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Design of ITLMS In-transit Logistics Monitoring System

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Abstract

A design of in-transit logistics remote video monitoring system is proposed based on cotex-A8 processor hardware and Android software systems platform, by the terminal USB infrared camera driver transplant, video streaming H.264 codec, and 3G wireless transmission network, the in-transit logistics remote video monitoring real-time display is achieved, which can prevent the loss of goods and cargo in logistics process and be served as the evidence for the responsibility distinguishing in the event of goods damage. Managers and customers can track the transport status of goods by computer or mobile phone in real-time, and provide better service to customer, therefore enhance the competitiveness of logistics enterprises.

Keywords: *ITLMS; In-transit logistics; 3G wireless transmission;H.264 codec; video monitoring; Android*

1. Introduction

Logistics is the process of in the physical movement process of goods from suppliers to the receptors, according to the actual requirements to combine transport, storage, purchasing, handling, packaging, circulation and processing, distribution, information processing and other functions to achieve user requirements [1, 2]. Modern logistics is the product of economic globalization, but also is the important service industry to promote the economic globalization. Logistics industry started relatively late in China, with the rapid development of the national economy, the logistics industry in China to maintain a rapid growth rate, and gradually expand the scale and constantly improve the logistics system, but as a direction of the national "Twelfth Five-year Plan" key support.

In the modern logistics industry, on conveyance and carriage of goods monitoring and management is the service quality assurance of logistics enterprise, but also an effective means to improve the internal management level [1]. Especially in the logistics of valuables, the importance of In-transit monitoring more prominent. In the course of carriage of goods, the goods lost or default, send the wrong goods, damaged goods, long time not delivered, the driver illegal operations and some other phenomenon often occurs, resulting in increasing the amount of customer complaints and dissatisfaction of logistics enterprises.

On the other hand, people on logistics service requirements have become more sophisticated, very concerned and want to be able to real-time control in-transit situation and the current status of the goods consignment goods in what position, if timely delivery, and when delivered. Usually only get about information by telephone or network inquiry, and logistics companies are also struggling to cope with the customer to ask about the issue of quality of the goods. Nowadays, many companies have chosen to install GPS positioning system in the logistics vehicle, trying to solve these problems. This scheme can achieve the vehicle navigation and scheduling functions, but can not monitor the whole process, can not get the fact cause in goods damage, loss, accident and other circumstances [3]. Unable to evidence distinguishing relevant logistics accident

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responsibility, leading to frequent goods compensation disputes between logistics companies and customers and insurance companies.

In-transit logistics monitoring system (ITLMS) is to improve the above problems,the use of advanced embedded technology, video compression technology, data communication technology, software programming technology and computer processing technology ,the whole process of logistics vehicle cargo transportation and unloading monitoring and recording, to prevent loss of cargo, supervise the behavior of employees, and as to distinguish the responsibility evidence at the time of the loss of cargo. With 3G networks, Managers and customers can track the transport status of goods by computer or mobile phone in real-time, and provide better service to customer, therefore enhance the competitiveness of logistics enterprises.

2. System Overview

In-transit logistics remote monitoring system combined with embedded front-end server, to achieve point to point and point to mutilpoint real-time remote monitoring based network. The system adopts client/server (C/S) architecture, the hardware consists of a front-end chip processor based on the cotex-A8 kernel, infrared camera and a background monitoring terminal(PC or mobile terminal),the front-end system adopts the popular Android operating system. The core design is the front-end of infrared camera to capture video stream data and programmed to achieve H.264 encoding compression, finally using 3G wireless network transmit the compressed data to the monitoring terminal and real-time display. The overall system structure shown in Figure 1.

