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Design of Embedded Network Digital Video Information Monitoring Platform based on ARM

Hao Liang, Hua Wu
Department of Information Science and Electrical Engineering, Shandong Jiaotong University, Jinan, 250357, China

Abstract: With the rapid development of internet information and network digital video information, the security industry has also been greatly developed, and the research on video monitoring field has become an indispensable part. At present, security products are gradually entering the ordinary users, people can get monitoring information anytime and anywhere through the product. In order to better meet the needs of the people, the requirements for security products are also improving, embedded products have the advantages of easy management, small size and low cost. Security products based on ARM have further become the mainstream of the industry, in this paper, in the context of embedded products, and combined with ARM, and network digital video information detection platform is designed to build a set of video monitoring system.

Keywords: ARM; Embedded; Network digital information detection; Video transmission

1. Introduction

This paper, first of all, introduces the development process of digital video information detection platform and basic composition structure, and basic principle of related embedded technology and application methods, Secondly, the demand analysis of the platform design is carried out to clear the implementing principle of users in the realization of each function module, and then the construction problems of the embedded system is studied. Finally, we conduct compile and transplantation, in order to realize the video delivery. Finally, the software is tested, and the platform is analyzed and studied as a whole.

2. Background and Significance

Network digital video information detection is the main component of traditional security, widely used in the society, and it has been the necessary tool for public security, banks, hotels, schools and other large and small public places. In recent years, with the development of science and technology, social intelligent security facilities are also undergoing great changes, and embedded network digital video information detection platform is in dominant position.

Embedded network digital video information detection platform, based on embedded hardware platform, with digital video processing technology as the main support, the use of audio and video coding compression as a measurement method, combined with the actual application space, the synthesis of emerging artificial intelligence technology, is a new network video detection platform[1]. The information technology has gone through the test of different times, and now the network era has grown into a mature platform for application technology, the main characteristics are small size of system, good stability, high cost performance, simple construction and other advantages, compared with the traditional video detection information platform, it has more prominent advantages. The network digital video information platform based on ARM embedded technology has superior performance and affordable price, which is also suitable for the design of the popular smart home. Using this platform, users can complete remote control through the computer, and it has a lot of convenient in public security, remote monitoring and other aspects. PDA and other network terminal equipment login to the internet for real-time prevention and control, and eliminate family insecurity factors, reduce unnecessary economic losses, bring unprecedented security and intelligent life to users.

3. Research Status of Embedded Network digital Video Information Monitoring Platform based on ARM

Firstly, it introduces the ARM embedded network digital video information monitoring platform. In recent years, with the rapid development of internet of things, the video perception has attracted the attention of countries and researchers, many colleges and universities in the world and some enterprises and intelligence fields carry out study on it. And they have involved in video monitoring field, also provide larger driving force for the development of network digital video information monitoring

industry. In China, although the research progress in this field is hot, but there is still a certain gap with developed countries. The most appropriate design for people's life is the smart home design. The use of ARM embedded network digital video information monitoring platform can better meet the needs of the family users for the new lifestyle such as network remote control. Using the internet of things allows users to monitor and operate the object at any time. However, the only drawback is that the internet of things requires objects be dispersed. At this time, a single device is far from meeting the requirements, while the use of embedded hardware devices as a platform can solve the current problem, so that the resources of the entire platform can be well allocated. ARM embedded research has become an important direction of video monitoring.

The ARM embedded network digital video information monitoring platform can be divided into three stages from the development of monitoring products: analog video monitoring platform, analog video monitoring platform controlled by digital signal, and network video monitoring platform based on embedded technology[2]. From the names of the three stages, it can be concluded that technology continues to make qualitative leaps. The latest stage solves the problem that DVR/NVR obtains dynamic images by network and other methods. Moreover, the transmission of digital signals in the protocol network is faster, and the monitoring range and effect are improved.

As for the development of this technology, the future development trend is mainly two aspects, on the one hand, enter ordinary families, convenient for people's life, on the other hand, apply it to the management of security monitoring, in order to develop new markets, in this way, ARM embedded network digital video information monitoring platform has a broad application prospect and huge development potential.

4. Introduction to the Overall Design of Embedded Network Digital Video Information Monitoring Platform based on ARM

First of all, the functional requirements of the platform are analyzed. ARM embedded network digital video information monitoring platform has some necessary conditions: Firstly, the operating system is stable and reliable with good security. Secondly, it can complete the task of remote monitoring and maximize the compression coefficient of the compressed image without affecting the image quality. Finally, the development cycle should be shortened, with low cost and high completion effect. The main workflow is: the first task is to collect video, then conduct video storage and video compression processing, use the means of streaming media transmission to carry out video decoding, so as to display the image. We highlight the video compression technique here. There are two basic approaches to video compression, and one is to remove spatial redundancy, and redundancy includes spatial, temporal and data redundancy; two is to process according to human eye's sensitivity to the components of the video images, the data is reduced under the normal sensory conditions to achieve the compression of video.

