ISSN 2250-3153

Design and Implementation of the Lab Remote Monitoring and Controlling System Based on Embedded Web Technology

M.Manoj Kumar, G.Srinivasa Raju

M.Manoj Kumar (M.Tech)
Department of Electronics and Communication Engineering
CVSR College of Engineering, Hyderabad, India

G.Srinivasa Raju, M.Tech
Assistant Professor
Department of Electronics and Communication Engineering
CVSR College of Engineering, Hyderabad, India

Abstract— Describe a software and hardware design solution of an embedded web-based remote monitoring system for the environment in the laboratories. Build an embedded web server to publish the data of sensor networks and video images to achieve remote monitoring which is based on Web Technology. Managers can monitor and control the equipments in the lab through a web browser which is cross-platform. The embedded database manages the data collected by sensor networks, realizing the local management of environmental data. The Laboratory Monitoring and controlling system was developed to implement early warning remote control, real time Monitoring and other functions in the laboratories, which can realizes the local management and remote publishing applications for large-scale dynamic data of sensors networks and video images by using different sensors and webcam ARM Intelligent Monitoring center uses Samsung's S3C2440 processor as its main controller and Embedded Linux operating system. The experimental results show that the system designed implements safe and convenient remote monitoring and local management of the environment in laboratories and has high availability, reliability and popularization.

Index Terms— embedded web server; embedded database; remote monitoring system; S3C2440 ARM microprocessor.

I. INTRODUCTION

The web technology has begun to have a rapid development in the field of embedded systems in the post-PC era. The application of embedded web technology in the remote monitoring system has given rise to the technological change in the field of industrial control. Nowadays the management of the domestic laboratories in the research institute and universities has issues of poor real time, high cost and low precision .It is difficult to determine the quality of the environment of the laboratory. So the Laboratory Intelligent Monitoring System should be developed to implement early warning, remote control, real-time monitoring and other functions. This paper comes up with a design solution of an embedded web-based remote monitoring system for the environment in the laboratories, which realizes the local management and remote publishing applications for large-scale dynamic data of sensor networks and video images.

Lab remote monitoring and controlling system makes use of latest, less power consumptive, small size and fast working micro controller like S3C2440.This system is based on ARM9 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.

I. RESEARCH ELABORATIONS

A. Lab remote Monitoring and controlling system –

ARM Intelligent Monitoring Center uses Samsung's S3C2440 processor as its main controller, the performance and frequency of which are suitable for real-time video image capture and processing applications.

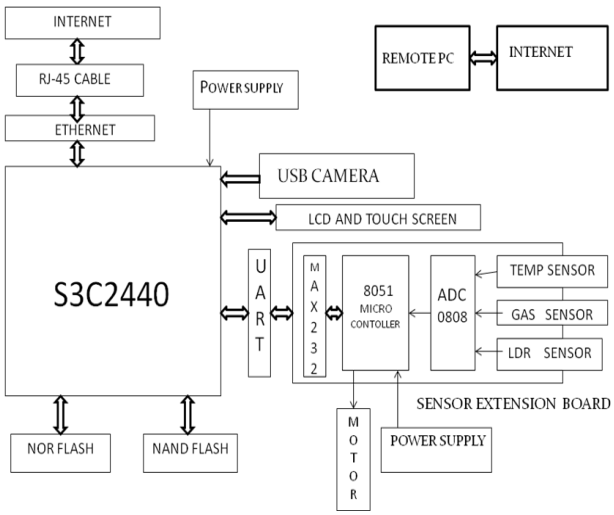


Figure 1: Block Diagram of Monitoring and controlling system

Embedded Linux operating system and embedded web server run on the main controller to manage various types of equipments including sensor networks, GSM / GPRS dual band module, USB cameras and so on. We are connecting different sensors also which are used to monitor the conditions inside the area and we can control the devices present at different locations by using web technology. The block diagram of Proposed Method is shown below. This system makes use of S3C2440 (ARM9), Webcam, Ethernet, touch screen, PC, temperature sensor, gas sensor and LDR, Fan, Motor, Light.

B. Mini2440 Development Board

Samsung Mini24440 is a practical low-cost ARM9 development board, is currently the highest in a cost-effective learning board. It is for the Samsung S3C2440 processor and the use of professional power stable core CPU chip to chip and reset security permit system stability. The mini2440 Immersion Gold PCB using the 4-layer board design process, professional, such as long-wiring to ensure that the key signal lines of signal integrity, the production of SMT machine, mass production; the factory have been a strict quality control, with very detailed in this manual can help you quickly master the development of embedded Linux and WinCE process, as long as there is C language.

