SMS-based Remote Computer Supervisory Control System Design

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Abstract—**Short message service (SMS) is a technology that can use mobile devices to send and receive text message, with wide coverage area, high popularity, high reliability, low expenditure, easy development and other characteristics. Using GSM module or short message platform of network, short messages can be sent and received between the computer and the mobile terminal. This paper has designed and realized a set of remote computer supervisory system based on SMS communication. The paper elaborates the communication means, hardware and software structure of the system and the working process of the software. The system has good application prospect in some domains, such as remote control, mobile control, miniature control, etc.**

Index Terms—**SMS service; remote control; computer supervisory control; text message**

I. INTRODUCTION

Remote supervisory control system is widely used and almost throughout each domain of national economy. With the rapid development of modern network techniques and computer technology, requirements for remote computer supervisory control technology are increasing day by day. The traditional remote control mainly adopts the following ways, Internet, short-distance long-line control, radio modem, etc.[1,2] Adopting any one of the above means should build private network, for that some characteristics of private network, such as high cost, high maintenance expenditure, bad mobility, restrict the application of remote control in miniature system and individual system.[3]

With the increasingly enlarging of mobile communication network, SMS has achieved rapid development. On the basis of data change technique of SMS, as it omits mass network construction investment and maintenance expense, the system with wide distribution area, sparse information point density and frequency of information point mobility has great advantage. [4-6]

The remote computer supervisory control system this paper discusses uses SMS as the communication means of system control and inquiring, which is convenient for users to promptly understand the operation status of controlled computer and make rapid corresponding conduct.

II. FUNDAMENTAL PRINCIPLES OF SMS COMMUNICATION

SMS is a kind of service of saving and transmitting. In other words, SMS is not directly sent to the receiver by the sender; instead, it is transmitted through SMS center all the time. The users send or receive words or data information in 160 English words or numerical characters or 70 Chinese characters for one time through mobile phone or other telecom terminal. [7-9]

SMS can be sent initially by mobile communication terminal, short message platform server of mobile network operators, and network SP (including ICP, ISP, etc.) interconnected by short message platform of mobile network operators.[10] With the constant development of internet websites and short message value-added service, although sending or receiving point-to-point information through mobile phone terminal holds the main stream, it is not only the sole form, for that internet and BeiDou Navigation System are becoming new tools or carriers.

A. Sending And Receiving Short Message through GSM Module AT Command

SMS is a kind of digital business provided to users by GSM system, transmitting through wireless control channel. At present, all of digital mobile communication network support this business. GSM module is controlled by adopting AT command set which is developed by Nokia, Ericsson, MOTO, HP, etc. AT command not only can realize the setting of module parameters, but also can realize the sending and receiving of data, including controlling SMS.[3] In the application research, the commonly used GSM AT command as shown in Table 1.

GSM AT command has set three control models for sending and receiving short message: Block mode, Text mode and PDU (protocol data unit) mode. The code of Text mode is easy in sending and receiving short message. However, the Chinese mobile phones basically do not support int. Block mode is gradually replaced by PDU which not only support Chinese-English short message, but also is the default mode. Therefore, when selecting

GSM module AT command, the content of the message should code or decode according to PDU format. [10]

B. Sending And Receiving Short Message Through Short Message Platform Of Network

Short message platform refers that the short message

TABLE I.
COMMONLY USED GSM AT COMMAND

AT command	Function
AT+CMGF	Selecting short message format: 0-PDU, 1-Text
AT+CMGS	Sending short message
AT+CMGR	Reading short message
AT+CMGD	Deleting short message
AT+CMGL	Inquiring short message

port directly provided by mobile operator connects with internet to realize message batch sending and self-defining sending of appointed number of clients. With the crazy increasing of value-added business of short message, there are so many SP who support message sending and receiving function on the Internet. Besides, many SP provide short message platform port and support user secondary development.[5]

Adopting short message platform only needs the computer to connect the internet. The computer sends the message to the server of SP through network, and then SP sends it to SMS center of mobile communication net through the gate way interface with each mobile communication companies. Finally, the mobile net transmits it to the users' mobile phones or terminal. Moreover, the short message can be sent to the computer through mobile phone terminal, SMS center of mobile communication network and SP server. The message receiving and sending between the computer and message platform adopts standard TCP/IP protocol. Furthermore, as for the content of the message, there is no need to consider the format conversion, coding and encoding of the content.[6]

Sending and receiving short message by short message platform of network, need to be connected to mobile operators' short message gateway through internet. Because mobile operators use different gateway interfaces, there are more difficulty or problems for development and application. But third-party short message platforms based on Internet provide a very good solution for developing or applying. Http protocol to be used by third-party short message platforms, it can shield the differences of each mobile operators' gateway, and achieve to send and receive short messages for users and mobile   terminals.   In   the   research, *http://www.smschinese.cn/* is be used for short message platform. The form of interface for sending a short message   is: *Url*?Uid=*UserName*&Key=*PassWord*&smsMob= *Number*&smsText=*Content* . Parameters and variables described in Table II. The form of interface for receiving a   short   message   is:

Url?Action=*UP*&Uid=*UserName*&Key=*PassWord*&Prompt=*1*. Parameters and variables described in Table III.

