

EMBEDDED WEBSERVER FOR METEOROLOGICAL DATA MONITORING

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Abstract- The meteorological data monitoring in India is done manually or the data are feed to the Personal Computer and then transferred to the internet. Due to this the data are not real time and also the there are some difficulties in management of resources for both the Government and also for the private bodies like industries. The proposed system could replace the use of the personal computer and other large server which consumes lot of power by a small low power Embedded Web Server. The data which are obtained are real time and would enable for the Government and other private bodies to manage their resource and plan according to it. The Embedded Web server uses ARM processor which could be directly connected to LAN or internet. Meteorological data are important in various applications like agriculture, industries and also in some cases for predicting natural calamity like flood etc.

Index Terms- Webservers, ARM Processors, Meteorological data monitoring

I. INTRODUCTION

India is an agriculture dependent country where 70% of the people are dependent on agriculture and allied activities. There are huge variations in topography and climatic zones resulting in different rainfall, timing of the rainfall and others. Agriculture planning, monitoring and support need accurate weather data. Central agencies use data from different sources to collect weather data and develop weather forecasts and lend advice to various agencies involved in support operations for agriculture and allied fields. At present weather monitoring, forecast in India is very inadequate in terms of coverage, quality and its application for day-to-day use by the ultimate beneficiary. The weather forecast too general and cover many times Lakhs of square kilometers and loses any sense of practical application to the farmers and others on when they

want to decide to seed, spray pesticide or apply water or when to harvest etc. The main reasons for this lacuna are the centralized weather monitoring systems (Hyderabad or Bombay), lack of weather conscious field staff, low quality crude manual equipment and others and lack of research discipline. Very few institutions like ICRISAT and others are using digital weather stations.

With the rapid development of technology, now we have entered the post-PC era with rapid development of digital information technology and network technology. The emergence of the embedded Internet technology is a marker of the Internet development history, which relies on the Internet, Web and embedded three technologies, and through Web and embedded technology to achieve the functions of monitoring, diagnosis, test, management and maintenance on the equipments and heterogeneous sub networks which are docked to the Internet from different subnets and physical areas. Monitoring of Meteorological data is needed for various fields like agriculture, defense, industrial process control and "Social and Economic Applications and Benefits of Weather, Climate, and Water Services", to advise on strategies that can be adopted to advance knowledge in socio-economic benefits of weather, climate and water.

This paper describes a Web-based gateway for the on-site monitoring equipment network to obtain meteorological data composed by RS-232, CAN and other communication protocols, thus to bridge between them and the Internet, allowing remote users to browse and manage these on-site monitoring equipments through browser anytime and anywhere. It also describes a method to optimize the network module based on applications of meteorological data monitoring, introduces the serial communication protocol integration of two types of

industrial digital monitoring equipment, and finally presents the establishment of Web server.

The proposed system would overcome the above difficulties. In the proposed system there is ARM based system which would collect Meteorological data according to real time and also transmit data through the Ethernet without any need of a Personal Computer and would even act as Web server and thus reducing the need of huge Server that has is needed in usually cases.

II. LITERATURE REVIEW

The Embedded System interaction with internet and prototypes to explore novel methods for human-computer interaction by internet and related technologies [1] is the base for the design of the embedded based web server. The embedded system is capable to be used as web server. The usual web server have Fat Server, thin client computer, while due to the application and structure the embedded web server has to be different. The embedded web server has to be thin server without any sacrifice of traditional server [2].The main objective of designing an Embedded based web server is to reduce the cost and low power dissipation without comprising the efficiency of the product. The web server should be capable to transfer to the data to the client based on the request from the client's request over the internet. Most of the web server needs at least a Personal computer running round the clock to act as a web server. This is difficult for the products which has be low power consuming and also the space available for the web server is a constraint as most of the data acquisition part are located in areas of such constraint. The embedded equipments can be divided into two parts: on-chip integration form and out-chip integration form [3]. However, both these two forms are costly and inflexibility and the whole system have to be changed once the suppliers of devices and terminals are changed. The former one also has long development cycle. Hence there is need for designing embedded device with low cost. The embedded system with supports the TCP / IP protocol, so it can transmit data directly without PC. This pattern also has many other advantages, such as speeding up the development of the system, facilitating the works of the future expansion, improving the timeliness and accuracy of the meteorological observation, and achieving the commands of automatic meteorological observation. There is various embedded data acquisition design which has its own limitation such as need of Personal computer for sending the data as the embedded system doesn't have the capability for connection to the internet. And also if the embedded

