ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Design of Remote Video Monitoring and Motion Detection System Based on ARM-Linux Platform and HTTP Protocol with SMS Capability

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Abstract:

In this paper, the structure of video capture system based on S3C2440 processor is presented. And the embedded system, video capture, short message service (SMS) alarm, and client video monitor are introduced. Video 4 Linux is used to get the camera video data, which is transferred to the Web Server, and the data is displayed on the client browser. The system can also be connected with mobile phones, using SMS to control alarm equipment. The system can be applied in intelligent anti-theft, intelligent transportation, intelligent home, medical treatment, as well as all kinds of video surveillance systems. Compared with video capture system based on digital signal processor (DSP), this system has the advantages of fewer modules, lower cost, higher intelligence, higher system stability, and higher security. With the development of Broad Band, computer networks, and image processing technology, video capture has been widely used in image acquisition, security, health care, intelligent community, alarm, transportation and so on. But it also has many problems, such as high cost, low intelligence, poor stability, weak security. In order to solve these problems, S3C2440 microprocessor is adopted in this embedded video Acquisition system which combing with the Linux operating system. Video capture is realized by the Video 4 Linux.

Keywords-:USB Cameras, Industrial Process, Remote Access, CCTV,SMS,GSM.

I.INTRODUCTION:

With the development of Broad Band, computer networks, and image processing technology, video capture has been widely used in image acquisition, security, health care, intelligent community, alarm, transportation and so on. But it also has many problems, such as high cost, low intelligence, poor stability, weak security. In order to solve these problems, S3C2440 microprocessor is adopted in this embedded video acquisition system, which combing with the Linux operating system. Video capture is realized by the Video 4 Linux. The Linux kernel provides programming interfaces and data interface functions API for a variety of devices. And it has the advantages of strong network function, system stability, and high safety. The SMS alarm and control function enable the system to the broader development prospects.A webcam is a video camera that feeds its images in real time to a computer or computer network, often via USB, Ethernet, or Wi-Fi. Their most popular use is the establishment of video links, permitting computers to act as videophones or videoconference stations. This common use as a video camera for the World Wide Web gave the webcam its name. Other popular uses include security surveillance and computer vision and there are uses on sites like video broadcasting service and for recording social videos.Webcams are known for their low manufacturing cost and flexibility, making them the lowest cost form of video telephony. They have also become a source of security and privacy issues, as some built-in webcams can be remotely activated via spyware.

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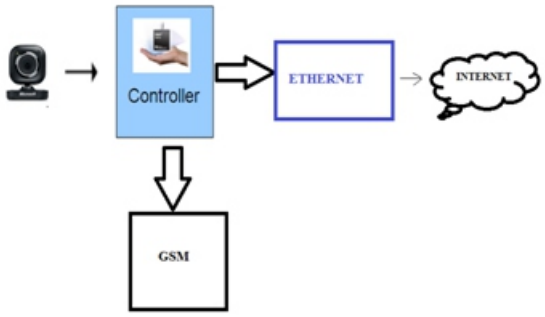

Figure 1.1: Block diagram

II.Capturing frames from the USB camera:

In Linux systems, external devices are managed by equipmental document. And the user application can see some system to call interface functions, and a device driver program includes many interface functions, so application can open, close, read and write such an operation of devices. Video 4 Linux provides a range of programming and data interface functions for a variety of devices in Linux. Equipment can be opened, captured, read and turned off by calling these functions. When an application operates the device file, Linux kernel will access interface functions provided by the driver program through the file_operations structure. Video Capture flowchart is shown in FigureIt is first to open the video device file, so-called the /dev/videoo device file, and use the function of open().

Program is "video_fd=open"/dev/video o"O_RDWR". After success call, the file descriptor returned by functions represents capture device hardware. And then the system obtains the image frame buffer information, equipment information and image attributes by calling the video_vm()video_capability() and video_picture() .Itcallsioctl(video_fd,VIDIOCGMBUF,&video_vm),ioctl(video_fd,VIDIOCGCAP,&video_capability and ioctl video_fd VIDIOCGPICT,&video_picture , and calls video_mmap() function to map the corresponding camera device file to the memory. That is void * video_mmap (void * addr , size_t len , int prot , int flags , int fd , off_t offset). void * video_mmap (void * addr , size_t len , int prot , int flags , int fd , off_t offset). Len-The number of bytes maps to the calling process address space, and the length of bytes starts from the beginning offset bytes in the mapped document. Prot: Specify shared memory access authority. PROT_READ(readable),PROT_WRITE(writable),PROT_EXEC (executable) Flags: MAP_SHARED or MAP_PRIVATE must be elected, MAP_ FIXED is not recommended to use. Addr: The starting address of the sharing memory, in general sets to 0, indicating the distribution by the system. The return value of video_mmap() is the start address of the system actual distribution. Finally, by calling VIDIOCMCAPTURE order in the icotl() function, the system will start the interception of a video, as well as VIDIOSYNC order to determine whether the interception of the video completes or not.Video 4 Linux data structure is as follows:

