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Control System Based Tiny Webserver

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Abstract:- With the growing popularity of Internet, Embedded Technology and Web Technology developing a control system based on embedded web server, by using a Ethernet as communication media, this is finding wide spread application in embedded field. The proposed work plans to control the appliances placed in industrial area through the web server, in this plans to use of LPC1768 CORTEX-M3 based embedded board in the implementation of a Tiny web server (embedded web server) for control of industrial appliances in the server side. To communicate server with client a Ethernet is using here, Ethernet network communication Interface by using TCP/IP protocol and an Ethernet interface with HTML web page. This TCP/IP protocol is act as bridge between client and server and initialize to communicate. The webpage and firmware is done in HTML and dynamic C programming language respectively. Here the embedded system board acts as central heart of the server between webpage and appliances.

Index Terms— Controlling appliances, Embedded web server, Remote I/O data, TCP/IP.

I. INTRODUCTION

With the rapid improvement in the x86 and ARM processor architecture in the recent years, 8 bit and 16 bit microcontrollers have become rather obsolete. However, their relatively simple architecture and cheap price make them ideal for simple functions in systems that do not require the higher computing power of the more expensive 32 bit chips [6]. Automation plays an increasingly important role in the world economy and in daily experience [2].

Nowadays, the system integrating web and embedded technology is gained more popularity. Controlling a system via PC is very common. A web base control and monitoring system can make us control a system without distance and without muscular power. So developing a cost effective, programmable and high efficiency controller webpage is necessary for the world competition so we are designing a web page that contains all necessary specifications [3].

Integrating web and embedded technology, the embedded equipment monitoring and controlling system based on web management can be done. Managers can remote access, monitor and maintain the on-site equipment through the network using a web browser without In today the world needs a fully automation system, that is use for control systems and information technologies to reduce the need for human intervention in the production field in the industries, such as services, and industry maintenance. In the scope of industrialization, automation is a step beyond mechanization.

Whereas mechanization provides human operators with machinery to assist them with the muscular requirements of work, the automation greatly decreases the need for human sensory and mental requirements. This automation system in industry and t limit of region and time with inter-access between the heterogeneous equipment [4].

And all Information's and data are measured either in electrical form or in non electrical form. The measured data can be displayed through web pages from the server In any control system Electrical Network is more important because Electrical Systems are necessary in each kind of building such as research laboratories, homes, factories, hospitals and so on. In many cases electrical systems manage critical applications, like freezer-temperature, incubator internal temperature and so on. All these systems contain devices that are sensitive to voltage variations, current deviations and to all the power quality and quantities. This system can measure and store any kind of electrical and non-electrical signals in embedded web server. And it can able to control the devices remotely.

II. WEB BASED SUPERVISION AND CONTROL SYSTEM

Web based automation is a recent development in the industrial sector. The implementation of industrial process control is made possible by the use of Internet,. This has actually lead to the concept called "Web Based Supervision and Control System "

The entire structure chart of the remote controlling and monitoring system based on embedded web server platform is shown in Figure 2.0.

The idea is to take a system with some controlling parameters, and connect the system directly via server and at monitor or control these various parameters through remote location. The function of Web-based equipment monitoring system is to collect data information of the onsite equipment, publish it through a Web form, and remotely send the data in the form of the user-defined data transmission style. The data will be published through web page form by the web server. The remote computer will collect the data and display it to on the web page, and it indicates level for example liquid in liquid tank, temperature in the boiler, humidity sensors reading. etc, all these information's will display on the web page which also allows all these control the appliances.

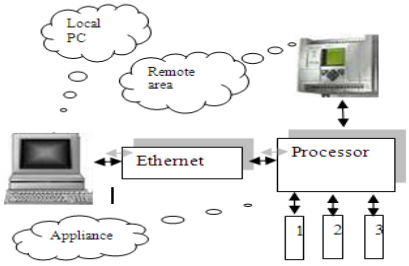

Fig 2.0: Control system based on embedded web Server

In the scheme of the system, the remote I/O data acquisition modules are developed as embedded web servers having static IP with port 80, which can be widely used to diversified industries such as electric power, petroleum, chemical, metallurgy, steel, transportation and so on.

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This system is mainly used for the concentrative controlling and monitoring of a variety of electrical and thermal signals such as voltage, current, thermal resistance, thermocouple in the production process.

III. SYSTEM DESCRIPTION

A. Hardware Description

The hardware boards which are built around microchip Ethernet controller (DP83848), Tx/Rx, MAC and PHY in one small chip. A display is used to (TM12864H6CCOWA) remote site area to monitor the value of temperature, liquid level. The display is TM12864H6CCOWA, Graphics LCM unit consists of 128 (segment) x 64 (common) dots dot-matrix LCD panel, NT75451 is a single-chip dot matrix LCD driver that can be connected directly to a microprocessor bus.

