
Smart Automation in Gas Level Monitoring with Leakage Detection and Refill Booking using Embedded System

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Abstract

The main aim of this project is to monitor the leakage of gas which used in households and restaurants to avoid fire accidents providing safety feature for the environment where security has been an important issue. The most common problem experienced in our day-to-day lives that is regarding GAS leakage system. When it comes it to safety of the surrounding as well as gas container we have an MQ-5(gas sensor), which will detect the gases by propane, butane, carbon monoxide ,smoke ,alcohol etc. The system detects the leakage of LPG using gas sensor and When the system detects the LPG concentration in the air exceeds the certain level then it immediately takes action by automatically. Thus here we are using the gas sensor which placed in the leak points, which senses the concentration value of gases such as propane ,butane ,smoke ,alcohol , carbon monoxide etc and when the concentration value exceeds the normal value the leakage of gas is detected , and alert system used by buzzer and the automatically open the windows prevent fire accidents. The gas sensor has been used which has high sensitivity to gases like propane and butane. When the concentration of LPG in air exceeds a certain level, the sensor senses the gas leakage and the output of the sensor goes LOW. The detection is done by the gas sensor, through the microcontroller the LED and buzzer are turned ON simultaneously. Using relay DC motor is automatically open the windows.

Keywords: *gas sensor (MQ-5) , Microcontroller , buzzer , LPG, Dc Motor , Relay.*

I. INTRODUCTION

Liquid petroleum gas is generally used in houses and industries. In homes, LPG is used mainly for cooking purpose. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. LPG leaks can happen, though rarely, inside a home, commercial premises or in gas powered vehicles. Leakage of this gas can be dangerous as it enhances the risk of explosion. An odorant such as ethanethiol is added to LPG, so that leaks can be detected easily by most people.

However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. In such cases, a gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. A number of research papers have been published on gas leakage detection techniques. In this project, advanced gas leakage detection technology is used.

This work attempts to build a safety device for detecting LPG and natural gas that leak at low levels to avoid any possible accidents [4-8]. The proposed device monitors the levels of LPG and natural gas as well as

other gases such as carbon monoxide. The device was intended for use in houses where leak of LPG and natural gas can pose a serious threat. It was built as a wireless system to increase the mobility of the alarm system within the premises of the house. In order to provide high accuracy gas sensor MQ-5 has been used. Therefore, there is a need for the development of lower complexity, low cost and fast response systems.

(a) Vapor pressure: The pressure inside a LPG storage vessel/ cylinder will be equal to the vapor pressure corresponding to the temperature of LPG in the storage vessel. The vapor pressure is dependent on temperature as well as on the ratio of mixture of hydrocarbons;

(b) Flammability: LPG has an explosive range of 1.8% to 9.5% volume of gas in air. This is considerably narrower than other common gaseous fuels;

(c) Combustion: The combustion reaction of LPG increases the volume of products in addition to the generation of heat. LPG requires up to 50 times its own volume of air for complete combustion;

(d) Odour: LPG has only a very faint smell, and consequently, it is necessary to add some odourant, so that any escaping gas can vapor phase, but can, however, suffocate when in large concentrations due to the fact that it displaces oxygen.

(e) Toxicity: LPG even though slightly toxic, is not poisonous in can pose a serious effect if they leak.

II. RELATED WORK

There are very few existing model for the same requirement .so the model have to be discussed to provide their flaws and reason for the origin of his new model.

A. Gas sensor (MQ 5)

MQ5 Sensor is basically an LPG(Liquid Petroleum Gas) which is composed of propane& butane, so when an gas leakage is sensed by the gas sensor it will send a high pulse to the microcontroller which will update and even buzzer is heard in the receiver kit.

Thus the overall component and sensors play role in the paper will explain



Figure 1 Gas sensor module

B. Arduino Uno Board

The Arduino Uno board based on the ATmega328. It has 14 digital inputs and output pins, 6 analog inputs, a 16MHz crystal oscillators, a USB connection and power jack and reset button.

