

Microcontroller Based LPG Safety System

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Abstract— The project “Microcontroller Based LPG Safety System” has been developed to provide the safety from LPG gas leakage. Here if there is enough LPG concentration in home atmosphere it will cut-off the power and BUZZER will get rung until the LPG concentration comes to normal. This project has two main parts – Microcontroller (ARDUINO UNO) and MQ5 Gas sensor. This project will prevent to set fire from short-circuit.

Keywords— ARDUINO UNO, MQ 5 Gas Sensor, Power Trip

I. INTRODUCTION

There is one input for this project that is LPG gas concentration in the atmosphere. If this value is greater than or equal to the threshold value then this system will get activated. There are 3 outputs of this system – BUZZER, LCD output, Power Trip. There will be a LCD attached to this system to provide the status.

II. IMPLEMENTATION

This project is based on microcontroller. Here we have used Arduino UNO. Here is the details of implementation.

A. Hardware

1) ARDUINO UNO:

Arduino[1] is a single-board microcontroller, intended to make building interactive objects or environments more accessible. It is a tool for making computers that can sense and control more of the physical world than our desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. The open-source platform, Arduino is mainly used for Electronic based project building purpose. Arduino consists a physical programmable circuit board (microcontroller board based on the ATmega328) and a piece of s/w or IDE(Integrated Development Environment) that is used to write and upload computer code to the physical board.

The Arduino Uno is ATmega328 based microcontroller board. Arduino board needs a power source connection connecting with a USB cable coming from computer or wall power supply that is terminated in a barrel jack. According to picture USB connection is labelled (1) & the barrel jack is labelled (2).

Including 6 digital I/O pins(3,5,6,9,10 and 11 on the Uno)used for PULSE –WIDTH MODULATION(PWM) output, the microcontroller has 14 digital I/O pins, 6 analog inputs pins(A0 through A5 on the Uno) which can read the signal from analog sensor(ex- temperature sensor) & convert it into the digital value that we can read,16 MHz ceramic resonator, an ICSP HEADER & a RESET button.

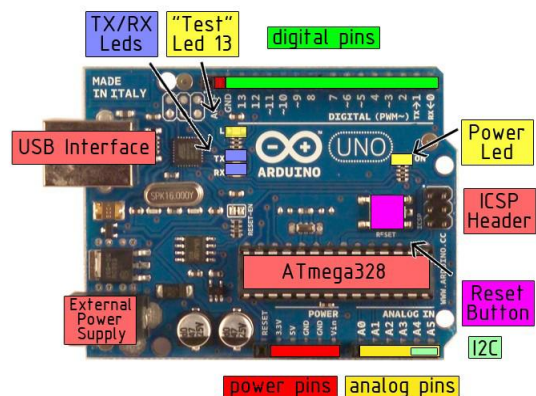


Fig. 1 Arduino UNO board

2) Relay Driver

Relays[2] have been around for a long time and though often now replaced with solid state switches, they have unique properties that make them more robust than solid-state devices and are not going away. The unique properties are high current capacity, ability to withstand ESD and drive circuit isolation.



Fig. 2 Relay Driver[3]

3) LCD:

Liquid Crystal Display[4] screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. 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.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.



Fig. 3 LCD Screen

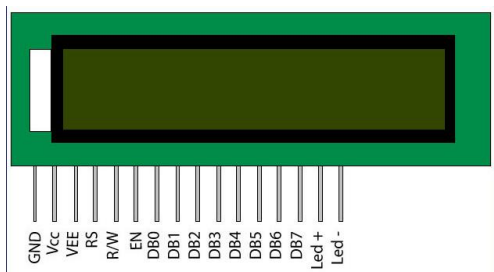


Fig. 2 LCD Pin Diagram

4) Gas Leakage Module using MQ 5 Gas Sensor:

The working principle behind the MQ-5[5] gas sensor is as follows: The sensor has a sensitive filament made of SnO₂. In the presence of clean air, this filament tends to have lower electrical conductivity. When a combustible gas such as LPG is introduced, the filament's conductivity rises, and the amount of change in its conductance/resistance can be used to indicate the equivalent gas concentration. This effect tends to be particularly pronounced at higher temperatures, and resistive heating element is present as well. SnO₂ is particularly sensitive to Methane, Butane and Propane, but is also sensitive to other combustible gases as well.

