

GPRS Based ARM Embedded Web Server Design

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Abstract: For monitoring & controlling either home appliances or industry devices networked embedded systems are important. This proposed work is an attempt to design a data acquisition system allows information to be collected with no labor requirements, cost efficient and easy to maintain technology. General web server requires more resources & large amount of memories. So ARM based servers are becoming popular instead of PC based servers. This paper proposes world's most powerful technology using advanced RISC machine (ARM 7) & in-build web server application with General Packet Radio Service (GPRS) technology. Users can monitor different remote machines/systems by using embedded web server. GPRS technology along with GSM makes it accessible from anywhere in the world. Need of server software & its maintenance are eliminated by this proposed system. This system is an optimized solution for industry automation, instrumentation & household devices. Various sensors installed at working place help in real time monitoring like temperature, humidity, carbon monoxide, Speed, LPG gas leakage etc. The results show that design of system is safe and convenient from local management data. Security of system enhances because of authentication process. Source code is written in well known embedded C language.

Keywords: ARM Processor, Data Acquisition System, Embedded Web Server, GSM, GPRS

I. Introduction

To study & monitor environmental changes in forests/oceans, surveillance application, home, laboratories, military & industry automation, it is necessary to monitor & control of physical environments remotely with great accuracy & ease [1]. So data acquisition & control devices are best solution for unmanned devices in a multisite job operation. In present days there are very few of companies which are making the Data Acquisition Devices and the available devices are very costly. Hence, there is need to provide user a cost effective or low cost device which can suite according to their proposed work. An acquisition unit design to collect data in their simplest form [2]. which is based on Linux [3]; it is popular choice for many embedded PC systems. The similar system [4] will increases set up costs due to data accessed through central server. For wide range data transmission typical client-server architecture is not suitable because general purpose computer requires large space, large amount of memory & more cost. The central server can be removed by using web servers. This system still based on industrial PC [5]. An embedded web server creates an easy way for monitoring & controlling any device which is at remote place. Embedded network contains Advanced RISC machine i.e ARM 7 supports real time application also minimizes the system cost. This system detailed in Interactive DAC system [6]. Remote signals measure & can control through Ethernet module. This system should require PC with internet at the client side. We proposed a system which is portable, low cost & removes the need of server software & maintenance by using GPRS technology. It helps to communicate with GSM phone. Now a days GSM has in-built powerful TCP/IP protocol stack for internet data transfer over GPRS technology. Therefore the status of different sensors installed at working place can be monitor at anywhere in the world.

The organization of paper is as follows. Concept explains in Section II. Section III will describe the operation when different sensors connected to the embedded system. In Section IV presents the expected results. Finally section V concludes paper & suggests some future work.

II. Embedded Web Server Architecture

General PC based web servers, which are developed for general purpose computers like UNIX, LINUX or NT servers requires large megabyte of memory, a fast processor, pre-emptive multitasking & many more. An embedded web server provides remote access to devices from a web browser. Static & dynamic information about industry machineries & system provides same to the web browsers on request by an embedded web server. An embedded web server is integral part of embedded network [7], which consists of an ARM processor. ARM processor contains an internet software & application code for monitoring & controlling the systems. Embedded web servers have lot of advantages; user friendly, low cost, supports to real time application, low maintainability, portability, high reliability, security, controllability which general purpose computers can not give.

Fig 1 shows proposed DAC system with embedded web sever. This contains a portable ARM processor. This hardware built on a single chip module. An ARM processor is responsible for handling all tasks like measuring & conversion of signals, data base updating, communicating with owner by sending HTML pages. An ARM processor manages all tasks in parallel in small amounts of time. The use of GPRS is familiar to all. Almost all GSM system providers give this service. So it is easy to be connecting to the internet world.

