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Gas Leak Detector using Arduino UNO Microcontroller

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Abstract: ***Today in this present era where technological advances are at its vertex, there is not even a single sector which remains untouched by technology. Technology has not merely established our lives simpler, but also offers a high level of safety and security wherever required. Technological devices are available which provides refuge for all the mankind. In our day to day lives, we all use cooking fuel for cooking our daily meals, but if this fuel gets leaked due to some or the other way, and then there is a large possibility of a calamity to occur around. Hazards due to gas leakage are dangerous and can become uncontrollable if timely actions are not taken. But this gas leak mostly remains unnoticed and there should be some means to observe them so that a quick action can be brought. The gas leak sensor is such a device which detects the gas leaks at initial levels and warns the people of the same. This paper basically deals with the development of a simple gas leak detector at the initial stage and then transforming this simple device into a most advanced gas detector system in the future.***
Keywords: Microcontroller, Arduino, GSM, MQ-6, LCD, SIM 800, Quad Band

I. INTRODUCTION

Liquefied Petroleum Gas [LPG] is the most common cooking fuel used throughout India. Besides being cheap and easily available, LPG serves as an ideal fuel for cooking purposes. With the increase in the number of people using this fuel, it is the need of the hour to provide some safety standards which are required to be implemented to lead an accident free life. The major accident related to the usage of LPG happens due to the leakage of the gas which is dangerous. Gas leaks can occur from the gas cylinders which are used in almost all the household of India. The other possibility of gas leakage is from the gas pipeline as the old pipelines often get corroded and thus may rupture, giving way to the leakage of the gas. If LPG leaks, the chances of fire hazards are at its peak as LPG is a flammable gas. Physically LPG is an odourless gas, but Ethanethoil is added as a powerful odorant so that its leakage can be noticed easily [1]. LPG Gas leaks have been increased from 0.72% of all kitchen accidents to 10.74% of all the kitchen accidents [2, 3]. The small LPG cylinder of weight 5kg in which the burner is located immediately over the cylinder without using a rubber tube is seen to be safer than the one which uses a rubber pipe as this subway has the hazards of getting cracked which in turn can make way to leakage [4]. A computer program to run online to detect the leakage locations has been originated and it functions as the automatic supervisor of the pipelines in remote areas [5]. Simple Gas leak Detector is a simple device which is used to detect the leakage of gas and if the gas leak occurs, an equivalent message is conveyed by the means of an LCD screen and a buzzer and with the help of the GSM module it is capable to broadcast messages to the stakeholders about the lpg leak. This device is at its initial level of development and with modification in future this device will also trip off the mains supply to ensure better safety and surety. The Gas Leak detector device can find application not only at residential homes but also it is applicable to hotels, restaurants and even in industries where LPG gas is used for some or the other purposes.

II. SYSTEM OVERVIEW

The brain of the Gas Leak Detector is the Arduino Uno Microcontroller which controls the entire function of the circuit and the MQ-6 sensor is used to sense the leakage of gas. The basic block diagram of the system is as follows:

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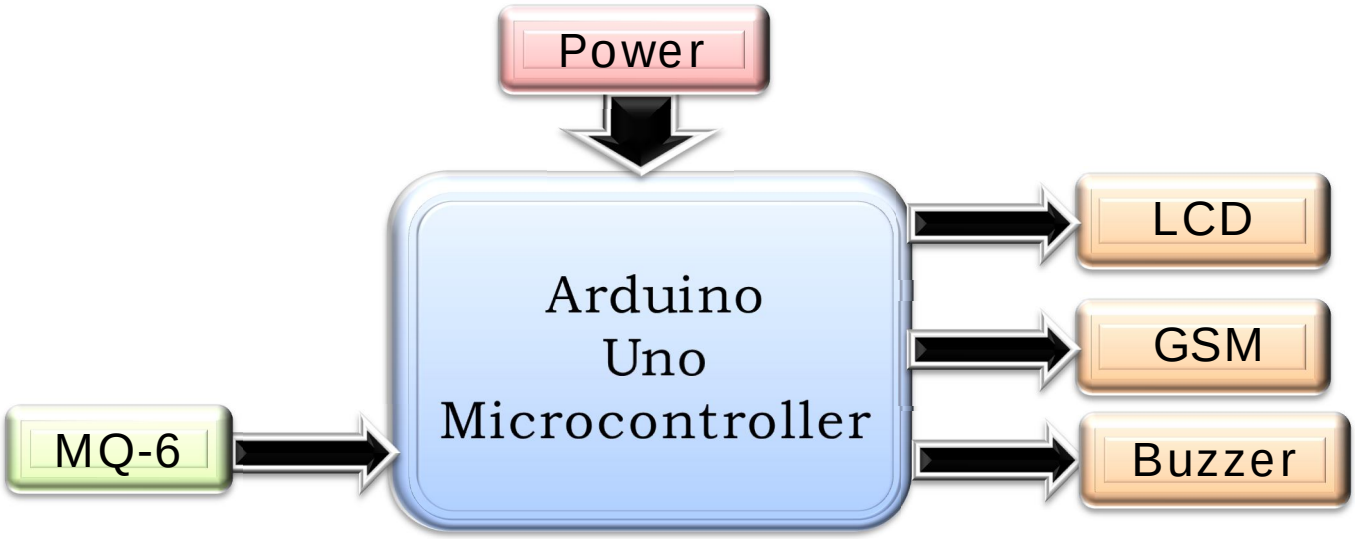