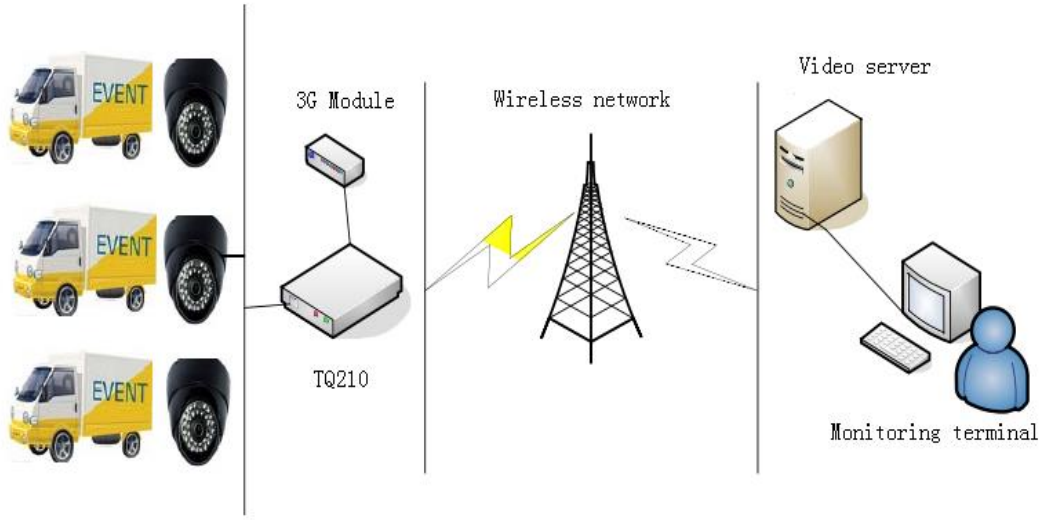

Figure 1. The Overall Structure of the System

3. The System Hardware Design

Monitoring system consists of front-end video capture module, software H.264 encoding module and 3G wireless network transmission module and display module. The video capture and encoding module is the front-end of the monitoring system, implementation by the USB infrared camera and Android system database. 3G wireless transmission module is the hub of the system, to complete the video data transmission between monitor front-end and terminal.

The design of this system adopts the Samsung’s Cortex-A8 S5PV210 embedded processor as the core, CPU using 45nm process technology, the maximum running speed can reach 1G, internal the processor for 64/32 bit bus architecture, 32 / 32KB cache class

A, 512KB cache class B. Comes with 3D graphics acceleration engine(SGX540),2D graphics acceleration, maximum support 8192 * 8192 resolution. Support MPEG-4/H.263/H.264 video encoding achieve 1080p@30fps,decode MPEG2/VC1/Xvid video reaches 1080p@30fps.Support HD HDMI TV output. The S5PV210 chip of high-performance and low power consumption, suitable for hand-held electronic devices, communications equipment or medical applications, netbooks, learning machine, video monitoring equipment and a variety of human-machine interface, can be applied to high-definition games, wireless GPS navigation, mobile video player, intelligent control, instrumentation, navigation equipment, PDA devices, remote monitoring, game development and other development [4].Combined with the external excellent interface equipment that can meet the needs of Android application development. Peripheral interfaces including serial port, JTAG debug interface and USB interfaces, the USB interface connecting the camera to complete acquisition the inside real-time video data of in-transit logistics vehicles, the LCD screen to display in real-time.

Front-end video capture device hardware structure as shown in Figure 2:

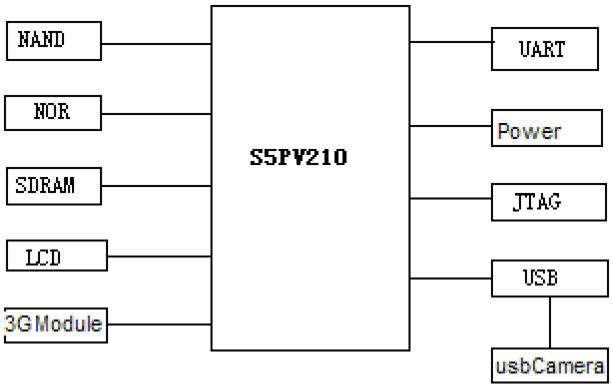

Figure 2. The Hardware Overall Structure Design

4. The System Software Design

Monitoring front-end based on Android operating system adopts USB infrared camera to capture real-time video data, Android application layer calls the package JNI Library H.264 compression[5],sent to the monitoring terminal ,PC or mobile terminal by the 3G network.

