GAS LEAKAGE MONITOR AND CONTROLLER

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Abstract — Liquefied petroleum gas (LPG) is one that is inescapable in everyday life. LPG is used as a propellant and a refrigerant in a wide variety of applications including heating and cooking appliances, industrial applications, in cars. Gas leakage is one of the major concerns with commercial premises, conveyor vehicles driven by residential and gas. LPG leakage creates dangerous and unfriendly environmental gases that affect humans and other living creatures. Considering that safety plays a major role in today’s world, it is necessary to implement good security systems at domestic or industrial sites. Setting up a gas leak detector at vulnerable locations is a preventive measure that can be taken to avoid the danger associated with gas leakage. The principal objective of the Gas Leakage Detection and By developing an automatic system that can detect the leakage of liquefied petroleum gas (LPG) at home and At the same time control it by turning off the regulator using a DC motor. Automated Control System is to provide a solution. , the window of that room is automatically and an SMS alert is sent to the house owner using the GSM module.

Keywords — LPG, MQ3 gas sensor, SMS, GSM module, Solenoid valve, PIC Micro controller, Relay Driver.

I. INTRODUCTION

There are several solutions to fireplace incidents that are continually approved by agencies. Sources of those devices include smoke detectors, heart alarms, hearth extinguishers, and sprinklers. Such devices can also alert or prevent the fire from unfolding when reflected, but they don’t save you heart injuries and that alone is already a major downside.

This has a look at makes a specialty of the LPG fuel and the way to save you it from causing greater injuries. There is a desire to build a system that helps the incompetence of people in their climate, even as it avoids the start of the conflagration. The system also implements a shut-off mechanism that acts as the first line of defense within the prevention of the accident inside the residence should be an absence of the person. Liquefied Petroleum Gas (LPG) is a highly flammable chemical blend of propane and butane. It is odorless gas which adds ethanethiol as a powerful odor ant, so that leakage can be detected easily. Some people have a poor sense of smell that may or may not respond to low gas leakage concentration. Nonetheless, most of the disaster usually occurs in homes or industries due to gas leakages, leading to several accidents and also causing human life. Some people have a low sense of smell, which may or may not respond to low gas leakage concentrations. Detection of gas leakage is not only important but it is equally essential to control leakage. A system is designed that senses and controls the leakage of LPG gas by switching the regulator off using Solenoid Valve and sending an SMS alert to the house owner to alert that Gas Was Leaked.

II. SYSTEM OVERVIEW

The Systemcomprisesofconsists of PIC Micro controller, Gas sensor(MQ3), GSM Module(SIM300), Solenoid Valve, Relay Driver, asshowninFig.1.
A. GAS LEAKAGE DETECTION AND TRANSMISSION MODULE

The main function of this module is to detect changes in gas concentration, activate an audiovisual alarm, and transmit a signal to the receiver unit. It consists of a gas detection sensor, a sensing circuit, a microcontroller. The gas detection is done using a solid-state gas sensor that is sensitive to LPG, natural gas (or methane) and other gases such as CO and H₂ but not sensitive to air; therefore, the reading is not affected by the presence of air. which is a resistive element with a resistance ($R_s$) that changes with the change of concentration of gases like LPG, CH₄, CO, and alcohol. The sensor can detect small concentrations of the above-mentioned gases as small as 0.1 mg/L, which makes it suitable for gas leak detection. It is worth mentioning that the sensor is also sensitive to room temperature and humidity.

B. RECEIVER MODULE

The receiver module is a mobile unit that receives state events from the gas detection and the alert message is sent to the mobile through GSM module. The Solenoid valve turn off the leakage of gas from the regulator and the gas sensor monitors the change in the concentration all the time.
III. HARDWARE REQUIREMENTS

3.1 PIC CONTROLLER
As a big part of this project the PIC controller is used. All other elements are regulated with it. It has eight Analog pins and more memory space that is used to automate gardening. It also has an efficiently connecting UART. The power required for this controller is given by the internal power supply. Different micro controllers have different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the most recently developed memories of which FLASH is one. Technology used in pic16F877 is flash technology, so that even when the power is turned off the data is preserved. Certain features of PIC 16F877 include ease of programming and erasing.