The Technical specifications for the MQ-5 sensor are tabulated here:

TABLE I
TECHNICAL SPECIFICATION

Model No.		MQ-5	
Sensor Type		Semiconductor	
Standard Encapsulation		Bakelite (Black Bakelite)	
Detection Gas		LPG, Methane, coal gas	
Concentration		300-10000ppm(Methane, Propane, Butane, H2)	
Circuit	Loop Voltage	V _c	≤ 24V DC
	Heater Voltage	V _H	5.0V±0.2V AC or DC
	Load Resistance	R _L	Adjustable
Character	Heater Resistance	R _H	31Ω±3ΩRoom Tem.
	Heater consumption	P _H	≤ 900mW
	Sensing Resistance	R _s	2KΩ-20KΩ(in 2000ppm C ₃ H ₈)
	Sensitivity	S	R _s (in air)/R _s (1000ppm C ₃ H ₈)≥ 5
	Slope	α	≤ 0.6(R _{1000ppm} /R _{500ppm} H ₂)
Condition	Tem. Humidity	20±265%±5%RH	
	Standard test circuit	V _c : 5.0V±0.1V V _H : 5.0V±0.1V	
	Preheat time	Over 48 hours	

The working of the MQ-5 sensor can be explained using Pic 1. The heating coil H is in contact with the SnO₂ filament. In the presence of clean air, the resistance across the heating coil does not vary, but when a combustible gas is present, the resistance of the SnO₂ filament drops, which results in a corresponding rise in Output Voltage (V_{out}), and this output voltage can be measured to indicate the concentration of any combustible gas that is present.



Fig. 5 MQ-5

B. Software

The Arduino integrated development environment (IDR) is a cross-platform application written in Java, and derives from the IDR for the language and the Wiring projects. It is

International Journal of Computer Architecture and Mobility (ISSN 2319-9229) Volume 4-Issue 3, March 2016

designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a sketch. Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a runnable cyclic executive program:

- Setup(): a function run once at the start of a program that can initialize setting.
- Loop(): a function called repeatedly until the board powers off.

III. ALGORITHM

Step – 0 : start
Step – 1 : initialize input pin and output pin
Step – 2 : if LPG sense goto Step - 4 else goto Step – 6
Step – 3 : buzzer activate
Step – 4 : SMS get sent to owner's mobile
Step – 5 : power trip
Step – 6 : goto Step – 1
Step – 7 : end.