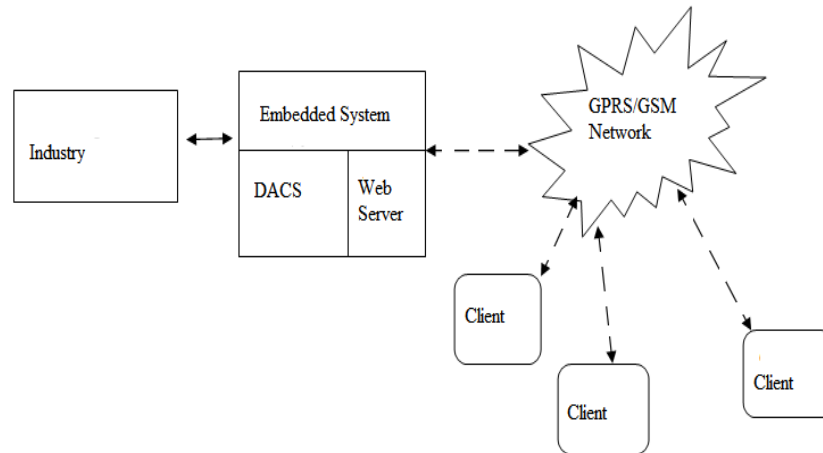


Fig 1. Embedded web server architecture

After a GPRS connection has been established queried data can be relayed to the client via a central server [7]. Real-time system correctness depends not only on the correctness of the logical result of the computation but also on the result delivery time [8]. This method also increases the data transfer cost as the number of clients increases due to the access amount of data transfers via GPRS. Direct communication enables access to only relevant information in the embedded system by pre processing the data. The embedded system should also handle the web services. Using a central server to relay acquire data has some disadvantages. It needs a client interface framework. There is no direct bidirectional communication between client & embedded system. This system is unsuitable for real time applications. So it is necessary to eliminate the need of a central server & reduce the amount of data sent from the remote unit. In the proposed system, the GPRS architecture works with GSM protocols [9]. Because of GSM network, this system is configured to be virtually online at all times. After booting of the operating system an admin script is executed, initiating GPRS connection software module. It supports instructions of AT commands. SIM 900 can be integrated with many applications. GSM/GPRS RS232 Modem from rhydoLABZ is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial port .The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. This GSM/GPRS RS232 Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface. The IP address of embedded devices should available at client side to directly access an embedded system. By using IP address people from remote location can access the information.

There are two types of IP address i.e static IP & dynamic IP. Dynamic IP assigned through a Dynamic Host Configuration Protocol (DHCP) server of the GSM provider for every connection established. The DHCP approach is more flexible and works better compared with the static approach as a cost-effective solution, despite the necessity for a script running on the embedded server, one-time broadcasting its IP to the FTP server. The hypertext file placed on the FTP server by the embedded system and queried by the client. With this mechanism in place, the embedded system updates it IP information on the FTP server upon every reboot, which causes an IP refresh from the GSM service- provider.

III. System design

3.1 Data Acquisition System

The remote I/O data acquisition and control system based on embedded ARM platform has high universality, each acquisition and control device equipped with 24-way acquisition/control channels and isolated from each other. Different types of sensors such as temperature sensor, Humidity sensor, speed sensor, carbon monoxide detector, and LPG gas leakage sensor are connected to each I/O channels of ARM processor. The data from sensors is collected & maintain by the ARM processor. The data is stored into the database. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key

requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems. The GSM modem is serially interfaced with the controller with the help of MAX 232. GSM modem shares data from the board to internet. In Web Server mode, the data can be accessed by the client from anywhere across the world through internet [9]. Fig 2 shows the general purpose DAC system which is at remote place.

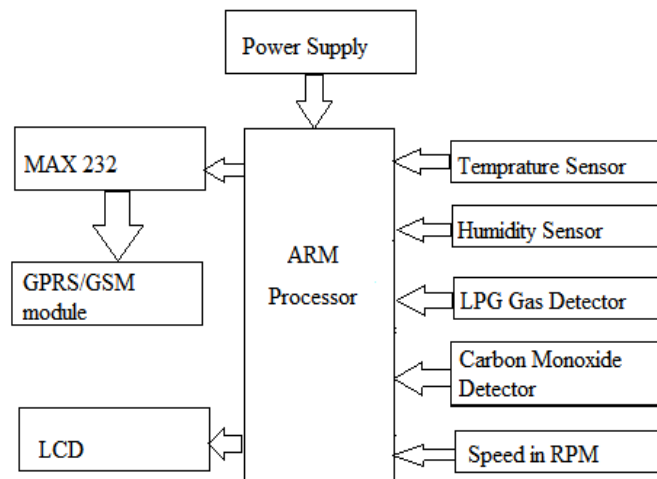


Fig 2. General structure of DAC system

1.2 Software

The software coding is written in embedded C language in Keil software. The software consists of two major components. They are RTOS and web development environment. The application runs in the form of tasks. Tasks are created by each user connecting to the server. An RTOS is required to manage these tasks, which perform the operations in real time. The software running on the embedded web server follows the same layered structure as used in the TCP/IP protocol suite. The TCP/IP protocol suite allows computers of all sizes, running different operating systems, to communicate with each other. It forms the worldwide Internet called a Wide Area Network (WAN) of several million computers. The TCP/IP protocol suite is a combination of different protocols at various layers. Every layer acts independently from each other. The Internet Protocol (IP) delivers packets to Transmission Control Protocol (TCP), UDP, and Internet Control Message Protocol (ICMP), the ICMP answers to PING requests and TCP/UDP delivers data to the applications. The applications can communicate with the transport layer through buffers with data and variables with control information.

