. C -programming is used for application in Arduino.

Gas sensor module is beneficial for LPG leakage detection whether inside the domestic or in industrial regions. It is noticeably touchy to LPG, Propane and Hydrogen. Due to its high sensitivity and speedy reaction time, measurements can be taken as soon as feasible. The sensitivity of the sensor can be adjusted by means of using the potentiometer. The price of these sensors is low and is appropriate for exceptional packages.

GSM Module aides in sending voice, SMS and information facts with low strength consumption. The module is compact and can be made to suit the needs of the. Featuring Bluetooth and Embedded AT, it allows total cost financial savings and is a quick method for customer programs.

Relay is an electromagnetic switch operated with a small electric current to activate or cut off a far large electric modern-day. The heart of a relay is an electromagnet.

Stepper Motor is a brushless DC motor that rotates in steps. This is useful to get precisely positioned without any feedback sensor and represents an open-loop controller. The stepper motor consists of a rotor that is usually made of permanent magnet and its miles surrounded through the windings of the stator. After activating windings little by little in a particular order and letting a present day to waft thru them they will magnetize the stator and make electromagnetic poles respectively in order to motive propulsion to the motor.

2.2 Working details

LPG is highly inflammable and can burn everything very easily. These gases are mostly used in large scale industries, Automobiles, home appliances as fuel. The paper concentrates on Smart DCM kit that assists in gas leakage detection, automatic controlling, monitoring etc. The Smart DCM kit consists of Arduino was programmed using Arduino IDE software. MQ2 gas sensor is heart of the kit, it is used to sense the leakage of gas if the concentration in beyond 400ppm, then a signal is sent to Stepper motors which in turn are connected to the stove knobs and regulator valve. In case of a gas leakage, Arduino firstly checks for the OFF/ON position of the knobs. Secondly, if any of the knobs are in ON position, they are shut off immediately and simultaneously regulators valves are shut OFF. Relay works as a switch between Arduino and stepper motor, if

leakage is sensed relay completes the circuit and charges the stepper motor to control stove knobs and regulator valve and is as shown in Fig. 1.

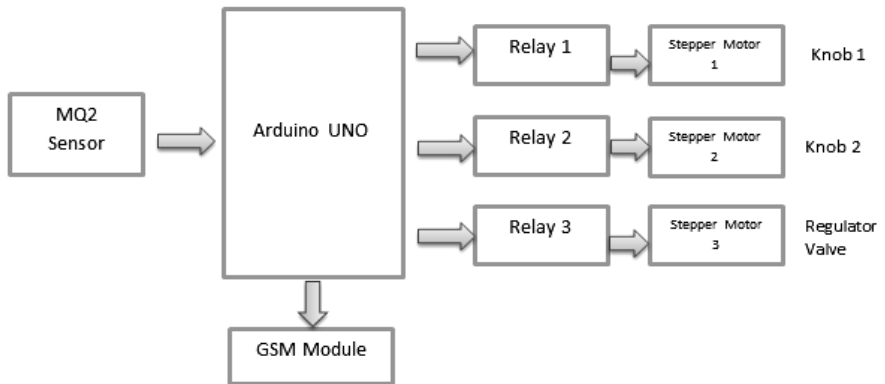


Fig. 1. Smart DCM Kit

2.3 Cause and Effect Diagram

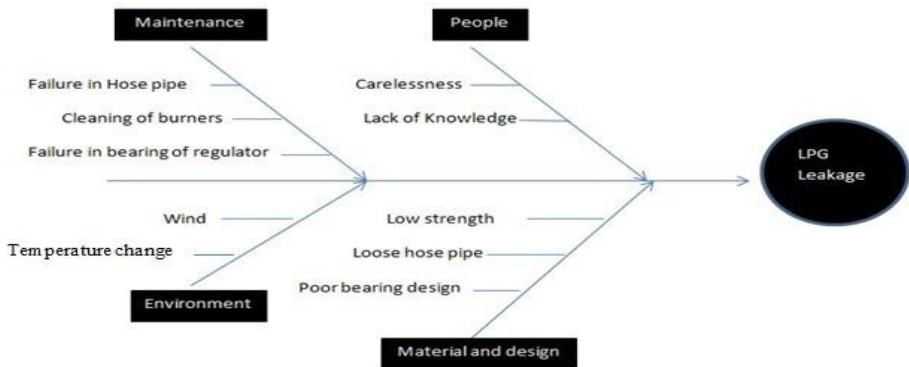


Fig. 2. Cause and effect of LPG gas Leakage

Cause and effect diagram for LPG leakage is presented in Fig. 2. Due to carelessness of users, accidents may occur. Carelessness includes improper tightening of hose pipe and regulator. If Water is boiling and overflowing on the gas stove putting the flame out might cause gas leakage. Maintenance is the main cause for any of the accidents. In the case of LPG Leakage there may be over usage of hose pipe and regulator even after their expiry date. Due to the deposition of oil and dust over the burner may lead to blocks in the burner holes which results in improper functioning of the burners. Environmental conditions like wind and temperature also leads to leakage. Every component cannot be manufactured exactly without any defects, leakage may be caused due to the

manufacturing defects like quality of the hose pipe, malfunctioning of bearings and etc.

3.0 Conclusions

The proposed Smart DCM kit provides better safety measures to user in a very affordable cost. It is programmed in such a way that automatically stove knobs and regulator valve are controlled when there is a leakage. The advantage of this kit is that there is no intervention of human in leakage detection, controlling of valves and monitoring of the unit. The modalities of DCM kit is shown in Table 1.

Table 1 Cost of DCM kit

Component	No. of units	Unit cost (Rs)	Total cost (Rs)
Arduino	1	350	350
MQ2 Gas sensor	1	90	90
Stepper motor	3	100	300
GSM Module	1	400	400
Relays	1	50	50
Stepper motor driver board	1	50	50

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