Video transmission technology is also very important. Efficient network transmission plays an important role in different network environments. There are three main transmission modes: RTP, TCP and UDP, the traditional TCP protocol is reliable, but for a large number of confirmation and response information, in the field of TCP application it is redundant, and it will cause picture delay and even the not timely transmission of pictures[3]. As a transmission mode without confirmation, UDP has a high error rate and no connection, making it an unreliable transmission. Here we use the streaming transfer protocol. Compared with traditional transfer protocol, streaming media technology has the following advantages: the means of transmission are diversified, which can realize unicast, multicast and other real-time transmission. The protocol used is RTP protocol, and developers can also expand the requirements on this protocol. Compared with the first two protocols, it has the advantages of convenience, high speed and so on.

5. Design of Embedded Network Digital Video Information Monitoring Platform based on ARM

In the direction of hardware design, it is mainly composed of embedded processor and peripheral hardware devices, and the software part mainly consists of embedded operating system and application software. The characteristic of embedded system is that it is usually embedded in the application system as a module instead of being used independently. Embedded processor has gone through many stages from single chip microcomputer, microcontroller to on-chip system chip. The final on-chip system chip has powerful computing power, and it can run more complex software and meet more and more complex functional requirements. It has a short design cycle, which is widely recognized.

The processor used in this paper is ARM processor, which has the advantages of small kernel size and low power consumption. In ARM, it mainly has the advantages of typical RISC processor, such as large number of registers, simple decoding of instructions, small appearance and high performance. At present, ARM processor occupies about 10% of the Personal Computer market, which indicates the application significance of the processor. The software design scheme is mainly digital video collection, and H. 264 is used to conduct encoding compression, and then it is connected to the video server, then carry out RTP protocol and RTCP protocol, transmit to the UDP protocol. Parallel operation is the IP protocol,

quality feedback control, and then the decoding display is conducted. After setting up the hardware platform, the next step is to build the software system. The analysis of the platform is carried out with an example here, mainly including the transplantation of the system platform and the creation of cross-compilation development environment[4]. Of which, the transplantation of system platform includes several steps includes the establishment of cross-environment, the transplantation and loading of Bootloader, the transplantation of Linux kernel and the construction of root directory.

After setting up the environment, it is to implement the video acquisition and the realization of transmission system. It mainly includes the video camera driver design for the UDB interface video cameras, video collection and compression under embedded Linux. Here we introduce the H. 264/AVC standard encoder, in design, H. 264 video frame is divided into macro blocks with equal size, and further they are divided into smaller, and use the sub-pixel motion vector, so that we can make it more accurate image movement, then we conduct video coding, on the issue of the video coding, it has attracted a lot of code developers since 2004, now we can find source code from the internet. Of course, there is also a certain code specifications involved, and V4L2 is commonly used as interface specifications under Linux video device program. About the implementation of video transmission, we mainly use the transmission of ORTP base to conduct streaming media transfer. ORTP base is a common way to achieve RTP transmission, and it is an open source RTP base followed by RFC3550, developed in C language, it can be more convenient to send and receive RTP package, conducive to the transmission of streaming media.

After the design platform is completed, and the application platform should be tested. The detection method is to use the embedded development board. The operating system selects SDRAM of FLASH64M of the transplanted embedded Linux256M, and the camera with USB interface carries out the collection of video. Firstly, we carry out cross-debugging environment, and connect the development board to the network, and then place the collection and transfer executables generated by the cross-compilation environment in the prize file, and set Linux as the execution program after system startup. In this way, after the system is started, it will directly enter the collection and transmission of audio and video. After testing, u-boot port, kernel load, root file system mount are successfully implemented, the figure shows the result of minicom terminal after starting the file system. Finally, it is the test of video acquisition and transmission. Embedded network digital video information monitoring platform based ARM can well make up for the transmission difficulties caused by the long transmission distance, and it can also better save the investment of equipment, which has certain economic benefits.

6. Optimization of Embedded Network Digital Video Information Monitoring Platform based on ARM

Of course, this paper is only a preliminary model, there is still much to be done to improve the details. However, many problems have been found in the study of the system platform. In the overall design process, it is found that there is certain space for improvement in both the selection of embedded system and the design of application software. For example, there is a certain time delay in the streaming transmission, which needs to be improved on the software encoder, therefore, more research on encoders is needed; Similarly, due to the limited conditions, it is necessary to further improve the hardware platform, and the selection of hardware is too limited, so the cloud equipment needs to be expand, and at the same time we should realize the control function of the cloud platform, and truly realize the remote operation of video monitoring; once more, the RTP base should be further optimized, and the implementation of related RTSP protocol should be added, so that the media data can be controlled through the client. Finally, the processor platform should be further optimized to choose a processor with high performance and more stability. In short, development of embedded network digital video information monitoring platform based on ARM has an important position in video monitoring, having an advantage that other platforms don't have and also is difficult to reach. The research on the system platform will continue, which also requires developers to master more technologies under the condition of understanding embedded products, so as to better apply in the video monitoring platform and meet the needs of more people.

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