A Design of Video Acquisition and Transmission Based on ARM

Ziqiang Hao[a], Hongzuo Li[b]

Changchun University of Science & Technology, Changchun, Jilin, China
[a]shuil47@163.com, [b]lihongzuo@sohu.com

Abstract. Recent years, the video acquisition and transmission in wireless technology is widely used in industry，security，medicine and military. The study of video acquisition and transmission in wireless has great meaning. A wireless video acquisition and processing based on S3C2410 is proposed in this paper .The system is based on the current wireless transmission module. Capturing video data by USB camera, and then encodes the video data using the codec of S3C2410 to transfer them to PC through wireless with the internet protocol.

1. Introduction

With the rapid development of the embedded technology and the widely use of Linux in information industry, video acquisition and transmission system has obtained a rapid development in recent years, as a core technology in remote video monitoring, video conference and industry auto control. This paper proposed a design that can achieve the video constant image acquisition and save to a file form then transfer to the receiving end in wireless. The design is based on Linux system platform, adopting USB camera to capture video signals, using V4L core application programming interface function. This paper will focus on the realization of the video acquisition sending end.

2. System composition

2.1 The hardware of the system

The system includes two parts: sending end and receiving end. Both of the two parts are based on the S3C2410 processor hardware development platform, which is produced by Samsung Company. S3C2410 integrates rich component in chip: Separated 16KB instruction Cache and 16KB data Cache, MMU for virtual memory management, LCD controller, NAND Flash boot loader, system manager provided chip select logic and SDRAM controller, 3 channels UART, 4 channels DMA, 4 channels PWM timer, I/O port、RTC, 8 channels 10 digits ADC and touch screen port, I2C bus interface, I2S bus interface, USB main device, USB slave device, SD and MMC card interface, 2 channels SPI and PLL clock generator and AMBA new bus structure.

The sending end hardware structure by using S32C2410 processor platform as Fig. 1, including S3C2410 processor, RS232 interface, JTAG interface, RJ-45 interface, SDRAM, Flash, power supply, the video capture module and video transmitting module connected through USB port. RS232 serial interface is used for human-computer interaction and low speed data transceiver. MAX323 switches between serial interface electrical level and TTL/CMOS electrical level. JTAG is used for download bootloader. RJ-45 interface is used to connect Ethernet, download Linux core, boot file and application software. SDRAM is used for system data memory. Flash is used for system program memory.
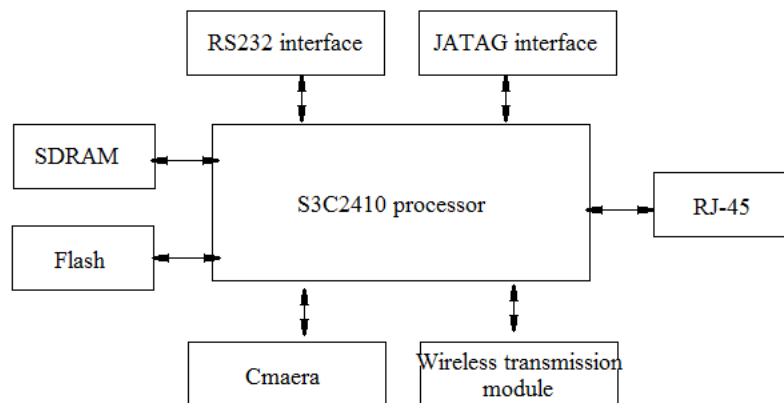
Fig.1 The sending end hardware structure

The receiving end hardware structure by using S32C2410 processor platform as Fig. 2, has a LCD monitor and a SD card additional than the sending end. SD card is used for data storage, and the LCD monitor is used to display.
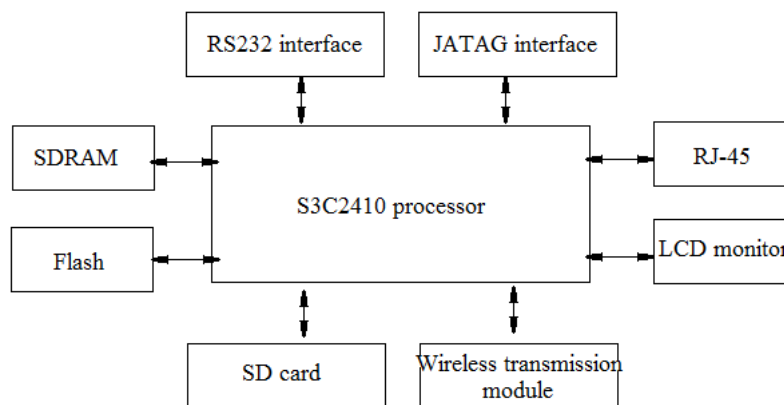

Fig.2 The receiving end hardware structure

2.2 Design of system software

The system software includes four parts: bootstrap driver, operation system, file system and application program. The bootstrap driver remaps memory when the system startup, it will remap the operation system and application program saved in Flash to the SDRAM. The core version of the system is Linux 2.6. The file system is Yaffs, it includes module, configuration file and database. The application program is based on the embedded Linux core, camera drive and file system.
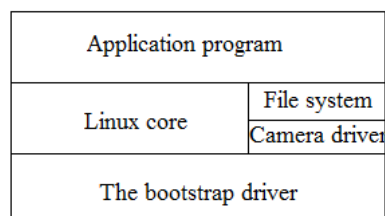