Features:

1. CPU Processor: Samsung S3C2440A, frequency 400 MHz, the highest 533 MHz

2. SDRAM Memory: On-board 64MB SDRAM 32-bit data bus SDRAM clock frequency up to 100 MHz

3. FLASH Memory: On-board 64 MB NAND flash, Power-down non-volatile. On-board 2 MB NOR flash, Power-down non-volatile, BIOS has been installed.

4. LCD Display: On-board integrated 4-wire resistive touch screen interface, you can directly connect 4-wire resistive touch screen. Support for black and white, 4 gray-scale, 16 gray-scale, 256-color, 4096-color STN LCD screen size from 3.5; to 12.1;, 1024x768 pixels screen resolution can be achieved. Standard configuration for the NEC 256K-color 240x320/3.5; TFT True Color LCD Screen with touch screen. Leads to a 12 V power supply on-board interface, for the large-size TFT LCD 12 V CCFL backlight module (inverting) power supply.

Mini2440 interface layout is shown below it in a very compact area of 100 mm x 100 mm delicate arrangement of open made from a variety of commonly used interface, and also leads to the need for development and testing of the surplus of the I/O ports and bus interfaces. We cannot get S3C2440 microcontroller individually. We will get it in the form of Friendly ARM board else, we can call it as MINI 2440 board which is designed and developed by a Samsung company. This is latest and less power consume microcontroller like ARM 9 to attain a real time remote monitoring and controlling system.

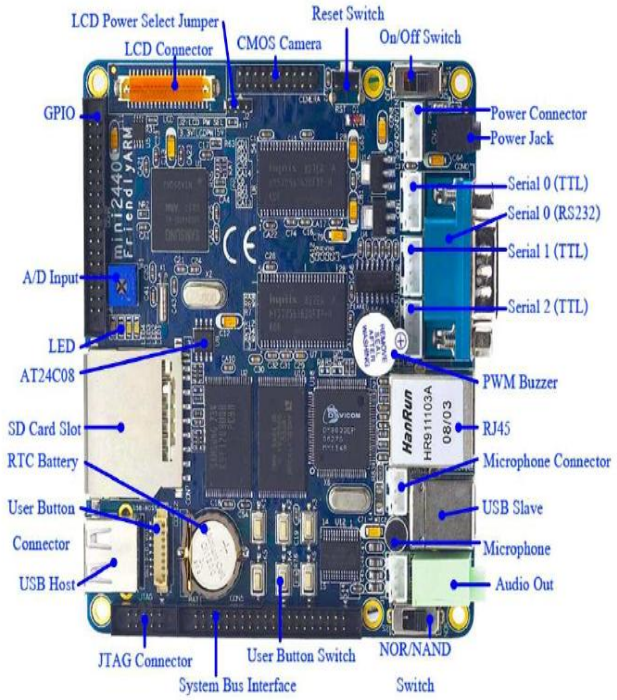


Figure2: Mini2440 interface layout

C. Monitoring and Controlling system algorithm –

The proposed lab remote monitoring system makes use embedded board which makes use of less power consumptive and advanced micro controller like S3C2440. S3C2440 is a Samsung company's microcontroller, which designed based on the structure of ARM 920T family. This microcontroller works for a voltage of +3.3V DC and at an operating frequency of 400 MHz, The maximum frequency up to which this micro controller can work is 533 MHz.

We cannot get S3C2440 microcontroller individually. We will get it in the form of Friendly ARM board else, we can call it as MINI 2440 board.

In order to work with ARM 9 micro controllers we require 3 things. They are as follows.

1. Boot Loader

2. Kernel

3. Root File System

The essential programs that are required in order to work with MINI 2440 like Boot loader, Embedded Linux related Kernel, Root File System will be loaded into the NOR flash which is present on the MINI 2440 board itself. The program

related with the application will be loaded into NAND flash, which is also present on the MINI 2440 board itself. By using bootstrap switch that is present on the MINI 2440 will help the user to select either NOR or NAND flash. After that by using DNW tool we can load Boot loader, Embedded Linux neither related kernel and Root File System into NOR flash by using USB cable and the application related program into NAND flash. Once loading everything into MINI 2440 board it starts working based on the application program that we have loaded into the NAND flash. So controlling station waits for the remote data that is coming from the remote location.

