

Research on Family and Shops Real-time Status of 3G Wireless Remote Monitoring System

Qian Zhao

School of Communication and Information Engineering
Xi'an University of Science and Technology
Xi'an, China
Email: qianzhaoza@sina.com

Abstract—Aiming at the development situation of 3G network, realization scheme is proposed based on 3G network B/S mode of embedded family status remote real-time monitoring system, avoid the shortage of traditional surveillance system which cannot networking, require a lot of storage media and query forensics more difficult. By constructing the embedded server can complete video collection, treatment, storage and transmission, and the development of embedded Web server software realize the real-time monitoring of the remote video. The scheme of the server is based on ARM11 hardware platform, embedded Windows CE software platform, with the aid of Windows CE operating system friendly human-machine interface watch history monitoring records, you can also phone with 3G web browser in real-time monitoring. Experimental results show, System has many characteristics about strong real-time property, good interaction and lower development costs and so on, which can be widely used in remote video monitoring.

Index Terms—Real-time monitoring, WinCE, 3G, B/S, ARM

I. INTRODUCTION

Because of the rapid development of 3G network technology, the mobile equipments based on the high speed of third generation (3G) mobile network application are more and more, the mobile phone as video monitoring equipment is a new 3G application, and also likely will be very popular a kind of application. With the features of mobile phone enhanced, we can basically inspect 3G mobile phone for an all-purpose terminal^[1-2]. Because the 3G mobile phone not only can be used as a collection of real-time data message, and then transferred to the center platform through its processing, is also can be used as real-time monitoring equipment for the client^[3]. To overcome the constraints of the traditional network bandwidth's lack, mobile video surveillance system can well meet the requirements of real-time and video quality, it not only possess such as video monitoring function, basically can also achieve real-time and anywhere remotely monitor the real-time control application requirements^[4-5]. General induction has the following advantages: the real-time and anywhere advantages, it satisfies no matter in any time, any place, through what equipment can undertake video monitoring, the cost advantage, because in the today's society, basically everyone have the mobile phone, that is used as one end of equipment of the video monitoring is a kind of

multiple use of resources, it reduces the cost of investment, and compared with the ordinary PC, the mobile phone's price is much lower, in cost investment, therefore, have a great advantage.

II. SYSTEM GENERALLY STATES

Based on 3G family conditions the remote real-time monitoring system includes both the client and the server. Client uses the generic 3G mobile phone and mobile phone Web browser to the server through the 3G network access, and obtain real-time monitoring data information. Server-side collects, processes, stores the video information, and accepts the browser's visit, transmits the real-time monitoring information to the browser, and it can process the monitoring information, when there is the abnormal, it can automatically send message to cell phone to report^[6]. System framework shown in figure 1:

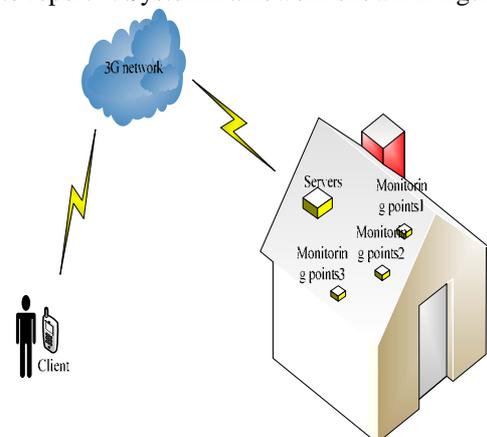


Figure 1. System framework figure

III. THE KEY TECHNOLOGY

In the whole system design, the core technology is the models of 3G technology and B/S network.

A. 3G technology

3G is a new technology that combines the wireless communication technology and the Internet and other multimedia technology, the 3G technology's improvements are mainly that the speed of transmitting such as graphics and sound or video information data has been greatly improved, it also can handle images and video and other forms of medias, it not only can provide all the information service which the second generation

communication (2G) can provide and on this basis have improved greatly, such as in transmission speed has greatly improved. Restricted and influenced by the configuration factors such as the network bandwidth, mobile equipment and terminal equipment and so on, in the 2G era, Most of the mobile phone users online function are just some simple applications, such as download some pictures or music, Internet browsing simple news page, etc. In the current 3G era, due to the widespread greatly improved, mobile terminal can provide more more advanced application or services, for instance you can via mobile phone watch TV, browse more online information, also mobile video call and more.

The 3G mobile phone has the functions of information collection, video browsing and the removable characteristic, so in the whole system structure, the 3G mobile phone can either as sle equipment, which can be used in real-time picture film and video collection or information alarm monitoring, etc, but also as a monitoring client to browse real-time video, alarm view, control result analysis or check functions of sle equipment configuration, etc.