4.1. Android System Architecture

Android operating system based on Linux kernel, mobile phone operating system released by Google company in November 5, 2007, general use a variety of portable devices for Android system is more common. Android system uses a layered architecture design, namely the application layer, providing a variety of API (Application Programming Interface) application framework layer, the system runtime layer and Linux kernel layer [5]. Application program using Java language, each application has a single Dalvik virtual machine instances, this instance stay in one by the Linux core management process. Dalvik support Java Native Interface (JNI) programmatically, Android application can use JNI calls the shared libraries that develop by C/C++, to achieve Java and C hybrid programming [7] [8]. The easiest and quickest way to develop Android applications is to install the Android SDK and the Eclipse IDE. Eclipse provides a rich Java environment, after compile Java code, Android Developer Tools will package it for installation.

Android system architecture shown in Figure 3.

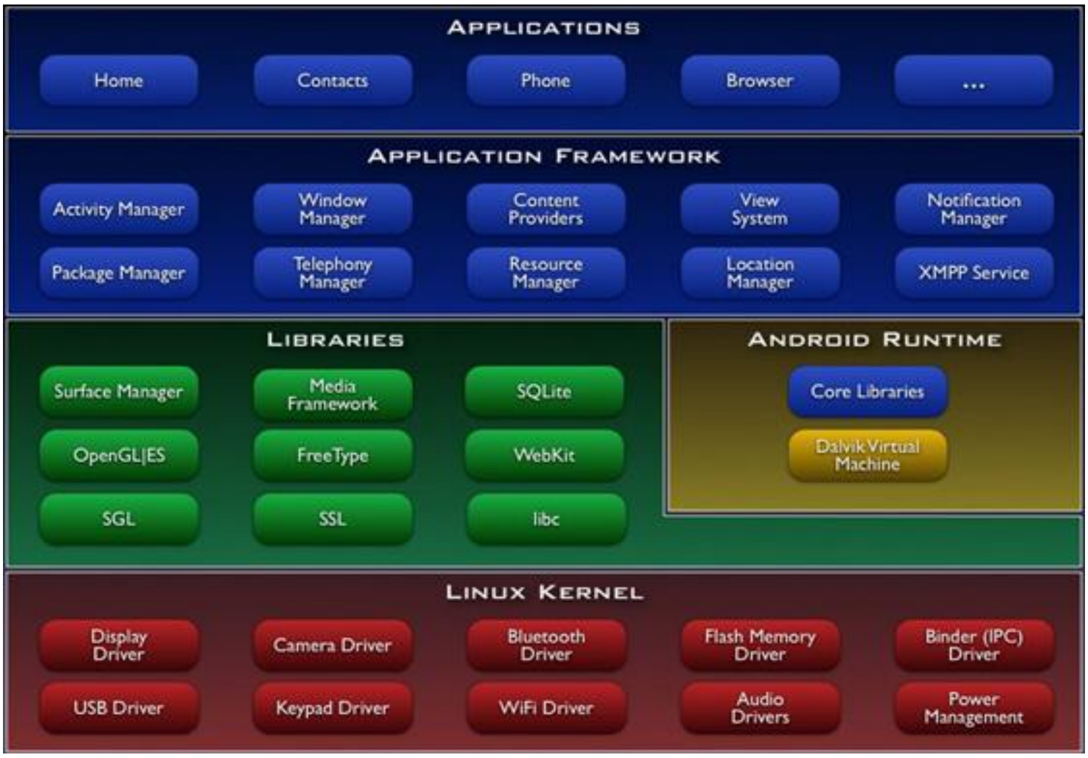

Figure 3. Android System Architecture

4.2. The Design of Video Capture Module

The front-end video capture module includes the android extract the video stream which shooting by USB camera. After initialize USB camera module(set image size, the number of frames per second transmission), Android acquisition of YUV format video data, then calling the corresponding function sent to the application layer for real-time display by system Surface View Class for each frame of video data.