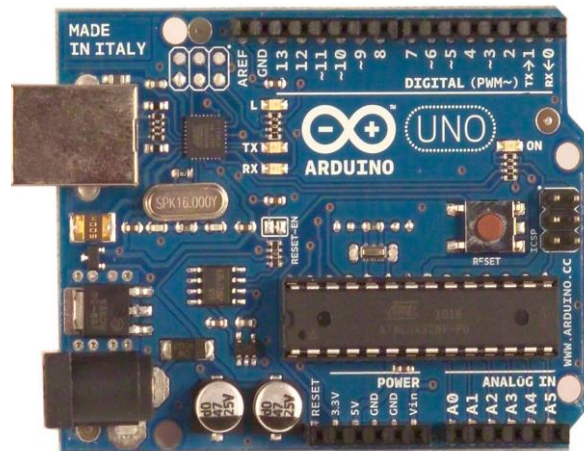


Figure 2 Arduino microcontroller board

III. SYSTEM ARCHITECTURE

Sensor nodes are systems of low cost, small size, and low consumption, capable of getting information from the environment,

processing it, and sending it to the Information to the embedded controller. Microcontroller system that is the core of the node

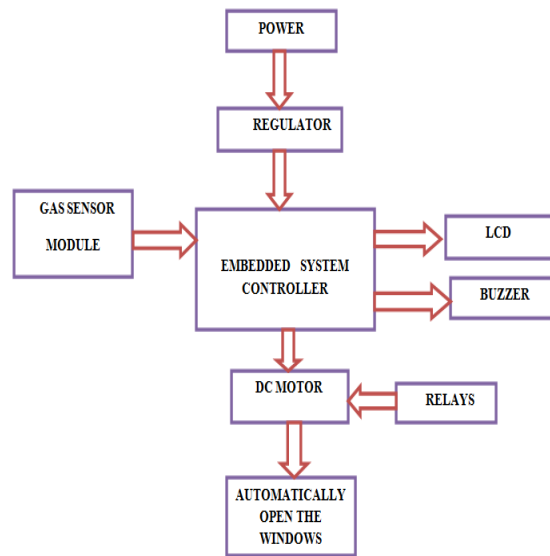


Figure 3 Block Diagram gas leakage detection

The above block diagram shows the outlay of the entire paper which has been discussed above the hardware requirements are quite limited & easily available as well as less feasible.

The gas container is placed on the gas sensor and it constantly keeps on sending the electric pulses to the microcontroller to compare it with the ideal value.

Their respective roles which is to maintain the Boards & gas container security, they are also connected with the Microcontroller and an trigger pulse is sent to the sensor sensing a gas using sensor module. The other block is the sub board which is helpful in the triggering of the buzzer alarm.

The reset Switch (pulse) is used to reset the microcontroller & the devices connected to it the LCD display is used to display the status of the gas container and as well as to used relays rotate the motor in forward and reverse by automatically open the window.

A. GAS SENSOR MODULE (MQ5)



Figure 4 Gas Sensor (MQ5) module

SPECIFICATION OF GAS SENSOR MODULE

Table:1 content of gas module Specification

Items	Parameter name	Min	Type	Max	Unit
VCC	Working Voltage	4.9	5	5.1	V
PH	Heating consumption	0.5	-	800	mW
RL	Load resistance		can adjust		
RH	Heater resistance	-	31	-	Ω
Rs	Sensing Resistance	3	-	30	k Ω

B.LIQUID CRYSTAL DISPLAY

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.



Figure 5 16x2 LCD DISPLAY

C.DC MOTOR WITH RELAYS

We can use DC motor to control garage door open and close, gate extract and retract,

curtain up and down etc, these all have one thing in common, the DC motor movement in two directions. While some motors have this feature built-in, most of them we seen today doesn't, so we may need a little trick to achieve the goal.

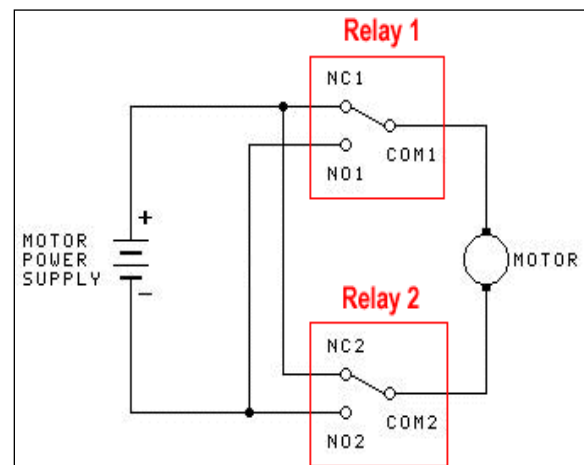


Figure 6 DC motor with Relays

D.BUZZER

This is a small 12mm round speaker that operates around the audible 2kHz range. You can use these speakers to create simple music or user interfaces. Each speaker is

PTH solder able and requires an operating voltage of 3.5-5V with a mean current of 35mA max. These speakers also have a typical sound output of 95 dB and a coil resistance of 42 ± 6.3 ohms.



