

Designing of Embedded Web Server Based on Energy Meter

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ABSTRACT

The embedded web server is a combination of hardware and application software. Now a day's these embedded web servers are widely used in industries for hazardous area data monitoring and controlling applications, like temperature, pressure, field device data can monitor and access remotely through wired or wireless communications. The wired embedded web server data accessed through Ethernet. In the big industries so many equipments are present, those all equipments monitoring directly is not possible, why because that places man not entered places are there like nuclear power plants turbines that type industries very useful web server. We can monitor directly viewing the real time data on web pages of the industries devices, in this web server access through Ethernet by IP address of devices. The web server is design in energy meter, that energy meter real time data can monitor by remotely, in energy meter ARM based microcontroller is used and real time operating system are used. The operating system accurately uses the resources and it is more reliable. The main aim of the energy meter is to measure how much power is consumed and its parameters in industrial or home based applications, its data can monitor remotely through the embedded web server.

Keywords - ARM Processor, Embedded Web Server; RTOS, Ethernet.

I. INTRODUCTION

The Embedded systems are more popular in now a day's, presently in all electronics based products microcontroller is plays a key role. Embedded based products are used in many places in industries for monitoring data through remotely. These applications like temperature monitoring and humidity. The measuring equipment data users all the times view by manually. In industries some critical applications means hazardous places. The web server is placed on the device and it monitors remotely real time data through Ethernet. By using embedded web server can continuously monitor the crucial application data. These web server web pages can design in two ways one is dynamic web pages and second is static web pages. It design is depending on user requirement. The web server is running on the device and it is waiting for the incoming requests. Whenever the user wants the real time data, simply configured the device IP address in the web browser that time our designed web pages are displayed through Ethernet and required real time data is displayed on web pages. ARM based microcontroller is used and its internally Harvard architecture. It consumes very low power consumption and high performance. Microcontroller is interfaced with Ethernet transceiver to establish Ethernet connectivity. In energy meter real time operating system (RTOS) is used and also more features can be implemented on real time operating system. The RTOS has multitasking, fast task execution and fully priority based operating system. Embedded software can be

developed in Embedded C, web pages can be developed in Java.

When RTOS is incorporated into this system, more devices could be controlled and monitored with high reliability [2]. The multi tasking capability and its fast response time is also added advantage of easy deployment and makes the system is capable for a wide variety of applications. The system designed here is an example of embedded technology and integrated with network technology, where the communication and processing technology works together. A web server can be embedded in a device to provide the remote access to the device through ethernet from Web browser of the client location. If the resource requirements of the Web server are is small, then the end result will be reduced and it is typically a portable set of code that can run on embedded systems with limited computing resources [3]. Firmware developed in embedded C language, it makes easily understandable by the user. In the current world scenario of globalization, where communication has become a necessity, this communication technology can be surely placed in the emerging trends of embedded systems technology.

II. EMBEDDED WEB SERVER ARCHITECTURE

Fig 1 shows in below the embedded web server architecture and its client servers are trying to access connectivity for the real time data. The web server can accomplish tasks such as receiving requests from the client side, analyzing requests, responding to

those requests, and finally return results to the client. Initialization of the Web server, such as creating socket, binding a port, creating environment variables, listening to a port, entering loop, and wait for connectivity arrival from a client [4]. In general purpose web servers running on the PC for large amount of data processing in the specified span of time, if the web server runs in PC it consumes more power, and maintains is very high cost. If the web servers are running in embedded system applications, it consumes the small image size and also it less power consumption.

