GAS LEAKAGE DETECTION AND CONTROL USING GSM MODULE

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Abstract:

In recent years due to explosion of LPG number of deaths has been increased. In this paper, a method is proposed to implement a security system for detecting leakage of gas. This system detects and monitors the leakage of Liquid petroleum gas (LPG) using gas sensors and send signal to the microcontroller then microcontroller alerts the person about the gas leakage using the buzzer and by sending the SMS to the specified mobile numbers using GSM Module. Simultaneously to take necessary action it automatically switches on the exhaust fan to decrease the gas concentration in the air.

Keywords: GSM (Global system for mobile communication), LPG (Liquified petroleum gas), ARM microcontroller (ARM7TDMI-S), Gas sensor MQ2

1. Introduction

Liquid petroleum gas is used as industrial fuel and for domestic purpose. The main constituents of LPG are propane and butane which is highly flammable chemical. It is odourless and has characteristic of smokeless burning in the air. LPG is also used as fuel in vehicles due to increasing prices of petrol and diesel. Leakage of this gas is a serious problem. The gases being heavier than air do not disperse easily and it may lead to suffocation when inhaled. The gas leakage in the air cause explosion. In this case, some high security system becomes necessary and essential. Gas leakage detection is the process of identifying potentially hazardous gas leaks by sensors. In order to monitor its presence sensing elements are deployed in its premises to detect the leakage and to avoid the accidents. A number of papers have been published on gas leakage detection and prevention techniques.

2. System design

Figure 1 shows the architecture of the implementation. The leakage of gas in environment is monitored using MQ2 sensor which has 4 pins and provides either digital or analog output. The sensor is connected to ARM microcontroller. After that ARM microcontroller receives the signal which has been send by the gas sensor. Then the microcontroller sends the activation signal to the external attached devices like buzzer, exhaust fan, LCD and activation of GSM which sends the SMS to the specified mobile numbers.

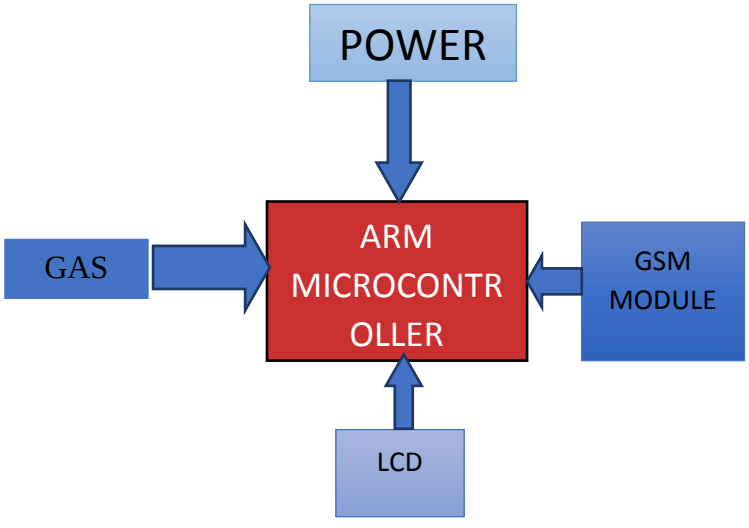

Fig. 1. System Architecture implementation

The objective is to collect the data from the sensor (gas leakage level (MQ2)) and send this data to the microcontroller. The microcontroller has acts as a gateway to external devices. It acts as a network having control over the sensor which give the updates of the gas leakage in premises.

3. Hardware description

a. Gas Sensor

MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible gas. Sensitive material of MQ-2 gas sensor is Tin Di-Oxide SnO2, which has lower conductivity in clean air. When the target combustible gas exists, MQ 2 senses and its conductivity is higher along with the gas concentration rising. MQ-2 has 6 pins, 4 of them are used to fetch signals, and other 2 are Heater coil used for providing heating current.