III. SYSTEM FUNCTION AND STRUCTURE

The development of system is based on computer,

TABLE II.
PARAMETERS AND VARIABLES OF SENDING MESSAGE

Parameter/variable	Describe
URL	Interface address： GBK format： http://gbk.sms.webchinese.cn/ UTF-8 format： http://utf8.sms.webchinese.cn/
Uid/UserName	The register username in short message platform
Key/PassWord	The register security password in platform
smsMob/Number	Destination terminal number
smsText/Content	Short message content

TABLE III.
PARAMETERS AND VARIABLES OF RECEIVING MESSAGE

Parameter/variable	Describe
URL	Interface address： GBK format：http://sms.webchinese.cn/web_api/SMS/GBK/ UTF-8 format：http://sms.webchinese.cn/web_api/SMS/
Uid/UserName	The register username in short message platform
Key/PassWord	The register security password in platform
Action	Action=UP, Output reply message
Prompt	Prompt=1, Has been output, the next longer prompted

network service and short message technology, making use of mobile network by taking the short message as basic control command and data information so as to provide all-around digital service for the remoter controlled computers. The system is comprised of monitoring level, network level and centralized control level. The first one is used to send and receive information for the software system and short message of remote controlled computer. The third one handles monitoring for the mobile phones or other terminals equipped with mobile communication devices through mobile change network. The function and structure of the system is shown in Figure 1.

A. Systemic Function

The basic function of system includes:

1) Real-time monitoring: make real-time monitoring towards the operating process of status information of the controlled computers, save journal files or data base to the monitoring information, form short message and save it to the transmit queue according to the preset threshold of the monitoring object.

2) Short message sending and receiving: send the information content of the message queue to the monitors' mobile phones or terminal through short message service center; receive the message from the
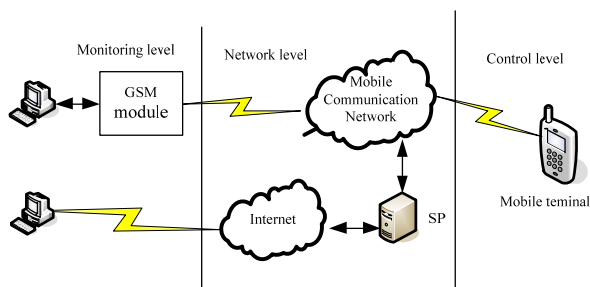
Figure 1. Structure of remote computer supervisory control system

message service center and save it into the received message queue in order.

3) Short message command management: the monitor can set corresponding different monitoring function of the short message sentence according to own habit.

4) Remote control: make real-time monitoring towards the received message queue, when discovering new message, start corresponding process to finish remote control through message command analysis and recognition, and form the performance result into short message and save it into message sending queue.

5) Data maintenance: check previous monitoring journal information through the controlled computer, set or revise threshold information, etc.

B. System Composition

The monitoring level not only finishes the remote control of the computer, but also finishes the development and maintenance of the software system. The main program of monitoring should input system allocating files so as to ensure the operating of the monitoring program in the back platform of the system after the computer system is started. The monitoring program makes real-time monitoring towards the operating process and network visiting information of the computers. When the operating status of controlled computer is changed, it is necessary to send the relevant data in the form of short message to SMSC, and meanwhile, to receive the message from SMSC. After recognizing the information command, start corresponding function module and finish remote control.

The main function of network level is to finish the transmitting function of SMS. When adopting GSM communication module to make short message communication, it is necessary to purchase SIM card (mobile phone number) from the mobile operators, and set the card into GSM communication module. Configuring communication parameters and set the short message service center number, enabling point to point communication between mobile terminals and GSM modules. Produced fee by sending and receiving short message charged by mobile operators. Communication with the computer generally needs to occupy a serial interface of the computer. Therefore, it is necessary to check and allocate the serial number after connecting GSM communication model with the controlled computer. There is no need to acquire mass allocating information when selecting network short message platform to

sending and receiving message, which is convenient for maintenance and management. If choosing to use the network platform to send and receive short messages, no need to install additional hardware, just to ensure network connectivity. Therefore, maintenance or management is easier. However, it is necessary to apply for a special service number from the SP through network. The short message exchange is finished between this service number and mobile phone number during the process of supervisory control. Applying service number and paying fees can be self-completed by the network.

