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Design of Embedded Real Time Video Monitoring System Based on ARM11 Processor.


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Abstract: ***In this paper, Embedded Real time video monitoring system based on ARM is designed, in which the embedded chip and the programming techniques are adopted. The central monitor which adopts ARM chip as controller is the core of the whole system. First, USB camera video data are collected by the embedded Linux system, processed, compressed and transferred by the processing chip. Then, video data are sent to the monitor client by wireless network. Tests show the presented wireless video surveillance system is reliable and stable. And it has a perfect application prospects with real - time monitor.***

Keywords: ***Video Capture, Video Compression, video streaming, server, Embedded Linux***

INTRODUCTION

Remote monitoring is applicable in a wide range of industries like the oil and gas industry pharmaceutical, food and beverage, electricity transmission and distribution, rail networks. Depending on the geography and the regulations involved in a particular industry segment, there has already been an investment in this area. In achieving these standards, remote monitoring plays a vital role enabling organizations to achieve the aforementioned benefits.

High functionality and interactivity of video services are strongly desired. Earlier reports have presented an encoding scheme and a fast joining scheme for interactive multi vision video streaming systems. Together, they enable numerous users to access any view area interactively at any desired resolution. The joining means the combination of multiple streams into a single video stream. The server our system describes details of a developed streaming server based on the proposed stream joiner. The core of the development is the joiner module that is incorporated into the server process, and which operates with them to satisfy client requests.

Block Diagram:

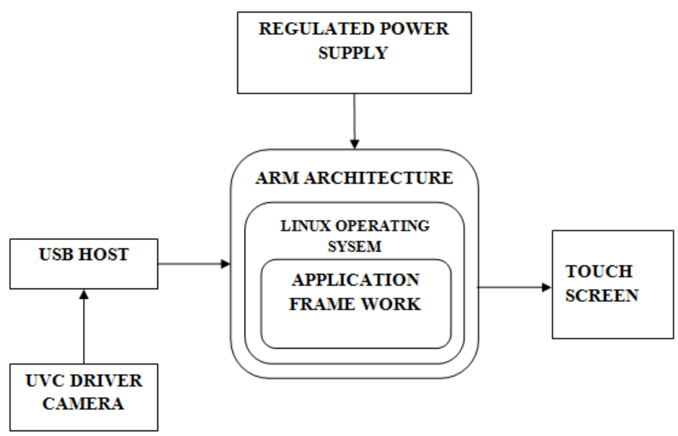

Figure 1: block diagram of a project

PROPOSED METHOD:

High functionality and interactivity of video services are strongly desired. Earlier reports have presented an encoding scheme and a fast joining scheme for interactive multivision video streaming systems. Together, they enable numerous users to access any view area interactively at any desired resolution. The joining means the combination of multiple

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streams into a single video stream. The server joins pre-encoded multiple streams into one bit stream according to a user request; then the server transmits it simultaneously to many clients. This structure obviates complexity at the client terminal because the client terminal simply receives and decodes the single stream. This paper describes implementation of an actual streaming server by embedding the stream joiner module into a widely available server. The contribution of this paper is that the joining speed of the server surpasses the necessary speed attained with practical network equipment connecting to the server. Results of experiments described in this paper underscore the proposed method's effectiveness.

Our system describes details of a developed streaming server based on the proposed stream joiner. The core of the development is the joiner module that is incorporated into the server process, and which operates with them to satisfy client requests.

ARCHITECTURE OF ARM PROCESSOR:

ARM is a 32-bit RISC processor architecture developed by the ARM corporation. ARM processors possess a unique combination of features that makes ARM the most popular embedded architecture today. First, ARM cores are very simple compared to most other general-purpose processors, which means that they can be manufactured using a comparatively small number of transistors, leaving plenty of space on the chip for application specific macro cells. A typical ARM chip can contain several peripheral controllers, a digital signal processor, and some amount of on-chip memory, along with an ARM core. Second, both ARM ISA and pipeline design are aimed at minimising energy consumption — a critical requirement in mobile embedded systems.