Figure 1 Block Diagram of the System

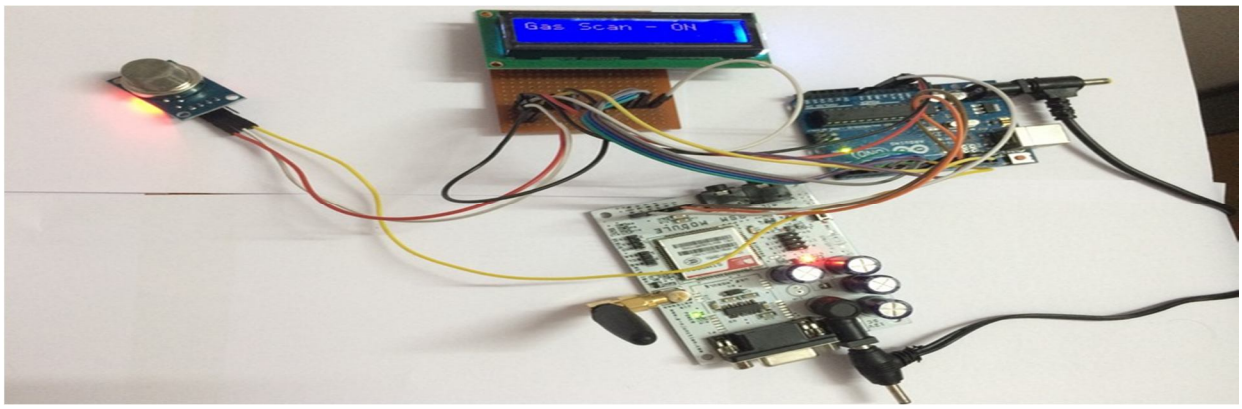

Figure 2 Project Layout

A. Arduino UNO Microcontroller

Arduino is open source electronics prototyping platform which provides an easy to use platform for beginners and hence serve as the most user friendly microcontroller for the first time users [6]. Arduino UNO Microcontroller is programmed using an Arduino Integrated Environment or rather Arduino Software [IDE]. This IDE helps in writing an instruction code for the Arduino. In this case the microcontroller is programmed such that it whenever it has a high signal from the sensor it drives the buzzer on and displays an equivalent message on the LCD display.

B. MQ-6 Sensor

MQ-6 Sensor is the back bone of this device and it senses the presence or absence of the lpg gas[7]. This detector has a fast reaction and induces a stable and long lifetime. It provides high sensitivity not only to LPG but also to iso-butane and propane. It has very low sensitivity to alcohol and smoke. The basic height of the sensor is 23 ± 5% mm and it has a width of 20 ± 5% mm. The detector can detect the gas concentrations anywhere from 200 p.m. to 10000 p.m. [8]. In this detector the MQ-6 sensor acts as the sensing element and can be counted as the sense organ of the system. If a gas is observed then the sensor feeds the output as high and when no gas is discovered then it makes a low turnout. The basic working of the sensor can be keyed out as when the gas interacts with the detector, it gets ionized into its ingredients and it is occupied by the sensing component. This absorption changes the potential difference and a current thus flows through the connecting leads and this current is termed as heating current. The value of sensing resistance changes as the current coursing through it changes and hence the gas leak is observed [9].

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C. Buzzer

It is a piezoelectric buzzer which has a piezoelectric diaphragm of three terminals which are related to the self drive circuits. Using suitable resonant circuits, a large output sound can be obtained. Such buzzers are used in gas alarms, burglar alarms, etc. [10]. In this detector the buzzer gives the output sound when the LPG gas is detected by the sensor. So the buzzer serves as the audio output of the detector.

D. LCD Display

In this detector 16*2 LCD display is used as the visual output for the detector. The LCD displays are preferred over the seven segment display because the lcd displays are economical and they can be programmed easily. A 16*2 LCD display means it has the capability to display sixteen characters per line and there are two such lines present [11]. The basic dimension of the whole LCD display includes a length of 80.0 ± 5% mm and a width of 36.0 ± 5% mm. The viewing area has a length of 64.5 ± 5% mm and a width of 16.4 ± 5% mm. The LCD can be operated with a power voltage of 7V [12]. In this system the lcd displays a message “Gas Leak” whenever the sensor senses the presence of lpg gas and it displays the message “NO Gas Leak” when the sensor does not sense any gas in the atmosphere.