system is capable of connecting to the internet or Ethernet they are not capable to act as a server [2].On the basis, embedded systems are developing fast and have been used in controls and data acquisitions [2][3][4]. As embedded system is of high performance and the cost is low, it has the tendency to play the great role of controls and data acquisitions. The meteorological data acquisition measuring interval and the number of parameters that has to be monitored are given by WMO (world Meteorological Organization) [9] and IMD (Indian Meteorological Department) [10]. The web server has to follow a set of protocol like TCP/IP so that it can transmit data to the internet without any need to modify the transmission protocol as it is widely followed and also without the need of a personal computer [5].The data package is taken as data transmission of application layer in TCP/IP internet. The data gateway is designed to be transparent for these two reasons: compared with opaque gateway; there is no need for transparent gateway to expand its memory for caching communication data in hardware, and in software, there is no need to further consider the collection and distribution of data.[2]

III. EMBEDDED DESIGN

The Embedded System consists of three parts as shown in the Figure 1.

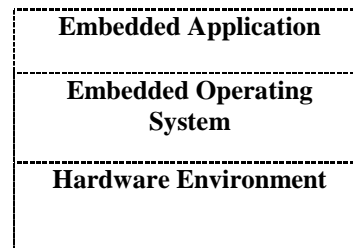


Figure1. Basic Blocks of Embedded System

The Embedded Application run on the operating system to complete the Embedded applications with special functions by using a mechanism the operating system provided, and different systems need to design different embedded applications. In this case Web server for Meteorological Data Monitoring.

Embedded Operating System controls the interaction of the application programming and the hardware to ensure the operation of the system and the implementation of various operations. It provides a software platform for the applications and is a relatively invariant. Some of Embedded Operating System is usually used for the Embedded System are

FreeRtos, Linux, Windows, etc Hardware Environment is the hardware platform of the entire embedded operating system and application running in it. Different applications often have different hardware environments. Hardware components used are Processor, Sensors, etc.

3.1. HARDWARE DESIGN:

The Hardware part of the Embedded Webserver is based on ARM processor and its peripherals. The Meteorological data are obtained from sensors which are connected to the ARM processor. The ARM processor stores the data inside its memory and if there is a need it could store at external medium either within the Embedded Webserver or it could also connect to an external data server through Ethernet module in the Embedded Webserver. As an ARM processor is used which consumes less power for its operation it would sufficient if a battery is used a Power supply. In case Power Supply of 230 V or 110 V AC is available there is a need for Step down Transformer and a Rectifier module in Power Supply section of the Embedded Webserver. The Embedded Webserver should have connectors for connecting Ethernet cable. The human interface module such as Keyboard and LCD display have to designed so that is a direct interface between the Embedded Webserver and the human being. The Diagrammatic representation is shown in the Figure 2.

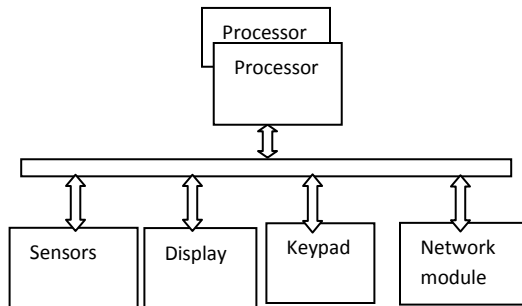


Figure 2 .Hardware Connections in Embedded System

3.2. SOFTWARE DESIGN:

To put the embedded system into practice, software design is very important. Firstly, Boot loader should be programmed to start up the ARM system. Boot loader is an assemble program that mainly accomplish the register settings of the ARM processor and initiate the system. The on-chip functions of the processor are realized by setting the related registers. After running the Boot loader, the system begins to execute a Real Time Operating System (RTOS) for the ARM processor. The RTOS is responsible for managing the hardware and

Software of the system. The RTOS is designed based on the requirement of the Embedded Webserver so that it would be able to schedule the task which available to it. The Kernel of the RTOS would schedule the task. The RTOS would contain device drivers for connecting external devices to the ARM processor.

