Embedded web server data monitoring and recording system based on ARM

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Abstract: **The embedded web server system is a combination of embedded system and Internet system, which provides remote monitoring and management function based on internet browser. Through this technology user can access the equipments remotely. The platform used is Linux and ARM9.The data transmitted is of high speed, reliably with less power consumption. The advantage of the system includes recording of data into the SD card and getting the status picture.**

Keywords: **Embedded web server, ARM, Linux, S3C2440**

I.INTRODUCTION

The web technology has started to grow rapidly in the field of embedded system. Web page is the control centre for the embedded web server [1].Embedded web technology in the remote monitoring system increases a technological change in the field of industrial control.The management of any chemical laboratories are facing problems such as poor real time, high cost and low precision. For this reason laboratory monitoring system should be developed to bring early warning system, remote control system, real time monitoring system and other functions[7]. In chemical industries data monitoring is the recurring problem. Currently there are many data acquisition system such as industrial data acquisition [6], environmental data acquisition system[9].These data acquisition systems are only outputting the sensor information, if sensors are outputting the wrong information then the same information will be recorded by the user and it will be accessed from the browser within the LAN .But the actual processing to the user is limited. But the user cannot rely only on the basis of the readings and if the readings are wrong one should physically monitor it on the site location.

This is one of the problems in the present data acquisition system. USB camera to the ARM along with the sensorsare Interfaced.Relying only on the sensor information will not help the cause hence one more web page is created for the video picture of the site place. Once the user selects the image pagestatus picture at the browser is displayed.Again if he wants to see the current status he just has to refresh the page. This system brings design solution of an embedded web-based emote monitoring system for the environment in the chemical Laboratories, which realizes the local management and remote monitoring forthe data of sensor networks and video images.

Remote monitoring and controlling system uses the latest, smaller size, lower power consumptive and fastermicro controller like S3C2440.This is based on ARM9, as it is not available individually. It will be available only with ARM9 board.Linux operating system for the management of data which are collected by sensor networks, creating the local management of environmental data and to automatically detect images.

II PROPOSED SYSTEM

The system block diagram is shown in fig1.The system uses LDR, temperature sensor and humidity sensor. All these sensor information will be displayed on the LCD .USB camera captures the images of the site location. when the user open the web page by giving the allocated IP address,he will get updated all the sensor information along with the camera information. That is, all the information in the site location will appear on the remote location by using Ethernet controller through the LAN cable using RJ45 connector.

SD card to this application is more advantageous for the user, because continuous checking of the process results is very difficult for the user. Once SD card is available, saving sensors information and still images to the SD card using some time interval is very useful. Once the user wants to observe previous reports he has to remove the SD card form the hardware and check the overall data which is available in the SD card.If the required intensity of the light is not present in the lab we can activate the LED'S and we can supply required intensity of the light for the lab.

We can automatically activate a blower fan (DC motor which acts as cooler) that is already interfaced to the embedded board and that can be used to reduce temperature before reaching the threshold value.One more dc motor acts as exhauster in case of chemical spill and a buzzer giving the indication . so that the people nearby can take the further action
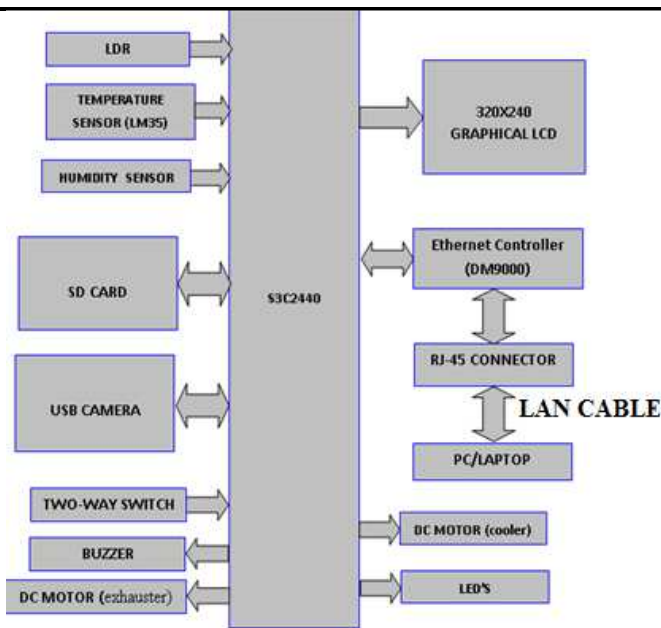
Figure1: Block diagram of monitoring and controlling system

