



The Design of Intelligent Home Control System based on Embedded System

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Abstract: This paper introduced a remote monitor system of information appliance, it bases on the microprocessor of S3C2410 as the main controller and Linux as the embedded operate system. It represents the main function and composition of this system, through mounting the Web Server Boa and setting up the embedded remote visit and monitoring platform. Adopting HTML to design friendly man-machine interface. After completing the loading of USB camera driving and transplanting the video server, user can call on page of web server by web browser, implementing the monitoring of appliance by the internet.

Keywords: Linux, USB, SDRAM, HTTP, HTML, TCP/IP, Server

1. INTRODUCTION

Our society is now in a new era of information, the informationalization process of the society evokes the request for residence zone intelligent. Smart home becomes the mainstream of the modem real estate. Computer business, Electric Household Industry, telecom industry, Safety monitor and control industry permeate each other, information technology is used in home life have come true.

With the development of the Internet technology and the technology of the information communication, intelligent information wave is sweeping every comer of the world, people's lives has undergone enormous changes. Intelligence and information become people's most basic needs. How to make communication technology, computer technology, control technology combine with each other in the smart home, and connect to the Internet, to achieve the home network of intelligent has become a hot research. With a user interface, remote monitoring of the development trend of the future. In this situation, embedded Internet becomes a reality based on the arm and other 32-bit microprocessor, so that the traditional PC Web server is replaced to complete the implementation by the embedded controller. As already familiar slogan, "the Internet into life", using the embedded Web technology in the home computer networks became the present network development direction and inevitable result.

2. SYSTEM STRUCTURE

Smart home system structure as shown in figure 1, I part is the remote control unit; part II is the centralized control unit; part III is the decentralized control unit. All equipment control data acquisition scattered through the home bus or general interface. The system includes multiple parts: control of electrical appliances, parts of environment monitoring and control, communications, household appliances, the video control. Each section include one or more devices, Individual device sample of the relevant information and its status by bus or a common interface to send to the controller, the controller work on the basis of the information and control strategies, the order by bus or interface to send to the various equipment units, and implementation control. The controllers realize the dispersal, concentration and remote control by Ethernet interfaces, internet, the local computer remote device and communication. the controller is the core of this monitor, choice the sbc-2410x development board of friendly-arm company, the development board has a wealth of the external components, including integrates 64M SDRAM, 64M and flash and 1m boot flash, RJ-45 network interface cards, standard serial port, USB, SD card socket, 117 universal 110, a 8-channel 10 bit ADC achieves and touch screen interfaces , the timer, 5 PWM timer broad modulation of DMA channels to external control and rich resources, 4-channel external DMA and so on[1].



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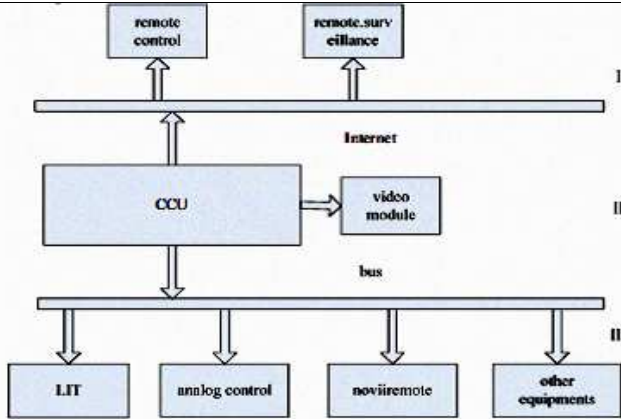


Figure 1. Smart Home system structure

Choosing the Linux operating system as real-time system, the embedded Linux includes the boot loader, the kernel, file systems. In a new hardware platforms, the selection of the embedded Linux operating system to develop software as are necessary to transplant. The need for the application system design in the Linux kernel of the needs of the source code to be revised or clipping then recompile kernel. Here select the boot loader vivi, the kernel version 2.4.