IV. PSEUDO CODE

```
mq2=A0;
rel=13;
buz=10;
swtch_state1=0;
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

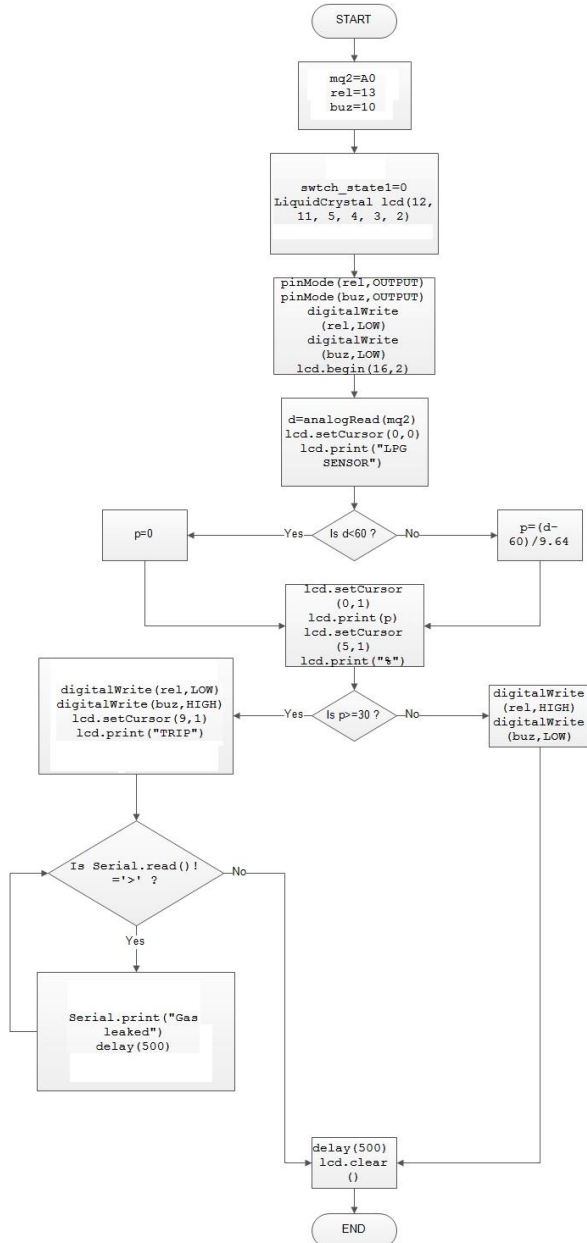
//setup()

pinMode(rel,OUTPUT);
pinMode(buz,OUTPUT);
digitalWrite(rel,LOW);
digitalWrite(buz,LOW);
lcd.begin(16,2);

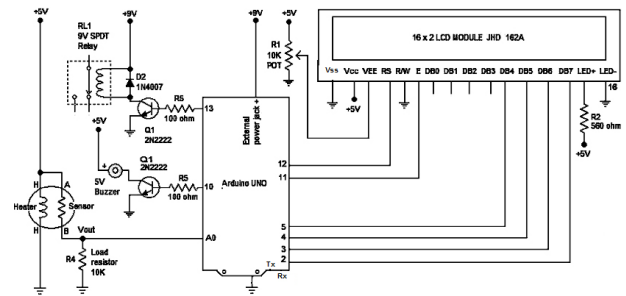
//loop()

d=analogRead(mq2);
lcd.setCursor(0,0);
lcd.print("LPG SENSOR");
if(d<60)
{
p=0;
}
else
{
p=(d-60)/9.64;
}
lcd.setCursor(0,1);
lcd.print(p);
lcd.setCursor(5,1);
lcd.print("%");
if(p>=30)
{
digitalWrite(rel,LOW);
digitalWrite(buz,HIGH);
lcd.setCursor(9,1);
lcd.print("TRIP");
while(Serial.read()!='>');
{
Serial.print("Gas leaked");
delay(500);
}
}
else
{
digitalWrite(rel,HIGH);
digitalWrite(buz,LOW);
}
delay(500);
lcd.clear();
}
```

V. FLOWCHART



VI. FUNCTIONAL CIRCUIT DIAGRAM



VII. CONCLUSION

Our System has several advantages like robust, microcontroller based – so reliable, ‘power trip’ feature – so no provision of setting fire from short circuit.

ACKNOWLEDGMENT

We are too much grateful to The Heritage Academy and University College of Science, Technology and Agriculture for making this project success.

REFERENCES

- [1] <https://www.arduino.cc/en/Main/arduinoBoardUno>
- [2] “Microcontroller Based Under/Over Frequency Relay for Power System Protection” by Akshy Kumar, Gaurav Mishra, Nandini Asthana, Atul Kumar Yadav, Mayur Agarwal, International Journal of Advance Research and Innovation, ISSN 2347 – 3258.
- [3] www.electronics-lab.com
- [4] “Liquid Crystal Display: Environment & Technology” by Ankita Tyagi, Dr. S. Chatterjee, International Journal of Environmental Engineering Science and Technology Research Vol. 1, No. 7, July 2013, PP: 110-123, ISSN: 2326-3113 (Online)
- [5] “LPG Leakage Monitoring and Multilevel Alerting System” by Selvapriya C, Sathya Prabha S, Abdulrahim M, Aarthi K C, INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, ISSN: 2277-9655