B. B/S model

In the traditional video monitoring system, basically its uses is based on C/S model, this model requires the monitoring client install the client software, therefore, it needs users spend a lot of time and effort to maintain. This system uses is based on B/S model, really realizes the user zero maintenance, and can also cross-platform operation, it not only saves the manpower and material resources also enables users in the environment as long as have a network to video monitor, it is really convenient for users^[7].

IV. SERVER-SIDE DESIGN

In the embedded Linux environment, there are three Web server: httpd, thttpd and Boa. Httpd is the simplest Web server, whose function is the weakest, and which does not support the authentication and CGI. If Web server only provides some static page, for example, simple on-line help, system introduction etc, it can completely be realized by static server httpd. Boa and thttpd support authentication, CGI, etc. the functions are more complete. If need to improve the security of the system, or need to interact with users, such as data query, real-time status query etc, it must use dynamic Web technology, can choose one of these two kinds of server to realize. The system adopts Boa to achieve embedded Web server. Between the server-side and each control points we use the wired mode, after obtaining video data it submits to the background MCU to complete data analysis and other processes, video displaying through LCD monitor and storing by mass storage unit, transmitting the real-time monitoring information to the browser, and can process the monitoring information, abnormal, it automatically send informations to the mobile to report, simultaneously, but also can locally alarm.

A. Server-side hardware design

As the server part need to finish the functions of video information collection, display, storage, inquiry and judgment alarm. This design selects the Samsung company's S3C6410 embedded processor as the core, combining 3G network technology, again complementary with related devices realize its function demand. S3C6410 is based on 16/32 bit RISC kernel's low cost, low power consumption, high-performance microprocessors solutions, adopts 64/32-bit internal bus architecture, interior has integrated many powerful hardware accelerators, its frequency can reach 533MHz. S3C6410 have excellent external memory interface ability, can satisfy the bandwidth requirements of the high-end communications services. Memory system has DRAM and Flash/ROM two external memory ports, which can do parallel access. DRAM port can be configured to mobile DDR or standard SDRAM. Flash/ROM port supports NAND-Flash, NOR-Flash, OneNAND, CF and ROM type external memory.

Server part hardware principle diagram includes: S3C6410 processor, power, storage unit, Wi-Fi module, LCD monitor, buzzer, mass storage, power supply module, clock module and RS232 serial interface. Hardware structure is shown as Figure 2.

S3C6410 processor is responsible for the unit's control, computation, processing and other functions; its storage unit is SDRAM and FLASH, Wi-Fi module mainly complete data transmission; LCD display the received data; when the image is abnormal, buzzer will alarm; the mass storage has large enough storage capacity to let the receive data stored, played back and processed; power module supply DC 5V for CPU and other modules as power supply.

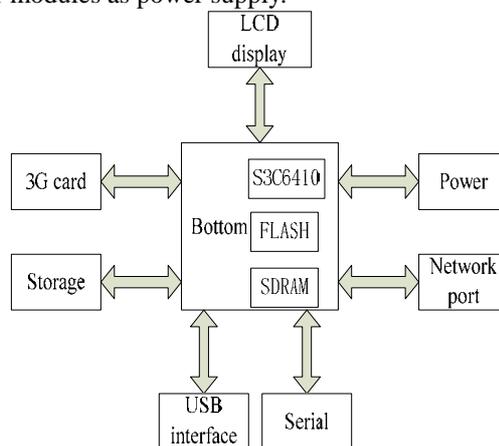


Figure 2. Hardware structure

B. Server-side software design

The software framework of this system is mainly based on embedded Windows CE operating system to realize system functions in EVC graphical interface development environments^[8]. The server-side's application development process uses the program design of multithreading modular, makes each function of the equipment according to its completing a specific task, tasks properties, real-time demand, combining with the data flow, detailed differentiate each functional modules. In the software design of this system, there are basically

the following modules: system interface, operating log, network communication, database storage, historical data

query and other parts. Software structure is shown as Figure 3.

