Real Time Embedded Web Server Based LED's Control using ARM Processor and Ethernet

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ABSTRACT

This paper presents a design and realization method for led control system through ethernet based on embedded linux.The terminal hardware design using ARM9 S3C2440 processor for centralization virtue of SDRAM, NAND Flash, Ethernet, USB module etc.Software system adopts the embedded linux.The main function realized by C programming to achieve real time status of system. The result shows the real time status and control of pulsating led's on different pulse rate.

Keywords-Ethernet, embedded linux, S3C2440, embedded webserver,boa.

I INTRODUCTION

Emerging technologies in Embedded and Networking together enable people to be connected to communicate and interact so as to make them to move isolated and alone even remotely. In numerous developments, people work on completely web-based configuration and services for embedded system. Embedded Internet integration for remote maintenance and diagnostic as well as mobile to mobile communication is growing with considerable speed rate. Everything in the environment will be connected often wirelessly and forced common people to think of communication, control and monitor in entirely new ways. Networking provides services on demand to people wherever they are whereas embedded systems provides minimal components devices to access these services to provide cost-effective solutions.Web-based technology is useful in browsing the data worldwide. The size minimization of embedded controller and inbuilt features increased capabilities to offer new rise (great) in remote communication and interactive information transfer. Thus gaining the benefits as reduction in cost, maintenance, high speed performance, security and remotely access.

The web-data is accessed by giving IP address of Particular web-site. The function of web-server is to serve web-pages which are loaded into standard web-browser. Web-server is H/W and S/W program helps to execute web-pages via internet to the user using HTTP. Embedded web server (EWS) mainly deals with management of dynamic contents and is fast, compact, simple to use.EWS design includes a complete webserver with TCP/IP support ,running different OS, memory ,application wise. Several EWS based systems are designed [3] for automation and monitoring purpose. Data transmission system [5] is presented using with ARM processor. Recent work[4] on EWS enables user to monitor and control remote temperature and video information.EWS with standard web-browser access data and update WebPages using ARM processor. A real time video performance and interaction is given in[7] which is applicable to online education and live broadcasting.

The goal of this paper is to put electronic design, using EWS with ethernet interface, so as to allow access real time data monitor as well as control that data irrespective of location and platform without any dedicated server PC or even special S/W.

II.SYSTEM ARCHITECTURE

The overall system architecture is shown in fig.1

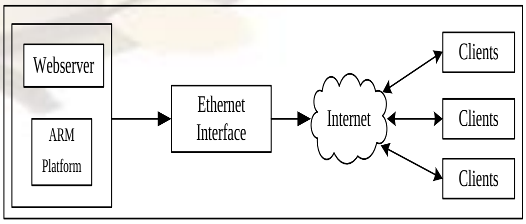


Fig1.Embedded Webserver

A. Hardware Diagram of System

The design principle of the hardware such as shown in figure 2

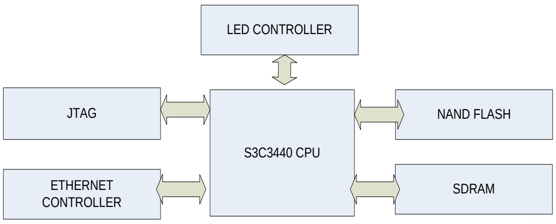


Fig 2 shows hardware architechture

Hardware Diagram of the System consist of the SAMSUNG's S3C2440 Hardware of the system takes advantages of the techniques of SAMSUNG's S3C24lOX 16/32-bit RISC microprocessor. This microprocessor is designed to provide hand-held devices and general applications with costeffective, low-power, and high-performance micro-controller solution in small die size. To reduce total system cost, the S3C2410X includes the following components separate 16KB Instruction and 16KB Data Cache, MMU to handle virtual memory management,LCD Controller (STN & TFT),NAND Flash Boot Loader, System Manager (chip select logic and SDRAM Controller), 3-ch UART, 4-ch DMA, 4-ch Timers with PWM, 110 Ports, RTC, 8-ch l0-bit ADC and Touch Screen Interface, IIC-BUS Interface, IIS-BUS Interface, USB Host, USB Device, SD Host & Multi-Media.K9F1208 of Samsung NAND flash production of the high-capacity, highly reliable Flash memory. Storage systems used for the start-up code, the kernel code and root file systems. RAM is two HYS7VS61620 of a total of 64 MByte SDARM for the linux operating system and a network connection. The H/W structure of the system is shown in fig.2 Typical system consists of three components; embedded system used in proposed work with S3C2440 processor as core of H/W. The MINI 2440 is an efficient ARM9 development board with a it simple method and high performance price ratio in a small form-factor, The S3C2440 features an ARM920T core, a 16/32-bit RISC microprocessor, to provide hand-held devices and general applications with cost effective, low-power micro-controller solution Friendly ARM.