Figure 3 Shows the Components of the Software design in an Embedded System the RTOS should have a module for TCP/IP which would define how the data are sent using TCP/IP protocol over the internet and also to communicate with other devices.

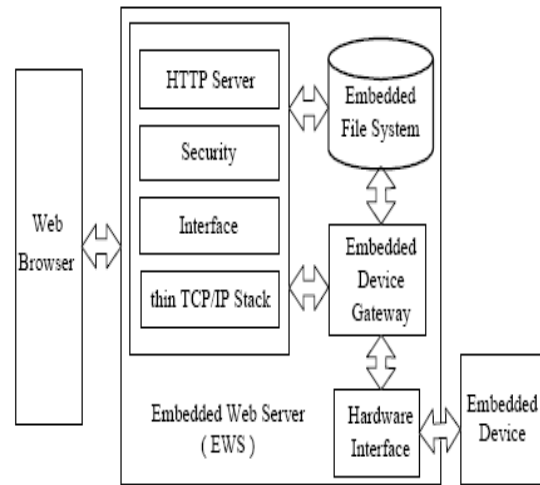


Figure 3. Software Components of Embedded System

The RTOS should have a module for receiving the data from the various sensors and other microcontroller or processors which are connected directly to the Embedded Web server or over the internet by using Ethernet cable. The RTOS should define at what intervals the data have to be stored either externally or internally to the Embedded Web server and also remove the data which are not required by Web server.

IV. BLOCK DIAGRAM

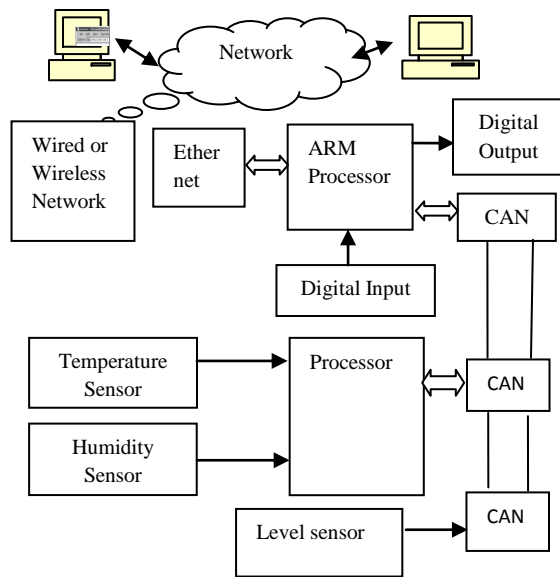


Fig 4 Embedded Web server for Meteorological Data Monitoring

V. WORKING OF EMBEDDED EBSERVER FOR METEOROLOGICAL DATA MONITORING

Figure 4 shows the Block Diagram of Embedded Web server for Meteorological Data Monitoring. In the block diagram the ARM processor acts as Web server and also collects and stores the Meteorological data which are obtained from various sensors which are available in the system. The ARM processor can not only be connected to the sensors but also to some microprocessors or microcontroller in case there is an availability of sensor which is already connected to microprocessors or microcontroller. The data which are obtained from the sensors or microprocessors or microcontroller are stored in the Web server i.e. ARM processor. The ARM processor has Ethernet connection which can transmit the data over the internet. TCP/IP protocol is followed to transmit the data over the internet so that there is no difficulty in transmission or reception of the Meteorological data, thus it Meteorological data can be monitored from a remote area or any location in the world with the internet or network connection.

CAN (Control Area Network) is followed to obtaining data from the microprocessors or microcontroller. CAN is followed since it can transmit data over a long distance and has security features within it.

The Web server has a display and keypad within itself so that there is no requirement of PC

interface and the data can be seen in the Web server directly and incases there is a requirement to enter some data manually it can be done with the help of the keypad which is available in the Web server.

5.1. HARDWARE SPECIFICATION

- ARM Processor
- LCD
- Keypad
- Sensors(Temperature, Humidity, etc)
- LAN or Internet connection
- Personal Computer(PC)

5.2. SOFTWARE SPECIFICATION

- FreeRTOS For ARM Processor
- ARM Keil μ C 3
- HTML design using Dreamviewer8
- XP or Higher Operating System for PC with Internet Explorer

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