DESIGN AND IMPLEMENTATION OF AN ANCRCHITECTURE OF EMBEDDED WEB SERVER FOR WIRELESS SENSOR NETWORK

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Abstract

In this paper, the embedded web server, by means of ARM9-S3C2440 processor as core, its operating system is Linux, and the system hardware architecture is obtainable. We present the principles and to plan a system for Internet-based data-acquisition system and control by using Advanced RISC Machine (ARM9) processor and in-build web server application. Client can observe and control remote temperature and video information. The platform used is Linux and ARM 9 processed. The embedded web server technology is the amalgamation of embedded device and Internet technology, which provide a flexible remote device monitor and management function base on an Internet browser and it has turn into an superior development trend of embedded technology and realize an embedded web server, which enable data acquisition and status monitor with the assist of any standard web browser. This embedded web server user can right of entry their equipment remotely. The embedded web server plan includes a total web server with TCP/IP support and Ethernet interface. It consists of application programs written in C-programming in LINUX for accessing data through the serial port and updating the web page, porting of Linux Kernel with application program on ARM9 board. Then the procedure of the Linux operating system being transplanted on ARM is introduced. Enterprise users can work together more flexibly and cost-effectively with business and trading partners. The server enable Web access to distributed measurement/control systems and provide optimization for educational laboratories, instrumentation, Industrial and home automation. The proposed system eliminates the need for server software and preservation and minimize the operational costs while operating with a big amount of data. The big benefit of this web server is embedding a PC based web server into the ARM platform without losing any of its features.

Key Words: *Code Vision AVR C Compiler, ARM-LINUX-GCC Compiler, LINUX KERNEL, ARM9 Processor, Embedded Web Server, XBEE Modules.*

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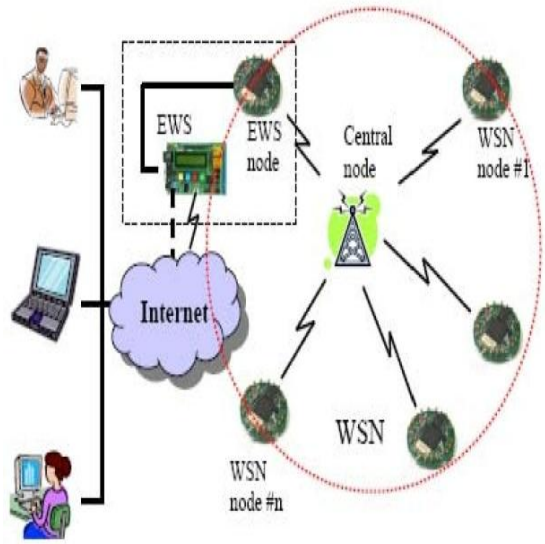
1. INTRODUCTION

A web server is a system which hosts a web site and provides services for any requesting clients. This paper introduces a solution for embedded system access to the Internet, through which we can remotely access, monitor, maintain conveniently. The solution is based on Web and embedded technology. Its core is S3C2440 processor on which they're embedded Web server in an ARM Linux platform. Its operating system is scissor-able, transplant-able Linux system. General web servers, which were developed for general-purpose computers such as servers or Unix and Linux workstations, typically require megabytes of memory, a fast processor, a preventative multitasking operating system, and other resources [1].

