Embedded Web Browser Based Device Monitoring and Control Using ARM11

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ABSTRACT
Availability of personal computer and internet everywhere is very useful for monitoring and controlling remote devices and their parameters. ARM processor based web servers not uses computer directly, it helps a lot in reduction of cost. Here our aim is to implement an Embedded Web Server (EWS) based on ARM11 processor and Linux operating system using Raspberry Pi. It will provide a powerful networking solution with Wide range of application areas over internet. We will run web server on an embedded system having limited resources to serve embedded web page to a web browser. The purpose is to build a remote control system through a webpage. And this system is controlled through local area network by using an embedded TCP/IP protocol suit which is inbuilt in Linux kernel.

Keywords - Embedded Web Server, Raspberry Pi, ARM, Ethernet.

I. 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 uses sensor controlling board in which 8-bit microcontroller as the main controller has been widely used in different fields, other than most of these applications in the low-level stage of stand-alone use of the embedded system. S3C6410 consists of ARM 11 processor, several media and graphic co-processors and various peripheral IPs. It is practicable to be relevant the high performance 32-bit microprocessors. At present the management of the Domestic laboratories in the research institutes has issues of deprived real time, high cost and low accuracy. It is complex to identify the quality of the environment of the laboratory. So the Intelligent Monitoring and Controlling System should be developed for giving early warning, remote control, and additional functions. 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 32-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. Now that single-chip microcontroller already contains the processor, memory, and numerous I/O interfaces with built in hardware controllers. The Linux operating system's kernel is able to provide good support to the ARM processor and manage most of components which connect to the periphery of the controller. The embedded Linux kernel only requires providing support to the hardware which will be used.

II. PROPOSED SYSTEM
This project realizes an embedded web server, which enables data acquisition, control system, status monitoring with the help of any standard web browser. A web server in the device provides access to the user interface functions for the device through a device webpage. A web server can be embedded into any appliance and connected to the Internet so the appliance can be monitored and controlled from remote places through the browser in a desktop. The aim of the project is to control the devices or equipments from the remote place through a web page. The web-server circuit is connected to LAN or Internet. The client or a person on the PC is also connected to same LAN or Internet. By typing the IP-address of LAN on the web browser, the user gets a web page on screen; this page contains all the information about the status of the devices or sensors interfaced. The user can also control the devices interfaced to the web server by pressing a button provided in the web page. The system is implemented using ARM11 running at 700MHz.
III. HARDWARE & SOFTWARE IMPLEMENTATION

3.1. Raspberry Pi
The Raspberry Pi is based on a Broadcom BCM2835 system on a chip (SoC), which incorporates an ARM1176JZF-S 700 MHz processor. The Raspberry Pi Foundation started off with a 256MB RAM, which was Labeled as Model A, and later made a Model B with 512MB RAM. The GPU used is the Video Core IV, owned by the Broadcom. It uses an SD card for booting and for memory as it doesn’t have an inbuilt hard disk for storage option. In this project, control of robotic unit is from remote end with the use of Internet and also we are able to get the videos from the robot end for the purpose of surveillance. At the user PC, we will have videos on the web browser and also we are able to control the robotic movement and also the camera movement in vertical direction and horizontal direction.

3.2. ARM1176JZF-S:
The ARM1176JZF-S processor has three instruction sets:
• The 32-bit ARM instruction set used in ARM state, with media instructions
• The 16-bit Thumb instruction set used in Thumb state
• The 8-bit Java byte codes used in Jazelle state.

Features
• Trust Zone™ security extensions
• Provision for Intelligent Energy Management (IEM™)
• An integer core with integral Embedded ICE-RT logic
• An eight-stage pipeline
• Low interrupt latency configuration
• Internal coprocessors CP14 and CP15
• Vector Floating-Point (VFP) coprocessor support
• External coprocessor interface

• 64-bit interface to both caches
• level one Tightly-Coupled Memory (TCM) that you can use as a local RAM with DMA
• trace support
• JTAG-based debug.

