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# The Design of the Household Appliances Remote Control System Based on GSM

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**Abstract***:* This article has designed a remote control system based on SIM900A with STC series single-chip microcomputer as the central processing unit and GSM network as its platform. By using short message service (SMS) communication between subscriber and GSM module, with AT command to complete the reading and sending of information, it realizes the remote control system via mobile phones to send and receive SMS.

**Keywords** Single chip microcomputer (SCM); SIM900A; AT command; Remote control

## INTRODUCTION

With the development of communication lines and equipment as well as the increase of intelligent household appliances in families, various applications of the existing communication lines and facilities to remote control of intelligent home appliances and instrument gradually lead the new trend of household development. The combination of GSM mobile communication module SIM900A with 51 SCM can realize the convenient and reliable remote control.

## THE GENERAL IDEA AND THE DESIGN DIAGRAM

### The General Idea of the System

As is shown in figure 1, this system chooses SIM900A module as transmission platform and intelligently controls monitoring equipment or interacts with information acquisition with mobile short message, such as locks, household appliances, lighting and alarm device, etc..

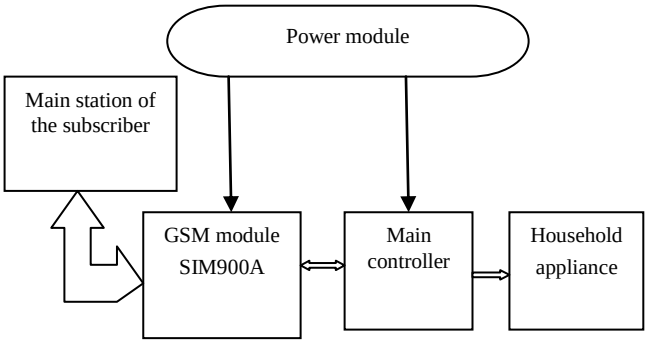


Figure 1 The framework of the remote control system

When subscriber's mobile phone sends command message to SIM in SIM900A module, the single microcomputer reads the message through serial port and makes the decision and controls the peripheral module (activating home appliances).

When it succeeds, the single microcomputer controls the GSM module and sends message to subscriber. Then the mobile phone will receive the reply of command successful from the SIM in SIM900A.

### The General Framework

The general framework can be shown in figure 2. It mainly includes single chip microcomputer and GSM module. The switch of the appliances controls the module. Its principle is using the single chip microcomputer technology, the AT command protocol and SMS text encoding and decoding pattern to realize the remote control system.

Sending short message to SIM in GSM module with mobile phone, when new text message is received by the receiving module, it will make the single chip microcomputer break off to make the program read the message and judge whether it is the control command and produce the corresponding operation to make some base pin output high level or low level. In this way, it controls the relay and sends replying message of the household appliances to the subscriber's mobile phone.

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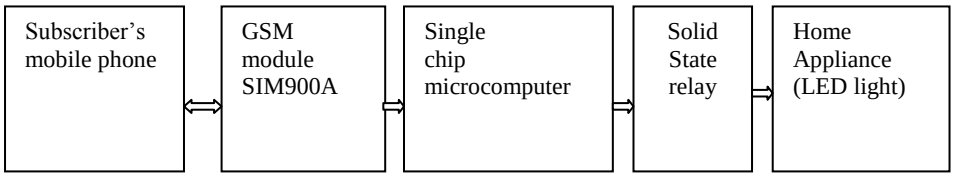


Figure 2 Framework of the system

## DESIGN OF THE HARDWARE

### The SCM Minimum System

This design uses STC89C52 SCM as its main controller which is of high performance and low power dissipation CMOS 8-bit microcontroller produced by STC Company with 8 k Flash ROM programming that can be repeatedly rewritten. STC89C52 uses the most common MCS-51 kernel which holds powerful programming environment: 8 k bytes of Flash ROM, 512 bytes of RAM memory, the built-in block 4 k bytes EEPROM, 32 bit of input and output ports, 4 external interrupt and three 16-bit timer/counters. In addition, it also has the function of power-fail protection with 8-bit CUP and system programmable Flash on single chip. The minimum system is combined by STC89C52, clock oscillation circuit and reset circuit.