III SYSTEM DESIGN

A. LDR: (Light dependant resistor): The resistance of this resistor vary according to light. It is used as light sensor for sensing light of the room. The important features are visible light response, sintered construction and low cost, applications include camera exposure ,shutter controls and night light controls
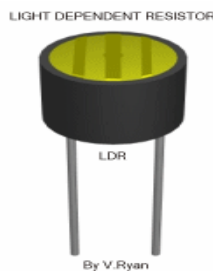

Figure2: Light dependant resistor

B. Temperature sensor: (LM35): The temperature sensor measures the temperature of the room. The user allocates a set point to measure the temperature and according to that set point, temperature of the room will be measured. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has and advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of $\pm 1\!/4°C$ at room temperature and $\pm 3\!/4°C$ over a full -55 to $+150°C$ temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air.
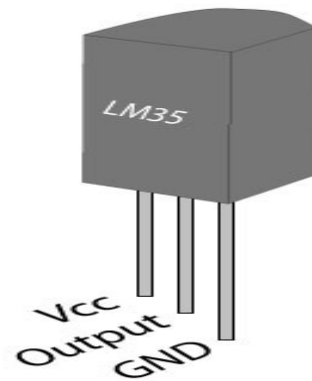

Figure3:Temperature sensor

C. ARM9: Microcontroller S3C2440 is not available individually; it will be available with the ARM9 board. The performance and frequency of ARM9 processor is suitable for real time video and image capturing and processing application. That is, frequency of 400MHZ.Maximum frequency up to which this microcontroller work is 533MHZ.ARM9 is a 32bit RISC cup family, it is a Harvard architecture so takes separate bus for instruction and data. This increases its potential

Figure4: ARM9 board

D. Humidity sensor: (units SYH-2,SYH-2s) Humidity is an important factor in personal comfort and in quality control for materials , machinery etc. It measures the humidity of the room

E. SDcard: All the sensor information and captured images will be saved into the SD card .Secure Digital (SD) cards are removable ash-based storage devices that are gaining in popularity in small consumer devices such as digital cameras, PDAs, and portable music devices. Their small size, relative simplicity, low power consumption, and low cost make them an ideal solution for many applications. The SD card standard is a standard for removable memory storage designed and licensed by the SD Card Association. The SD Card standard is largely a collaborative effort by three manufacturers, Toshiba, SanDisk, and MEI and grew out of an older standard, Multimedia Card (MMC). The card form factor, electrical interface, and protocol are all part of the SD Card specification. The SD standard is not limited to removable memory storage devices and has been adapted to many different classes of devices, including 802.11 cards, Bluetooth devices, and modems

F. S3C2440:S3C2440 is a 16/32-bit RISC microprocessor. The S3C2440 is developed with ARM920T core, 0.13um CMOS standard cells and a memory complier. Its low power, simple, elegant and fully static design is particularly suitable for cost- and power-sensitive applications. It adopts a new bus architecture known as Advanced Micro controller Bus Architecture (AMBA). The S3C2440 offers outstanding features with its CPU core, a 16/32-bit ARM920T RISC processor designed by Advanced RISC Machines, Ltd. The ARM920T implements MMU, AMBA BUS, and Harvard cache architecture with separate 16KB instruction and 16KB data caches, each with an 8-word line length. By providing a complete set of common system peripherals, the S3C2440A minimizes overall system costs and eliminates the need to configure additional components.

G. DM900:It s fully integrated, cost effective single chip fast Ethernet MAC controller with a general processor interface. Through this Ethernet controller information will be updated to the pc/laptop .It is designed with low power, high performance process that support 3.3v with 5v tolerance.DM900 supports 8bit,16bit and 32bit uP interfaces to internal memory accesses for different processors

H. RJ45 connector**:** It is a type of modular connector for Ethernet cables.

I. USB Cameras: They are used for capturing the images of the site location. they are imaging cameras that use USB 2.0 or USB 3.0 technology to transfer image data. USB Cameras are designed to easily interface with dedicated computer systems by using the same USB technology that is found on most computers. The accessibility of USB technology in computer systems as well as the 480 Mb/s transfer rate of USB 2.0 makes USB Cameras ideal for many imaging applications. An increasing selection of USB 3.0 Cameras is also available with data transfer rates of up to 5 Gb/s. USB Cameras contain out-of-the-box functionality for quick setup

J. LCD: LCD is used to display the information about the current process Graphical LCDs are designed to display images..LCD's adds the application in terms of providing a useful interface for the user, debugging an application or just giving it a professional look. The most common type of LCD controller is the Hitachi 44780 which provides a relatively simple interface between a processor and an LCD. LCD has single line display, Two-line display, four line display. Every line has 16 characters.