The heart of hardware part is LPC1768HPLUS EX microprocessor cortex M3 board version developed by NXP's. this processor is 100 pin processor has well features like, on board JTAG debugger, USB connector, and board has a USB Device and Host Connectivity Options, Onboard 2 Serial Ports. (UART0 and UART3), Pixels Graphical LCD connectivity port Ethernet with DP83848 PHY MAC,SD Card (Micro) Interface, Analog input via AD0.5 I/O pin out, Onboard Reset and ISP Switches, On Board Power Supply Circuit for +5V and +3.3V (USB or external Power Source input options), On Board 12 MHz Oscillator. 32.768 KHz Clock for RTC . Option for a CMOS Battery , Onboard 20 pin JTAG connector for debugging /programming applications. On board TFT Connector for 3.2inch TFT connector (with touch and without touch). LED for Power Supply, USB, Ethernet and Test LED. Power Supply – DC input 7.5 - 9V/ 500ma - 1A. Board Dimensions 8.6 x 9.1 cm2. Material: FR4, Finish: ENIG.

B. Board Use Requirements

The board usage purpose the PC should contain the following requirements:

PC with ablest 2.0 GHz processing speed or higher version CPU, at least 512 MB or above RAM, USB Port, Serial Port and Ethernet Port. Windows XP OS Integrated Development Environment (IDE). Keil software with version 4, Flash magic for software loading in to the hardware LPC1768 board. Electrical connectors, power supply of 12 volt.

C. Ethernet Standard

A typical Ethernet frame format is shown in following figure 3.0. A data packet on an Ethernet link is called an Ethernet frame. A frame begins with preamble its size is 7 bytes and start frame delimiter is of 1 byte. Following which, each Ethernet frame continues with an Ethernet header featuring destination and source MAC addresses. The middle section of the frame is payload data including any headers for other protocols (e.g. Internet Protocol) carried in the frame. The frame ends with a 32-bit cyclic redundancy check which is used to detect any corruption of data in transit.

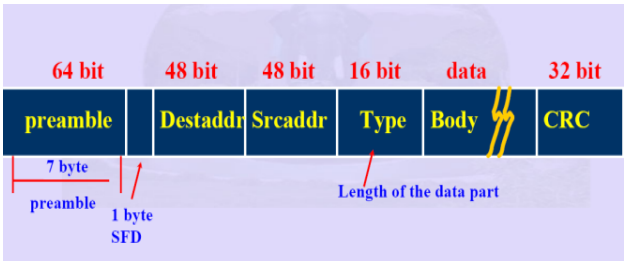

Fig 3.0: Ethernet frame structure

The Ethernet block interfaces between the off-chip Ethernet PHY using Reduced MII protocol and the on-chip Media Independent Interface Management serial bus Preamble and start frame delimiter:

A frame starts with a 7-octet preamble and 1-octet start frame delimiter (SFD) Prior to Fast Ethernet.

Header :

The header features destination and source MAC addresses which have 6 octets each, the Ethernet Type protocol identifier field and optional IEEE 802.1Q tag.

Payload:

The minimum payload is 42 octets when 802.1Q tag is present and 46 octets when absent.[2][note 4] and the maximum payload is 1500 octets. Non-standard jumbo frames allow for larger maximum payload size.

Frame check sequence:

The frame check sequence is a 4-octet cyclic redundancy check which allows detection of corrupted data within the entire frame.

D. Communication Between Client And Server

In this how the client communicate with server shows, when client wants to communication with equipments that connected with the server remotely, then it should first enters the configured IP address of the server and it can monitor through the web page that is on HTML page. For communication take place first perform the CRC checksum bytes and then begins the communication process. Once the start process the system allowed to collect the data from various sensors through the specified particular ADC channel. For different data collection the system should always load the fresh HTML page having a sensors new data's.

E. Software Description

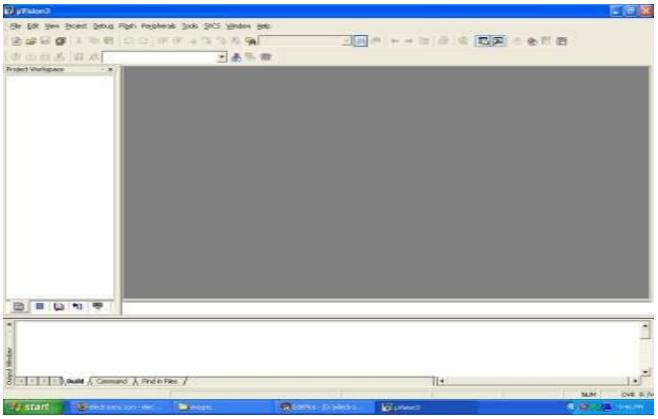

Fig 3.1: Flash magic screen shot

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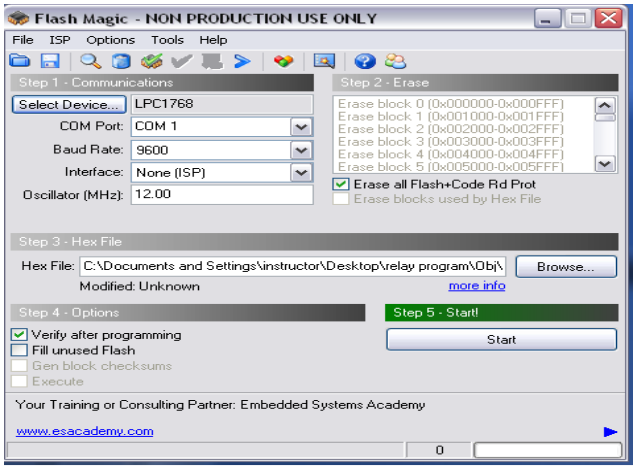

Fig 3.2: Keil Microvision screenshot.

