

Microcontroller Based LPG Detector and Response System



Aditya Singh, Priyanka Datta, Aman Patel, Aman Singh, Vikash Gupta

Abstract- The purpose of this work is to introduce such project that can find and pause gas leakage in risky areas. A gas sensor was used mainly with high propane sensitivity and butane. The gas leak detection model has a Global System of Communication modulus, which warns owner by sending SMS. Gas leaks are a very big problem with the industries and residency areas. Top of these, most effective preventative measures allied with gas leaks is to establish a gas leak investigate system in high-risk areas. However, the prior gas leak system cannot retaliate later. This paper confers a hardware design approach.

Keywords— Global system of communication (GSM), Gas Sensor (MQ-6), Microcontroller (ATmega328), LCD Display

I. INTRODUCTION

LPG has a mixture of propane and butane which are highly flammable chemicals. It is a fragrance free because Ethane the oil is compiled due to its strong aroma, that’s why leaks can be easily find out. There are variant worldwide norm such as EN589, amyl mercaptane, tetrahydrothiophene generally used as perfumes[2]. LPG is used in most of the areas as oils nowadays. At times liquefied petroleum gas is also called as LPG, LP gas, automated gas etc. LPG gas is widely used for electrical heater appliances, water boiling, making food and various other reasons[1]. LPG is also consumed as alternative oil to cars because of rising prices of conventional fuels. In such a situation, leaky gas safety systems become an important factor and help protect against the risks of gas leaks. Dozens of research papers on gas leak safety research have been published .

Revised Manuscript Received on July 30, 2020.

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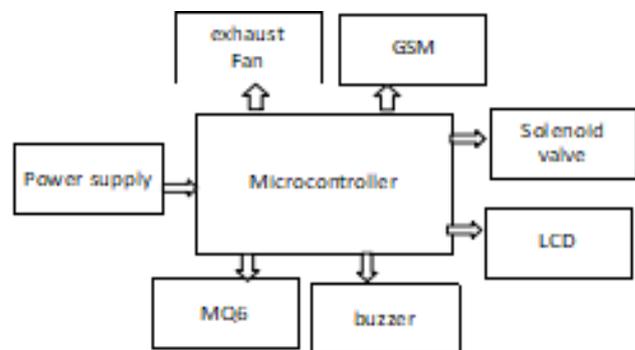
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An integrated Hazardous and Alerting gas discovery process is mentioned in the literature. Alarm gets activated there, if the gas concentration exceeds normal[10]. The Bhopal gas tragedy is a lesson of the leakage of gas risk in India. It was the biggest leak for the world’s most rewarding industries. Gas leakage discovery is not only necessary but blocking leaks are important. This work provides an efficient and highly precise system, whose aim is not only to detect gas leaks but also beep and shutdown gas supply pipeline, and sends message. A GSM modulus is used that alerts the user by giving an SMS. To detect it a sensor known as MQ-6 was used. So the purpose of this project is to design a microcontroller based LPG detection system and system detects LPG leaks using the MQ-6 gas sensor and alerts the user to leaks through GSM-based SMS and buzzer[7].

II. METHODOLOGY USED

The main function of gas leakage system is described below.

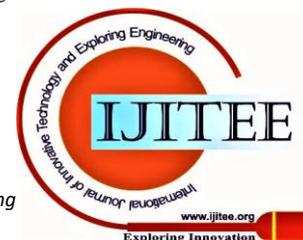


(Figure 1. System block diagram)

In this prototype, gas leak detection is already in place given the priority. MQ6 is located next to gas cylinder. **Step-1:** When the leak starts, resistance of the sensory nerves it decreases and increases its conduction. **Step-2:** The associated pulses are transmitted to the microcontroller as well simultaneously the buzzer and exhaust fan and solenoid valve shutdown the main gas pipeline system[7-9], and a high voltage pulse logic (+5 V) is provided as an interrupt in the ATmega Microcontroller. **Step-3:** Microcontroller sends a message that LPG gas leaks detect the required cell numbers with GSM modules[3] and the same will be displayed on the LCD.

2.1 Microcontroller

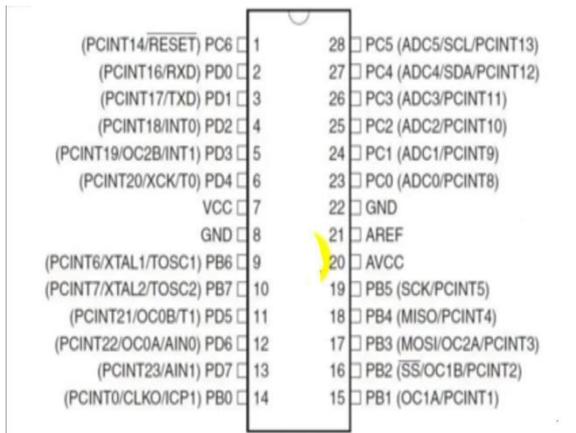
The project, using the ATmega328 microcontroller to control the Emergency Shutdown



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System (ESD), Buzzer module and GSM. After the MQ-6 gas sensor detects an LPG leak, the microcontroller works by sending signals to the ESD to terminate the LPG transmission, the GSM modulus giving an alert intimation to the appropriate authority and buzzer is used to sound the alarm. We are using 8-bit microcontroller with flash memory having capacity of 32K, EEPROM of 1K, and internal SRAM of 2K.