1) The system chart of the STC89C52 SCM (figure 3)

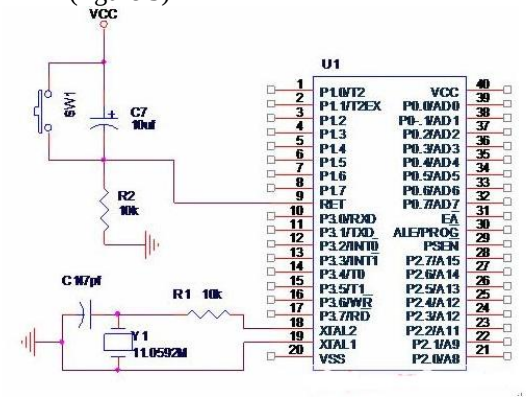


Figure 3 The system of the STC89C52 SCM

2) Circuit of the clock

In the STC89C52 chip, there is a high gain inverting amplifier which is used for oscillator. The RXD pin is the input of the amplifier, and TXD pin is the output. The CLOCK can be produced both in the external and internal ways. Figure 4 shows the internal clock circuit. The external timing circuit is on the TXD pin and RXD pin, and its internal circuit forms self-activated oscillation. The parallel resonant circuit constructed by capacitance and quartz crystal is used as the timing circuit part. The Frequency of the quartz crystal is between 1.2 and12MHz, and the capacitance value is between 5 and 30 pF which functions as the fine tuning to the frequency.

Figure 5 shows the external clock circuit. It connects the external oscillator with FXD, and RXD with GND. Due to the simple requirement to the signal from the external oscillating, it needs only to ensure the pulse width, usually less than 12 MHZ square wave signal. The internal clock signal generator spares the oscillation frequency. It outputs one as the two phase clock used by the SCM.

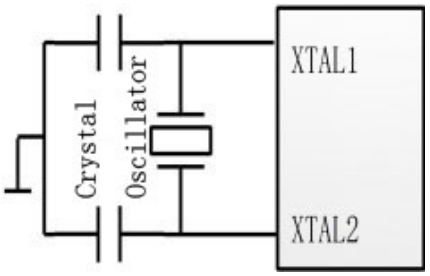


Figure 4 The circuit of the internal oscillating clock

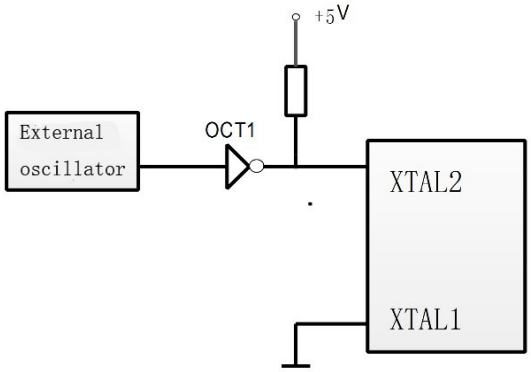


Figure 5 The circuit of the external oscillating clock

3) Reset circuit

The reset operation could make the SCM back to the initial state, which mainly resets the registers in the SCM and makes the SCM run the program from the initial state (000 units). Reset not only initializes the system, but also reset the system when operation error or system error lead to the locked state. Man-machine combination. Its functions can be found in figure 6.

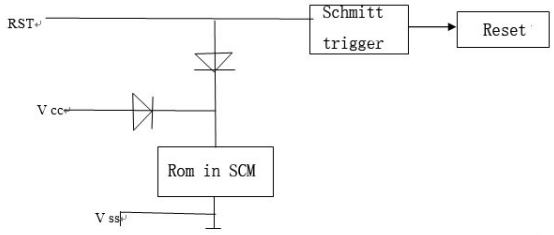


Figure 6 Logical diagram of the reset signal

### GSM Communication Module

This design uses the GSM module used in this design is SIM900A module. SIM900A is a compact and highly reliable wireless communication module,

using single power supply, a serial port (UART) communication and industry standard interfaces. Battery voltage is 3.2 ～ 5V with recommending voltage of 4.0 V. It can complete the SMS, voice, data and fax transmission under the condition of low power consumption.