E. SIM 800 GSM Module

SIM 800 is a quad band GSM module which operates at 850 MHz or 900 MHz of frequencies. The chip has the dimensions as 15.8*17.8*2.4mm and weighs 1.35g. SIM 800 module requires the supply voltage in the range of 3.4 to 4.4 V [23]. This module is basically used to send alert messages to the stakeholders regarding the leakage of the gas.

III. WORKING

The working of any advanced system is mainly dependent on the microcontroller which controls the entire functioning of the device. In this case the Arduino Uno microcontroller acts like a conditional switch. It performs two set of action depending upon the condition present. It triggers the buzzer and the LCD to display the message “Gas Leak” when the leakage of the gas is detected by the sensor. The other action is to display the message on LCD “No Gas Leak” when the leakage of the gas is not detected by the sensor. If the sensor detects the presence the gas in the vicinity the GSM module will send “Gas Leak” message to the relevant contacts. If no gas is detected by the sensor in the vicinity then the GSM module will not send any messages. GSM module is included in this device to make the stakeholders aware about the leakage of gas taking place at their house in their absence so that necessary actions can be implemented immediately to prevent an accident. The working of the Simple Gas Leak detector can be summarized in the figure 2.

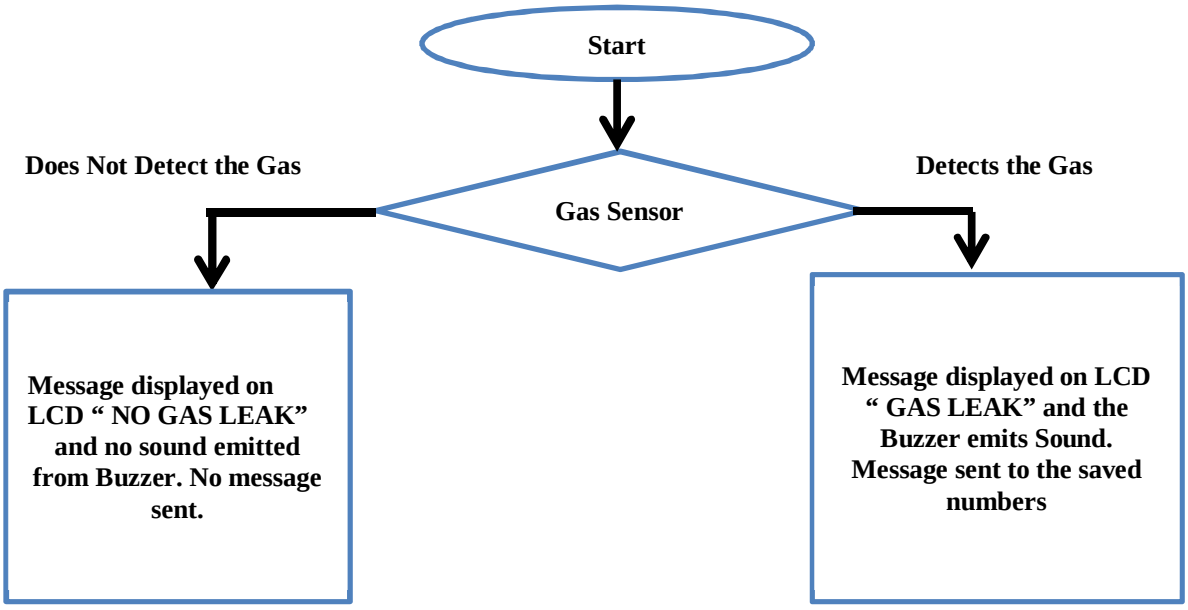

Figure 3 Flowchart of depicting the Working of the System.

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IV. FUTUROSCOPE

There are many ways in which this gas leak detector can be modified and made more complex by including more advanced features into it. The gsm module enables us to send the gas leak message to the relevant stakeholders and hence it increases the efficiency of this system [13-16]. Usage of GSM module for this detector prevents the accidents from taking a hazardous turn. The other modification which can be implemented in this gas leak detector is using a tripper circuit which will trip off the main supply once the gas leak is detected. During a gas leak it is dangerous to switch any appliances as it may spark and this tripper circuit helps to reduce the electrical hazards that can be caused due to a gas leak [17, 18]. Along with the tripping off of the main supply it is very much necessary to turn off the gas regulator so that no further leakage of the gas occurs [19, 20, 21]. A robot has been used in replacing human for handling various tasks in a hazardous and dangerous workplace where human life may at risk. A mobile gas sensing robot can be constructed to sense the leakage of gas through pipelines as the robot can move on a track which is situated along the length of pipeline [22]. This technique further increases the overall efficiency of the system and makes the system a perfect gas leak detector providing overall safety of the residents.