IV SOFTWARE PLATFORM

Linux kernel-based operating systems have found wide adoption and a very far-reaching range of use. All the advantages and benefits of free and open-source software apply to the Linux kernel itself and also to most of the rest of the system software.

The advantages of embedded Linux over proprietary embedded operating systems include multiple suppliers for software, development and support, no royalties or licensing fees, a stable kernel, the ability to read, modify and redistribute the source code.

Linux kernel has been ported to a variety of CPUs which are not only primarily used as the processor of a desktop or server computer, but also ARM, AVR32, ETRAX CRIS, FR-V, H8300, IP7000,m68k, MIPS, mn10300, PowerPC, SuperH, and Xtensa processors. Linux is also used as an alternative to using a proprietary operating system and its associated tool chain Development for embedded platforms is usually done using cross development tools.In case of linux,the host platform is often a linux host computer connected to the target board using ethernet,serial and/or ICE/JTAG.The GNU compiler is required to build the linux kernel.

Linux is very portable
Supports 23 architectures in the upstream "mainline" kernel tree of Linus Torvalds.Kernel is mostly written in C, with some assembly (most architectures only need a dozen such files) .Split between high-level generic functions and low-level functions to abstract architectural

differences Linux is cost effective. A large amount of code to build upon.Large (growing) community of developers. Linux supports 32 and 64-bit systems of little and/or Big Indian in nature.Macros, wrappers, functionpointers and common function names abstract away such differences.The kernel is split into arch and platform code.All stored under the "arch/" directory.Each arch has flexibility into handling its own platformsThe "core kernel" includes the low-level arch support and high level functions .e.g. those in the top-level "kernel/" and "mm/" directories.Other stuff (filesystems, networking, drivers) are not considered to be "core kernel".
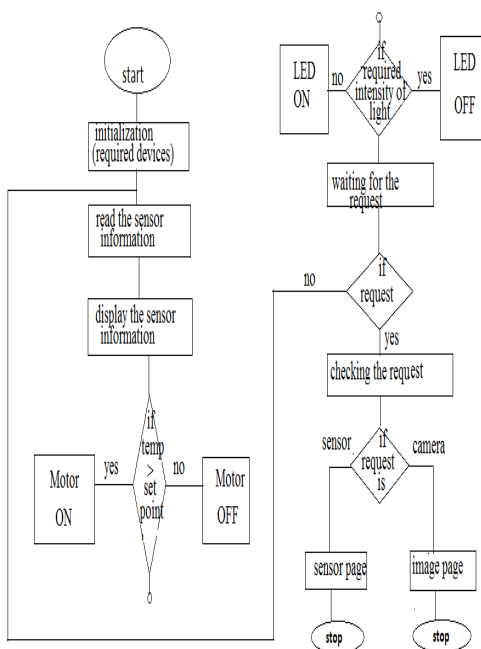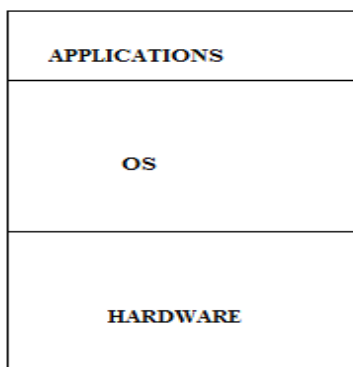

Figure5: flow diagram for monitoring and controlling system

V   RESULT

When the designed embedded board is placed in the chemical laboratories, the information such as temperature, humidity and Light will be displayed on the LCD and the same information will be saved into the SD card. Along with these information,the images of site locations are captured by USB camera and they will appear in the remote location. This is obtained by Ethernet controller through LAN cable using RJ45 connector. The designated web page can be opened by inputting allocated IP address.

VI CONCLUSION

The designed embedded web server, data monitoring and recording system based on ARM has been successfully designed and tested. The system introduced here allows transmission of data much faster by using ARM9 processorand makes the user accessibility easier. Web page is the control centre for the embedded web server which achieves good performance and can be used in industry, medical and other fields .The system performance can be enhanced by using GPRS which is more efficient in real time and this is taken up by the author as the future work

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