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Design of Embedded Media Player Based on Linux System

[1]Shi Hao-su and [2]Han Li-na
[1]School of Economics and Management, Northwest University of Politics and Law, Xi'an, 710063, China
[2]School of Information Engineering, XianYang Normal College, Xian Yang 712000, China

Abstract: Multimedia application is becoming more and more popular based on the ARM process in Linux embedded system, so designing a multi-functional player including audio and video function is very urgent. This study is focused on the design of embedded media player based on the Linux system. It selects the audio and video media library function and uses DMA control and LCD display technology to design multimedia player for fear of single function. In order to have a good graphical user interface it takes Qt to complete the function. With the audio and video data input/output, software decoding, technology using, the player achieve the play, pause, stop and other functions of media. At the same time the player has a good interface and a certain practical value.

Key words: Embedded media player, audio, video, DMA, IIS interface

INTRODUCTION

At present with the improvement of people's living standards, consumer electronics products in the market will be bigger and the development of embedded applications will become increasingly extensive. The products are audio and video with relatively complex processing. How to design suitable operating system applied to consumer electronic products? It has become primary concern for consumer electronic product development areas. Linux is a suitable open source operating system for embedded system it can be efficient to handle complex tasks.

This study introduced a kind of multimedia player application of embedded Linux method. Then studied the embedded Linux system and finally completed the embedded Linux operating system based on ARM equipment. This method can also be applied to other consumer electronic product design.

EMBEDDED MULTIMEDIA PLAYER SOFTWARE PLATFORM

Embedded operating system is not simple: It includes soft and hard resource allocation, scheduling, control and coordination of concurrent activities (Chen and Shi, 2006). It must embody the characteristics of their systems, be able to handle systems of certain modules in order to achieve the required functions. Embedded multimedia player software's main function is to receive and play the input file information and process data, to use S3C2410 built-in IIS audio interface. Then through the DMA data transmission programming on the input file playback and displaying in real time on the LCD screen, interface design beautiful, personalized display system, so users can easily operate the player. Therefore, system software platform consists of embedded operating system, graphics support system, application software and other parts. As shown in Fig. 1.

PLAYER PROGRAM DESIGN

It used IIS audio interface built-in S3C2410, through the DMA data transmission programming on input files, then the player are played.

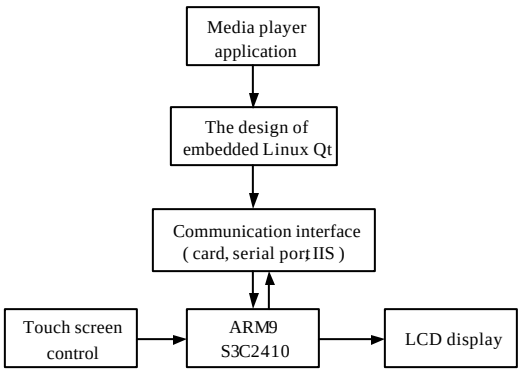

Fig. 1: Media player system

Corresponding Author: Han Li-Na, School of Information Engineering, XianYang Normal College, Xian Yang 712000, China

AUDIO AND VIDEO INTERFACE

IIS (I2S) is recently widely used digital audio bus protocol. In 2410 there is an integrated IIS controller. The main board IIS bus and Philips audio interface chip UDA1341TS complexes, an audio input/output circuit, can be used for audio signal recording and playback. The CON302 CON301 used for external microphone, earphone. IIS audio input/output interfaces as shown in Fig. 2.