Fig. 2. MQ2 Sensor

b. ARM microcontroller

The ARM7TDMI-S CPU with real time emulation and flash memory ranging from 32kB to 512kB. Due to their tiny size and low power consumption, LPC2148 is ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM. It is well suited for communication gateways and protocol converters, soft modems, voice recognition and low-end imaging. The ARM7TDMI core is a member of the ARM family of general-purpose 32-bit microprocessors. The ARM family offers high performance for very low power consumption, and small size. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles

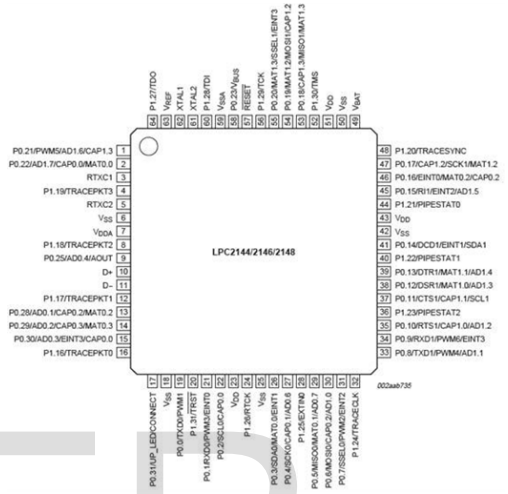

Fig. 3. ARM Processor

c. Liquid crystal display

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates to a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7-pixel matrix. Most LCDs contain Hitachi HD4478 controller. CG-RAM is the main component in making custom characters. It stores the custom characters once declared in the code. CG-RAM size is 64 bytes providing the option of creating eight characters at a time. Each character is eight bytes in size.

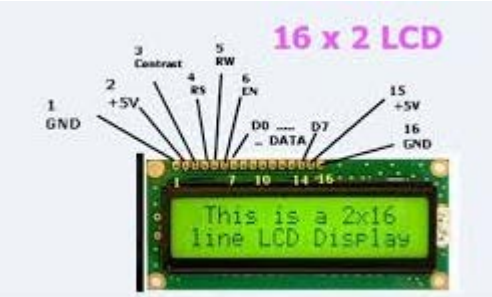

Fig. 4. Liquid Crystal Display

d. GSM

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS.

Fig. 5. GSM Module

4. Hardware and Software Aspects

As shown in figure 6, gas sensor MQ2 is connected to micro-controller ARM7TDMI. The port 0 (P0.17) of LPC2148 is connected to MQ2 sensor which is used for measuring gas leakage. GSM module is connected to port (P0.1 & P1.31) corresponding to transmit and receive signals. Buzzer is connected to P0.1

Fig. 6. Connections of the system

In the proposed system, the Keil µv4 software development tool to write and compile the source code, which has been written in the C language, is used. The Flash-magic programmer has been used to write this compile code into the microcontroller.