B. Embedded Toolchains

Installlation of cross compilation as follows copy the arm-linux-gcc-4.4.3.tgz to directory such as "/tmp", then go to the directory, extract using the execution command:

```
#cd /tmp
#tar xvzf arm-linux-gcc-4.4.3.tgz –C /
```

Execute the command, will install arm-linux-gcc to "/usr/local/arm/4.4.3" directory

Add the path to the compiler environment variables of the system to run commands.

```
#gedit /root/.bashrc
```

Edit "/root/.bashrc" file, add last line:

```
export
PATH=$PATH:/opt/FriendlyARM/toolschain/4.4.3
/bin
```

save and exit the editor

For checking successfully installation of cross compiler to be check by using command

```
Arm-linux-gcc –v
#cd /opt/ARM/mini2440
#tar xvzf /tmp/linux/linux-2.6.32.2-mini2440-
20100106.tar.gz
```

Will create a generation linux-2.6.32.2 directory, which contains a complete Linux 2.6.32.2 kernel source code

Extracting file system

```
#cd /opt/FriendlyARM/mini2440
#tar xvzf /tmp/linux/rootfs_qtopia_qt4-
20100816.tar.gz
```

Embedded operation system Linux 2.6.32 kernel with S3C2440 is promised to be little cores,cut,opened sound code,network support and easy migration. Due to embedded system hardware resource is finite, in order to store the whole linux operating system

into Flash,so it is necessary to custom system such as modifying linux kernel, disposing linux kernel, using embedded C library and embedded shell. It is easy to modifying linux kernel because of dynamic module loading method of linux.ln this design operation system is armlinux and software developing of embedded system uses the crosscompiling method[3].

C. Boa webserver

Boa is a single-tasking HTTP server. That means that unlike traditional web servers, it does not fork for each incoming connection, nor does it fork many copies of itself to handle multiple connections. It internally multiplexes all of the ongoing HTTP connections, and forks only for CGI programs (which must be separate processes), automatic directory generation, and automatic file gunzipping. Preliminary tests show Boa is capable of handling several thousand hits per second on a 300 MHz Pentium and dozens of hits per second on a lowly 20 MHz 386/SX.The primary design goals of Boa are speed and security. Security, in the sense of "can't be subverted by a malicious user," not "fine grained access control and encrypted communications". Boa is not intended as a feature-packed server;. Modifications to Boa that improve its speed, security, robustness, and portability, are eagerly sought. Other features may be added if they can be achieved without hurting the primary goals Boa webserver add in rootfs file system and configure the boa.conf file for mentioning server and index.html path

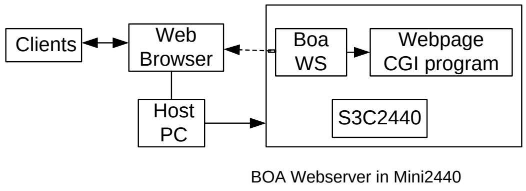


Fig 3 Boa webserver architecture

The H/W structure of the system is shown in fig.2 Typical system consists of three components; embedded system used in proposed work with S3C2440 processor as core of H/W. The MINI 2440 is an efficient ARM9 development board with a it simple method and high performance price ratio in a small form-factor, The S3C2440 features an ARM920T core, a 16/32-bit RISC microprocessor, to provide hand-held devices and general applications with cost effective, low-**power** micro-controller solution Friendly ARM Mini 2440 SBC with 400 MHz Samsung S3C2440 ARM9 processor,

The machine on which the development is done is an x86 machine and is called as the host. The ARM for which development is going on is referred to as the target connected by RJ-45 Ethernet connection. These two connections fulfil separate needs. The target's boot loader as well as kernel sends it output to the serial port usually at /dev/ttySX. Now this has been connected to the serial port of the host maybe a /dev/ttySX or /dev/ttyUSBX. Thus all the activity starting from boot sequence to the kernel and finally the shell is output on the serial port of the target. On the host a utility such as minicom or picocom can be run to capture that activity, thus enabling us to work on target's embedded linux system directly from host

II.CONFIGURATION OF EMBEDDED WEBSERVER.

A.Basic Description chooses linux minimum S/W installation is required which includes basics such as console tty,serial port,kernel ,bootloader ViVi.The running kernel is around 1MB of code built into flash memory.

The user interface is developed using CGI programming with BOA server running on MiniS3C2440 board.

Fig

The client can access web-pages stored at board side through web-browser and BOA webserver.

A client interface i.e direct link establishment done by CGI and BASH script files executed on embedded board. web-browser and webserver.The code is compiled into CGI format to be installed in the Embedded board through a cross compiler platform. BASH scripts are triggered by application.

