International Journal of Electrical and Electronic Engineering & Telecommunications

ISSN 2319 – 2518 www.ijeetc.com
Vol. 4, No. 1, January 2015

Research Paper

SAFETY PRE-ALARM MONITOR SYSTEM BASED ON GSM AND ARM

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This paper presents a remote monitor and control alarm system based on GSM and ARM. This system uses ARM based microcontroller LPC2368 as the MCU, a smoke sensor MQ-2 to detect the harmful gas, the temperature sensor DS18B20 to monitor the temperature, the humidity sensor HS1101 to check the humidity in the room. Gate magnetic switch is fixed on the door and windows to monitor the invasion. If the householder comes back,he can enter the password through the keyboard. The microcontroller then disables the alarm from the gate magneticswitch. Once the abnormality occurs, the MCU gets the alarm signal immediately, and the system controls the camera to take photos and send multimedia messages to inform the alarm information.

Keywords: Real time monitor, Remote alarm, MCU

INTRODUCTION

As the standard of living improves, people focus more on home safety and the warehouse safety, and the demand of the protection on the gas leakage and the fire in the room higher and higher .The guard against theft is also the key aspect to consider. Remote monitor and control system (Shuchao Ma *et al.*, 2009) that contains temperature, humidity, smoke sensors to monitor the house and gate magnetic switch to guard against housebreaking. Whenever the abnormal situations happen, the MCU control the camera to take photos and send MMS through GSM module (Huiping Huang *et al.*, 2010) to the householder.

Comparing with the tradition protection method using the buzzer alone or only camera to monitor, multimedia messaging service to inform is more efficient. Also, the warehouses in the factory need more protection. Compared to the tradition methods applying video monitoring, this system saves human resources and time. This protection system can be used not only in the houses but also in the warehouses, and we can also use this system in the corner of the workshops.

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SYSTEM INTRODUCTION

The alarm system uses ARM-based microcontroller LPC2368 (Shang He *et al.*, 2010), the monitoring module includes the temperature sensor DS18B20, the humidity sensor HS1101, the smoke sensor MQ-2, the gate magnetic switch, serial camera, digital door lock module and the GSM mode. The block diagram of the system construction is shown in Figure 1.

The smoke sensor is MQ-2. This sensor can be applied in the house or in the factory to detect the leakage of the harmful gas. It can detect the natural gas, methane, propane, butane, alcohol, hydrogen and so on. It can measure wide range and respond quickly, it is high sensitive and steady. The driving circuit is simple. The interface circuit of MQ-2 is shown in Figure 2.

