

**Research Article**

# Video Monitoring System Based on ARM9 Core in Client-Server Model

**SHAIK MUBARAK**M.Tech student  
Department of ECE  
VBIT College,  
Hyderabad, T.S., India.**BHASKAR GUGULOTHU**Assistant Professor  
Department of ECE  
VBIT College  
Hyderabad, T.S., India.

**Abstract**— In this paper, Embedded Real-time video monitoring system based on ARM9 is designed, in which the embedded chip and the programming techniques are adopted. It focus the hardware composition and the methods of realization software modules. First, USB camera video data are collected by the embedded Linux system, processed, compressed and transferred by the processing chip. Then, video data are sent to the monitor client by LAN network. In the client-server model and Linux Input sub system, and develop a driver and tested it. By using Input subsystem, it can control the LED's flashing types and rates on the target board through the network. Embedded Linux is chosen an operating system which provides open-source, multi-task, multi-process, highly modular, multi-platform support, performance and stability to the system.

**Keywords**- ARM9; IP Address; MINI 2440; MPEG streamer; video monitoring

## I. INTRODUCTION

This paper consists of an integrated system with strong ability. Depending on its intuitive, convenient, rich information the video monitoring system widely applied in many kinds of situations. It has a widespread application in the industry, military and civilian areas, especially in the modern enterprises. Video cameras used for the purpose of observing an area. They are connected to recording device or IP network and may be watched by a security guard or law enforcement officer. In recent years, with the rapid development of computer, network and the imagery processing, lots of embedded video monitoring system emerged. Video monitoring system is experienced in three stages those are analog video surveillance system, digital video surveillance and wireless video surveillance network. The analog video surveillance system is traditional video monitoring simulation system based on the coaxial cable is complex in structure, poor stability and expensive. In this paper Video data is captured from a USB camera, compressed into MPEG format, transferred the LAN network under the control of the ARM9 S3C2440 chip, Then the monitor client will receive the compressed data frame to restructure, and recompose video images. We can play live streaming at client side by using IP address of Target board.

## II. CHARACTERISTICS OF S3C2440,MINI2440 BOARDS

### A. SC32440

S3C2440 is a 16/32-bit RISC microprocessor. It is designed to provide hand-held devices and general applications with low-power, and high-performance microcontroller solution in small die size. By using

it we can reduce total system cost. It is developed with ARM920T core, 0.13um CMOS standard cells and a memory complier. Its low power, simple, elegant and fully static design is particularly suitable for cost- and power-sensitive applications. It adopts a new bus architecture known as Advanced Micro controller Bus Architecture (AMBA). The ARM920T implements MMU, AMBA BUS, and Harvard cache architecture with separate 16KB instruction and 16KB data caches, each with an 8-word line length.

### B. MINI2440

The MINI2440 Development Board is based on the Samsung S3C2440 microprocessor. Its PCB is 4-layer boarded, equipped with professional equal length wiring which ensures signal integrity. MINI2440 boards are manufactured in mass production and released with strict quality control. On startup it directly boots preinstalled Linux by default. There are no extra setup steps or configuring procedures to start the system. It is easy for users to get started. Anyone with very basic knowledge about the C language can become proficient. Friendly ARM, Mini 2440 with 400 MHz, Samsung S3C2440 ARM9 processor. [2]The board measures 100 x 100 mm, ideal for learning about ARM9 systems. On board 64M SDRAM and NAND Flash, 2M NOR flash with preinstalled BIOS, 100M Ethernet RJ-45 port (powered by the DM9000 network chip), The MINI2440 development board currently supports Linux 2.6.32.2.

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### III. WHOLE SYSTEM DIAGRAM AND HARDWARE DESIGN

#### A. Whole System

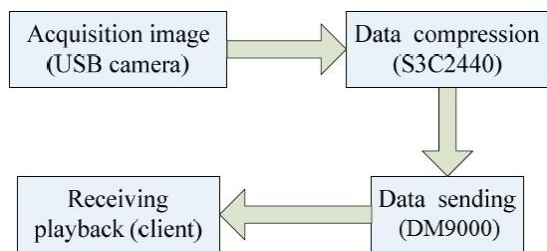


Figure1. The whole system structure

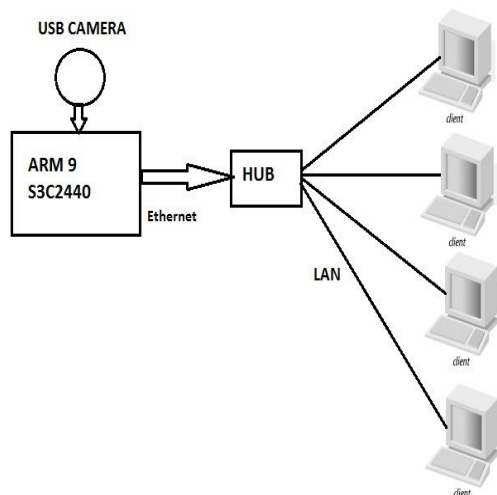


Figure2. Block diagram of the whole system.