This design adopts SIM900A module adopted in this design containing the TTL and RS232 interfaces with standard AT commands to control SIM900A module and complete the functions of message and phone call. So, as long as the SCM, computer or other controller is connected to the TTL interface or RS232 interface of the SIM900A module, it will send command to GSM module to control home appliance via a serial port through short message or phone call.

**SMS Module**

Short Message Service (SMS) is one of the applications provided by GSM system.Service center provides the message interaction between mobile phone (GSM) terminals, among which the forwarding and storage are carried out in the service center, and wireless data transmission is in the GSM network. On this basis, the prospect of a variety of development and application is very considerable, such as wireless remote detection, control and two-way wireless data transmission and so on. SMS has stable performance in two-way data transmission, which provides the strong service platform for the remote monitoring devices and remote data transmission. Subscribers interact with the SIM card of SIM900A via short messages.

**The Peripheral Cell**

The peripheral cell is the control equipment composed of LED light and household equipments driven by relay. It controls the switch of the light through I/O port of the SCM or the relay driving equipments in the form of weak current driving strong ones.

## DESIGN OF THE SOFTWARE

SCM writes different AT command to SIM900A and complete the initialization of GSM and data sending and receiving to achieve the communication between SCM and SIM900A module. Figure 7 shows the diagram of the system, testing state of the receiving data of the serial port, breaking off the service routine processing to receive the data, then decoding and sending AT through the serial port and achieve the communication with the mobile phone

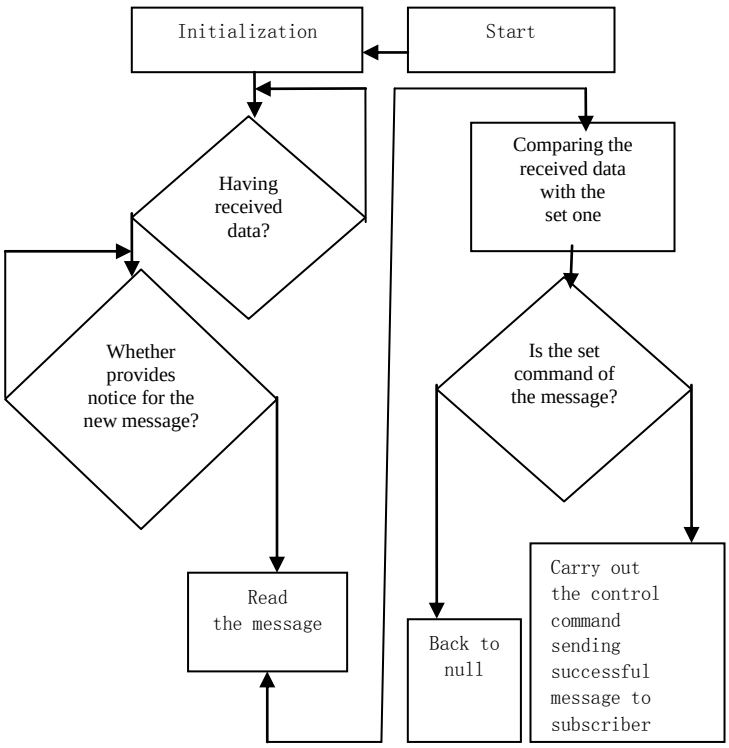


Figure 7 Circuit System Flowchart

When SCM receives data, the serial port will break off and store the data in buffer, and the data will be processed in the serial port.

Receiving the short message. When GSM module receives the short message, it will echo the notice of the message. Then SCM will check the notice returned by GSM and read the short message. Finally, it will analyze and execute the message acquired by GSM.

Sending the short message. Set GSM as AT+CSCS="GSM" and the text pattern as AT+CMGF=1, then set the phone number as 18979223075 and send the command AT+CMGS="18979223075", after the module

returns, the short message will be sent. Finally, switch on the sending command 0X1A.

Giving the command of control. Subscribers preset the control command of system, and then the SCM will receive the information from GSM module. If the command is preset, the decoding will be done and carry out the command. After the operation, the successful short message will be returned.

## CONCLUSION

The advantage of the system is mainly shown in its expansibility and cost performance. This system realizes the owners' monitoring and control to their home appliances via the way of receiving and sending message. This has greatly increased the convenience and practicability of the home control, because almost every one can use mobile short message service. In conclusion, this design holds great market value.

## ACKNOWLEDGMENT

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