Keil microvision4, it is the compiler software using here. For editing using a Embedded C language. The code will written in Embedded C and this code will load in LPC1768 CORTEXM3 board by Flash magic software.

The flash magic is the software which is used to load the source code in processor, it communicate between PC and processor. At PC side HTML is used to design a web page. This HTML is interface with Ethernet (TCP/IP) protocol. In Flash magic the baud rate is always 9600 and oscillation is 12 MHz, com port we can use either 1 or 2.

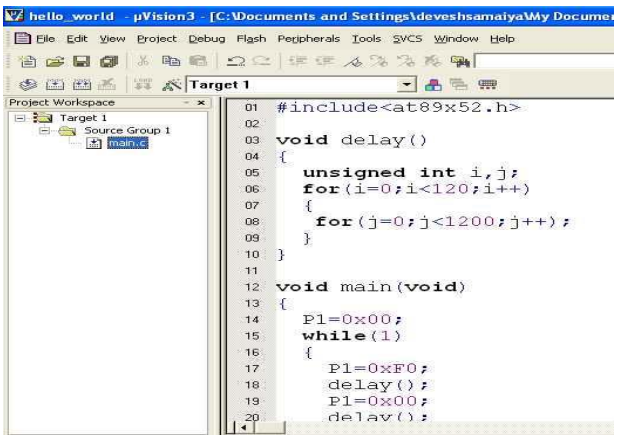

Fig 3.3: Keil Microvision editing window.

IV. RESULT AND CONCLUSION

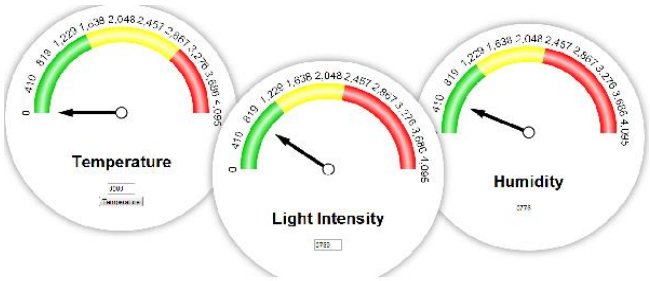

Fig 4.0: Reading on Web page for Temperature , light intensity, humidity

The web based remote supervisory control and information implemented with leading technology enables remote end user to easily obtain secured data information and knowledge to support decision-making at all the levels of the process plant. A number of positive and successful initiatives are investigated to improve the operations and utilization of process control system, information system and infrastructures used by the plant engineers and remote expert support team.

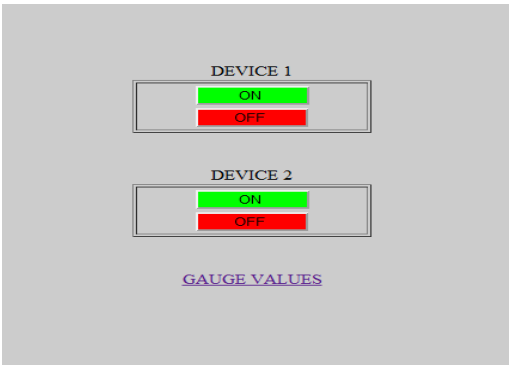

Fig 4.1: Web page for appliances ON and OFF

Figure 4.0 shows that web page design for analog data reading, this analog data reads from server side and according to that, on web page the analog meter will show the corresponding values, these values are in hexa decimal form which is the client side and the same is displayed on the graphical display of the LPC1768 which is the server side shown in figure 4.2. The appliances on remote site area can be controlled through Ethernet by simply clicking on buttons shown in figure 4.1 as

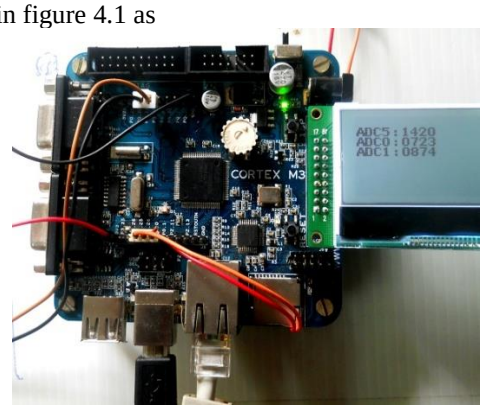

Fig 4.2: Embedded server with display

ON and OFF buttons. This setup can be used for many projects here we are just controlling two devices and reading the temperature, humidity, and light sensitivity analog data.

V. ACKNOWLEDGMENT

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