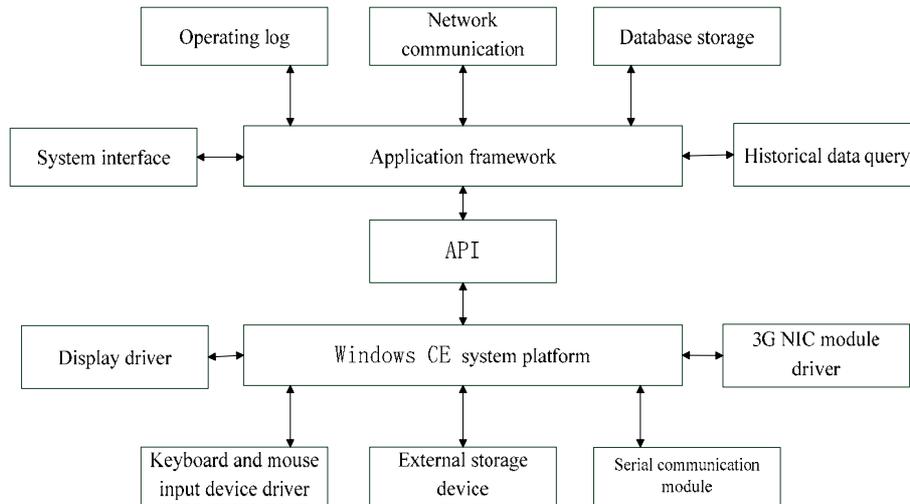


Figure 3. Software structure

(1) WinCE operation system

Windows CE is having an embedded operating system which has the preemptive multi-tasking function, and has strong communication ability. It is a newly designed operating system products which Microsoft designed especially for mobile equipment and consumer electronic products, embedded application such as non-PC field. Therefore according to its features of application environment, Windows CE is designed with highly modular, good real-time, strong communication ability, supporting multiple CPU embedded operating system. Through the platform cutting tool Visual Studio.NET we establish the operating system platform according to system needs and carry on the corresponding configuration. This design uses the Windows CE6.5 version.

(2) Device driver development

WinCE driver is divided into: this machine device drivers and stream interface drivers. This machine equipment means integrated into the target platform, its driver is provided by the original equipment manufacturer (OEM). Stream interface drivers refers to the external device drivers connected to the WinCE operation into platform, developed by the user. Stream interface drivers see the external devices as special file in the file system, through document reading function indirectly access external devices.

(3) Network communications introduction

The network communication module is the main part of the system, it contains three data channels: Monitor channel, control channel and video data channel. Monitor channel is used to transmit command data to the control sle equipment; Video data channel is used to transmit video data of each group. Three channels use different communication port, so each channel transmits data independently of each other. Network communication module design development is through the network programming interface WindowsSocket, abbreviation Winsock to fulfill. According to the system

browser/server's network transmission model, in the server-side the SOCKET type of listening SOCKET, control SOCKET are established, in the client-side the SOCKET type of request SOCKET, control SOCKET are established, they all use TCP protocol to encapsulate the transfer data. In addition, both ends of the server and client use a multicast class (CMulticast), it is the packaged class specially for video transmission, derived from COject, which defines SOCKET and group SOCKET of the transceiver video data of SOCKET type, thus realized using multicast communication mode to transmit the video packets encapsulated by the UDP protocol. Network data communication process is shown in figure 4.

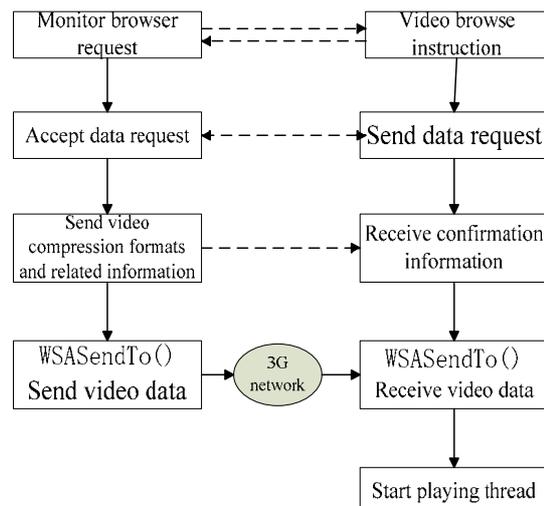


Figure 4. Network data communication processes

(4) Application design

The application layer on server-side of this system is developed on the basis of graphics development environment of Embedded Visual C++ 4.0. EVC is the mainstream development tool on WINCE, it is similar to

VC++ development environment, but provides some unique tools and resources to develop the applications on WINCE^[9]. EVC program support a subset of MFC library, can give developers to provide the most powerful support.

For the application development process of the server terminal we adopt the modularized program design, make each function of the equipment, according to its completing a specific task, tasks properties, real-time demand, combining with the data flow, detailed differentiate each functional modules. Based on the system function requirements, embedded server terminal has the following several main functional modules: data transceiver module, judge alarm module, database storage module, real-time/history video data inquiry module, system interface module.

The server-side software uses multithreading to realize modular: main program, network communication thread (transceiver thread), SMS sending thread, alarm thread etc. Main program is first executed, after system is initialized, it configurate 3G module, and then creates three thread respectively executed follow: receiving data storage and display data and judgment alarm, three threads are finished, main program exit. The alarm thread compares surveillance video data state with alarm threshold, if overrun the buzzer is started, and then it waits for police clearance to determine whether the exit. When abnormal, but no real-time monitoring on the client-side, SMS sending thread will send a warning message to the client. Software flow chart is shown in Figure 5.