In the Whole system, video monitoring system adopts the client-server structure. In that the structure contains mainly two parts: the server and the client. The server is running on S3C2440 platform mainly includes the sampling, compression, transmission program, and the client is PC operation of receiving, decompression, playback program. The video monitor terminal captured the real-time video information from the scene of the camera, and transmitted to the ARM9 S3C2440, where video is compressed by MPEG compression algorithm. The compression video is transferred to Ethernet HUB. The video is transferred by DM9000 Ethernet controller. From the client side live streaming can be watch. This video monitoring system overall structure is shown in figure 1. Video image acquisition and packaged send are completed in the server, image of receiving unpack and playback will be finished on the client.

#### B. Hardware Design

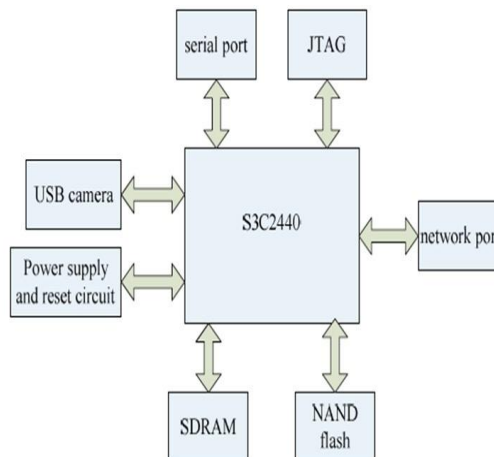


Figure3. The hardware structure of the system

In the hardware design, It adopts modularization design scheme. It includes several modules mainly: the main controller module, USB camera, storage circuit module, periphery connection circuit module, power and reset circuit, as figure 2 shows. The S3C2440 processor [2] is the core of the whole system and one of the ARM920T processor core based on the 32-bit microcontroller. The S3C2440 processor can have the highest running frequency 400MHz, its low power consumption and lean and fully static design are particularly suitable for the application of sensitive to cost and power consumption. The S3C2440 provides rich resources in chip, supports Linux, it is a suitable choice for this system. It can be finish the whole system scheduler work, when the system is on power and it could finished the configuration of needed working function registers, complete the video coding, and control physical chip through the Ethernet LAN.

The S3C2440 provides the USB interface circuit. It includes two USB controllers. USB controller provide a high performance complete rate function control solutions through DMA interfaces, USB controller allows the use of four ways by bulk transmission, interrupt transmission, control transmission, isochronous transmission through DMA. Isochronous data is continuous and real-time in creation, delivery and consumption. Isochronous data must be delivered at the rate received to maintain its timing. Serial interface circuit, serial ports plays an extremely important role in system development, generally the commissioning and download is through a serial port. At the same time serial port is generic interface equipment, we can expand many other equipment through a serial port. Almost all of the micro controller provide serial interface. S3C2440 could supply 400M Hz running speed for investigations, 2 road UART serial port, it can realize baud rate 115200bps for serial

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communication. The system uses expanded network interface DM9000A. The DM9000A is a fully integrated and cost-effective low pin count single chip Fast Ethernet controller with a general processor interface, a 10/100M PHY and 4K Dword SRAM. It supports 8-bit and 16-bit data interfaces to internal memory access for various processors.

### IV. THE SYSTEM SOFTWARE DESIGN

#### A. Linux Operating System

In view of the open source code, Linux becomes a very powerful option in the field of embedded operating system, and many microprocessors have been transplanted into the Linux operating system. This system will transplant Linux operating system into MINI2440 board. The Linux has a number of advantages, such as open source, Powerful kernel, supports multiple users, multiple processes, multithreading, powerful stability function, good real-time, Size function customizable, Supports multiple system structure. To build embedded Linux development platform needs to construct cross-compiling environment first, a set of complete cross-compiling environment includes the host and the target machine. For developing the host is a PC equipped with Ubuntu operating system with LTS version 12.04, the target machine is video monitoring terminal based on the MINI2440 board. The crossover compiler is GCC 4.4.3 for ARM edition, the version number for embedded Linux kernel source package is 2.6.32.2. It contains all the function module and system software.

#### B. System Application Design

The software of video monitor terminal is divided into video collection, video data compression, and video data transmission three parts according to their function.