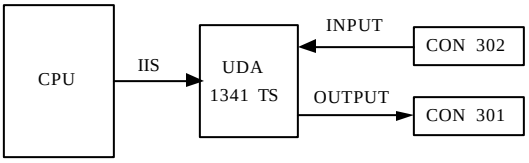

Fig. 2: IIS and audio input/output interfaces circuit schematic diagram

AUDIO AND VIDEO COMMUNICATION

DMA (Direct Memory Access) technology is a place of microprocessor memory and an external device or memory between the large volumes of data transmission method known as direct memory access method (Barr, 1999). In the computer system we know that a peripheral data read into memory or flash memory data farewell peripherals, Generally CPU executes a program to complete (Kim *et al*., 2008). But by using DMA technology, CPU cannot achieve peripherals and memory data transmitted directly. Compared to the CPU executive program, DMA direct data transmission rate is higher but this is not the main advantages of DMA technique. As compared to the CPU program execution speed, peripheral data transmission rate is often quite slow, also present in some high-end computer system, CPU reading and writing memory rate may be higher than that of DMA transfer rate. The main advantage of DMA is that it can automatically transmit task, when they need to put a large amount of data sent to the designated peripherals and memory. That is to say the peripheral sends a DMA request, DMA circuit suspend CPU operation and control the peripherals and memory for a pass and then let CPU continue program execution. This saves a lot of peripheral query time for CPU, thus improving the overall performance of the system. From this point of view it seems to be associated with microcomputer interrupt function. In fact, the vast amount of data and the data transmission rate are high, frequent interruptions will greatly reduce the performance efficiency of the system and data transmission rate is not high.

S3C2410 supports DMA 4 channel controller located between the system bus and a peripheral bus. Any way DMA controller cannot limit the system bus and/or a peripheral bus to transfer data between.

AUDIO AND VIDEO MEDIA LIBRARY FUNCTION

In the audio device driver design, DMA cache design and memory management is the most complex. Because the audio equipment has high real-time requirement, a reasonable use of memory can accelerate the audio data processing and reduce the time delay.

The Samsung BDMA controller does not have a built-in DMA storage area, the driver must allocate DMA buffer for audio equipment. Through DMA it can directly need to replay or recording voice data stored in the DMA kernel buffer zone (Samsung Electronics, 2002).

In order to facilitate various physical device using DMA resources, the procedures used in the struts s3c44b_DMA data structure management system of each DMA channel resource. Each DMA channel by a plurality of external devices is common, for each peripheral distribution of the DMA buffer size and number of possible inconsistencies, the allocation of all the data block using a DMA cache data block DMA_buf management. Various devices for data buffer to form a one-way linked list, each node contains a starting field, the actual DMA cache storing the start position of the physical address. In the apparatus a first when using DMA, use the mallow function DMA_buf memory allocation and the use of consistent_alloc function DMA distribution of continuous physical cache, then the node is inserted into the queue. From second time begin by buffer identifier to buffer operation.

Memory management is important to the cache block design. A common design is the use of a buffer, CPU first of the buffer and then hang on a cache operation, audio equipment, audio equipment after processing wake CPU, so the cycle. To deal with a large number of audio data, the audio device driver, you can use double buffering. The recording system using for example, cache 2 stored audio equipment to quantify the good sound, CPU (application) for processing cache 1 voice data; when the Codec equipment finished filling the cache 2 it moved to the 1 cache fill the data, while CPU to cache data in 2; alternating cycle.

Using this method could process audio data and improve the parallel capacity. Application in audio work while processing incoming audio data transmission.

The practical system is designed to support full duplex audio system, so allocation of memory must be input and output at the same time, the corresponding data structure design as shown in Fig. 3.

