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Real Time Bare Machine Sensor Application For ARM11 Processor

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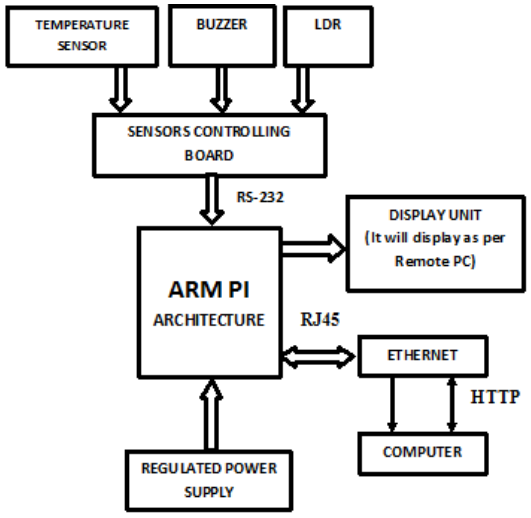
Abstract: ***The intelligent monitoring system is design to store the data in small microcontroller system and for watching that data we need to connect that small microcontroller system to Computer System. The data presented on the computer is not in presentable format. Our embedded project is designed to difficult points of developing the GUI applications based on Qt/Embedded and the Linux drivers for various types of sensors in the Intelligent Monitoring System project, achieving the combination of Qt/Embedded and the Linux system programming. Our proposed project eliminates the need of separate computer system connected to microcontroller board. Our Proposed project is the sensor board plus a full flag computer system. The sensors like temperature, fire and LDR are connected to ARM11 controlling board. The sensor values we are monitoring on the ARM11 board or on any computer using easily available Ethernet access.***

Keywords: ***Temperature sensor, LDR sensor, buzzer, server, Embedded Linux***

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. Here, we propose the design and implementation of low cost web based remote monitoring system with built-insecurity features. Due to the usage of an embedded intelligent monitoring module which is the Samsung S3C2440 32-bit ARM Samsung processor as its main controller, the performance and frequency of which are suitable for real-time video image capture and processing applications.

Block Diagram:



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ARM ARCHITECTURE:

ARM is a 32-bit RISC processor architecture developed by the ARM corporation. ARM processors possess a unique combination of features that makes ARM the most popular embedded architecture today. First, ARM cores are very simple compared to most other general-purpose processors, which means that they can be manufactured using a comparatively small number of transistors, leaving plenty of space on the chip for application specific macro cells. A typical ARM chip can contain several peripheral controllers, a digital signal processor, and some amount of on-chip memory, along with an ARM core. Second, both ARM ISA and pipeline design are aimed at minimising energy consumption — a critical requirement in mobile embedded systems. Third, the ARM architecture is highly modular: the only mandatory component of an ARM processor is the integer pipeline; all other components, including caches, MMU, floating point and other co-processors are optional, which gives a lot of flexibility in building application-specific ARM-based processors. Finally, while being small and low-power, ARM processors provide high performance for embedded applications.

For example, the PXA255 XScale processor running at 400MHz provides performance comparable to Pentium 2 at 300MHz, while using fifty times less energy.

ARM Bus Technology:

Embedded systems use different bus technologies. Most common PC bus technology is the Peripheral Component Interconnect (PCI) bus.Which connects devices such as video card and disk controllers to the X 86 processor buses. This type of technology is called External or off chip bus technology. Embedded devices use an on-chip bus that is internal to the chip and allows different peripheral devices to be inter connected with an ARM core.

There are two different types of devices connected to the bus

- Bus Master
- Bus Slave
- **Bus Master:** A logical device capable of initiating a data transfer with another device across the same bus (ARM processor core is a bus Master).
- **Bus Slave :** A logical device capable only of responding to a transfer request from a bus master device (Peripherals are bus slaves)

HARDWARE IMLPIMENTATION OF SENSORS

TEMPERATURE SENSOR:

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, temperature can be measured more accurately than with a thermistor. It also possesses low self heating and does not cause more than 0.1^{o}C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature,

Figure 2: Temperature sensor

Light Sensor (LDR):

A light-dependent resistor, alternatively called an LDR, photo resistor, photoconductor, or photocell, is a variable resistor whose value decreases with increasing incident light intensity. An LDR is made of a high-resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

Figure 3: light sensor (LDR)

Ethernet (TCP/IP Protocol)

Ethernet LAN Features:

• Bus topology, Wired LAN in IEEE 802.3 physical layer standard

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• 10 Mbps, 100 Mbps (Unshielded and Shielded wires) and 4 Gbps (in twisted pair wiring mode)
• Broadcast medium─ Passive, Wired connections based.
• Frame format like the IEEE 802.2
• SNMP (Simple Network Management Protocol) Open system (therefore allows equipment of different specifications)
• Each one connected to a common communication channel in the network listens and if the channel is idle then transmits. If not idle, waits and tries again.
• Multi access is like in a Packet switched network