4.3. The Design of Video Compression Module

4.3.1. The Necessity and Feasibility of Video Coding Compression

Use the current video equipment to capture video, the amount of image data obtained is huge, therefore, in order to save memory space, reduce bandwidth occupancy, generally do coding compression processing. On the premise of not affecting the image objective information expression, we often take the lossy coding (irreversible) treatment. Local space of the image in a certain sense is smooth and continuous, especially in gradation consistent constant region; at the same tiome, in addition to the target motion or little illumination change, most of the residual between image frames is very small, even to zero value. Physiological experiments show that the human eye is more sensitive to luminance than chrominance. These factors contribute to the necessity and feasibility of video coding.

4.3.2. The Current Dominant Video Coding Standards

With the growing demand for video compression and huge market potential, the video coding algorithm standard has been development and improvement, accordance with the relevant technical literature, concluded that the current dominant video coding standards are MPEG-4 and H.264.

In 2001, MPEG and VCEG co-founded the JVT (Joint Video Team). September 2001, formulated a H.264 standard draft based on H.26L and TML-9 test model. March 2003, JVT form the final draft standards, submitted to ITU-T and ISO/IEC to examination and approval. Finally formed a uniform standard of H.264/AVC issued in May 2003. The standard is called H.264 in ITU / T, and the ISO/IEC called MPEG4-Part10 AVC (Advanced Video Coding).A protocol of two name, commonly referred to as H.264/AVC.

The current video compression standards development process is shown in Figure 4.

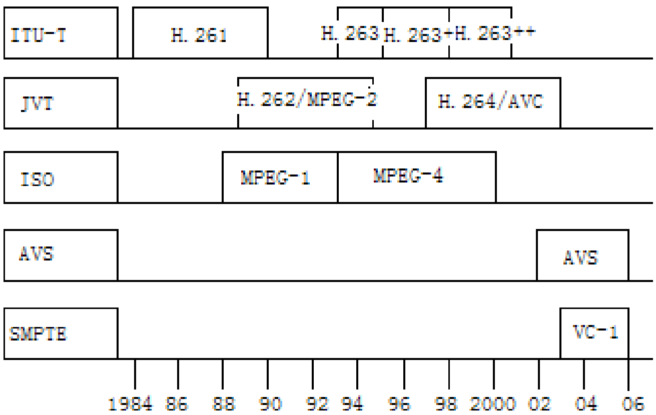

Figure 4. Overview of Video Coding Standard

4.3.3. H.264 Coding Standard

H.264/AVC put video compression system divided into video coding layer (VCL) and the network abstract layer (NAL).Video coding layer VCL through time domain, spatial prediction and transform coding to complete the compression of video information. Network abstract layer NAL abstracted the network-related information from video compression system, so that the network is transparent to the video coding layer, it is mainly responsible for package the encoded data, in order to improve its robustness, reduce error rate. Using hierarchical structure is conducive to the separation between compression coding and network transmission, making video coding layer can be transplanted to non-heterogeneous networks, to adapt to different network transmission.

Video coding layer VCL is the core technology of H.264/AVC, video coding algorithm is a hybrid technology framework, including the transformation, quantization, coding three steps. Not only hybrid coding technique, and the use of intra-frame and inter-frame image data compression techniques. Intra-frame compression based on the DCT transform coding, in order to reduce the redundant information of video image in the spatial domain;and the inter-frame compression using predictive coding, in order to reduce the redundant information of video image in the time domain. Its codec processes include five parts:inter-frame and intra-frame prediction, transform and inverse transform, quantization and inverse quantization, loop filter, entropy coding.