##### (i). Implementation of USB video capture driver

Video4Linux (V4L) is video equipment's kernel driver which is under embedded Linux. It provides a series of interface functions for the programming application of video equipment under Linux [6]. The driver of USB interface camera needs to provide the realizations of basic I/O operational functions, interrupting handling, memory mapping function and ioctl functions of I/O channels, control interface, and define them in the struct file operations. Thus when the application program carry on system calls such as open and close operations, the Linux kernel will visit the function which is provided by the driver through the struct file operation.

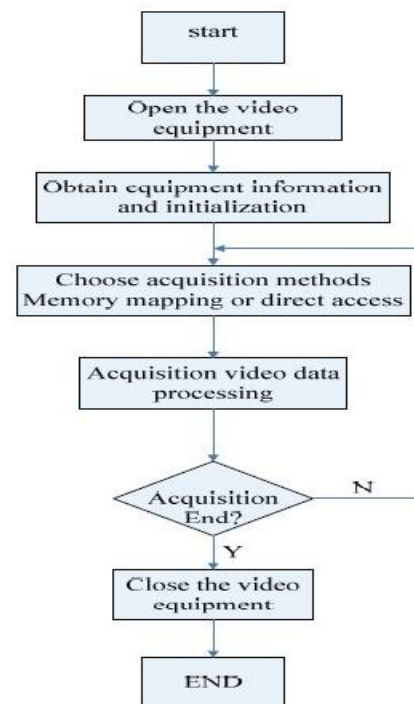


Figure4. Video collection flow chart

##### (ii). MPEG-streamer

Video data compression is adopted to mpeg-2 coding compressed standard. In the video monitoring system, a large amount of data realized transmission through network, in order to guarantee the quality and the transmission in real-time, we need encoded compression before transmission in order to reduce the amount of data. For this MJPG- streamer is used to capture the video frames and transmit to the output plugin. The MJPG-streamer is designed by C language. The stream viewer is built by JAVA language, the client-side code for use in a web page, or from the command line.

The function of video data transmission part lies in spreading the compressed video to the remote PC customers, The DM9000A Fast Ethernet controller is used to transfer the video. The transmission of video data streaming is based on TCP/IP protocol. The video transmission adopts the standard RTP transfer protocol. TCP/IP [7] application protocols included in the TCP/IP suite of protocols is an extensive list of applications designed to make use of the suites services. It is through these entities that resources can be made available data can be moved between hosts and remote user can communicate.

The processed stream data packets are uploaded into server using TCP/IP protocol and transmitted through wireless device so that user

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input the corresponding IP-address <http://192.168.0.105:8080/stream.html> or <http://192.168.0.105:8080/javascript.html> and then the webpage is opened and the output video is streaming as shown in below Figure 6.

### V. RESULTS

#### A. MPEG-Streamer Execution

In below figure shows the MPEG-Streamer execution output

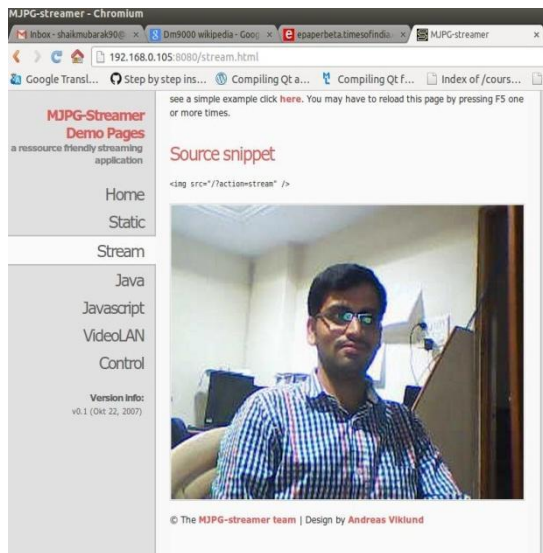
```
Terminal
root@esl:/home/esl

root@esl:/home/esl/work1 x | root@esl:/home/esl

[root@FriendlyARM mjpg]# ./start_uvc.sh
MJPEG Streamer Version.: 2.0
i: Using V4L2 device.: /dev/video0
i: Desired Resolution: 640 x 480
i: Frames Per Second.: 15
i: Format.....: YUV
i: JPEG Quality.....: 80
format asked unavailable get width 320 height 240
o: www-folder-path...: ./www/
o: HTTP TCP port.....: 8080
o: username:password.: disabled
o: commands.....: enabled
```

**Figure5. MPEG-streamer execution**

#### B. OUTPUT



**Figure6. Resultant output**

### CONCLUSION

In this paper the composition of embedded monitoring system is based on the S3C2440, considering the current most video monitoring systems cost more. To realize the Linux Input subsystem and client-server develop a driver and tested it. The live steaming can be in Mozilla Firefox, Google chrome and VLC media network stream player by using board IP address. By using Input subsystem we can control the LED's flashing

types and rates on the target board through the network. We can effectively improve the performance of the system.

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