Automatic Detection And Power Shutdown For Gas Leakage And Its Monitoring System

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Abstract: *Generally LPG Gas leakage accidents mainly caused due to electrical fluctuations in power system, during leakage of LPG gases then immediately react if it's any power fluctuations is there then it causes rapid explosion to the whole system. Recently In our country there are certain accidents due to this gas leakage incidents and most probably occur in household areas. So, overcome this problems, we are developed our idea to implement a Gas leakage detection with automatic power shutdown through MQ-6 gas sensor and SCR & sms alert to a respective person through GSM & GPS module and also a Gasvalve closing system by using servo motor to reduce more gas leakage problems and also we have proposed in this paper for monitoring LPG gas level present in the cylinder through IoT by using Nodemcu and Load cell. This paper describes about to reduce gas leakage accidents in residential areas and monitor the gas level present in the cylinder.*

Keywords: *MQ-6 sensor, LPG level & leakage detection, IoT, Power shutdown, GSM & GPS module, SCR module, Alarm System, Gas valve closing method, Load cell.*

1. INTRODUCTION

Basically LPG consists of mixture of butane and propane which is highly flammable. It is immediately reacts if it's any power fluctuations is there then it may lead to explosion. Safety is the level of protection against danger and loss [1]. This help of technology is needed to provide high safety features and warning in order to ensure to enough time is available to prevent potential dangers. In this study, gas leakage detection systems have been highlighted along with troubleshooting directives. The proposed system detects the LPG gases. Whenever a gas leakage occurs, the MQ-6 sensor detect and arduino sends an active signal to the protection systems like Gas valve closing system, Alarm System, sms alert systems, power shutdown using SCR module and also this proposed system provides a real-time gas level indication present in the cylinder to identifying the gas level usage, pre booking of gas cylinder is enable to ensure to increase effective usage of Gas cylinder safety & monitoring systems. The purpose of this project is to detect the LPG gas leakage with automatic power shutdown and also provides alerts to the consumers to prevent any harmful effects due to gas leakage [1]. In this paper we have proposed another safety feature to detect the LPG gas level present in the cylinder with help of Nodemcu and load cell module. The entire system is

affordable and reliable to implement at residential area to prevent our society from gas leakage incidents.

2. METHODOLOGY USED

The functionality of whole system is divided into five main steps. The fig.1 shows the block diagram of whole system.
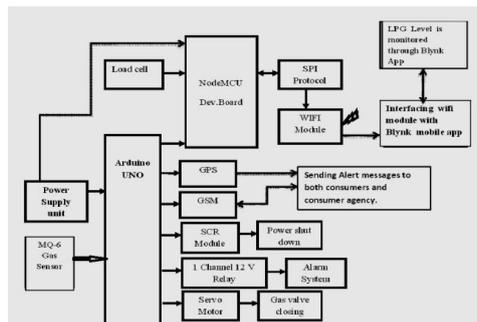

Fig.1.Block diagram of gas leakage detection & level monitoring system.

In this first step, the leakage of gas is detected by the MQ-6 gas sensor at the specified level of ppm range. Commonly the dangerous level is leakage is above 400 ppm. But we have decided to put MQ-6 gas sensor because this sensor detects at the range of 250 ppm itself at high effective fast response.

So if the gas leakage is reached specified level then immediately send an active signal to arduino with the help of ADC. After that it receives the signal, send by gas sensor [13]. In this second step, arduino sends an active signal to the other systems like Alarm system, SCR module, Gas valve closing system. In Alarm system will be activated by single channel relay and power shutdown will be activated through SCR gate triggering method. In this third step, send an alert message with location of accident area through GSM & GPS module and servo motor will be activated by rotating clockwise manner to immediately close the gas valve [2]. The SCR will be triggered when the arduino sends an active signal then it will be cut off the power supply. Because of Soft switching process we have decided to use SCR as a power cut off module. In fourth step, by detecting gas level present in the cylinder with the help of Load cell , For this experimentation purpose we had decided to set an initial weight as 3 kg , if the weight is exceed up to 3kg then it shows 100% in Blynk mobile app through nodemcu and if the weight is specifically reduced to half load then it shows 50% in the mobile app. In the last step use of load cell amplifier it sends a digital signal to the nodemcu wifi module. Through this wifi module it directly sends a SPI protocol connected to mobile app through wifi connectivity [3]. At the end, when the gas leakage is stopped then with the help of reset button in the arduino and nodemcu the whole system back to initial stage.