The functional block diagram as shown in figure 5.

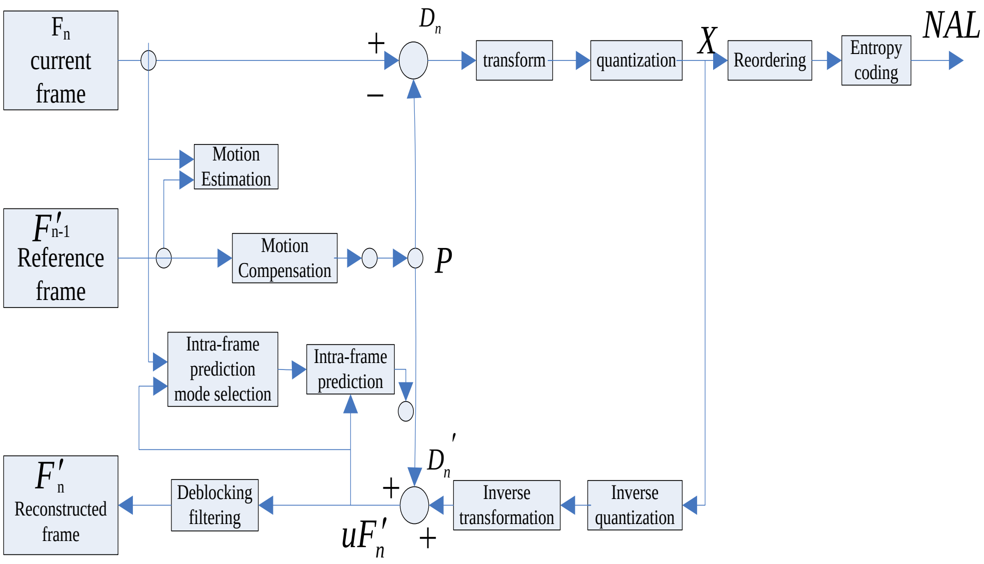

Figure 5. Functional Block Diagram of H.264/AVC Encoder

The system was implemented by used in a free open source X264 encoder, which eliminates some of the complex gain, coding speed, can be real-time coding for the GIF format images. Download X264requires specialized software such as CVS, SVN, Git, *etc.*, these are the application software under Linux environment, but also have the corresponding version for Windows. Git download address is: http: //code.google.com/p/msysgit/downloads/list, x264 related website:

http: //www.videolan.org/developers/x264.html.

The command of use Git to get the X264: #git clone git://git.videolan.org/x264.git.

4.4. The Design of Video Transmission Module

The design is based on real-time remote monitoring, so need a network. Taking into account the limitations of logistics vehicles, the system uses 3G wireless network transmission of video data. Android operating system uses android.net. Connectivity Manage Class to check network connection. In addition, because the Android system connecting to the network need relevant permissions, so it is necessary to give a statement permissions in AndroidMainifest.xml file, otherwise it would not be able to properly use the network. Need to make the following statement:

<uses-permission android:name=“android.permission.INTERNET”/>.

The real-time remote video transmission technology is implemented by Socket network communication technology. First, create a socket and bind its IP address and port number, and then began listening port. The main program has been loop listen to the received requests and create a new connection, and establish a communication thread for this connection. The process shown in figure 6:

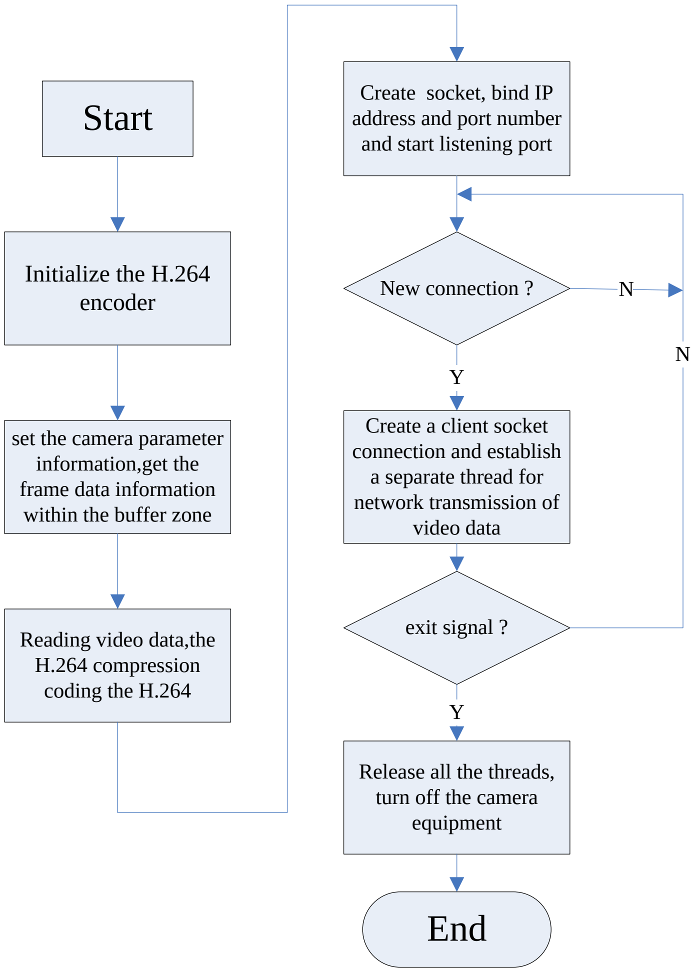

Figure 6. System Flow Chart

1.start the system, the initialization of H.264 encoder

2.open the camera, get and set the camera parameter information, call the system function to capture video stream data, and finally get the frame data information within the buffer zone

3.call the H.264 encoder to compress the acquired frame data

4.the detection of all currently connected clients and for all clients to generate their separate thread, transmission by 3G wireless network to the client display.

4.5. Client Display

The monitoring terminal real-time display is required for H.264 decoding the video data, finally display on the screen. Decoding is the reverse process of encoding, that is the frames of the video stream decompression, not repeats them here. Client test is shown Figure 7:

Figure 7. Mobile Phone and PC Monitoring Terminal

5. Epilogue

By installing the ITLMS monitoring system in logistics vehicles, can effectively solve the problem of logistics enterprises encountered. Monitor and video the whole process of goods transport and handling, prevent loss of the goods ,but also can be as the evidence for the responsibility distinguishing in the event of goods damage. With 3G wireless networks, Managers and customers can track the transport status of goods by computer or mobile phone in real-time, and provide better service to customer, therefore enhance the competitiveness of logistics enterprises.

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References

[1] D. A. Zhang, "Logistics industry development present situation,obstacles and countermeasures", Logistics Technology, **(2014)**.
[2] "Logistics terminology standards", China.
[3] W. Wu and C. Z. Yu, "Design and implementation of embedded remote video surveillance system", Electronic Design Engineering, **(2010)**.
[4] "TQ210 manual", Guangzhou Tianqian Technology Co. Ltd.
[5] "Richardson I E. H. 264 and MPEG-4 video compression: video coding for next-generation multimedia", John Wiley & Sons, **(2004)**.
[6] L. Y. Yu, "Discussion on the design and implementation of video monitoring system based on Android", Innovation and application of science and technology, **(2014)**.
[7] K. Yaghmour, "Embedded Android: Porting, Extending, and Customizing", O'Reilly Media, Inc., **(2013)**.
[8] Y. C. Zhon, J. X. Wang and J. K. Hu, "Android kernel porting and application in remote monitor", Journal of Chongqing University of Technology: Natural Science Edition, **(2011)**.
[9] T. Wiegand, G. J. Sullivan and G. Bjntegaard, "Overview of the H.264/AVC video coding Standard", Circuits and Systems for Video Technoloy, IEEE Transaction, **(2003)**.

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