

Design an Embedded Web Server for Monitoring and Controlling Systems or Devices

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Abstract--The paper presents the design of embedded web server based on ARM9 Micro-processor and Linux platform and analyses hardware configuration and software implementation for monitoring and controlling systems or devices. In various applications like client server architecture it is better to use embedded web server other than pc server because we can control the electronic devices without distance by using web technology. It mainly targets on crucial points of promoting the GUI applications which are based on Qt/Embedded and the Linux drivers for different types of sensors in monitoring and controlling system projects. QT is the leading application and UI framework for devices powered by embedded Linux. The monitoring and controlling system uses Samsung S3C2440A processor as its main controller. Embedded Linux operating system and embedded web server run on the main controller to manage various types of equipments including sensor networks etc. The different electronic devices are connected to ARM9 through UART ports. The data from these electronic devices are stored in ARM9 micro controllers through RS-232 serial bus communication. The data from web server is received through http protocols and displayed on web page.

Keywords— Embedded web server, ARM9, Linux Kernel, Qt, Open CV

1. INTRODUCTION

The web server concept gives us the flexibility of monitoring and controlling the electronic devices from every nook and corner of the world. This can also be used as security system and has wide range of applications. Nowadays, monitoring and controlling systems or electronic devices through pc are very common. In this technology pc itself act as a server. The electronic devices which are going to monitor and control are connected to pc. They are bit more cost and cannot work continuously for a long time. The hardware architecture is very complex. The development of this system not only brings more difficulties but also increase maintenance of client software. With the rapid development of technology the embedded systems plays a major role and go through into the areas of people's life. A new technology known as web technology used to monitor and control the systems or electronic devices through web page. Web-based

technology is the more popular technology in the world for sharing or browsing data. Whenever we find internet facility We can monitor and control the devices through web technology.

The electronic devices are interfaced to the ARM9 micro controller. The data from the devices are stored in the memory locations of the ARM9 controller through serial bus communication cable RS-232 present on SAMSUNG mini 2440 board. The data will be finally stored in the web server through TCP/IP protocols. By entering unique IP address the data will be received from web server through http protocols and will be displayed on web page. For accessing the information from the remote location computers we need a web server at that computer side. The web server will maintain the database which contains all the information. The user from the remote location will access the information by using unique IP address. The user can request a particular web page from the web server.

This paper introduces the architecture of the embedded web server for monitoring and controlling systems using ARM9 and the application of the embedded web server.

2. PROJECT FLOW

Initialize the Samsung S3C2440A board with power supply. The serial communication between source and MINI 2440 with hyper terminal for a baud rate of 115200 must be initialized. Next, change the boot mode of MINI 2440 board to NOR flash. After displaying BIOS settings press "V" and browse for the Super vivi file, press "K" and browse for Linux Kernel, press "Y" for Root File system and send it through DNW tool into NOR flash. After Kernel is loaded change the boot mode to NAND flash and load with application program by using RS-232. Interface USB Camera to MINI 2440 board for the continuous video capturing. Interface sensors to MINI 2440 through UART. The data from the devices are stored in the memory locations of the ARM9 controller through serial bus communication cable RS-232 present on SAMSUNG mini 2440 board. By using TCP/IP protocols the data stores in the data base of web server. Monitoring and controlling of device can be done by remote pc through web server by entering into the web browser which contains a unique IP address.

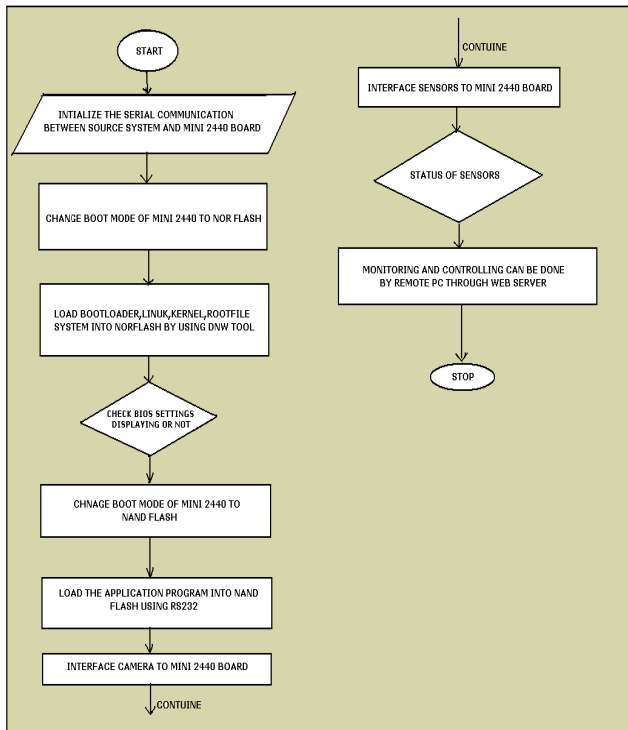


Fig 1. Complete project Flow

3. SYSTEM DESIGN

The monitoring and controlling system consists of mainly two parts i.e. hardware and software. The hardware part of this system consists of ARM9 development board, USB camera, and electronic devices which have to control. The software part of this system consists of software, drivers, Linux kernel, Boot loader, Root file system, Qt, Open CV, GUI program and coding.