Fig.3 System software structure

3. The realization of the video acquisition

USB camera is widely used because it connects easily, convenience, cheap and performs well. Linux core has various USB camera drive, including the camera based on OV511. OV511 chip includes CAMERA interface,

SDRAM interface, ISO FIFO interface and USB controller etc. This adopts ZC030X serials camera chip. The video subsystem Video4Linux in Linux provide a set of unified API. The video application program, by calling API, can operate various video capture devices, such as TV card, video capture card and USB camera. The design realization process as follows:

3. 1 The realization of the camera drive

1) Setup Video4Linux core

Using make menuconfig order open the main menu window compiled by S3C24I0 Linux，and go to "multimedia device--->" menu option，setup Video for Linux as module:

Device driver--->

Multimedia devices--->

<*> Video for Linux

2) Setup OV511 driver

Return to the main menu，go to "USB support--->" menu option，setup USB OV511camera support as module:

USB support--->

<* >USB OV511camera support(NEW)

3) Module installation

Execute the following command to install video input module:

insmod videodev. o

Execute the following command to install video input device driver module:

insmod usbcore. o

insmod usb-ohci-s3c2410. ko

insmod ov511. o

Load USB kernel driver and the host controller driver before loading the OV511.o module, because the camera is of USB interface.

3. 2 Realize the video acquisition by using Video4linux

The video acquisition device driver installation, and compiling a video acquisition program are needed. In Linux, the video file is a kind of device file, so it can be read and write just as a normal file. The camera file is usually /dev/v4l/video. Before the video capture, a series of setup is necessary, which includes:

struct video_picture

{

_u16 brightness;// Brightness

_u16 hue;

_u16 colour;

_u16 contrast; // Contrast

_u16 Whiteness; // Black and white

_u16 depth;// Color depth

_u16 palette; // The palette

};

Strct video_window

{

_u32 x,y;// Window position

_u32 width, height; // Window size

_u32 chromakey;

_u32 flags;

Struct video_clip_user * clips;

```
Int clipcount;
    define VIDEO_WINDOW_INTERLACE 1
    define VIDEO_ WINDOW_CHROMAKEY 16
    define VIDEO_CLIP_BITMAP-1
    define VIDEO_CLIPMAP_SIZE(128*625)
};
struct video capture
{
_u32 x,y;// Image offset
_u32 width, height; // Capture region
_u16 decimation; // Sampling interval
_u16 flags;// Sampling symbol
    define VIDEO_CAPTURE_ODD 0
    define VIDEO_CAPTURE_EVEN 1
};
```

The first step, turn on the video device:

```
Int fd=open("/dev/v4l/video"，O_RDONLY );
If(fd<0) return -1;
```

The second step, set the camera parameters. Read the device information through I/O control order, and then modify the particular item, finally save the modification to the core.

After the basic information is obtained, it can be output display, also can be modified by calling ioctl system. The video data pointer can be obtained by calling function Char* Carmera_get_image (video_device *vd). This function is very important because it decide the efficiency of the video acquisition. There are two methods to obtain the video data: get the video driver buffer through the mapping and then directly read the buffer; read the device and call read function. They are shown as follows:

(1) The method to call read function is simple. It only need to input the camera parameters into read function，return after obtain the video data pointer picture_p: read(vd->fd, picture_p , width*hight); vd->fd is the device file descriptor.

(2)By using ioctl (fd, VIDIOCGMBUF, &grab_vm) function to obtain the camera memory buffer information，and then modify the settings of voideo_nmap. For example, it needs the following sentence to reset the video height, width and the format.

```
grab_buf. height=240;
grab_buf. width=320;
grab_buf. format = VIDEO_PALETTE_RGB24;
```

And mapping the device file to the memory，by using grab_data=(unsigned char*) mmap (0,grab_vm. size，PROT_READ|PROT_WRITE, MAP_SHARED, grab_fd,0). Thus the device file would be mapping to the memory. This memory area can be read, written and even be shared. This function will return to the pointer of the video data if succeed, -1 if fail.

4. Wireless transmission module

This design select MC35 produced by Siemens as the GPRS module, to realize the video wireless transmission. This module has a lot of functions, such as voice and data transmission, message service etc. Its maximum transmission rate can reach 85. 6 Kbps. It especially applies to data monitoring and transmission.

It needs a lot of settings before GPRS transmission: (1) set the communication baud rate; (2) set terminal categories; (3) set the access gateway; (4) test the GPRS service, activate GPRS function. These settings will be

accomplished in the main program initialization code. During the test, GPRS works well. The packet loss rate, throughput and other performance indicators has no substantial difference between the theoretical indicators of wireless module. The whole system already meets the design requirements.

5. Conclusion

This paper realized video acquisition and wireless transmission, based on S3C2410 hardware platform and embed Linux software platform. The system is stable and reliable, convenient installation, low cost etc. It can be applied in industrial control, video conference system, video telephone, remote monitoring system and many other fields

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