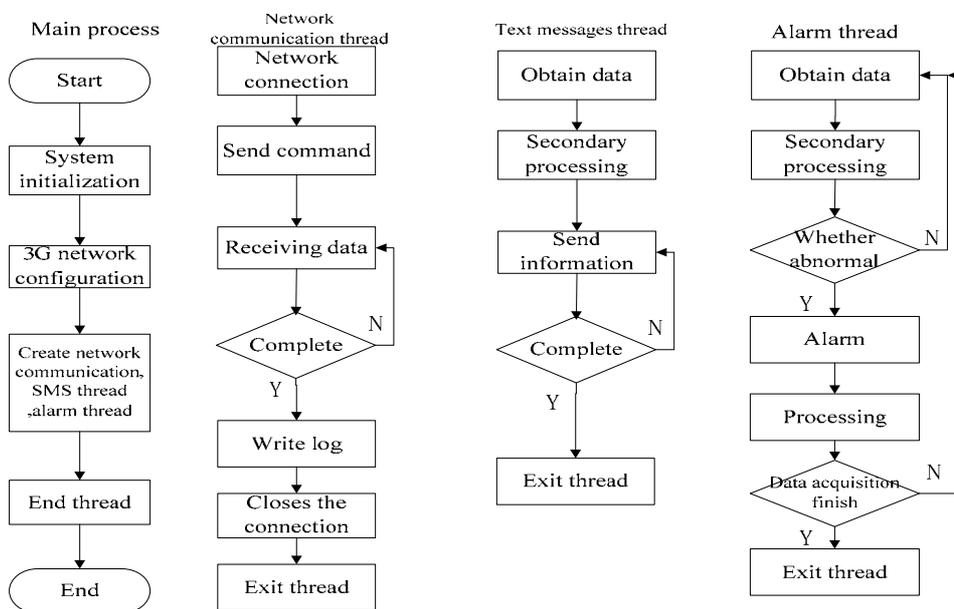


Figure 5. Main software process of the server

Application software started, first we do the initialized work, including initializing the 3G network module, recording log books, opening the database etc tasks, if the initialization is fails, the applications cannot run normally to exit. After the initialization is successful, the server has been monitoring the family status, and

(a) System interface. The system interface is a man-machine interface which the user use to view the sampled video, a well-designed system user interface helps users conveniently carry on equipment operation, data storage and querying historical video data locally. Software interface uses hierarchical structures, each test is processed separately by the metord of the pop-up sub-interface, so it makes the software for more modular management. The whole interface framework of the software including the menu bar, the toolbars, the button, the edit box, the main window status bar and other parts.

(b) Operation log. The operation log records the user name, time, instructions and other detailed informations of users' equipment operation. Log information is stored in a text files to search easily.

(c) Data communication module. The data communication module realize the data communication function through 3G wireless network, receiving the control instruction and sending the video data.

(d) Database stores. The data storage finish the database storage of the real-time data, a good database stores scheme not only save system memory, disk and other hardware overhead, but also can improve the efficiency of the database query^[10].

(e) Historical data query. The historical data query module completes the operations of querying the historical video data information, by observing the historical data, the situation when no one at home can be analyzed. The historical data query model including form code design and database query code design.

waits or keeps communications with the client, when closing the equipment, the real-time monitoring is over, otherwise have been circulating.

V. CONCLUSIONS

Base on the remote real-time monitoring system of

3G family conditions, the Web server of the embedded video network monitoring system directly connect to 3G networks, without restrictions of the cable length and signal attenuation, simultaneously, the network is a no distance concept, which completely abandoned regional concepts, expanded the supervised areas. The client is an ordinary 3G mobile phone, anywhere and anytime it can carry on the real-time monitoring for family safety condition. Also, because video compression and Web function are focused into a small size equipment inside, it directly connects to the LAN or WAN network, plug-and-see, the system's real-time, stability and reliability are greatly improved, without specially assigned management, which is very suitable for the environment of non-People on duty. With the rapid development of the computer technology and the network technology, people's request on the video monitoring system will be higher and higher. This system not only in the family status remote real-time monitoring system has important role, but also in the e-commerce, the video conference, the long-distance teaching, remote medical treatment, water conservancy and electricity monitoring etc has broad application prospects.

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Qian Zhao was born in Shannxi, China ,in 1977.He received the M.S. degrees in communication and information system from Xi'an University of Science and Technology, Shannxi ,China , in 2005.

He is a lecturer in School of Communication and Information Engineering at Xi'an University of Science and Technology. He has published over thirty papers in academic journals and international conference. His research interests include B3G Mobile communications key technology.