V. CONCLUSION

The main advantage of this simple gas leak detector is its simplicity and its ability to warn its stakeholders about the leakage of the LPG gas. The future aspects of this detector include the gsm module and a tripper circuit which increases the efficiency of the system and provides more safety to the users. The other advantage of this system includes its audio – visual warning systems. This detector is implemented successfully and is easy to use and also a low cost product. Another advantage of this device is that even though if no one is there in the house and then gas leaks occurs, GSM module is there to send immediate messages to the stakeholders regarding the gas leak and thus it lowers the intensity of accidents. GSM module in this device ensures better safety regarding the gas leaks.

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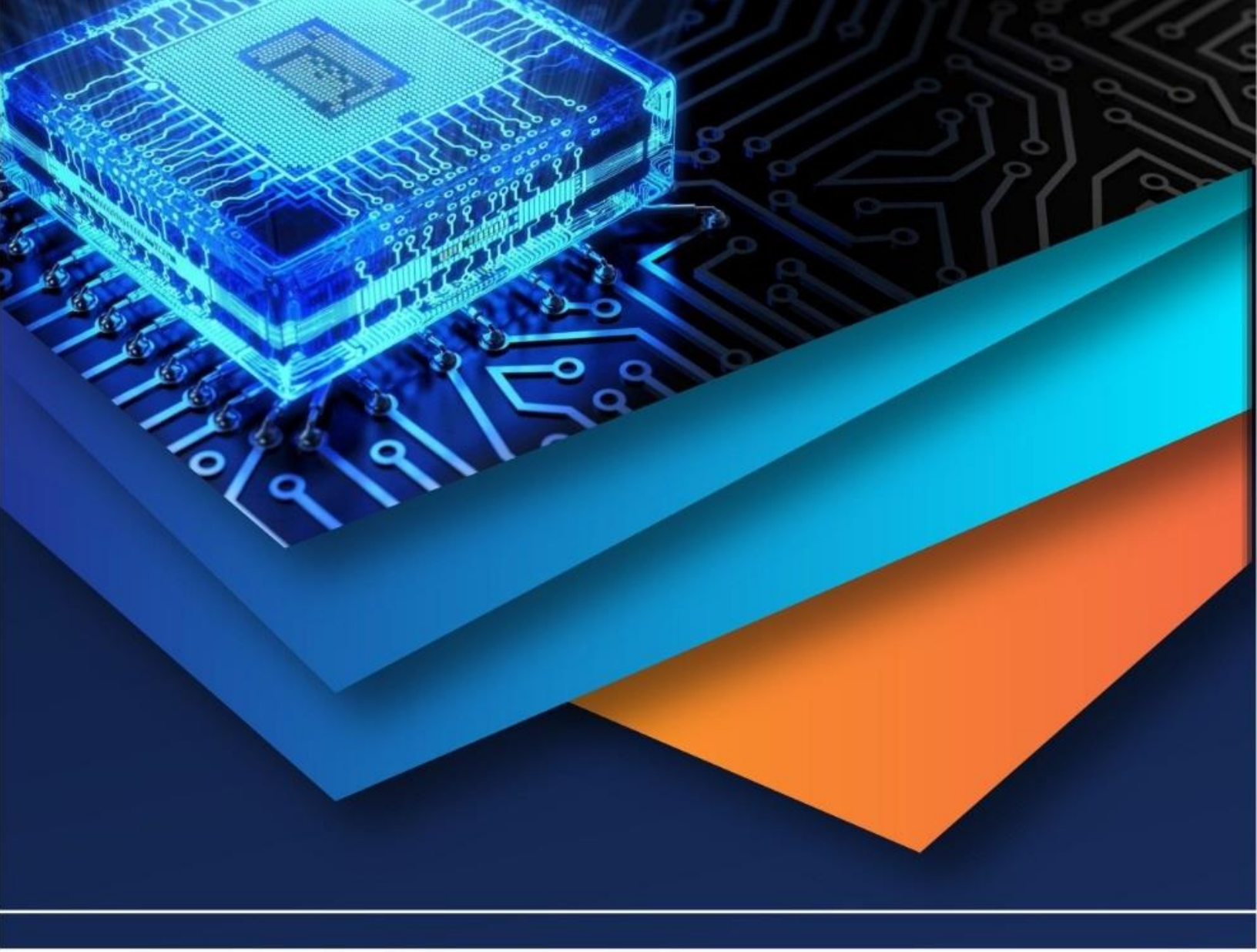

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