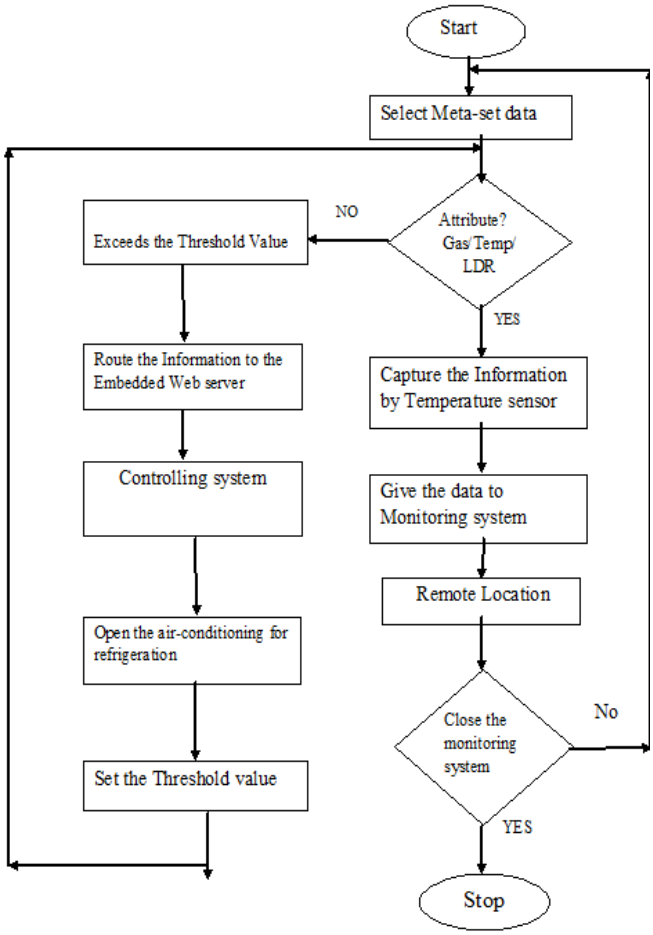


Figure 3: Flow chart for Monitoring and Controlling System

The remote location like lab consists of an embedded board, which interfaced to the sensors like light, temperature and gas. Light Dependent Resistor (LDR) will continuously measure the intensity of the light and converts the analog quantity like light intensity into voltage format. In order to check whether any poisonous gas that is released in the lab or not for that purpose we are having a gas sensor. This gas sensor also converts the analog quantity like gas release into voltage format. To indicate the temperature present in the lab we are having a temperature sensor, which will convert analog quantity like temperature into voltage. But in order to observe the step to step changes that are occurring in the lab we need to connect the output of the temperature, LDR and gas sensors to the ADC so that we can

observe the step to step voltage change that are occurring in the lab with the help of temperature sensor , LDR and gas sensor.