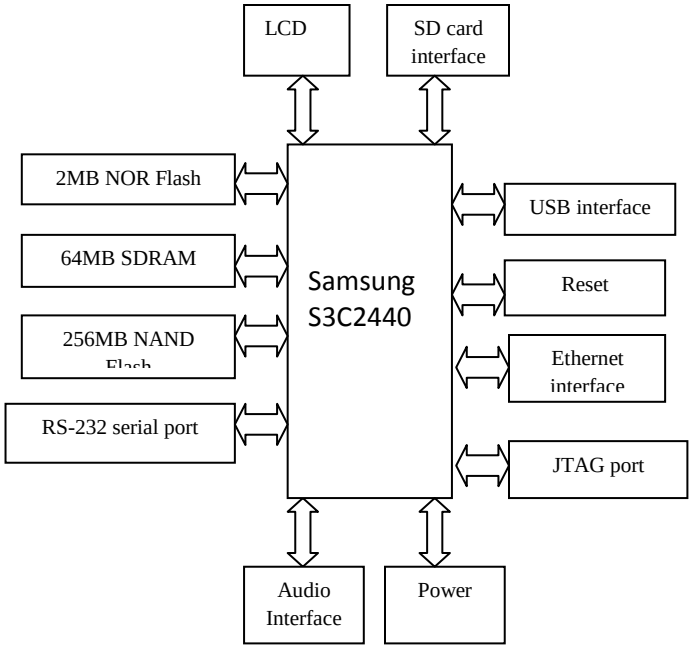


The general block diagram of a web enabled WSN

A webserver in the device provides access to the user interface functions for the device through a device web page A web server can be embedded in a device to provide remote access to the device from a web browser. The embedded system can be utilize to serve the embedded web documents, including static and dynamic information about embedded systems, to web browsers. A webserver can be embedded into any appliance and linked to the Internet so the appliance can be monitor and controlled from remote places through the browser in a desktop. This brings in a need for web services being deployed on a variety of embedded processors such as Advanced RISC Machine (ARM) in a real time context. Usage of Linux as the operating system brings the advantage of performance, reliability, availability and support from large developing community. High performance ARM Processor further enhance the quality of features obtainable by the web server [2]. This type of web server is called an Embedded Web Server. An embedded web server is a microcontroller that contain an Internet software suite as well as application code for monitoring and controlling systems. Embedded web servers are integral part of an embedded network and paves way for faster time to market products. Embedded web server refers to import Web Server at the scene the monitor and control equipment, in the support of appropriate hardware platforms and software systems, transfer traditional monitor and control equipment into an internet based, possessed with TCP/IP protocol as the underlying communication protocol and Web server technology as its core. General web servers, which were developed for general purpose computers such as NT servers or Unix and Linux Workstations, typically require megabytes of memory, a fast processor, a preemptive multitasking operating system, and other resources. A Web server can be embedded in a device to provide remote access to the device from a Web browser if the resource requirements of the Web server are reduced. The end result of this reduction is typically a portable set of code that can run on embedded systems with limited computing resources. The embedded system can be utilized to serve the embedded web documents, including static and dynamic information about embedded systems, to Web browsers [6].

2. DESIGN OF THE HARDWARE SYSTEM:

S3C2440AL processor is used as the core of the hardware platform in this paper. The Figure shows block diagram of hardware system. Include: serial port, Ethernet interface, JTAG port, storage systems and so on. The frequency Samsung S3C2440AL is 400MHz and can up to 533MHz in the maximum. According to its mode of internal circuit. 12MHz chosen for the crystal. JTAG (Joint Test Action Group) is an international test protocol standard, software simulation, single-step debug and u-boot download can be carried out through the JTAG port, it's a simple and efficient means of developing and debugging embedded systems.

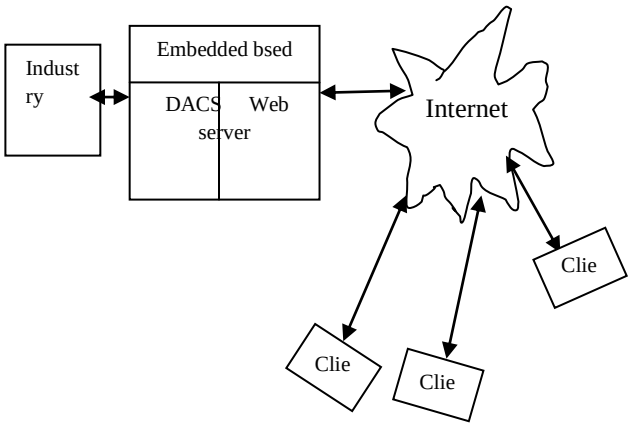


Block diagram of hardware system

The SDRAM capacity in the system is 64MB, working voltage is 3.3V, the data bus is 32bit, clock frequency up to 100MHz , Auto-Refresh and Self-Refresh are both supported. For supporting boot loader in the NAND Flash a buffer named Steppingstone is equipped in SDRAM. When the system starts, the first 4Kbyte content in NAND Flash is loaded to the Steppingstone and be executed. When Startup code, the contents of the NAND Flash are copied to the SDRAM in general. The data in NAND Flash are checked when ECC is used. The main program will be executed on the SDRAM based on the completion of copy. S3C2440AL UART provides three serial I/O each port can operate on interrupt or DMA mode. The UART can support a maximum baud rate of 115.2Kbps when using the system clock. Each UART channel of the receiver and transmitter includes two 64-bit FIFO. The LCD interface of S3C2440Al has integrated 4-wire resistive touch screen interface which can be directly connected to four wire resistive touchscreen.

3. EMBEDDED WEB SERVER ARCHITECTURE:

An embedded web server is an ARM processor that contains an internet software suite as well as application code for monitoring and controlling machines/systems. Embedded web servers are integral part of an embedded network. The Fig Shows the proposed concept of DACS with embedded web server on a single chip module. This is a single hardware it contains RTOS portable ARM processor. ARM processor is the responsible part of measuring signals and controlling the devices remotely [9].