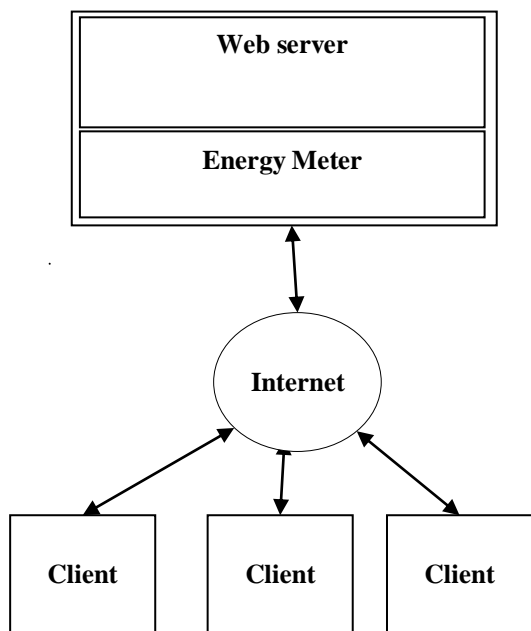


Figure 1: embedded web server architecture

III. System Architecture

Embedded web server is designed on Real time operating system. It is running on the ARM processor, that web server continuously waiting for incoming request .if any request come that time web server responds. Energy meter measure the power calculation parameters, the web pages access those parameters access on web server using the GET and POST methods. Send or receive the data to or from embedded server in two ways. One is if the web pages want to access the data from server by using GET method. If the web pages want to send data to server POST method is used [6]. The Fig. 1 shows the top level embedded web server architecture block diagram. It consists of one web server and three clients, the communications between server and clients by using ethernet protocol. It says that web server can accessed three remote clients. Those clients monitor field device data and its parameters.

An embedded web server is program it can be integrated with ARM microcontroller. It contains an internet software suite as well as application code for monitoring data. Embedded web servers are integral with part of an embedded network [5]. System

on chip is responsible for measuring power consumption data. ARM processor is the responsible for handling all tasks.

Real time operating system is scheduling the tasks according that tasks priority and these tasks executes in concurrently. Web server interfaced devices have so many advantages. Those are user-friendly, easily monitor the data. Embedded web servers have different requirements, Such as small resource usage, security and portability high reliability.

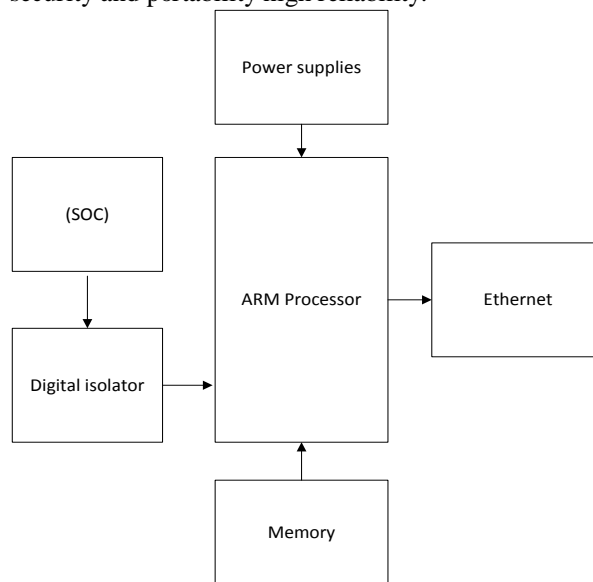


Figure 2: system architecture

IV. Hardware Architecture

The Fig 2 shows hardware architecture of energy meter, the System on Chip (SOC), digital isolator, memories, ethernet driver IC and power supplies required for all the IC in the board. The ARM microcontroller is heart of the hardware [9]. Metering IC and responsible for measuring three phase line power consumption parameters like power factor active energy and accumulation data. These values loaded into the non-volatile memory. Web pages access the data by using GET/POST methods, web server send the data through Ethernet of the RJ-45 port of device. ARM processor is interfaced with ethernet transceiver driver IC processor and it is connected with the LAN network cable.