MQ-6 GAS SENSOR:
MQ-6 gas sensor is a semiconductor type sensor which the detects the harmful LPG gases. The material used in this sensor is tin dioxide (SnO_2), it has very low conductivity in clean air. The sensor which has high sensitivity to the LPG gases like butane, propane, methane, and low sensitivity to the smoke and alcohol. The MQ-6 sensor is shown in fig.2**.**

Fig.2. MQ-6 Gas sensor

The concentration range of MQ-6 gas sensor is 200-1000 ppm. The sensor has fast response time and high reliability and efficiency range up to 90% especially of LPG gases [4]. The power need by the sensor is 5V.

LOAD CELL:
Load cell is a force transducer. it converts a force such as tension, compression, pressure into an electrical signal that can be measured. As the stress applied to the load cell then, electrical signal changes proportionally. Load cell will have full scale output is expressed in mV/V [12]. The load cell is shown in fig.3.
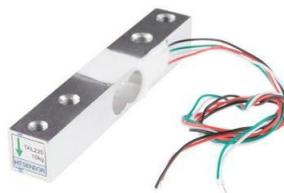

Fig.3.Load cell.

(A) SCR MODULE:

SCR module is used to control and rectify current in only one direction. It works like a mechanical switch, when a gate pulse is applied gate to the SCR; it triggers on and starts to conduct. The SCR module is shown in fig .4.

Fig.4.SCR module.

The operating voltage is 0V to 240V and current rating from 110A and power rating is 3000W.

HARDWARE PROTOTYPE:
In this proposed system consist of two sections. One is Gas leakage detection and another is Gas level monitoring system. If the gas is leaked around 200 ppm then immediately all systems will be activated like alarm system, power shutdown module, Gas valve closing module with the help of Arduino and another system of Gas Level monitoring is activated at any time we want if we had use household cylinder, then we fixed initial weight as a 30kg [5]. if cylinder at the full load of 30 kg it shows 100% level in the Blynk mobile app and after

that specifically weight is reduced rapidly then it automatically to half load, 50%   shown in the mobile app. This system will run at anytime and anywhere the wifi connectivity is available through smartphones [11,13]. The whole hardware system is shown in fig.5.
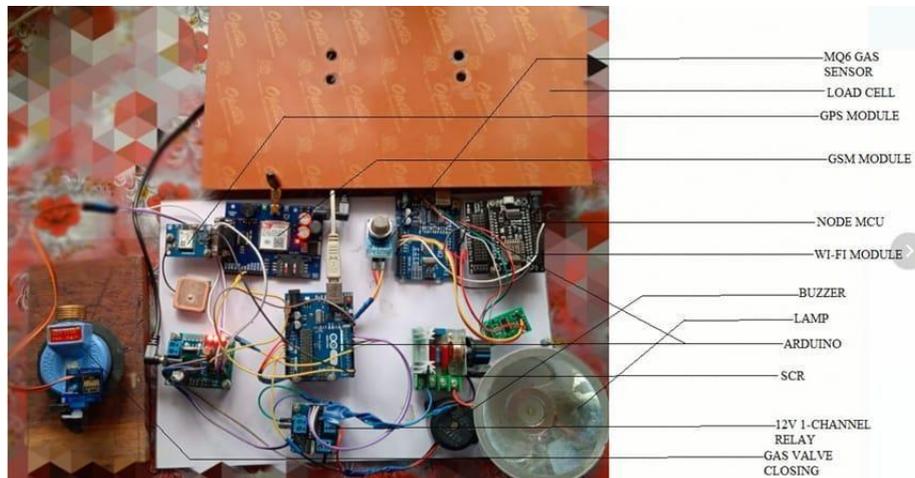

Fig.5. Hardware prototype.