3. LOADING THE USB WEBCAM DRIVER

The mode of loading device driver includes a module (dynamic loading) and core of the initialization loading (static loading) : the former users ins mod order to load to the kernel, uninstall driver module by rm mod order; For the latter, the module is insert into the kernel, loading in the kernel initialization[2] .

Mesh pc350 security camera used USB interfaces and chips for ov511, it owns the chips driver, the driver can use module way, also insert in core, here choice the latter.

- Starts PC machine, enters the Linux operating system.
- Enters the Kernel table of contents, carries out make menu config, and presents the essence disposition contact surface. First chooses under Multimedia device-> Video for Linux. Loads the vide04Linux module, has provided the programming connection for the video frequency gathering equipment.
- Then USB support->directories support for USB and usbov511 camera support. This allows the kernel to join with OV511 interface chip and provide the driver support of USB digital camera.
- Save configuration exit.
- Modify the ov511.c file.

The key is to modify the Ov511 file. Due to the LCD displays the RGB 16bits pictures, so ov511 output picture format should also be 16bits RGB image data, the macro VIDEO]ALETTE_RGB565 defining a 16bits RGB data picture. While Linux native image acquisition in the ov511 driver is a 32-bit, so that the picture appears in the LCD is snow. Therefore you need to modify the driver. In kernet/driver/usb/directory under the ov511 chip driver ov511.c, driven in the ov51x set_defaultyarams function is to set the chip default output format a picture, the modified functions are as follows:

```
for (i = 0; i < OV511_NUMFRAMES; itt)
{
ov511->frame[i].width = ov511->maxwidth;
ov511->frame[i].height = ov511->maxheight;
ov511->frame[i].bytesJead = 0;
ov511->frame[i].format= VIDEO] ALETTE RGB565;
ov511->frame[ i ].depth=ov511_get_>depth( ov511-
>frame[i].format );
}
```

Withdraw after the modification, then compile the kernel.

- Make dep0
- Make zImage 0

Build a kernel with the OV511 driver under the directory of /kernel/arch/arm/bootlto, in the enter the command load under vivi flash kernel u, open the DNW software, make zImage programming to the Board.

4. REMOTING MONITOR

Remote monitor is an important part of domestic surveillance, the owner can implement the real-time monitoring. Through the household management interfaces, for example, the host at the office, the child or the sick old man at home, the owner may, by the remote computer monitor concern at home and response in time. Remote monitoring of the implementation process, first of all need to transplant the embedded Web server target board and video server into the target board, and then through the language of html to design intelligent home management interface, in order to achieve real-time monitoring on the Web page shown.

4.1. Embedded Web Server: Embedded Web server is remote access and control home platform to replace the traditional PC Remote Access Control Agent. On the one hand to achieve Internet access and browser access, but also to control remote device. The key is structuring the HTTP engine based on the TCP/IP protocol and realizing the static and dynamic HTML pages visit through COI Common Gateway technology. Design an embedded control system, the final design aims to monitor any place with Internet, customers can access the system via the Internet. The operator can access a variety of information about



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a remote device, view the status of the system. User enters the IP address in the IE browser when visiting, that is very convenient.

There are three main embedded Web server for Linux: httpd, tthtpd and Boa. Httpd is the simplest, the weakest of its functions, does not support authentication and CGI. Boa and tthtpd support authentication, CGI, etc. their functions are more full, boa is a single task http server, open source, high performance. The design choices boa as a server, transplant the boa server into the target board [3].