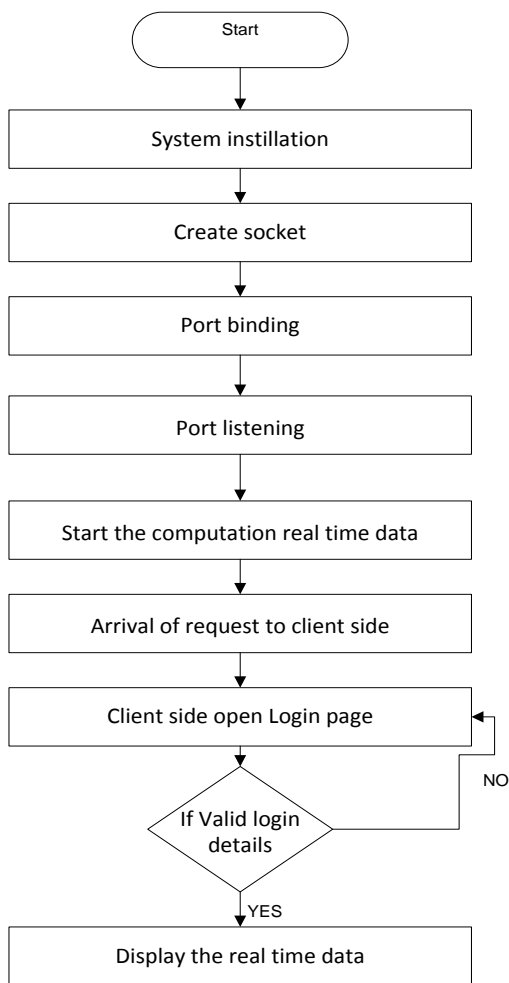


Figure 3: embedded Web server flow chart

V. SYSTEM SOFTWARE DESIGNS

The application software code is written in embedded C. The embedded web pages are developed in java.

I. System Design Flow

In below Fig. 3 shows that, the flowchart of the embedded web server and its execution flow. The application code for a specific RTOS is written and all applications are integrated.

RTOS: Real time operating system used to develop the web server applications are executed in the form of tasks. It executes based on priority. Tasks are executed by connecting the users to web server. An RTOS manages all the tasks in the meter. Which perform the operations in real time scenario. The web server is implemented in real time operating system, it is a powerful RTOS used for real time applications. In the application developed binary images are ported into the processor [8]. Some of simple system calls function for task creation methods are given below.

- *Task spawn ()* Spawns means creates a new task.

- *Task create ()* Creates, but not activates a new task.
- *Task open ()* Open a task (or optionally create one, if it does not exist).

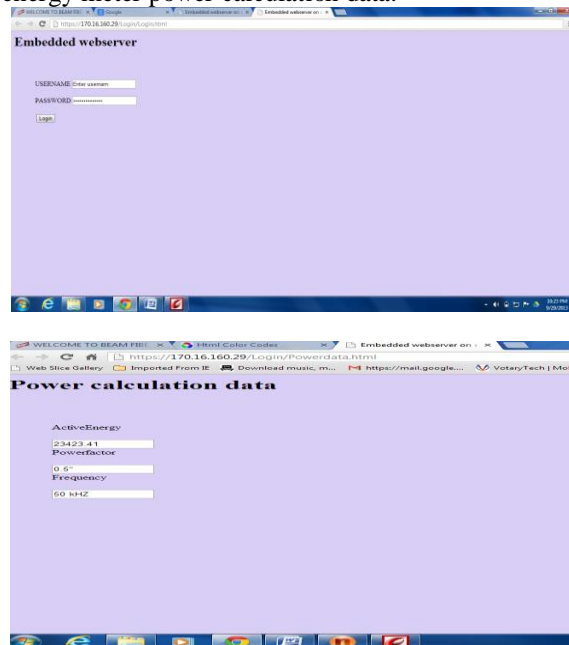
HTML Pages: HTML pages are used for user interaction, these are opened dynamically opened, and the information of the web server data is displayed in the client web pages.

VI. TESTING THE EMBEDDED WEB SERVER

First testing the hardware booting process, by using the hyper terminal, it is connected to serial port. it shows the booting hardware done successfully. After the hardware is successfully booted with RTOS, it is tested over the network using command prompt. In the command prompt enter the ping command and IP address of device. That time web server replies the client requests [7]. In the web browser enter the IP address of the device. The device has unique IP address in the LAN. it checks the entered IP address and entered IP address, if it matches it will responds the client request and shows the web page of device After displays the web page it asks the username and password will be validating after successful authentication it display the data., if not it will ignore the request by client.

VII. Result

Execution result for embedded web server on energy meter power calculation data.



VIII. CONCLUSION

The embedded web server designed on energy meter which can be used for viewing the real time data is useful for power sub stations and industrial applications. It is low coast and easy to monitor the data.

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