A. Hardware Approach

The above fig shows the Block diagram of system hardware. The core part of this hardware architecture is Samsung S3C2440A processor. This Samsung S3C2440A processor is used as the main controller in this system. On the main controller, embedded Linux and embedded web server runs to manage various types of devices or external peripherals. The frequency of this Samsung S3C2440A is 400 MHz and maximum up to 533MHz. The capacity of SDRAM in this system is 60MB. Working voltage of Samsung S3C2440A processor is 3.3V, data bus is 32bit, clock frequency is up to 100MHz, Auto-Refresh and Self-Refresh both are supported. Mini 2440 board or Friendly ARM board has two flash memories in which one NOR flash and another one is NAND flash. By using DNW tool we can load Root file system, Linux kernel, Boot loader and all other board related software and drivers will load in to NOR flash. The application program will load in to NAND flash by using RS-232. The selection of these two flashes are will be done by using

bootstrap switches. S3C2440AL UART provides three serial I/O ports, each port can operation on Interrupt or DMA mode. The maximum baud rate of 115.2Kbps can be supported by Samsung S3C2440 UART.

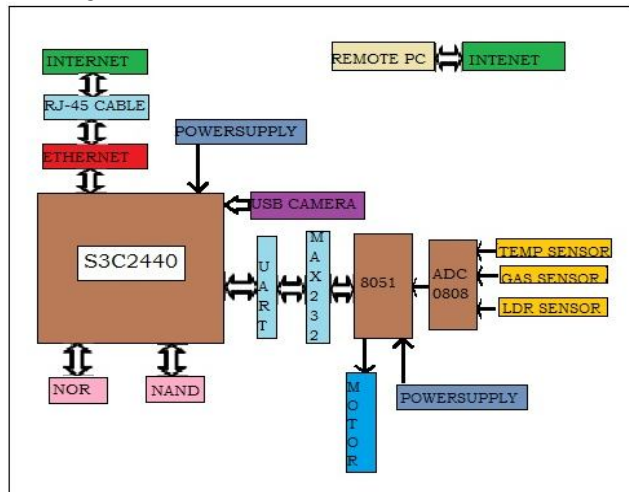


Fig 2. Block Diagram of Design an Embedded Web Server for Monitoring and Controlling Systems or Devices

B. Software Approach

The software part of this system mainly consists of Linux kernel, Qt, and Open CV. Linux kernel is a operating system kernel. It is a free and open source. It supports multiuser and multitasking. It is highly securable. Qt is a cross platform framework written in C++. It is developed for desktop target platforms. It is used for developing GUI and non GUI programs. Qt is easily ported on to different platforms like embedded Linux, Windows, and Max OS etc. Open CV is a open source computer vision library written in C and C++. It contains the basic image processing and higher-level computer algorithms.

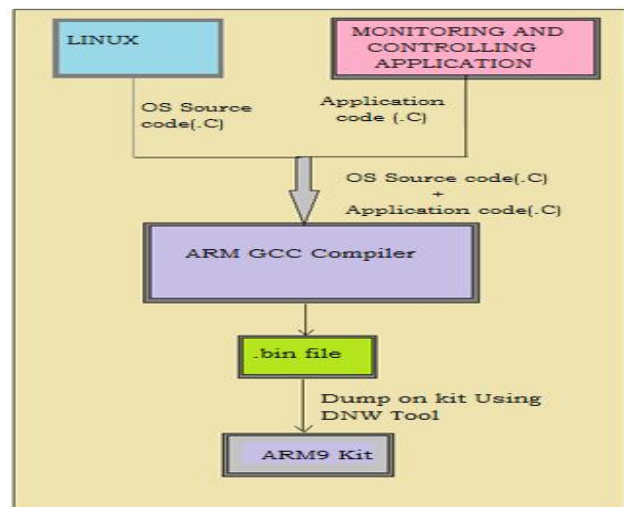


Fig 3. Complete Software Approach

The above figure shows the software approach which tells about the both Linux source code .C file and application .C file. The application used here is embedded web server for monitoring and controlling systems based on ARM9 with its .app code which is combined with Linux platform. The GCC compiler is used in ARM9 which will help to compile source code .C into .bin file. This GCC compiler contains editor, linker, and compiler to generate three different files. The application code .C file will be developed by a user. This application code .C file is used as a task in Linux Platform. The ARM GCC compiler can compile the source code .C file and application code .C file together at a time and generates the file consists of .obj files and .bin files. By using linker the .obj files are linked and send it to compiler to generate .elf file, .bin file and .obj file. In these three different files .bin file is used to dump on ARM9 kit by using DNW tool.

4. RESULTS

As mentioned earlier the application design an embedded web server for real time monitor and control of devices through internet has to be developed on Samsung S3C2440A board. The proposed approach tests the operation successfully and produces the required result. The data from devices which we have to control is stored in the data base of web server through TCP/IP protocols can be retrieve through the web browser by using internet facility.



5. CONCLUSION

In this paper the system for monitoring and controlling devices based on embedded web server replaces the pc web server. The user can monitor and control the devices through web technology. The system has low cost, portability and is easy to upgrade and maintain. This system can be applicable

in educational institutes, industries etc. It is concluded that the system can be connected to internet for monitoring and controlling devices.

6. FUTURE SCOPE

In this paper we are connecting temperature sensor, gas sensor and LDR to control board. By using control board hardware as well as cost is increased. By connecting the sensors directly to ARM9 board we can reduce the hardware components as well as cost.

In this paper we are not maintaining the database of the different parameters like temperature, release of any poisonous gas and intensity of light. By using SQL LITE in the future we can maintain the database in the MINI 2440 board itself.

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