Figure 7 Speaker Buzzer

Table: 2 Different gases sensing values in ppm

S.NO	NAME OF THE GAS	SENSING VALUE	VOLTAGE
1	LPG	2.5-3.0PPM	5V
2	SMOKE	3.8-4.8PPM	5V
3	PROPANE	4.5-5.0PPM	5V
4	BUTANE	3.8-4.6PPM	5V
5	CH ₂	4.0-4.8PPM	5V

IV.DISCUSSION AND RESULTS

The below graph shows the updating in the sensor adjustment for any change in the LPG gas level, there are only two levels that is either 0(low) level or 1(high) level. The gas is considered as low if the 0 level is appeared, else it is high if the level 1 is appeared See **Table: 2**

The below graph shows the status of the gas sensor which senses for any chance of gas leakage near & around the gas container, the sensor continuously keeps on sensing, if any change is 300-10000ppm observed then it is updated in the table. If the level is at 1 then there is an gas leakage from the container.

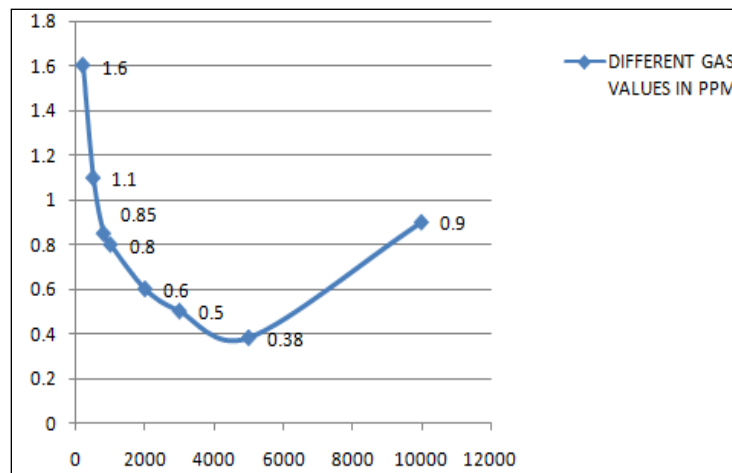


Figure 9 Gas sensing leakage detection

HARDWARE OVERVIEW

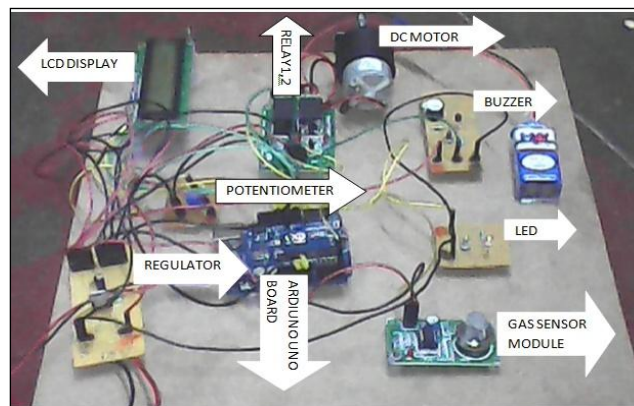


Figure 10 Hardware Discription

HARDWARE OUTPUT

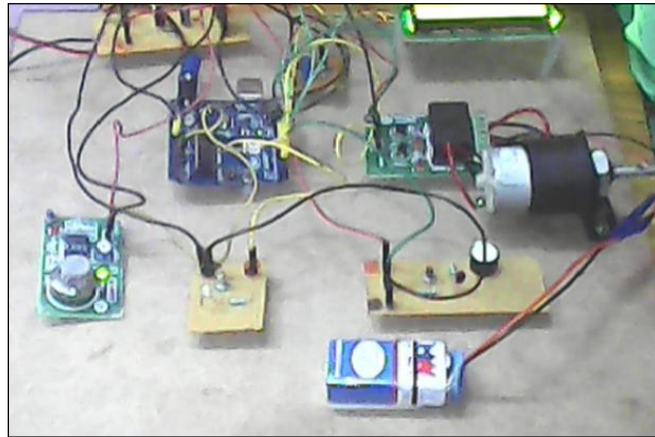


Figure 11 Hardware output

CONCLUSION

The project presented a new approach in the detection of LPG at ambient conditions. A cost-effective gas leakage detection system was proposed, designed and successfully implemented in this paper.

Along with gas leakage detection, this system gives a fully automated approach towards the automatically window opening.

Real time sensing the gas leakage and detect the leakage alert to the user by buzzer and its display on LCD makes it an efficient home security system and also can be used in industries and other places to detected the gas leakage.

Additionally we will obtain a service which will be very much useful for all urban and

rural people. Even we can control the gas usage which is done through black-market.

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