Measurements can be done by DACS mode and the data are shared with clients through an embedded web server by embedded web server mode. The real time operating system manages all the tasks such as measuring signals, conversion of signals, data base up-dating, sending HTMLpagesandconnecting/communicating with new users etc., The RTOS manages all the required tasks in parallel and in small amounts of time. Web based management user interfaces using embedded web server have many advantages: ubiquity, user friendly, low-development cost and high maintainability. Embedded web server has different requirements, such as low resource usage, high reliability, security, portability and controllability for which general web server technologies are unsuitable. . A. Establishing a Direct Communication Link between the Client and the Embedded Device: The use of GPRS is well known to everybody and almost all service providers on GSM are giving this service. GSM and GPRS are developed for cellular mobile communication. Hence it is very much easy to be getting connected to the Internet world. Once a GPRS connection has been established queried data can be relayed to the client via a central server. Using a central server to relay the acquired data has some disadvantages. First, a central server needs a client interface framework. An additional data transfer corresponds to time delays before the data are made available to the client. In addition, since the server acts as a relay, no direct bidirectional communication between the client and the embedded system can be established. This makes the system unsuitable for real-time control applications. The basic idea behind real-time processing is that the embedded system is expected to respond to the queries in time. Real time should be fast enough in the context in which the system is operating and reliable as well. Real-time system correctness depends not only on the correctness of the logical result of the computation but also on the result delivery time. This method also increases the data transfer cost as the number of clients increases due to the excess amount of data transfers via GPRS. Direct communication, on the other hand, enables access to only relevant information in the embedded system by preprocessing the data. The embedded system should also handle the web services. This eliminates the need for a central server and reduces the amount of data sent from the remote unit since only the queried data will be transferred. In the proposed system, the GPRS architecture and protocols are compliant with this system is configured to be virtually online at all times in a GSM network.

4. THE TRANSPLANT OF LINUX KERNEL:

Linux is used as operating system because Linux system is a hierarchical structure and completely open it's kernel source, the important feature of Linux is portability to support a wide range of hardware platforms, can run in most of the architecture. Contains a comprehensive set of editing, debugging and other development tools, graphical interface, a powerful network supporting and rich applications. In addition, the kernel can be reduced by configuring [5]. Transplantation include the following sections :

1) Kernel configure. Make menuconfig is used to configure the Linux kernel. Support TCP/IP protocol in the Networking options, Add Network device support option in the Device Drivers, and select DM9000 support in Ethernet (10 or 100Mbit).
2) Modify the corresponding kernel code
3) Connect script.
4) Mount the file system.
5) Driver transplantation (USB device driver migration, LCD driver transplantation, etc.).

Existing Work: The use of single chip Data acquisition system (DAS) method in Industrial automation, Instrumentation and process control application is not only limited in processing capacity and also the problem of poor real time and reliability. General web server require more resources and huge amount of memories. This system can only measure the remote signals and it cannot be used to control the process.

Proposed Work: Limited processing capacity and the problem of poor real time and reliability of DAS system has been overcome by the replacement of embedded ARM processor for a single chip method to understand data acquisition and control (DACS) for Industrial automation. This DACS system can measure remote signals and control the remote devices through reliable protocols and communication network. This system uses Embedded Linux Multitasking operating system to measure and control the entire process. And the embedded web server mode requires less resource usage, high reliability, security, controllability and portability.

CONCLUSIONS

With the fast improvement of the field of industrial process control and the broad range of application of network, intelligence, digital distributed control System, it is essential to make a higher order of the data accuracy and reliability of

the control system. This embedded ARM system can make known yourself to the strict requirements of the data acquisition and control system such as the function, reliability, cost, size, power consumption, and remote access and so on. Embedded web server mode is used to share the data with clients in online. Both modes are professionally carried out by real time multitasking operating system (Embedded Linux). This system can be extensively applied to electric power, petroleum, chemical, metallurgy, steel, transportation, Electronic & Electrical industries, Automobiles and so on. In this paper, ARM and embedded Linux OS are used as hardware and software platform. The embedded web server that has been designed can be used with industrial equipments medical instruments, and in many other places. An administrator can monitor and control the equipments with a simple but improved and more powerful user interface without additional hardware. Software argument and architectures can significantly affect web server performance. Poorly designed and configured software architectures strength even generate high response times while the physical resources display low operation. A remote client only require a common internet browser to hold out experiments on real hardware .

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