The function of centralized control level is to send control command and check monitoring information. The using device should be the mobile phones or digital communication terminal with messaging function. The monitor can send the control command to or receive the monitoring information message from the monitoring computer through SMSC in the scope of mobile network coverage. The monitoring level is not restricted by the time, location, environment, etc. It can meet the needs of real-time mobile monitoring.

IV. WORKING PROCESS

In order to maintain each function independence by development and operation, the system designed by modular approach. There are three main function modules in the system--system initializing, system monitoring, short messages sending and receiving. When the system works, firstly, it is necessary to check whether the connection between computer and short message transceiver module is normal or not. If GSM communication module is used for messaging, it is necessary to set the serial port number and message format. If using the short message platform for messaging, it is only need to test the network's connection. To protect the system is not impacted by non-monitoring short message, the short messages that are saved SIM card or SMS gateway need to be removed, and two queues of short message sending and receiving need to be set blank. And then, start the system monitoring module and short message sending and receiving function module, and complete the system initialization. Two data variables of "Short message sending queue" and "short message receiving queue" are associated with communication between system monitoring module and short message sending and receiving module. The working process of the system is shown in Figure 2.

The system monitoring module detects the operating system process and network accessing information at real-time, and obtains the monitoring data. The data will be compared with the initial setup information. If the result is found to exceed the threshold, the monitoring data will be written in monitor log or database and a short message will be generated and put into short message sending queue. Such as the run time of OS and game program, browsed the harm information in non-health sites or pages that contain have bad information and other, there are the key points of sending short message initiatively. The monitor can send control command to the monitored computer after received short message

from the computer and also can send inquiry-based control command at any time. The system monitoring module performs and completes matching function (such as cuing message, closing program or process, shutting down computer, etc.) through message recognition after received the short message commands from "short message receiving queue". The monitoring program saves the control commands into monitoring log or database, and reports the results of implement to the monitors through short messages. The working process of the system is shown in Figure 3.
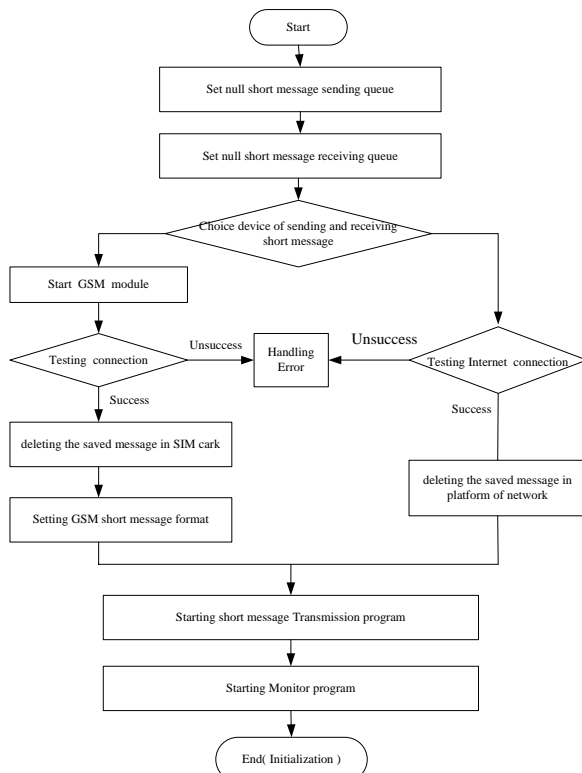

Figure 2. Working process of the system -- System initializing

The function of short messages sending and receiving module is responsible to send and receive short message commands. The working process is shown in Figure 4. If any short messages are monitored in "short message sending queue", the sending module read a short message according to the order and sent it to the SMSC by GSM

module or Internet. The short message will be recorded in the log or database and deleted from the queue after confirming the short message be sent successfully. The module continues to monitor whether unsent messages in the queue. The receiving module checks unread message in SIM card or network platform in real-time. The module reads unread message and saves it into "short message receiving queue" if it comes from monitoring client. The module records the event into the log or database.