WampServer is a Windows web development environment. It allows you to create web applications with Apache2, PHP and a MySQL database. Alongside, PhpMyAdmin allows you to manage easily your database. WampServer provides various Functions such as manage your Apache and MySQL services, switch online/offline (give access to everyone or only localhost), install and switch Apache, MySQL and PHP releases, manage your servers settings, access your logs, access your settings files, create alias. WampServer is used for data communication between the client and the server. In the embedded web server, web pages are selected as the media of interaction. HTML is used in designing these web pages. To increase the security of database authentication process is include. User has to enter valid ID & Password to access the data. Every time the new password is generated & send to the user's registered mobile no. Multiple users can access the data at a time. The HTML pages are saved on the board. Fig 3 Shows the Flow of System.

Following steps are used to execute the system:-

- First initialize the System.
- Start monitoring & sending control parameters to an embedded board from different sensors.
- Display these parameters on server.
- Client requesting web page for monitoring control parameters through IP address.
- Client must enter correct log in name & password.

- If log in name & password is correct then send control parameters to client at remote place through HTML page via GPRS, otherwise reentered it.

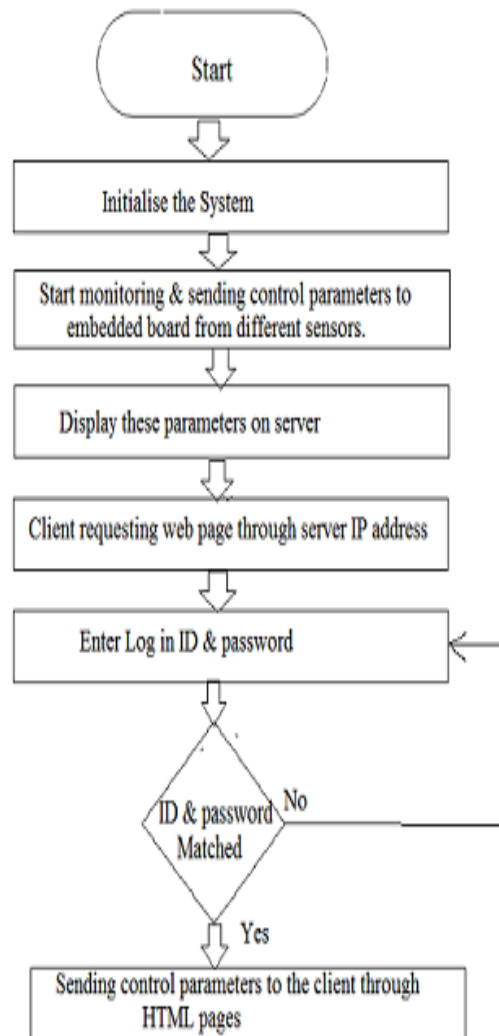


Fig 3: Flowchart of System

IV. Result

Firstly Run the Wampserver and then by using your IP address access the Admin page. After requesting the web page through server IP address by the client, the online processing web page for client authentication is opened. Client has to enter valid user name, Port & click on “Generate OTP (One Time Password)”. Automatically a new password will generate and it will send on users registered mobile no. This provides a great security which is essential in Military & most of the industrial application. These web pages are requested by the client and served by the embedded web server which is ported on ARM processor. Client can interact with the machine through its own browser via these embedded web pages. Every client’s control has been executed in industry via the embedded web server. The online Processing web page is shown in fig 4.

The dynamic web page representing the sensor values in the Climate sensing & monitoring System maintained by the embedded web server is shown in fig. 5. The client access the data dynamically through this web page send by the server. The client can save these readings for further reference. This is the simplest way of accessing data by the client. Moreover more than one client can access the data at the same time from different parts of the world.