4.2. The transplanted of webcam server: Webcam is one of the more popular video applications, through the network to download the Linux version of web cam_server, it is based on the GNU frame work, free and open source. This design uses a webcam server-0.50.tar.gz, download from <http://www.neilbriscoe.co.uk/scratch/>, The transplant process is as follows:

- Decompressing in the Linux operating system of Pc.
- After decompressing Ihome/tt directory to obtain webcam server-0.50 document and enter this folder.
- Configuration folder and generate the corresponding Makefile file. Carries on to the Makefile document revises. Modify the Makefile file, modify the compilation environment, mainly. Open webcam server-0.50 file under the Makefile file. `CC = gcc to CC = I usr/local/arm/3.3.2!hinlarm-Linux-gcc.`
- Enter the the src file under webcam server-0.50 folder: `CC = gcc to CC = I usr/local/arm/3.3.2!hinlarm-Linux-gcc.`
Note: The cross compiler is best to use 3.3.2 version, if uses 2.95.3 and 3.4.1 versions, when translation will make a mistake (mainly will be lacks the jpeg storehouse support).
- Modifying the webcam-server.c file of src directory, the following three statements must be moved to the beginning :
`struct RGB fg = DEF TEXT JG;`
`struct RGB bg = DEF TEXT_BG;`
`struct RGB trans = DEF TRANS;`
- Using the make command to compile, under the folder in the src generate a webcam-server executable.
- Copying the execution document to the bin directory of the board through using the way of u drive mounted:
`Mount/dev/sdal mnt`
`cd rntt`
`cp webcam_server /bin`
`cd/umount/mnt`

The source code of Camera surveillance interface is as follows, <http://202.193.74.230> refers to is the board IP address, we may according to actual need to adjust the actual size of the video screen (by changing the source code inside of the height and width).

```
<html>
<head>
```

```
<title> WebCam</title>
</head>
<br><br><br>
<p align= "center" ><APPLET CODE =
"WebCamApplet.clas" archive= "applet.jar" WIDTH =
"320" HEIGHT = "240" >
<param name=URL value= "http://202.193.74.230:8888" >
<param name= FPS value= "1" >
<param name=width value= "320" >
<param name=height value= "240" >
</APPLET>
<p align="right">
</body>
</html>
```

4.3. Monitoring Results: Finishing the designing of Html file, through u put the .html file and webcam_server\src\client of the applet.jar file to development board root file system under the/www directory. Finally, a host computer installed jre1.6.0 03; the purpose is to make the browser supports java [4]. In other parts of the browser, enter the computer IP address to access the board of intelligent home management interface, which the host is not at home, you can take this way to achieve home remote monitoring. The following Figure 2 is collected by remote monitoring (this Web on real-time displays another laboratory monitoring screen).

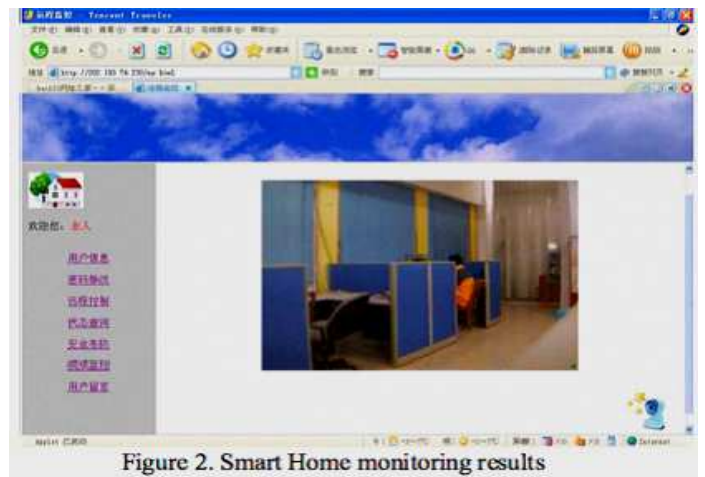


Figure 2. Smart Home monitoring results

5. CONCLUSION

Practice shows that the system successfully used embedded technology to build a low cost, stable, practical intelligent home control system. The system has the friendly interface, remote surveillance images smooth, clear and easy to operate, scalability. Meet the needs of different users, have the very high promoted values in the smart home market.



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