- video_capability: device name, include the minimum or the maximum supported resolution, signal source and other information.
- video_picture: equipmental properties of the image collection.
- video_channel: the properties of the various signal sources.
- video_window: collect window parameters.
- video_mbuf: the data frame information.
- video_buffer:to describe the buffer.
- video_mmap: interception of video by memory-mapped mode.
- video_vm:the image frame buffer information.

III.CLOSED-CIRCUIT TELEVISION (CCTV):

Closed-circuit television (CCTV) is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors.It differs from broadcast television in that the signal is not openly transmitted, though it may employ point to point (P2P), point to multipoint, or mesh wireless links. Though almost all video cameras fit this definition, the term is most often applied to those used for surveillance in areas that may need monitoring such as banks, casinos, airports, military installations, and convenience stores. Video telephony is seldom called "CCTV" but the use of video in distance education, where it is an important tool, is often so called.

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In industrial plants, CCTV equipment may be used to observe parts of a process from a central control room, for example when the environment is not suitable for humans. CCTV systems may operate continuously or only as required to monitor a particular event. A more advanced form of CCTV, utilizing Digital Video Recorders (DVRs), provides recording for possibly many years, with a variety of quality and performance options and extra features (such as motion-detection and email alerts). More recently, decentralized IP-based CCTV cameras, some equipped with megapixel sensors, support recording directly to network-attached storage devices, or internal flash for completely stand-alone operation.Surveillance of the public using CCTV is particularly common in the United Kingdom, where there are reportedly more cameras per person than in any other country in the world. There and elsewhere, its increasing use has triggered a debate about security versus privacy.

IP Cameras used for Simulation:

This system uses A VTECH Model no A VI202 IP camera for this project. Its specifications are:

1. Low time delay for video streaming with sharp and clear images.
2. Motion detection, alarms and email notifications.
3. External microphone.
4. Night Vision.
5. LAN port for Ethernet.
6. Supported Protocols: TCP/IP, FTP, HTTP etc . . .

Comparison of Existing system & Proposed System is presented in following table:

FEATURES	Existing System	Proposed System
WAN	NO	YES
Control room Needed	YES	NO Need
Remote Access	NO	YES
OPC Server	YES	YES
Communication Protocols	YES	Includes Wireless Technology
Live Video Monitoring	NO	YES

IV.IMPLEMENTATION:

Make sure the arm-linux-gcc-4.4.3 cross compile tool chain is correctly installed and PATH variable is set to the cross compiler toolchain.in this first we write code for capturing frames from the USB camera then the captured frames will be stored in a file. We write a server socket program for configuring our board as web server which listens on port number 8080 and serves html requests for the video and performing client requested operations. Then we write socket program for client which sends requests and receives data from the server. Then we write HTML code for web page interface. In Linux systems, external devices are managed by equip mental document. And the user application can see some system to call interface functions, and a device driver program includes many interface functions, so application can open, close, read and write such an operation of devices. Video 4 Linux provides a range of programming and data interface functions for a variety of devices in Linux. Equipment can be opened, captured, read and turned off by calling these functions. When an application operates the device file, Linux kernel will access interface functions provided by the driver program through the file_operations structure. Video Capture flowchart is shown in Figure.

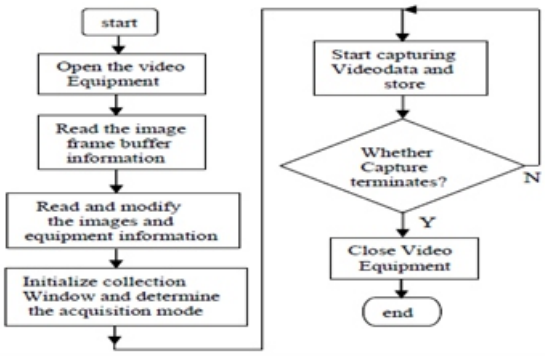

Figure 4.1: capturing video from the V4L device

Short message Service:

The system integrates SMS alarm and monitoring components, and makes the mobile phone to bind to it. When alarm signal is detected by the system, it will notice the user of the mobile phone in the form of text messages.Then the user sends text messages to control and manage the abnormal event. The SMS completes the SMS alarm and data transmission, remotely monitoring and controlling equipments through Global

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System for Mobile Communications (GSM) of wireless communication modules. GSM is an abbreviation of global system for mobile communications, and GSM has the function of a wireless communications. In general, many phones have a GSM network module. It is associated with the operating system through a serial port, supporting GSM07.07 of the AT commands and using the AT instructions to realize SMS transceiver, alarm and query. It is the most mature mobile communication system. In this system, when video abnormal changes or exceeds the threshold of setting appears, the camera will automatically capture the new image data and send it to the PC, and the PC will transport an abnormal information of "discover a new image" to server-side mobile phone in the system through the serial port, then this cell phone will convert the information into a format of text messages so as to send to the user mobile phone. System structure is shown in Figure:

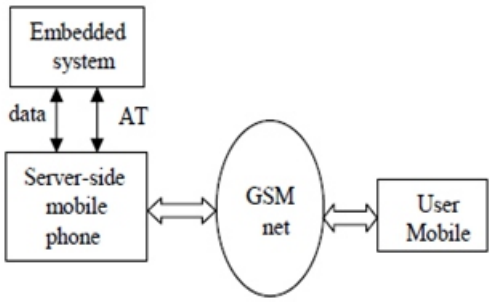

Figure 4.2: Structure of GSM network

It is need to use the SMS protocol description unit (PDU) encoding and serial communication class libraries for communication between systems and mobile phones, and the realization of SMS receiving and sending requires AT commands.

AT commands	Function and Notes
AT+CMGD	Delete SMS message
AT+CMGF	Set SMS Format
AT+CMGL	List all SMS
AT+CMGR	Receive SMS commands
AT+CMGS	Send a SMS command
AT+CMGW	Write a text message and store the command
AT+CSCA	Set SMS center command
AT+CSMP	Set Text Mode Parameters
AT+CSMS	Set SMS service
AT+CSDH	Display the current text mode code
AT+CNMA	The new SMS confirm response
AT+CNMI	Set a new way of SMS Tips
AT+CMSS	Send text messages from memory
AT+CPMS	Select SMS Memory

Table 4.1: List of AT Commands.

Results:

When the camera is inserted the device will be shown in "/dev/video0" on the development board root file system. Connect the board using UART cable from UART0 to PC COM port. Now configure IP address for the mini2440 board in the terminal by typing the following command.

#ifconfig eth0 10.0.0.166 netmask 255.0.0.0

Connect the board to network using Ethernet cable using RJ45 connector. Now at client side open the web browser and type the following IP address in address bar.

10.0.0.166:8080/video_capture.html

Now we can see the following output on the browser on the client side. We can see the video at the development board and a button for sending short message service. When we click that button browser sends the request to the board, it checks for the command type and performs the requested operation.

Figure 4.3: The final output when no object is present

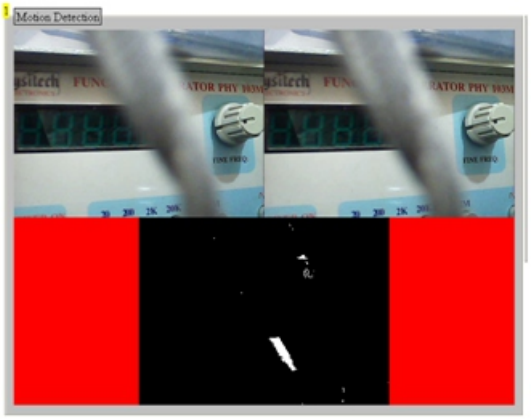

Figure 4.4: The final output when object is present

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V.CONCLUSION:

The structure of video capture system based on S3C2440 processor is presented. And the embedded system, video capture, short message service (SMS) alarm, and client video monitor are introduced. Video 4 Linux is used to get the camera video data, which is transferred to the Web Server, and the data is displayed on the client browser or on client. The system can also be connected with mobile phones, using SMS to control alarm equipment. The system can be applied in intelligent anti-theft, intelligent transportation, intelligent home, medical treatment, as well as all kinds of video surveillance systems. Compared with video capture system based on digital signal processor (DSP), this system has the advantages of fewer modules, lower cost, higher intelligence, higher system stability, and higher security.

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