Real-time monitoring program is needed to have a certain degree of secrecy. So the system needs to be run and hided in the background and followed to start by monitored computer starts. To obtain this functionality, the rules of designing and developing Windows service program are be used for developing system and programming. The monitoring system will be registered into Windows operating system service process after it is installed. It is not displayed in taskbar when it is running. [11,12]

V. SUMMARIES

SMS has some characteristics as follows: no need to dial number, low expense, permanent online, wide coverage area, etc. When the data is not mass, and the real-time requirement of the system is not strict, reasonably design software system of remote monitoring unit, make use of the existing hardware and network resource, and build remote supervisory control system by taking the short message as the data transmitting means, which has great flexibility of networking. The remote control by taking the short message as the means is widely used in some domains, such as data collecting, system control, logistics tracing, etc. This system does not show high requirement for the software environment. Besides, it has easy allocation, flexible operation and control. The monitoring software occupies less resource of the monitoring computer, which does not have influence on the normal use of controlled computer. The system can meet the demands of the monitor's real-time monitoring towards not only one computer during the moving status, which is suitable for the parents to know their children's situation of using computer and promptly prevent the computer games and harmful internet information and others which does harm to the children.
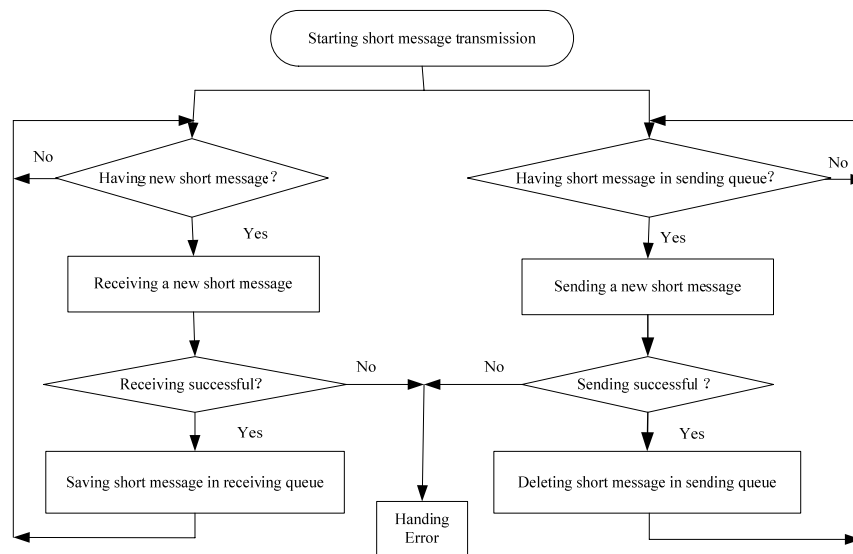
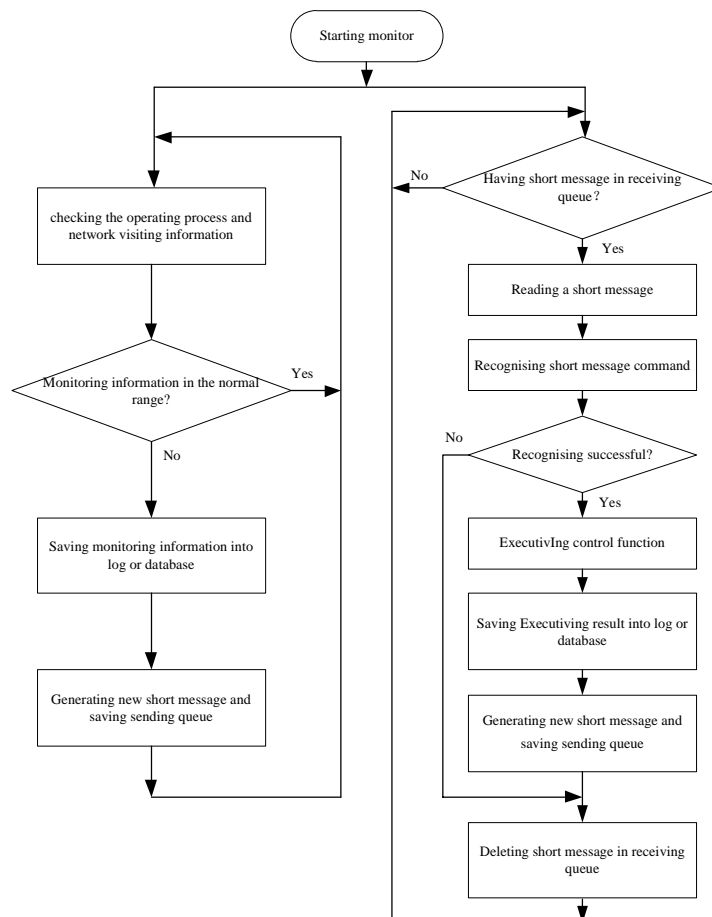Figure 3. Working process of the system -- Short message receiving and sending

Figure 4. Working process of the system -- System monitoring

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