3.3. PIC18F452:
PIC microcontrollers come in a variety of “flavors”, each with different components and capabilities. The PIC is a very general purpose microcontroller that can come with many different options. General Instruments produced a chip called the PIC1650, described as a Programmable Intelligent Computer. This chip is the mother of all PIC chips. Maybe that is why most people think PIC stands for Peripheral Interface Controller. Microchip has never used PIC as an abbreviation, just as PIC and recently. PIC microcontrollers are finding their way into new applications like smart phones, audio accessories, video gaming peripherals and advanced medical devices. Microchip Provides solutions for the entire performance range of 8-bit microcontrollers, with easy-to-use development tools, complete technical documentation and post design-in support through a global sales and distribution network. There are hundreds of 8-bit PIC microcontrollers to choose from ranging from 6 to 100 pins and up to 128 KB Flash that are pin and code compatible.

3.4. Sensors:
3.4.1. Humidity sensor
Humidity is an important factor in personal comfort and in quality control for materials, machinery etc. Now we are using SYH2 and SYH-2S humidity sensors in most of the circuits. Humidity sensors are gaining more significance in diverse areas of measurement and Control technology. Manufacturers are not only improving the accuracy and long-term drift of their sensors, they are improving their durability for use in different environments, and simultaneously reducing the component size and the price. Conventional sensors determine relative air humidity using capacitive measurement technology. For this principle, the sensor element is built out of a film capacitor on different substrates (glass, ceramic, etc.).

Features:
• Operating humidity 20-95%RH
• Standard characteristics 33KQ (At 25degree centigrade, 60%RH)
• Storage temperature -30—85° centigrade
• Storage humidity within 95%RH
• Humidity accuracy +/- 5%RH (at 25degrees centigrade,60%RH)
• Humidity response time <60sec (40-80%RH)
3.4.2. Gas sensor

Gas sensor (MQ-5) detects the gas leakage. They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, natural gas, town gas, avoid the noise of alcohol and cooking fumes and cigarette smoke. Resistance value of MQ-5 is difference to various kinds and various concentration gases. So, when using these components, sensitivity adjustment is very necessary. When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

3.4.3. Temperature sensor (LM35)

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an 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 can be applied easily in the same way as other integrated-circuit temperature sensors. It can be glued or cemented to a surface and its temperature will be within about 0.01°C of the surface temperature. This presumes that the ambient air temperature is almost the same as the surface temperature; if the air temperature were much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the air temperature.

Features:
1. Calibrated directly in ° Celsius (Centigrade)
2. Linear + 10.0 mV/°C scale factor
3. 0.5°C accuracy guarantee able (at +25°C)
4. Rated for full -55° to +150°C range

3.4.5. LDR (Light Dependent Resistor)

A photo resistor or Light Dependent Resistor or CdS (Cadmium Sulphide) Cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor. A photo resistor 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. When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the LED does not light. However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor.

The preset resistor can be turned up or down to increase or decrease resistance, in this way it can make the circuit more or less sensitive.

3.5. HTML:

HTML is a markup language for describing web documents (web pages). HTML stands for Hyper Text Markup Language. A markup language is a set of markup tags. HTML documents are described by HTML tags. Each HTML tag describes different document content.

When you look at a web page in a web browser, you see, at the simplest level, words. These words usually have some style characteristics, such as different fonts, font sizes and colors. In many cases a page also displays images or maybe video. Sometimes there is a form where you can enter (or search) for information, or customize the display of the page to your liking. Often a page contains content that moves or changes while the rest of the page remains the same.

IV. HARDWARE & RESULTS

Below is the figure which shows hardware connectivity.

![Fig2: Hardware](image)

By entering the IP Address and html page in browser with which the system is connected, it will display the following webpage.

![Fig3: webpage](image)
According to the control commands which are mentioned on the webpage, the relay/device can be controlled.

REFERENCES

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