Atmega328 microcontroller has total 28 pins. Different pins like 14 pins of digital I / O, six pins for PWM output and 6 input pins of analog. There are total 20 I/O pins.



(Figure 2. Atmega328 microcontroller)

2.2 Gas sensor

The semiconductor gas type gas sensor is MQ-6 that investigates gas leaks. The critical substance is dioxide (SnO_2) of MQ-6. There is a very less flow in fresh air. Sensitivity of MQ-6 electric sensor is not for only to increase in propane and butane, it is also to other natural gases, low levels of tobacco fume and alcohol[5]. The MQ-6 transducer has concentration range which is 200-1000ppm. This transducer has total 6 pin package. In which 4 pins have work of downloading signals and the other 2 pins are work for providing heating current. This transducer has a quick response time. Sensor required 5V for performing. For different pressures, sensor have different resistance for that[10].



(Figure 3. MQ6 Gas Sensor)

2.3 GSM Module

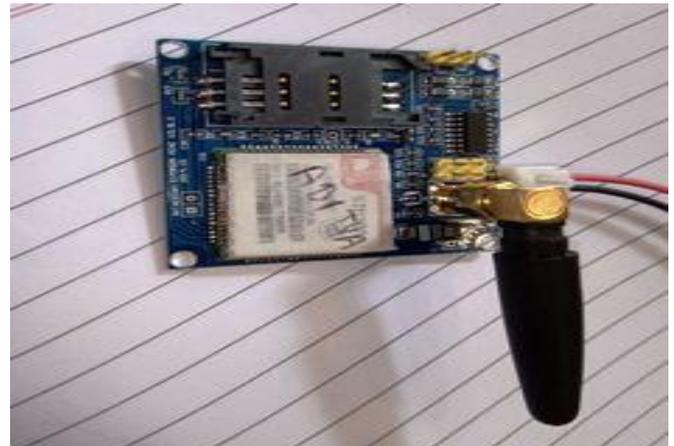
The powerful single-chip processor that integrates the AMR926EJ-S core, allows you to benefit from smaller sizes and cheaper solutions. It is very dense in size and easy to use as plugs in the GSM Modem. It is built with 3.3 and 5 V DC

TTL circuit breakers, which allow the User to communicate directly with the 5 V Microcontroller (PIC, AVR, Arduino, 8051, etc.) and 3.3 V Microcontrollers such as ARM and ARM Cortex XX[6][11].

It operates at frequencies of 850MHz, 900MHz, 1800MHz, and 1900MHz.

Characteristics:

- GPRS / GSM Quad band : 850 MHz/900 MHz/1800 MHz/1900 MHz;
- Manufacture from opposite of Logical Converter (MAX232) concept;
- Adjustable Baud Level;
- Sub Miniature A connector (SMA) and GSM L-Type Antenna connector;
- Built-in Subscriber Identity Module (SIM) hold slot;
- Manufacture in LED Status network;
- Powerful Transfer Control Protocol or Internet Protocol Stack for Internet data transmission through General Packet Radio Service (GPRS);
- Connectors for Audio Interface;
- Many status and control pins are present;
- Standard operating temperature: $(-20^\circ\text{C})-(+55^\circ\text{C})$;
- Input voltage: 5 V-12V DC; and
- DB9 serial Port is given for easy separation.

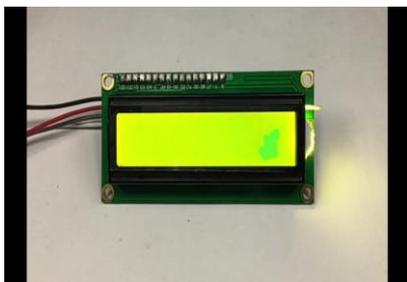


(Figure 4. GSM module)

2.4 Display

Since the system operates control and control functions, it is necessary primarily to place an indicator on the system that displays various messages such as gas leak detection, the reservation value of the cylinder in the event of filling the cylinder and will also indicate move taken by the ATMega328.

The 16X2 LCD (Liquid crystal display) has characters running on + 5V rendering and running in mode of 4-bit is used for function of displaying the required message. Interfacing with ATMega16A or code like short program make it very helpful to make the program much easier[4].



(Figure 5. LCD display 16*2)

2.5 Gas Electromagnetic solenoid valve

The Emergency Shutdown system is designed to provide ultimate safety to toxic or reactive gases. We have a direct solenoid valve system where a weak spring connected to a plunger in the gas system and works when it get energy. In the absence of energy, the LPG moves within it without any limitations. However, when the microcontroller sends a signal to it to respond to a leak, it powers the plunger that connected with spring by electromagnetic force and forces the system to stop the gas flow.