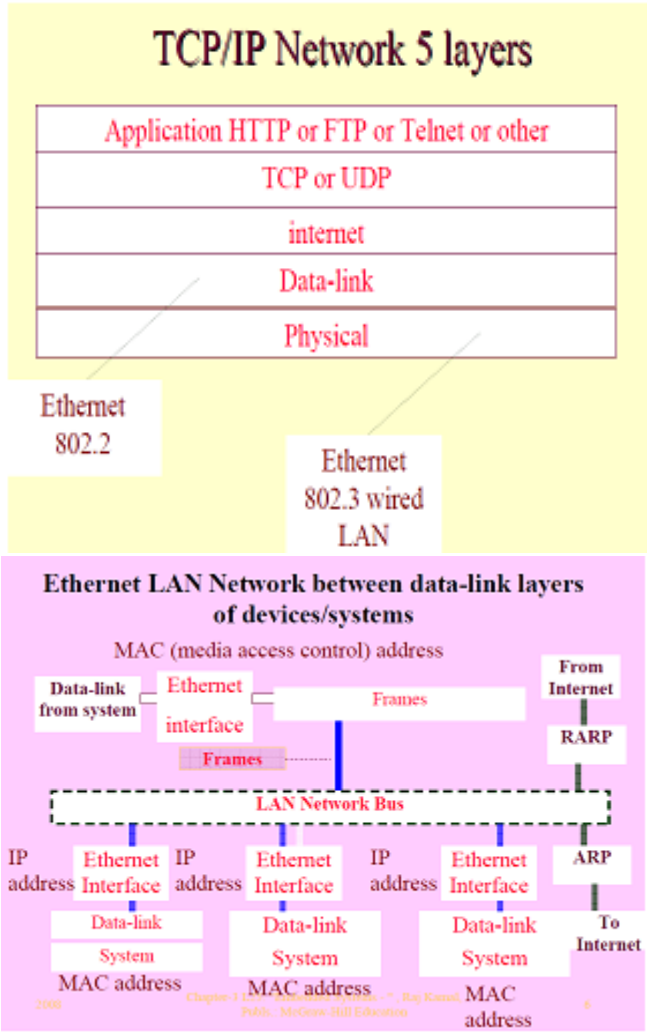

Figure 4: Ethernet (TCP/IP protocol)

WORKING PRINCIPLE

In this section, we give an overview on the proposed system architecture. The 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 is 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 otherwise we can call it as MINI 2440 board. Our ARM board comes with integrated peripherals like USB, Ethernet and Serial etc. On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on XServer, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. In this Lab Remote monitoring system we are using USB camera for monitoring the surrounding areas and sensors like temperature, gas and LDR are connected for monitoring the environmental conditions inside the laboratory. All the sensors are connected to sensor board. Internet is provided for arm board via Ethernet connectivity.

After connecting all the devices power up the device. When the device starts booting from flash, it first loads the Linux to the device and initializes all the drivers and the core kernel. After initialization of the kernel it first checks whether all the devices are working properly or not. After that it loads the file system and starts the startup scripts for running necessary processes and daemons. Finally it starts the main application. When our application starts running it first check all the devices and resources which it needs are available or not. After that it checks the connection with the devices and gives control to the user.

The GUI for the user has the following options.

• GUI will appear with two tabs.
• For one tab, an optional label for displaying the image taken from the camera.
• For other tab, status boxes for representing the monitored

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sensor values like temperature, gas and LDR.
• Buttons (ON/OFF) available for controlling the devices from the control room.

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.

Results:

Figure 5: monitoring values 01

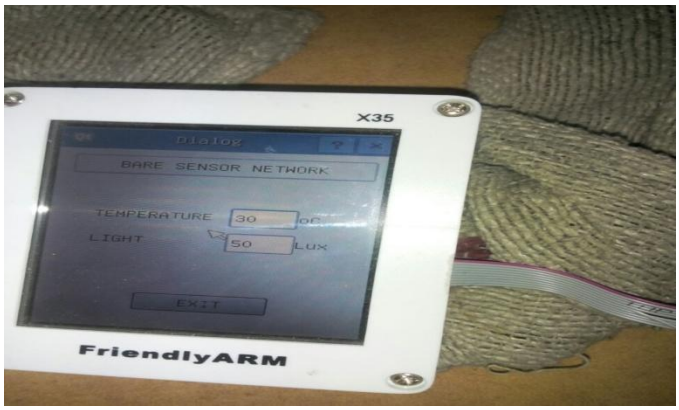

Figure 6: Monitoring the Values 02

FUTURE SCOPE:

• The cost of ARM9 is more that's why in future we can implement this system using ARM11, Beagle boneetc as well as updated processors with high frequencies will work fine.
• As the storage space is also less in future we can also record these live streaming data by connecting external memory storage.
• We can complete our project using wireless technology.
• In future we can provide more security to data by usingencryption, decryption techniques.

CONCLUSION:

The project "BARE MACHINE SENSOR APPLICATION FOR AN ARM11 PROCESSOR" 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.

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