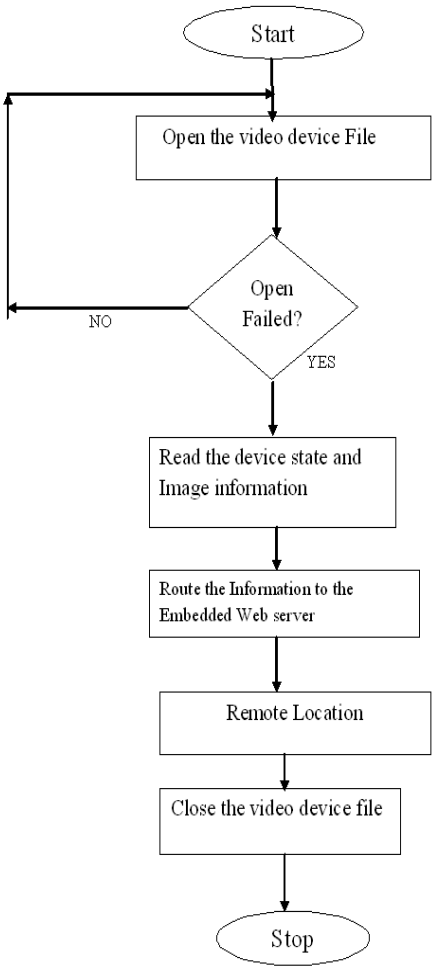


Figure 4: Flow Chart for Video Capturing

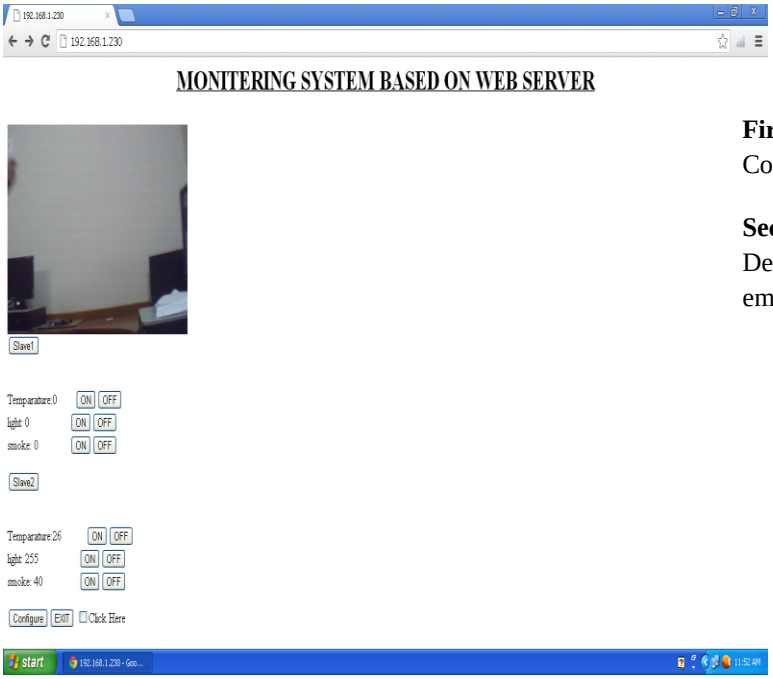
In this way, the output of the light, gas and temperature sensors is given as an input to the microcontroller. The measured values sent wirelessly through the Ethernet connection to the controlling station. At the controlling station, we will have Ethernet connection by using which the parameters measured at the remote location is received and given as an input to the MINI 2440 board by using serial port. The measured values of temperature, gas alert and the light intensity will be send from the controlling station to anywhere by using the technology like Ethernet with a speed of 100Mbps the Ethernet technology. From the remote locations, also we can monitor the parameters that are present at the lab.

We can control the parameter like the temperature then from the remote location through any PC. We can automatically activate a blower fan that already interfaced to the embedded

board and we can reduce the temperature before reaching the threshold value. If the required intensity of the light is not present we can activate a bulb and we can supply required intensity of the light for the lab.

III. RESULTS

Here after connecting and placing this equipment in the Lab then the Data related to this will appear in the remote location as below.



IV.CONCLUSION

The project "Design and Implementation of the Lab Remote Monitoring and Controlling System Based on Embedded Web Technology" 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 ARM9 board and with the help of growing technology the project has been successfully implemented.

REFERENCES

[1] Liu Yang, Linying Jiang, Kun Yue ,Heming Pang, "Design and Implementation of the Lab Remote Monitoring System Based on Embedded Web Technology" 2010 International Forum on Information Technology and Applications.

[2] Jing Li, Yong Xu. Remote Monitoring Systems Based on Embedded Database [C]. Third International Conference on Genetic and Evolutionary Computing.2009 :381-384.

[3] Ali Ziya Alkar, Member, IEEE, and Mehmet Atif Karaca, Member, IEEE"An Internet-Based Interactive Embedded Data-Acquisition System for Real-Time Applications " IEEE Transactions on Instrumentation and Measurement, VOL. 58, NO. 3, Mar. 2009.

[4] Mo Guan, Minghai Gu"Design and Implementation of an Embedded WebServer Based on ARM"

[5] HongTao Yang , Eagleson, R. "Design and implementation of an Internet-based embedded control system" Control Applications, 2003. CCA 2003. Proceedings of 2003 IEEE Conference on.

[6] Xiaojun Zhao Haixia Su ; Mingwei Ren ; Yong Cao ; Lei Chen ; Fei Wang "Internet-based automation equipment intelligent monitor system" Electronic Measurement & Instruments, 2009. ICEMI '09. 9th International Conference on 16-19 Aug. 2009.

[7] Yu Li-min, Li Anqi, Sun Zheng, and Li Hui" Design of Monitoring System for Coal Mine Safety Based on Wireless Sensor Network"

AUTHORS

First Author – M.Manoj Kumar, Pursuing M.Tech in CVSR College of Engineering and email: manoj.m432@gmail.com

Second Author – G.Srinivasa Raju, Assistant Professor, ECE Department in CVSR College of Engineering and email:g.srinu3333@gmail.com