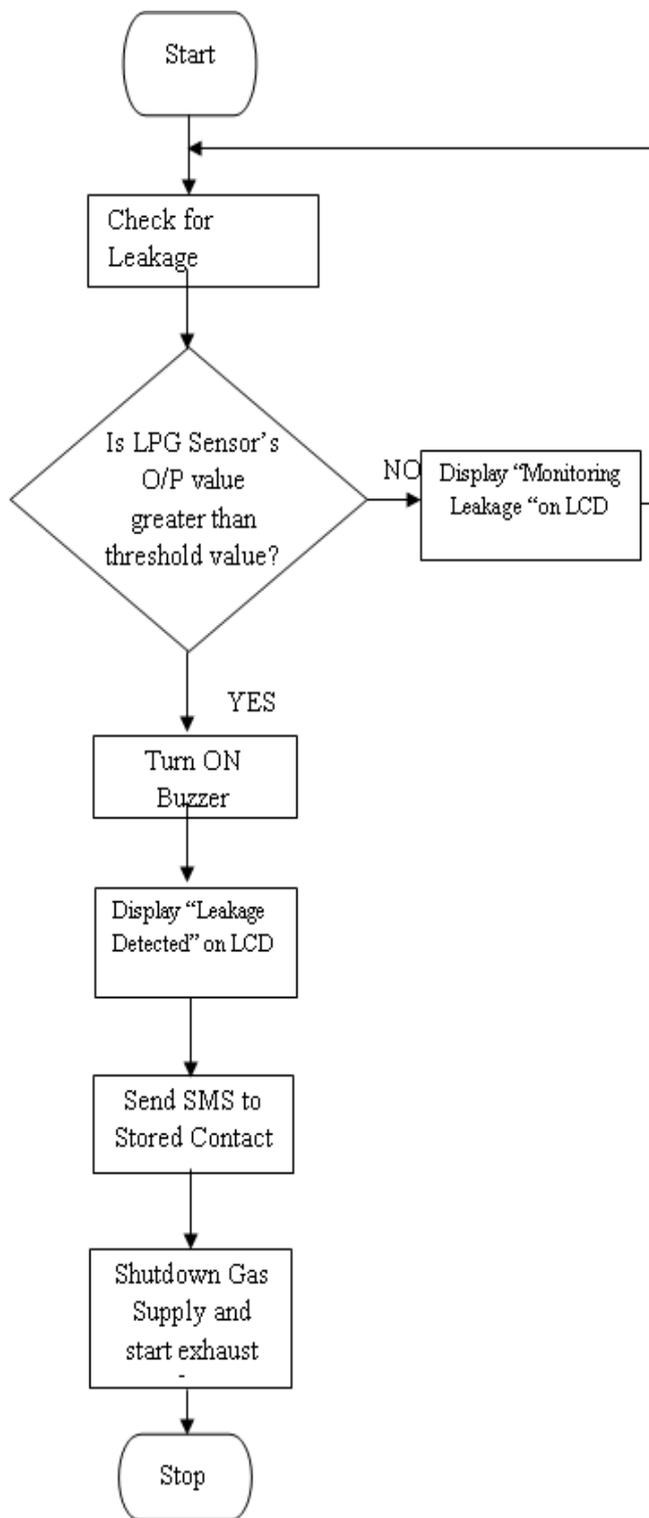


(Figure 6 - Electromagnetic solenoid valve)

III. FLOWCHART OF PROPOSED DESIGN

When the system gets power, then in normal conditions our transducer output is less than the threshold value so LCD displays the message of “Monitoring Leakage”, and if the transducer output is greater than threshold value, then it give the input to microprocessor and further commands to shutdown mechanism and exhaust fan, for giving message to owner, buzzer and LCD display to show message “Leakage detected”.

On the basis of this flowchart, we can write the coding of microcontroller. So that it perform controlling of other equipments according to that coding. This can also help in writing algorithm of the coding.



(Figure 7. Flowchart)

IV. RESULT

A prototype default system is created and if a small quantity of LPG gas is brought closer to the prototype, the system detects a leak by using sensor and then gives the message to the house mates and give input to an alarm for activation and shutdown mechanism with activation of exhaust fan.

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(Figure 8. Prototype model)

V. CONCLUSION

This work poses the problem of LPG leakage that has resulted in numerous catastrophic injuries and damage to multi-million dollar buildings. As such a machine capable of detecting such leaks and blocking gas delivery was designed and successfully manufactured with the help of Proteus. The device is able to detect LPG leaks through the MQ-6 touch sensor and with the help of a microcontroller activate a buzzer that continues to alert anyone who is about to leak. A detailed SMS "LPG leak detected" is sent to the SIM900A GSM Module as a backup alert with the appropriate leak authority. Also, the delivery is closed by the unit of solenoid value less than one minute to avoid potential damage. That's how we minimize the risk of accidents and money loss associated with that.

FUTURE SCOPE

This project is limited only to monitor LPG leaks, alerting the user and turning off gas supply using a microcontroller. In future, countless modifications, such as using variety of MQ series family sensors for detecting different kinds of gas leakages etc. can be done to enhance the performance and enlarge area of application of this project.

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