A Review on Remote Monitoring and Controlling System Using ARM 11 Processor with Zigbee Technology

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ABSTRACT

This paper achieves application of Remote Monitoring and Controlling Systems (RMCS) which is growing popularity. Here we implements a monitoring and controlling system using ARM Intelligent Monitoring and Controlling Center which uses Samsung's processor as its main controller (S3C6410). The environmental conditions present inside the lab can be monitored using sensors like temperature, gas and LDR. All the sensors and devices are connected to sensor board. From the sensor board we are sending monitored values to control room (ARM board) through RS232 serial cable. The serial cable is connected to one of UART port of ARM board. Whenever a person is entered inside the lab, the person’s image can be captured by camera and send it to controller. The controller transmits the data to remote PC through Ethernet by using FTP. FTP is a protocol through which users can upload files from their systems to server. Once data is placed at server we can view the data at remote PC (with internet) on web page with unique IP address. We can view continuous streaming of video as well as senor’s data. If we want to control the devices based on sensor’s information we can control through web page from remote location using HTTP protocol. HTTP protocol continuously requests the server for control (turn on or turn off) the devices. We focus on the difficult points of developing the GUI applications based on Qt/Embedded and the Linux drivers for various types of sensors in the Lab Intelligent Monitoring System project, achieving the combination of Qt/Embedded and the Linux system programming.
1. INTRODUCTION

Monitoring and controlling systems from remote locations has been increasing in day to day life which makes easy to control and monitor condition from any place at any time. The embedded systems which use micro-controller such as 8-bit microcontroller as the main controller has been widely used in various fields, but most of these applications are still in the low-level stage of stand-alone use of the embedded system. It is feasible and forward-looking to apply the high-performance 32-bit microprocessors such as S3C2440, embedded Linux system and Qt / embedded GUI application to practical industrial control in certain occasion. Nowadays, the management of the domestic laboratories in the research institute and Universities has issues of poor real time, high outlay and low precision and it uses for only single purpose laboratory. It is difficult to determine the superiority of the atmosphere of the laboratory. So the Laboratory Intelligent Monitoring System should be developed to realize early forewarning, remote maintenance, real time monitoring, multiple purpose laboratory and other functions. This paper focuses on the process and difficult points in the application of embedded GUI based on Qt / Embedded and Linux device driver in the laboratory atmosphere intelligent monitoring system.

Typically, programming, digital logic design and often a computer architecture course are prerequisites for the more advanced embedded systems or microprocessor design course that is the focus of this paper. For software development in the embedded systems industry, the C/C++ family of languages is still used in the large majority of new designs, according to annual industry surveys. Many embedded systems, microcontroller, or microprocessor design courses started out with low-cost 8-bit processors with limited capabilities, but most of the development effort in industry has moved on to modern System on-a-Chip (SOC) 32-bit devices that contain a reduced instruction set computer (RISC) processor with volatile memory, non-volatile flash memory, and a wide assortment of standard I/O interfaces, all on a single chip. According to annual industry surveys of embedded designers, 70% of new designs now utilize an operating system (OS), and 59% include networking. The widespread development of these new embedded devices with networking. Now that a single-chip microcontroller already contains the processor, memory, and numerous I/O interfaces with built in hardware controllers, it is appropriate to use a higher level of abstraction in such a course. An increased focus can be placed on robotics, networking, the use of existing C/C++ application programming interface (API) libraries to enhance productivity, basic operating system concepts, and rapid prototyping of devices. Less time can be spent on assembly language and lower-level hardware topics. This paper describes the experience gained developing a laboratory to support development of these devices; it will primarily focus on the new technologies used in the student instructional laboratories during the first three offerings of the new course.

2. REVIEW ON RMCS

The Embedded web technology is having such a vast applications in various field and use of virtualization in terms of software or hardware methods which is based on ARM processor. Many people has been working in this field and proposed methodologies for enhancing this techniques. The central idea of this research is to develop low cost intelligent remote monitoring and controlling system using embedded web technology which will utilize for multiple purpose labs with emphasis on its utilization in rural areas. In past few years, there has been increase in using wireless sensor networks. Due to widespread growth of wireless cellular networks which realizes the confined management and remote publishing applications for large-scale dynamic data of sensor networks and video images. For web-based network management provide an administrator with a simple but enhanced and more powerful user interface without additional hardware. Software contention and architectures can significantly affect web server performance. It realizes an embedded web server, which enables data acquisition and status monitoring with the help of any standard web browser. The embedded internet assimilation for remote maintenance and analysis as well as machine to machine communication is rising with a substantial speed [1][2][3].