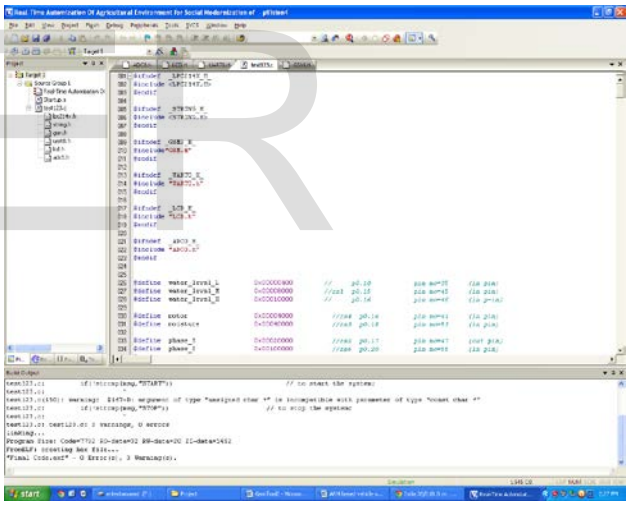

Fig. 7. Keil µVision

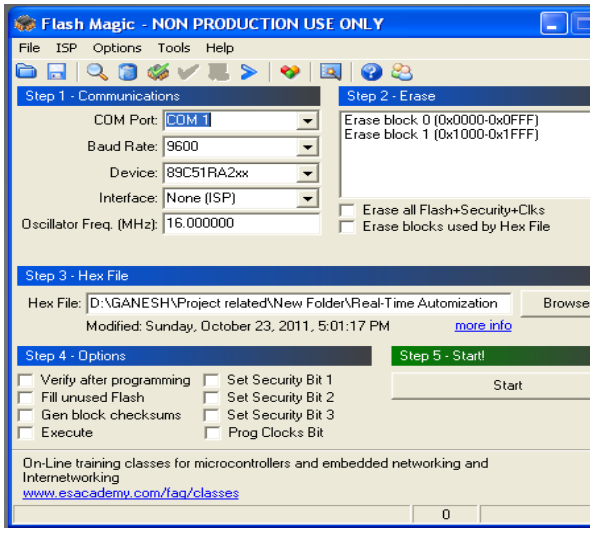

Fig. 8. Flash Magic

5. Results

Figure shows the result part of the GSM initialization. It illustrates GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. In the initial step MQ2 gas sensor senses the gas leakage of the system. After that in second step ARM microcontroller receives the signal which has been send by the gas sensor. Then the microcontroller sends the activation signal to the external attached devices.

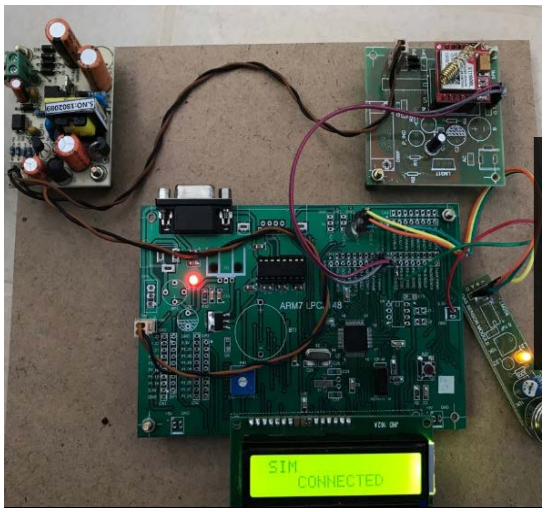

Fig. 9. GSM Connection

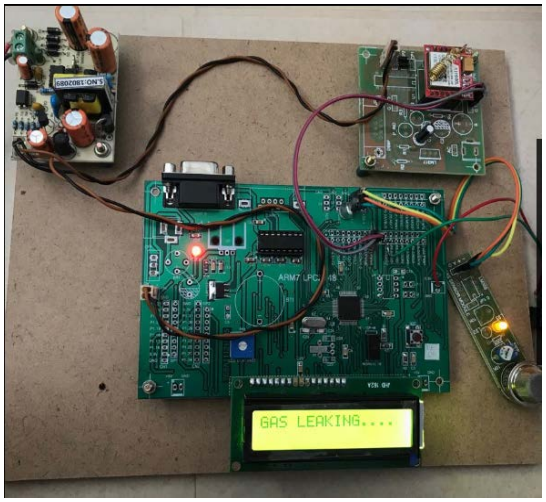

Fig. 10. Gas Leakage Detection

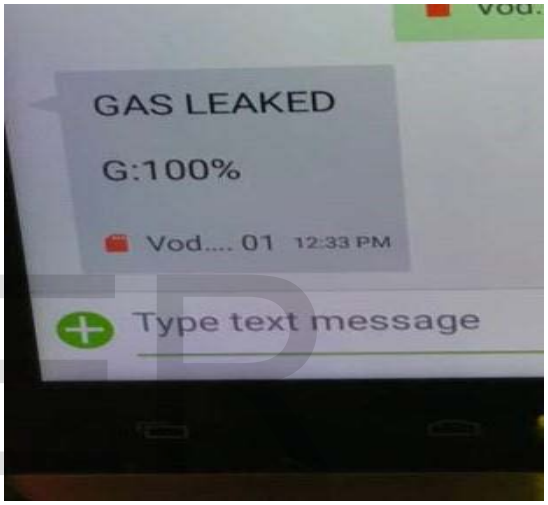

Fig. 11. Message to Registered Mobile Number

6. Conclusion

The proposed gas leakage system is based on Gas sensor MQ2, ARM LPC41028 microcontroller, GSM and LCD. By using ARM, Gas sensor MQ2 and GSM module, are implemented with low cost, portable, and easy to operate. It automatically detects the leakage of gas and sends an alert SMS regarding gas leakage. Experimental work has been carried out carefully. This made the project more user-friendly and reliable.

7. References

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