Third, the ARM architecture is highly modular: the only mandatory component of an ARM processor is the integer pipeline; all other components, including caches, MMU, floating point and other co-processors are optional, which gives a lot of flexibility in building application-specific ARM-based processors. Finally, while being small and low-power, ARM processors provide high performance for embedded applications.

For example, the PXA255 XScale processor running at 400MHz provides performance comparable to Pentium 2 at 300MHz, while using fifty times less energy.

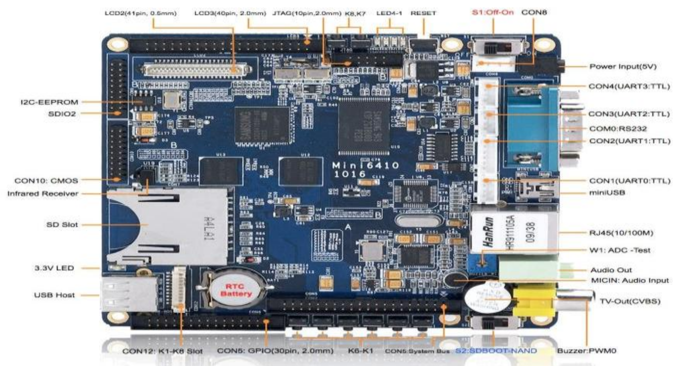
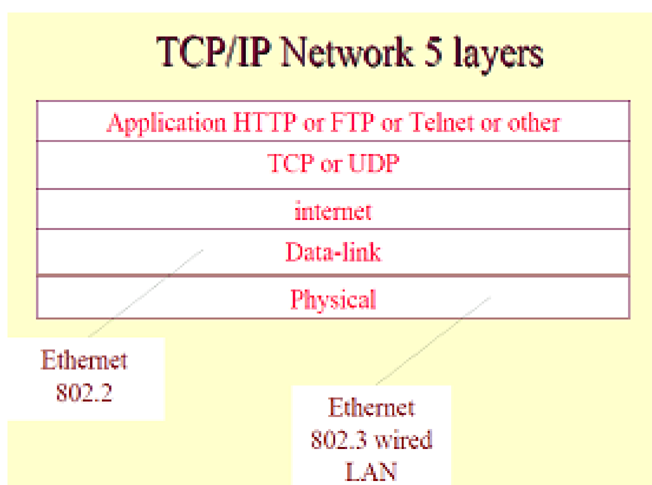


Figure 2: architecture of a ARM processor

HARDWARE IMLPIMENTATION

Ethernet LAN Features:

• Bus topology, Wired LAN in IEEE 802.3 physical layer standard
• 10 Mbps, 100 Mbps (Unshielded and Shielded wires) and 4 Gbps (in twisted pair wiring mode)
• Broadcast medium─ Passive, Wired connections based.
• Frame format like the IEEE 802.2
• SNMP (Simple Network Management Protocol) Open system (therefore allows equipment of different specifications)
• Each one connected to a common communication channel in the network listens and if the channel is idle then transmits. If not idle, waits and tries again.
• Multi access is like in a Packet switched network



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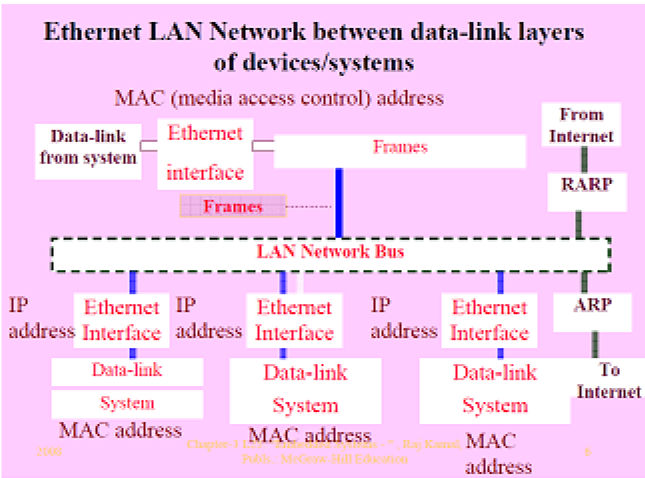

