Microcontroller based Gas Leakage Detection and Accident Prevention System with GSM

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***Abstract* :- Home fires have been taking place frequently and the threat to human lives and properties is growing in recent years. LPG is highly inflammable and can burn even at some distance from the source of leakage. Most fire accidents are caused because of a poor-quality rubber tube or when the regulator is not turned off. The supply of gas from the regulator to the burner is on even after the regulator is switched off. By accident, if the knob is turned on results in the gas leaks. This paper deals with the detection, monitoring and control system of LPG leakage. Using relay DC motor the stove knob is automatically controlled. This system also consists of GSM (Global System for mobile communications) module, which alerts by sending SMS to the owner.**

Keywords: -CNG (compressed natural gas), LPG (Liquefied Petroleum Gas), MQ-6 Gas sensor, Microcontroller (89c51).

1. INTRODUCTION

LPG (Liquefied Petroleum Gas) is a popular cooking fuel. LPG gas is a flammable mixture of hydrocarbon gases (composed of mostly propane and butane) used as a fuel in house appliances and vehicles and in industries. It is odourless gas due to which Ethanethiol is added as powerful odorant, so that leakage can be easily detected. LPG is one of the alternate fuels used now days. Sometimes liquefied petroleum gas is also known as LPG, LP gas, Auto gas etc.

This gas is commonly used for heating appliances, hot water, cooking, and various other purposes also. LPG is also used as an alternate fuel in vehicles because of soaring in the prices of petrol and diesel.

Compressed natural gas (CNG) (methane stored at high pressure) is a fuel which can be used in place of gasoline (petrol), Diesel fuel and propane/LPG. CNG combustion produces fewer undesirable gases than the fuels mentioned above. It is safer than other fuels in the event of a spill, because natural gas is lighter than air and disperses quickly when released. CNG is mainly used for powering vehicles but it is also used for household and industrial purpose as an alternative for LPG gas and other fossil fuels due to is non-polluting nature.

Some people have low sense of smell, may or may not respond on low concentration of gas leakage. In such a case, gas leakage security systems become an essential and help to protect from gas leakage accidents. A number of research papers have been published on gas leakage security system. Embedded system for Hazardous gas detection and Alerting has been proposed where the alarm will be activated immediately, if the gas concentration exceeds normal level.

There have been many accidents that have been caused due to leakage of gas and have caused loss of life and property. Gas leakage detection is not only important but stopping leakage is equally essential. This paper provides a cost effective and highly accurate system, which not only detect gas leakage but also alert (Beep) and turn off the gas supply as well as turn off main power and gas supplies, further it will send an SMS. GSM module is used which alert the user by sending an SMS. In order to provide high accuracy gas sensor MQ 6 has been used.

2. LITERATURE SURVEY

Many Systems have been proposed earlier by different authors and researchers and that has helped us to improve the gas safety issue in our every day to day lives.

LPG detection, measurement and booking system. This system presented how to detect the leakage using a gas sensor and book a new cylinder automatically by sending a message to agency. But there was no steps taken to prevent accident in case of leakage. [1]

LPG leakage monitoring and multilevel alerting system was proposed. A system using LPG gas sensor for sensing the leakage and produce the result in audio and visual formats also alerts human via Short Message Service (SMS). But it lacked an automatic prevention system. [2]

Design and implementation of an economic gas leakage detector was proposed. A system, detecting low and high gas leakage levels and alerts the users by issuing appropriate audio-visual warning signals. The cost involved in developing the system is significantly low and is much less than the cost of gas detectors commercially available in the market. [3]

A controlling and monitoring system for LPG was proposed. In this system the stove knob is automatically controlled using relay dc motor. Additionally, they have proposed the automatic rebooking of cylinder when the level of gas goes below the normal weight of cylinder. But there was no provision for detection of gas and prevention of fire accident due to gas leakage. [4]

Gas leakage Detection and Smart alerting and prediction using IOT. This system detected the leakage of gas and alerted and also it predicted for any future detection. But there was no provision for prevention and elimination of the leaked gas. [5]

Most of the LPG safety devices present in the market or proposed earlier are mostly based to detect the leakage of gas and home automation like automatic booking etc, but there are very few that deal with prevention of accidents that are caused by LPG/CNG gas there are devices that are either designed to prevent leakage or to detect leakage. And here the question arises that what if there is a leakage and how to control it automatically so as to prevent and accidents.

The solution to this problem is our device. Our device not only detects any leakage but automatically stops further leakage and it also alerts the user by sending an SMS.

3. BLOCK DIAGRAM

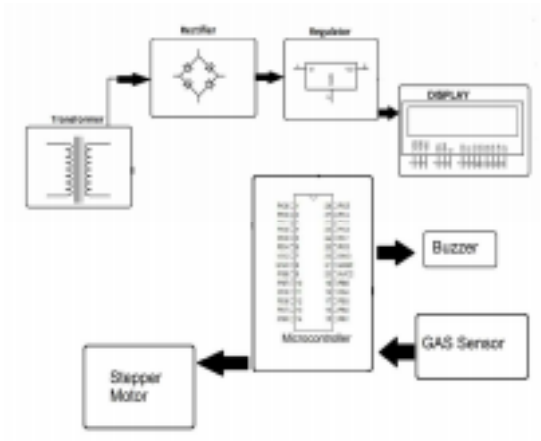

Figure 1: Block Diagram

Gas Sensor (MQ-6)

• The LPG gas consists of isobutene, propane, methane, etc. A sensitive, efficient gas sensor is required that senses only LPG gas contents and is less sensitive to other gases like cooking fumes, cigarettes, etc.MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG, also response to Natural gas.