3. SIMULATION AND RESULTS:

The whole circuit simulation in Proteus works by applying either a hex file or a debug file to the embedded programming of project prototyping in areas like arduino and nodemcu is part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it [6,17]. This enables its use in a full control system, alarm system control, servo motor controlling and power shutdown feature will be activated and controlled by arduino. Also it is convenient to use as training or teaching tool. The various simulation result of Before Gas leakage , after gas leakage, and also gas level monitoring are shown in
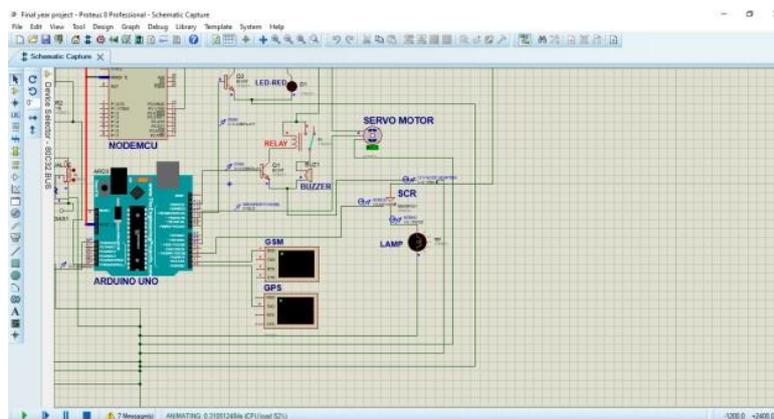

fig.6,7,and 8 [7,14].

Fig.6.Before Gas leakage

If there is no gas leakage in this system, then power supply will be normally turned ON and likely other security systems of servo motor, alarm system , gps and gsm will not be activated [8,15]. For this simulation and experimental part we had used lamp if there is lamp is ON, then power supply will be normal and there lamp supply is OFF position then we had identified LPG gas is leaked position.

Fig.7. After Gas leakage.

Also we had simulated Gas level monitoring by using potentiometer work as a load cell, if we vary the potentiometer level then it changed accordingly to the voltage level. The Gas level monitoring is shown in fig.8.

Fig.8.Gas level monitoring.

(A)   GSM MESSAGE RESULTS:

Fig.9.SMS sent to consumer agency.

In a hardware prototype, one of the part is that sending alert message to both consumer and consumer agency. These all are activated by if the LPG gas is leaked [9,16]. The results are shown in fig.9,10.
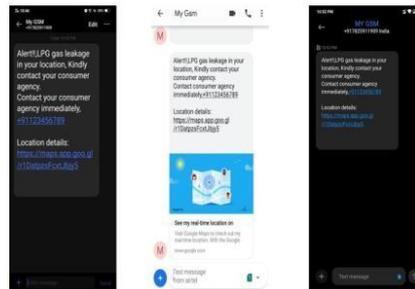

Fig.10. SMS sent to consumers.

(B) GAS LEVEL RESULTS:

Initially we have fixed a weight up to 3Kg, if the load is reached 3kg it shows 100% and their weight is reduced to half load, then it shows 50% on a mobile app. These experimental results are shown in fig.11, 12.

Fig.11.Half load (50%).

Fig.12.Full load (100%)

4. CONCLUSION:

Gas leakage accidents are a very challenging problem. This proposed project proposes to detect gas leakage in residential areas. It shut down the household power supply during gas leakage by using our proposed methods and also alerts a consumers and consumer agency immediately. Also we have proposed Gas level monitoring through IoT, this enable to ensure the person to identify what gas level is present in the LPG cylinder.

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