Figure 1: GSM Construction

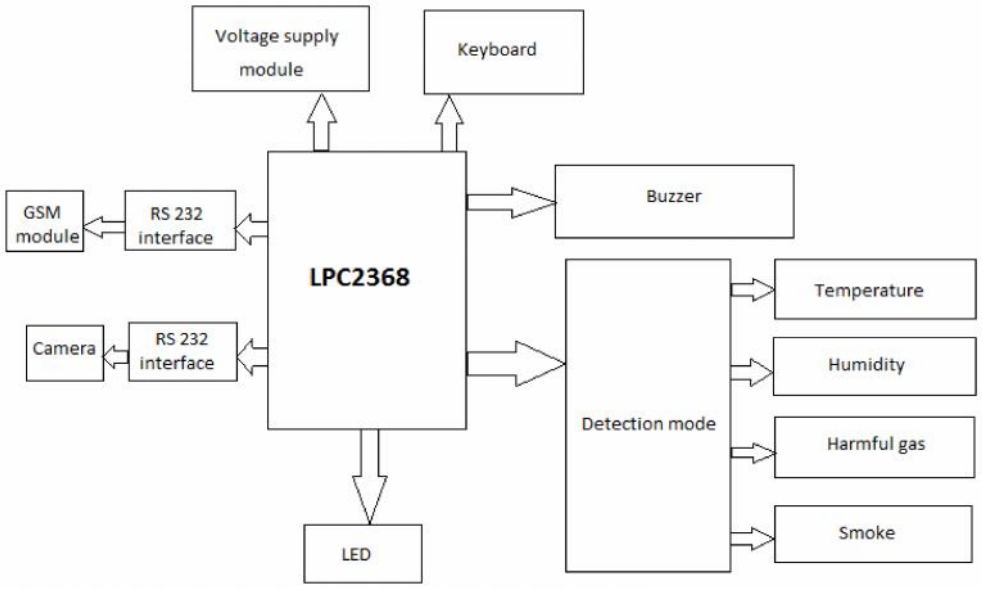
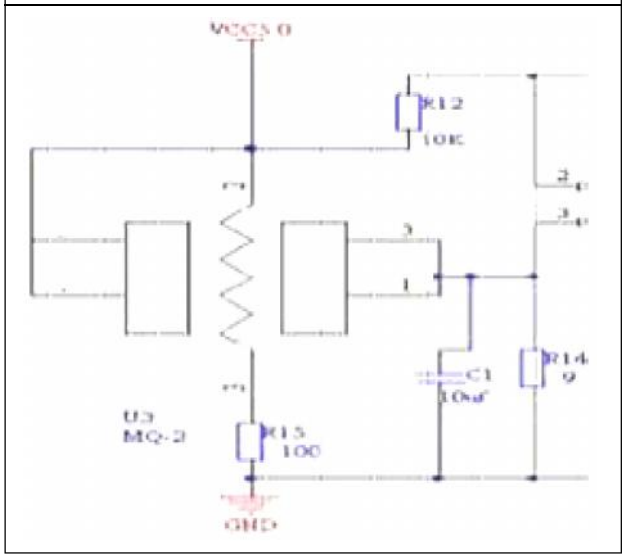


Figure 2: Interface Circuit



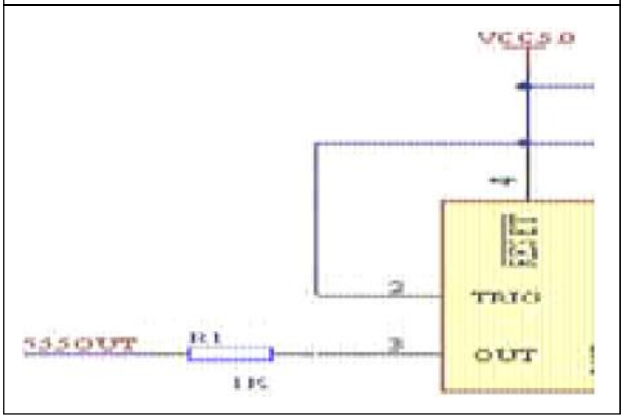
To guard against housebreaking, this system also contains gate magnetic switches to alarm the theft. The gate magnetic switch is normally closed. Whenever the door is open, the normally closed switch disconnects, the voltage changes, if the voltage beyond the limit, it will alarm. The keyboard is a numerical keyboard which has a USB interface. LPC2368 has internal USB transmission protocol (Shuixiang Li and Ying Cai, 2010). So it connects with LCP2368's pins directly. The

camera has up to 300 thousand pixels. Its output format is JPG. It transfers the data to the microcontroller through RS232 interface. The GSM mode also communicates with LPC2368 through RS232 interface. GSM mode is used to send MMS (Maohai Li *et al*., 2009). There are some LEDs to show the working state. LPC2368 has internal SD card interface, the system stores data into the SD card.