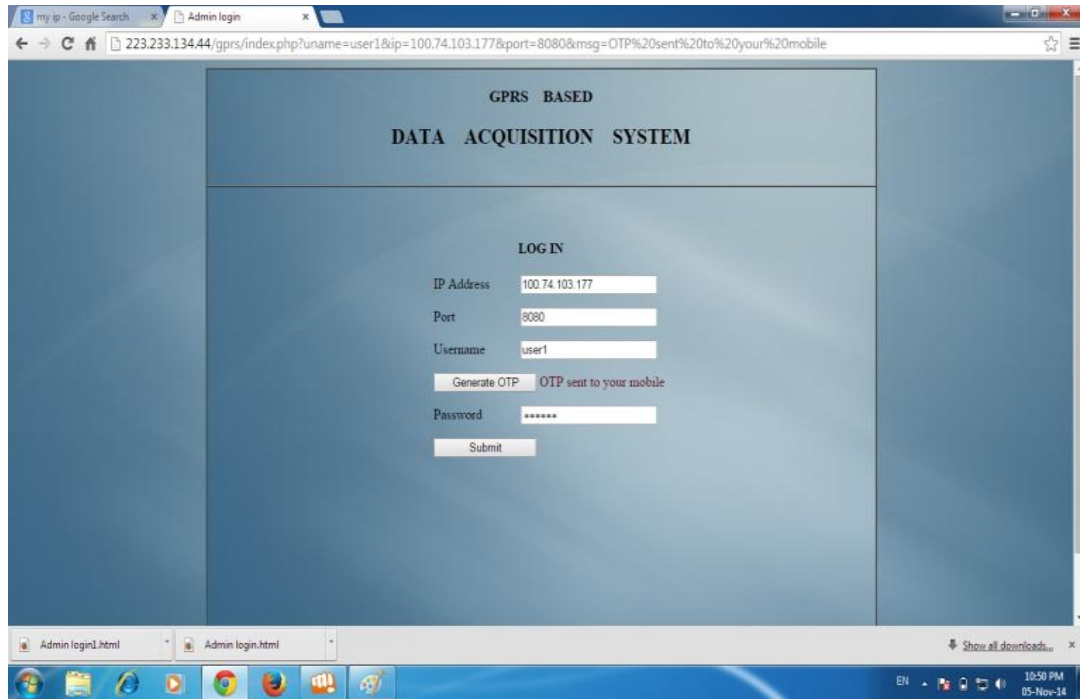


Fig 4: Online processing page

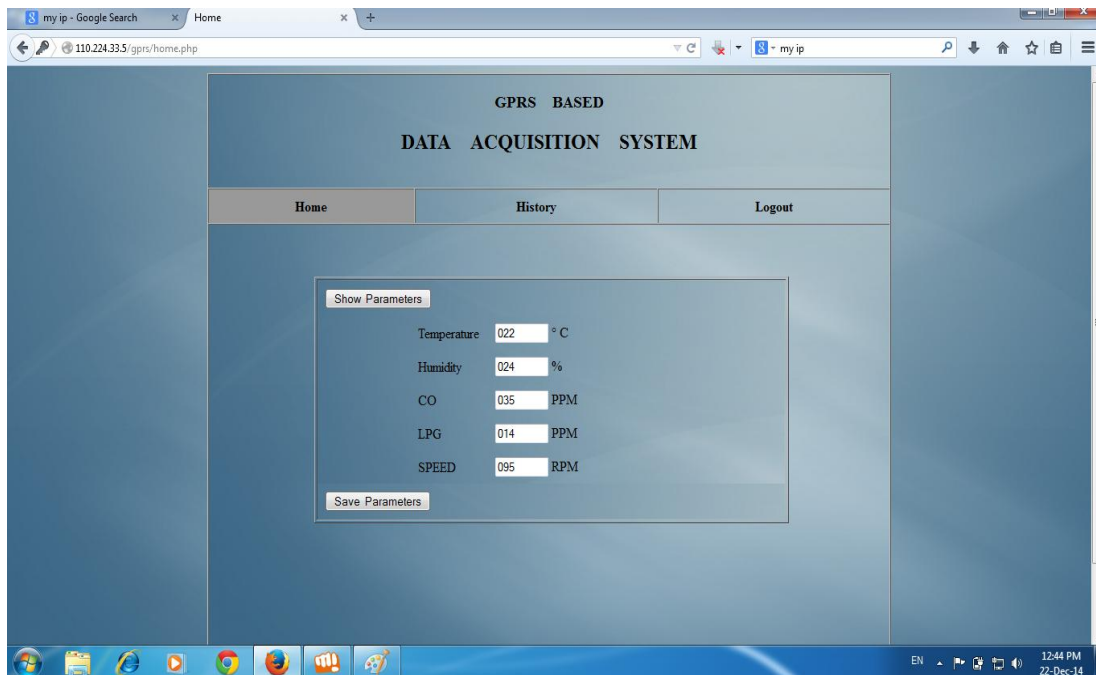


Fig 5: Clients requested web page

V. Conclusion

In this application, a low-cost, Internet-based data acquisition system has been designed and implemented that should find interest from researchers. The application possibilities are virtually unlimited by attaching modules with appropriate interfaces, although the usage of the system is demonstrated with only a few sample devices. Compared with other applications, this system has advantages in terms of allowing direct bidirectional communication and reducing overhead, which can be vitally important for some real-time applications. The operational costs have been reduced by relinquishing the storage of large data to an FTP server on the Internet. The system is designed to support dynamic IPs. A method to distribute the IP information has been developed. This cost-minimization effort is a big concern for mobile systems using wireless communication methods. The overall cost advantage of the system in terms of the components used makes it an attractive choice for data-acquisition applications. This system can be widely applied to electric power,

petroleum, chemical, metallurgy, steel, transportation, Electronic & Electrical industries, Automobiles and so on. The sending of video recording of control room is still in process.

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