Figure 3: Ethernet (TCP/IP protocol)

UVC CAMERA

A UVC (or Universal Video Class) driver is a USB-category driver. A driver enables a device, such as your webcam, to communicate with your computer's operating system. And USB (or Universal Serial Bus) is a common type of connection that allows for high-speed data transfer. Devices that are equipped with a UVC driver, such as the Logitech® QuickCam® Pro 9000 for Business, are capable of streaming video. In other words, with a UVC driver, you can simply plug your webcam into your computer and it'll be ready to use. It is the UVC driver that enables the webcam to be plug and play. A webcam with a UVC driver does not need any additional software to work. Once you plug your webcam in, it can work with a video-calling application, such as Skype®, Windows Live Messenger®, or Microsoft Office® Communicator.

WORKING PRINCIPLE

In this project, we are giving the complete description on the proposed system architecture. Here we are using Raspberry Pi board as our platform. It has an ARM-11 SOC with integrated peripherals like USB, Ethernet and serial etc. On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on XServer, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. The Raspberry Pi board equipped with the above software stack is connected to the outside network and a camera is connected to the Raspberry Pi through USB bus.

The architecture of the web server has the following layers.

- In the lower level the web server has the physical hosting interfaces used for storing and maintaining the data related to the server.
- Above the Physical hosting interface the server has HTTP server software and other web server components for bypass the direct interaction with the physical interaction with the lower levels.
- The final layer has the tools and services for interacting with the video streams which includes the Image codec and storing interfaces, connection managers and session control interfaces etc.

After connecting all the devices power up the device. When the device starts booting from flash, it first load the linux to the device and initialize all the drivers and the core kernel. After initialization of the kernel it first check weather all the devices are working properly or not. After that it loads the file system and start the startup scripts for running necessary processes and daemons. Finally it starts the main application. When our application starts running it first check all the devices and resources which it needs are available or not. After that it check the connection with the devices and gives control to the user.

Results:


Figure 4: hardware device connection

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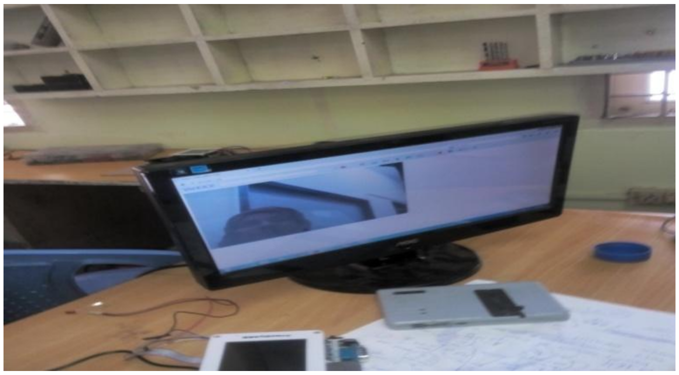

Figure 5: video monitoring and controlling using Ethernet

FUTURE SCOPE:

• The cost of ARM9 is more that's why in future we can implement this system using ARM11, Beagle bone etc as well as updated processors with high frequencies will work fine.
• As the storage space is also less in future we can also record these live streaming data by connecting external memory storage.
• We can complete our project using wireless technology.
• In future we can provide more security to data by using encryption, decryption techniques.

CONCLUSION:

The project "DESIGN OF EMBEDDED SYSTEM FOR REAL TIME VIDEO MONITORING BASE ON ARM 11 PROCESSOR" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM11 board and with the help of growing technology the project has been successfully implemented.

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