3.2 Gas Sensor(MQ3)
Ideal sensor for use in detecting dangerous LPG leakage in your car or in a service station, storage tank environment. This unit can be easily integrated into an alarm unit, sounding an alert or providing a visual indication of the concentration of LPG. The sensor blends excellent sensitivity with a fast response time. The sensor can also sense propane, LNG and cigarette.

3.3 Solenoid Valve
Solenoids are basic electrical components and have a huge effect on daily life. The main advantage of the solenoid is that the reaction of the solenoid is immediate if electricity is used. Solenoid valve work involves either opening or closing the orifice in the valve body, which either allows or prevents flow through the valve. The plunger opens or closes the orifice by raising or lowering the sleeve tube by energizing the coil. Solenoid valves are made of a wire, a plunger and, a sleeve assembly and used to turn off the regulator when the gas leaked and controlled by the GSM module.

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Figure 3 Pin Diagram of PIC16F877

Figure 4 MQ3 Gas Sensor
3.4 Relay Driver
A relay is an electric switch that opens and closes under another electrical circuit's power. In the original form, an electromagnet operates the switch to open or close one or more sets of contacts. It was invented in 1835, by Joseph Henry. Because a relay can control a higher-power output circuit than the input circuit, it can be called, in a broad sense, a form of an electrical amplifier.

3.5 GSM Module
GSM stands for Global Mobile Communications System. It is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe digital cellular networks used by mobile phones using second generation (2 G) protocols. The technology made sending and receiving messages very easy using GSM module that operates on a basic AT command that can be implemented by interfacing it with the Rx and Tx pins micro controller. The GSM module being used is SIM 300 which uses SIM memory to store the owner's or housemates' mobile number to whom the messages are to be sent.

It requires very less memory to send and receive text messages and operational simple 12 Volt adapter. Sim300 is used in many projects and therefore many development board modifications have been built for this. Such development boards are supported with different features to make the SIM300 module simple to work with. Some boards only consist of a TTL interface while some boards have an RS232 interface and a USB interface.

3.6 Mobile Phone
Mobile phones belonging to the Global Mobile Communications System networks are capable of sending and receiving the information. A mobile phone with advanced features similar to a computer is called a smart phone, while a standard mobile phone is known as a smart phone. Mobile phones
can be used to connect over long distances without wires. It operates by connecting with a nearby base station that links it to the main telephone network.

IV. WORKING
Regulated power supply is fed to PIC16F877 Micro controller MCLR pin which is also supplied with OSC 1 and OSC 2 crystal oscillator frequency for micro controller operation. With the support of the 230V AC primary to 0-12V step-down transformer, 500mA secondary power supply is taken from main supply. The full-wave rectifier and the condenser filter provide the voltage output, and then Fed to a 5-volt regulator (LM7805) whose performance is used as IC and micro controller power supply. In addition, the micro controller is attached to the temperature sensor and gas sensor. The full contact diagram includes the micro controller circuit, GSM module, power supply, GAS sensor module. The GSM module is fed with power supply. The sensor output goes low as soon as the MQ-3 Gas Sensor senses any storage gas leakage. The micro controller detects that, and the LED & buzzer is turned ON. The Solenoid Valve is also switched OFF the gas leakage from the Regulator after the delay of a few milliseconds and the micro controller continues to send a message as “GAS LEAKAGE” to a predefined mobile number using GSM Module.

Figure 7 Schematic Diagram of Gas Leakage Detector and Controller

V. CONCLUSION
Gas leakages in households and factories put life and property at risk. These leakages have to bear a huge loss for the incident. A solution to such a problem is to set up a Monitoring and Controlling system which keeps on monitoring the leakage of any kind of flammable gases and protects the consumer from such accidents. This circuit is a simple circuit consisting of an MQ-3 gas sensor, a PIC controller and a Solenoid valve to monitor the gas leakage from the regulator, a GSM module to give user a message that a gas leakage occurs at home. This device enables us to track and monitor LPG gas leakage and avoid many incidents, saving lives and property.

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