Video Capture System Based on PXA270 Platform

QingLi Yang, Patent Examination Cooperation Center of The Patent Office–SIPO, China

ABSTRACT

In this paper, the author introduces a video capture system based on embedded Linux PXA270 platform. First, the paper briefly introduces PXA270 platform. The author then describes implementation of video capture on the platform. The system captures a real-time video stream by USB camera and designs video program by Video 4 Linux APIs. The paper particularly presents the method and process of realizing video data capture, as well as how to implement the application to target board.

Keywords: Embedded Linux System, PXA270 Platform, Video Capture, Video Capture System, Video4Linux

1. INTRODUCTION

An embedded system is a computer system designed for specific control functions within a larger system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today. Embedded systems contain processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task.

Embedded systems span all aspects of modern life and there are many examples of their use. Telecommunications systems employ numerous embedded systems from telephone switches for the network to mobile phones at the end-user. Consumer electronics include personal digital assistants (PDAs), mp3 players, mobile phones, videogame consoles, digital cameras, DVD players, GPS receivers, and printers (Haibo, Yang, & Gui, 2007).

The XScale, a microprocessor core, is Intel’s and Marvell’s implementation of the ARMv5 architecture, and consists of several distinct families: IXP, IXC, IOP, PXA, and CE. XScale microprocessors can be found in products such as the popular RIM BlackBerry handheld, the Dell Axim family of Pocket PCs, most of the Zire, Treo and Tungsten Handheld lines by Palm, later versions of the Sharp Zaurus, the Motorola A780, the Acer n50, the Compaq iPaq 3900 series and many other PDAs (Hou, 2009).

DOI: 10.4018/japuc.2012010104
2. PXA270 PLATFORM INTRODUCTION

The PXA270 processor is the first Intel XScale technology-based processor to include Intel Wireless MMX technology. This enables high-performance multimedia acceleration with an industry proven instruction set. Enabled by Intel Quick Capture technology, the PXA270 provides one of the industry’s most flexible and powerful camera interfaces for capturing digital images and video (Lin, Liu, Xiong, Wang, & Zhang, 2007).

A set of serial devices and general-system resources offers computational and connectivity capability for a variety of applications. Figure 1 shows the development platform of PXA270 processor.

The paper introduces a video data capture system based on PXA270 platform.

3. VIDEO CAPTURE SYSTEM

In Linux, device driver to the application details of shielding concrete implementation of hardware, so the application can operate like a normal file to operate as an external device. In Linux, the normal use of video capture device relies on the support of Video4Linux standards (Liao, Zhang, Peng, & Li, 2010).

Video4Linux (referred to as the V4L) is a Linux kernel on the video device driver that is for video equipment to provide a series of application programming interface functions, these video devices including TV cards, video capture card and USB cameras. The general process of video capture is:

1. Open the video device;
2. Read the device information;
3. Video capture;
4. On the acquisition of video data processing and display;
5. Off the video equipment.

Video capture comes from two methods:

1. Read directly from the device;
2. Memory map.

The system uses the second method for video acquisition, and the advantage is when using memory mapping, the direct use of mmap() system call allows processes by mapping a regular file with the shared memory.

Common file address space is mapped to the process, the process can access the common memory, the same as the file access, do not have to call read(), write() and other operations. The use of shared memory communication is an obvious advantage is efficiency, because the process can read and write memory directly without any data copies.

Using memory-mapped portion of video capture source code is as follows:

1. call VIDIOCGBUF information for mapping the buffer ioctl (vd-> fd, VIDIOCGBUF, & (vd -> mbuf))
2. to mmap with video_mbuf bound int v4l_mmap_init (v4l_Device * vd) {if (v4l_get_mbuf (vd); map = mmap (0, vd-> mbuf.size, Port_READ | PORT_WRITE, MAP_SHARED, vd-> fd))}
3. pre-set for image capture int v4l_grab_init (v4l_device * vd) {vd-> mmap.width = 640; / / set the image window vd-> mmap.height = 480; / / window size is 640 × 480 vd-> mmap.format = VEDIO_PALETTE_YUV420P; / / sample format for YUV420P ; ...}
4. start a call interception VIDIOCMCAPTURE ioctl (vd-> fd, VIDIOCMCAPTURE, & (vd-> mmap));
5. call to wait for an interception VIDIOSYNC end

If (ioctl (vd-> fd, VIDIOSYNC, & frame) the function returns successfully, said an acquisition has been completed, the collected
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