Communication between external expansion applications and web server can be achieved through CGI technology. This method can not only improve system security, but also make it possible to interact with users and create dynamic web pages. It presents an implementation of a platform independent embedded web server and its integration into a network of wireless sensor nodes. The embedded web server is intended and built as an expansion unit for one of the nodes in the wireless sensor network (WSN). The flow & practicability of an application for computer laboratories through which supervision & management of entire laboratory become easy for users [4][5][6]. System is a distributed network for laboratory management & can carry out the functions for user log in, attendance management, schedule querying and experiment booking, among others. Lab remote monitoring and controlling system makes use of latest, least power consumptive, small size and fast working micro controller like S3C2440. This system is based on ARM and Linux operating system for managing the data collected by sensor networks, realizing the local management of environmental data, and to automatically detect and identify images [7][8]. Remote monitoring and diagnosis are prevention of unplanned downtime, making optimal control operation and maximizing the operational life of plant resources. It combines real-time background updating and three frame differentiating to reduce the impact from the gradient and emergency in ambient light when long-term monitoring.[9][10][11]. In the monitoring system, the existing resource of Ethernet is used to remotely monitor power network parameters. The user can also control the devices interfaced to the web server by pressing a button provided in the web page. It modifies an existing safety and security model for the environment of educational institutions and in home. The aim of this project is to
design an embedded system for remote monitoring of the laboratory environment. It has high reliability and easy to implement a system like this wherever needed. It 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. [12][13][14]. The design and development of the system has been carried out based on the pedagogical outcomes expected from the laboratory and the subject. The review is based both on the literature and consequences of own cooperation [15].

3. PROPOSED SYSTEM

The general framework of the Laboratory Intelligent Monitoring System is divided into two parts which are the local ARM Intelligent Monitoring Center and its peripheral equipments and all kinds of remote monitoring terminals with zigbee technology. The overall system plan is shown in figure1.

![Figure 1: Total System Block Diagram](image)

The system is mainly made with ARM controller unit. The design in this paper applies S3C2440 which is 32-bit ARM microprocessor which takes ARM 11 as its core that consist of only 66 microprocessor. This microprocessor has rich resources, including Clock, USB, SDRAM, UART, NAND Flash, LCD, RS - 232 Interfaces, Ethernet Interface, JTAG, Power, etc. These modules can help achieve Ethernet services and zigbee sensor services.

4. OBJECTIVE OF THE PRESENT WORK

The main objective of the project is to “design and develop of the remote monitoring and controlling system using ARM 11 processor with zigbee technology”. The embedded internet integration for remote control and diagnostic and machine to machine communication is increasing with fast speed rate.

5. WORK PLAN AND METHODOLOGY

This system consists of sensor controlling board using one or more IC 8051 is connected with ARM 11 development board. The Zigbee sensor technology is used at both boards for transmission and receiving process. ARM 11 development board works as computer or controller having the speed up to 533 to 750 MHz S3C6410X consists of ARM1176 processor, several media and graphic co-processors and various peripheral IPs. ARM1176 processor is connected to several memory controllers through 64-bit AXI-bus. This is done to meet bandwidth requirements. Media and graphic coprocessors, which include MFC (Multi-Format Codec), JPEG, Camera interface, TV encoder, 3D accelerator and etc, are divided into six power domains. The six power domain can be controlled independently to reduce power consumption when the IPs is not required for an application program. This require one hub and one
USB camera for making prototype. Embedded Linux operating system and boa embedded web server run on the major ARM controller to manage various types of equipments including sensor, USB cameras etc. The sensors mainly used in our system are atmospheric conditions sensing sensors like Temperature, Gas and LDR sensors etc. USB camera monitors all the conditions inside Lab. We are implementing this paper using Linux, Qt for embedded Linux and open CV library. The Linux open source operating system, or Linux OS, is a freely distributable, cross-platform operating system based on Unix that can be installed on PCs, laptops, net books, mobile and tablet devices, video game consoles, servers, supercomputers and more. Qt for Embedded Linux is a C++ framework for GUI and application development for embedded devices. It runs on a variety of processors, usually with Embedded Linux. We are using application Language either C or C++. Open CV is an open source computer vision library originally developed by Intel. It is free for commercial and research use under a BSD (Berkeley Software Distribution) license. The library is cross-platform, and runs on Linux, Windows. The communication from sensor board to ARM board is also done using UART through RS-232 cable. These monitored circumstances are viewed at PC on web page by means of FTP protocol by providing specific IP address. To control devices from web page, we use HTTP protocol.

5. CONCLUSION

In the post-PC era, the embedded system technology develops rapidly and the design of embedded GUI and the Linux device drivers are important and indispensable components of it. This paper focuses on solving the issues of poor real time, high cost, low precision and incapability of determining whether the lab environment is in line with the body’s health indicators in the laboratory management of domestic institutions of higher learning. It develops a laboratory intelligent monitoring system with S3C2440 microprocessor as its main controller, elaborating the difficult points of the development of the GUI applications based on Qt / Embedded and Linux drivers for various types of sensors in the project. With a perfect support of the embedded system technology, we believe that the intelligent monitoring system will have better performance and broader market prospect.

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