HARDWARE DESIGN

The microcontroller LPC2368 is ARM-based microcontroller for applications requiring serial communications for a variety of purposes. It contains up to 512 kB of embedded high-speed flash emery and up to 32 kB SRAM, 10-bit ADC with input multiplexing among 6 pins, four UARTs with fractional baud rate generation, it can realize all the communication means of this system. The data of the pictures stored in the SD card. The temperature sensor is DS18B20. It measures temperatures from -55 °C to+125 °C. The accuracy is 0.5 °C. Thermometer resolution is programmable from 9 to 12 bits information is sent to/from the DS18B20 over a 1-Wire interface. The humidity sensor is HS1101; it has full interchangeability with no calibration required in standard conditions, including wave soldering, reflow and water immersion. Integrated circuit TLC555 is used to record the change of the signal from the sensor and turn the signals into the change of frequency. So the microcontroller captures the frequency signal. The circuit is shown in the Figure 3.

Figure 3: Block Diagram of Interface Circuit



SOFTWARE DESIGN

First, the microcontroller is initialized to program the PCON register to enable the idle mode, configures the “PCONP” register to disable the undesired peripheral functions. Then the normal data is decided for every sensor. The microcontroller waits for the instructions from the AD pins or counter pin. The LPC2368 has 10 bit A/D converter with input multiplexing among 6 pins. AD is set to convert time sequence and AD convert precision, configure the AD interrupt register, when the AD convert finishes, the interrupt requests come, and the microcontroller generates interrupt and receives the data. While comparing the data with the presetting ones, if the data are abnormal, the microcontroller asserts an alarm. The humidity sensor HS1101 (Maohai Li, 2008) shows the changes of the humidity through the change of capacitance. So we use TLC555 to turn the change of capacitance into the change of frequency. The compute of the cycle is as formula (1):

$$T_2 = c(R_2 + R_2)\ln 2,\ t_2 = CR_2\ln 2$$

$$F = 1/T = 1/T_1 + T^2$$

The output pin of the sensor connects with the external counter pin of LPC2368 to read the change of cycle, the counter pin record the sampling frequency then the microcontroller

decides whether the humidity of the room is abnormal or not after comparing with the presetting numbers. The USB pins receive the data by interrupt. If the right password enters, the microcontroller shall ignore the signal from the gate magnetic switches on the door and windows, other sensors will work as usual. If the data received from the sensors are abnormal, the microcontroller operates the camera, sending the receive instruction to take a photo. Then it stores the image data into the SD card that configures the "MIC Clock", "MCI Data Length", "MIC Data Ctrl" and so on registers to operate the MCI. The passwords are also stored in the SD card. At the same time, the MCU control the buzzer making a sound for 30 seconds or more. The microcontroller sends "AT" instructions to operate the GSM mode. Send "AT^UPLOADFILE" instruction to upload the image data to the GSM mode from the SD card, if the acknowledge is "UPLOAD FILE OK", send the instruction "AT^MMSSEND" to GSM mode to tell the phone number. Then the GSM mode sends the MMS to the householder's mobile phone to inform the alarm.

EXPERIMENT RESULT AND CONCLUSION

The overall core structure of the system and the test result is shown in Figures 4 and 5.

Through the test, we can see whenever the danger happening, the system will inform the householder at once.

This system is good at house or warehouse protecting. It can detect many aspects and can be adapted in many places. It informs the householder by giving alarm through GSM.

Figure 4: Overall Structure of the System and the Test Result

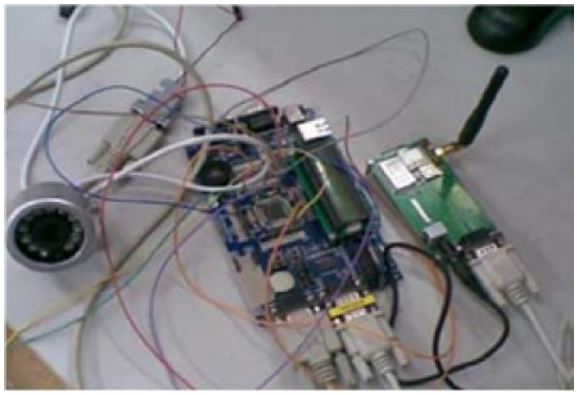


Figure 5: The Overall Structure of the System and the Test Result

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