• The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application. Whenever there is an leakage It senses the leakage of LPG gas and provide the alert signal to the microcontroller alternatively turn on Buzzer when it reaches the danger level.

Microcontroller

• The microcontroller board Atmel 89C51 is a widely used open-source microcontroller.The board is equipped with set of input/output
(I/O) pins, it is an CMOS 8 bit
microcontroller. A flash programmable and erasable read only memory (EPROM) is
present in Atmel 89C51.The board features 40 pins. It has four ports and all together provide 32 Programmable pins. It is programmable with the IDE (Integrated Development Environment) via MAX232 with RS232 to USB converter. It can be powered by an external 9 volt battery, though it accepts voltages between 4 to 5.5 volts.

• Microcontroller receives the signal from the gas sensor and then it turn off the main gas supply by the help of stepper motor which is attached to the valve of gas supply controller. The stepper motor is programmed to rotate to the degree till the valve is completely closed. Microcontroller also stars the buzzer. And it also alerts the owner by sending him or her SMS regarding the leakage.

GSM Module

GSM module (SIM 900A) is used to send an SMS to the user cell phone. When the gas leakage is detected by the gas sensor, microcontroller sends a signal to GSM module, in which one of the tasks is to send the text SMS. GSM module requires one SIM card. This module is capable to accept any network SIM card. This module has a unique identity number like mobile phones have. These module works on 12V DC supply.

We can send SMS. These SMS are saved in the microcontroller memory. Multiple SMSs can also be sends to Number of users.

Stepper motor

This system consists of stepper motor driver and stepper motor attached to valve. Stepper motor is connected to the stepper motor driver IC (ULN 2003A). A 12V external DC supply has been given to the stepper motor. The main purpose of the stepper motor is to turn off the main Gas supply. The stepper motor is programmed to rotate to a degree till the valve is completely closed for the valves used in home its 180 degree and for the valves used in industry are 360 degree.

4. METHODOLOGY

There are no automatic device to prevent household disaster caused by LPG and CNG so our device is the solution that problem.

Our device consists of three main parts

- Detection System
- Prevention System
- Alerting System

Detection system

This part consists of a gas sensor and LCD these will continuously monitor the gas concentration.

Prevention System

This part consists of a special type of Gas valve that we will be designing it will be similar to our present regular valves but a stepper motor will attached to its control knob to allow automatic and as well as manual control.

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And this parts will be interfaced with Microcontroller which will be controlling the whole device.

Alerting system

It consists of a GSM modem to send an Alert message to the user via SMS.

The detection System gas sensor will continuously monitor for any leakage in gas and if there is any leakage it will send a signal to the microcontroller and then the microcontroller

will sound the alarm and turn off the gas supply using an stepper motor and then by using GSM module it will also send an SMS to the owner alerting him or her about the incident.

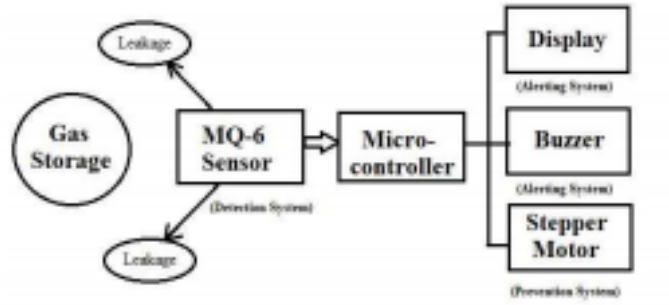

Figure 2: Methodology

5. RESULT

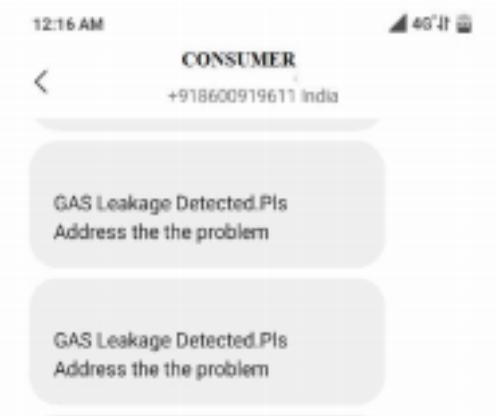

Figure 4: Mobile View

6. CONCLUSION

In this paper we have successfully designed and implemented the gas leakage detection system for home safety and industrial applications. This system detects the leakage of the LPG/CNG and alerts the consumer about the leak by sending an SMS and as an emergency measure the system will turn off the valve of Gas supply Multiple SMS can be sent by changing programming GSM module. This project is implemented using the Atmel 89c51 Microcontroller.

This system has great scope in the home automation industry this system can be added with extra features like automatic gas booking system and home fire safety system. This system can be modified to be used for industrial and household purpose especially in the industries where there is emulsion of harmful and flammable gases. The cost involved in developing the system is significantly low and it can be easily made available to the people and the usefulness of this device is immense.

When leakage is detected by the sensor alerts the onsumer about the leak by sending an SMS and turn off the gas supply useing an stepper motor.

Figure 3: LCD View

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