When home button is clicked, all parameter will be shown at the resulting webpage and when click on particular button like “pulse”, “high” and “ok” button is pushed, according board parameters get changed and host computer execute programme QUERY-RESULT.C displays time delay.whereas web browser shows next page as “BACK”. After pressing BACK button ,webbrowser again come back to controller home Page and displaying it.The source code of Led-control is in Led-control.C.Flow chart of led control shown in fig.4

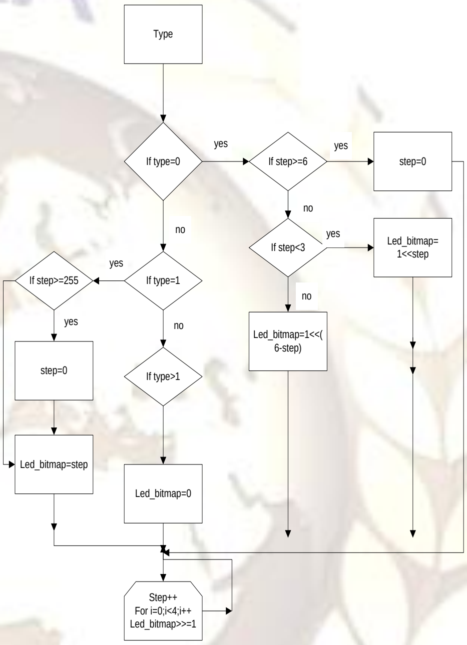


Fig 4 pulsating leds flow chart

III.TEST RESULTS.

All the outputs are shown as follows

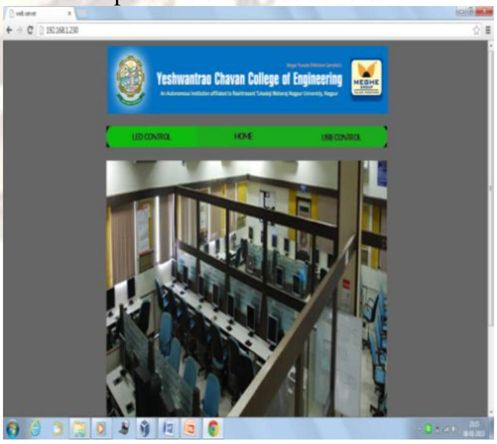
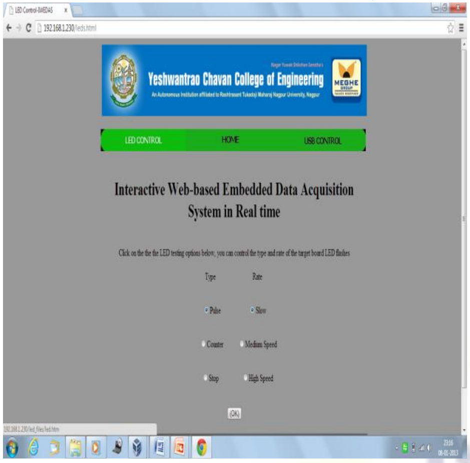

web server
192.168.1.230
Yeshwantrao Chavan College of Engineering
An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
MEGHE GROUP
LED CONTROL
HOME
USB CONTROL

Fig 5 shows the index.htm page


LED Control-IWEDAS
192.168.1.230/leds.html
Yeshwantrao Chavan College of Engineering
An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
MEGHE GROUP
LED CONTROL
HOME
USB CONTROL
192.168.1.230/led_files/led.htm
23:16
08-01-2013

Interactive Web-based Embedded Data Acquisition System in Real time

Click on the the the LED testing options below, you can control the type and rate of the target board LED flashes

Type	Rate
● Pulse	● Slow
○ Counter	○ Medium Speed
○ Stop	○ High Speed

(OK)

Fig 6 led_control.htm page

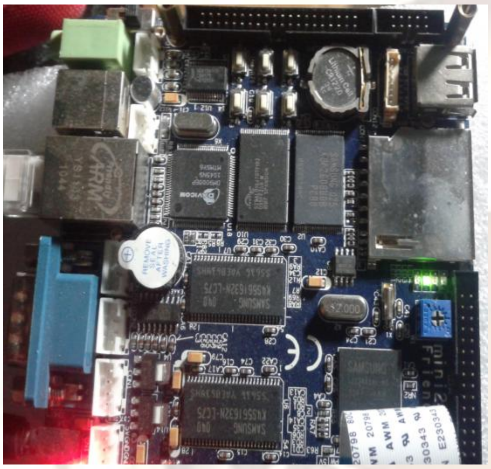


Fig.7 shows real time output

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