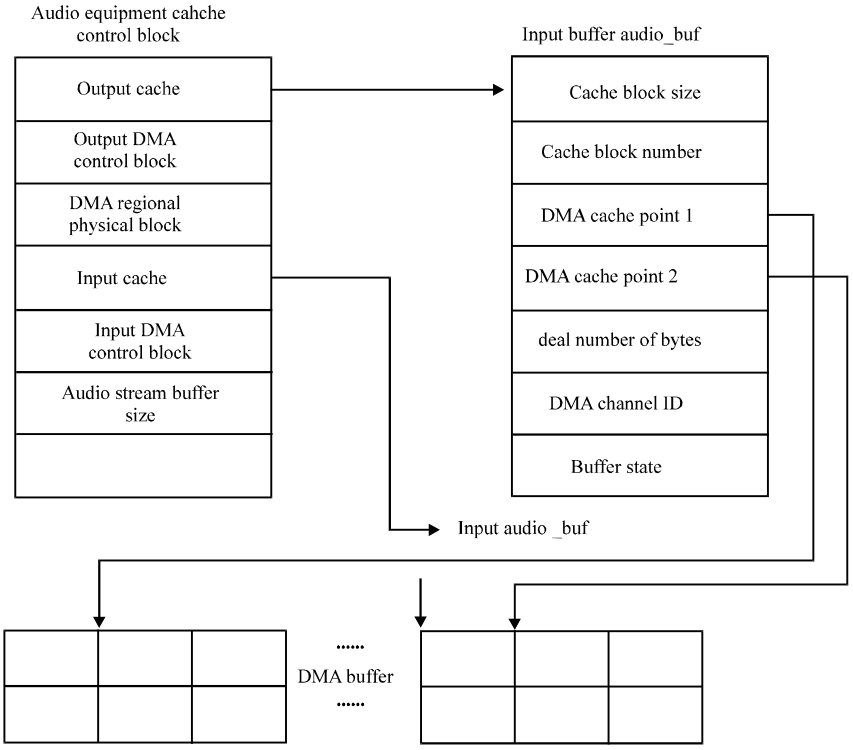

Fig. 3: Audio device to use the data structure

MUSIC FILES FORMAT AND EXECUTION

In the Windows environment, most of the multimedia file by a structure to store information, this structure is called resource interchange file format (resources interchange file format, RIFF) (Ma *et al*., 2003). For example, voice WAV file, video AVI file and so on are all derived from this structure. RIFF can be viewed as a tree structure, the basic unit for the chunk, like the tree nodes in the structure, each chunk by" code discrimination"," data size" and" data". Identify code consists of 4 ASCII codes, data size is shown followed by the length of the data (unit: Byte) and the size of the data itself can use up to 4 Byte, so that the last chunk length is data size 8. In general, the chunk itself does not allow internal contain chunk but there are two exceptions, respectively with “RIFF" and" LIST" to identify the code chunk. And in the light of this two kinds of chunk, RIFF and from the original "data" cut out 4 Byte. The 4 Byte is called" format code discrimination", however RIFF also provides file can have only one" RIFF" to identify the code chunk. As long as it is to follow the structure of the document, we are called the RIFF document. This structure provides a systematic classification. If the MS-DOS file system for comparison," RIFF" chunk is like a disk root directory its format code discrimination is the hard disk logical code (C: or D:) and" LIST" chunk its subsidiary directory, other chunk is the general file. As for the processing of the RIFF file, Microsoft provides a correlation function. Windows under a variety of multimedia file format as in a disk provided only can put what directory, the directory can only put the data.

- Music file operation steps include three parts:

- Read the wav file data using the code
- The sound file" 1.wav" downloaded to the development board
- Insert earphone platform" PHONES" Jack, or adjust the volume potentiometer to the proper position and using onboard speaker pronunciation, debugging procedures, can hear the music

- Hardware interface register control process as shown in Fig. 4.

The embedded multimedia player is achieved in the Linux playback audio, video files (Yang *et al*., 2005). In order to watch a video file

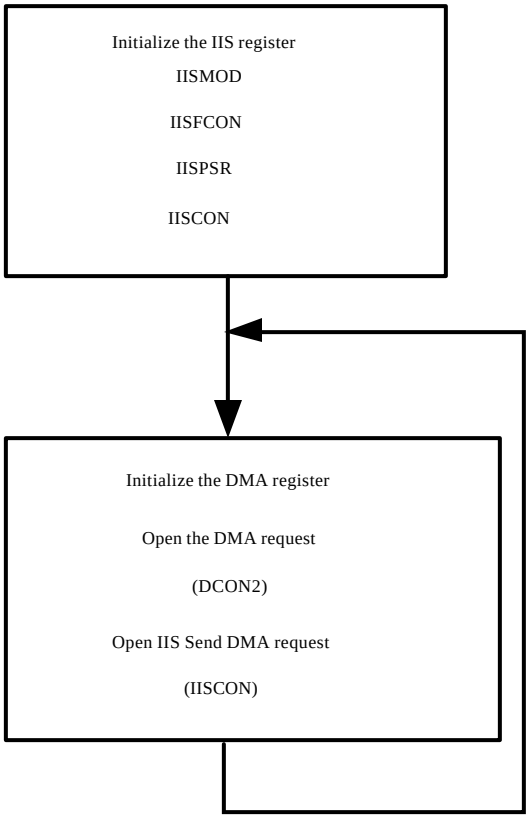

Fig. 4: Flow chart of register control

for ordinary users through the LCD screen and through the touch screen to achieve human-computer interaction.

CONCLUSION

The embedded multimedia player is designed based on ARM S3C2410 hardware platform and the use of Linux embedded real time system, at the same time application software testing at S3C2410 development board. Using LCD display technology, video display, the effect is very clear and smooth. The software using the standard library function has the very good platform independence, easily ported to other platforms, easy application extension.

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