Advanced RISC Machine Based Data Acquisition Development and Control

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Abstract- *A Popular QNX Neutrino real time operating system that supports multiple scheduling algorithms upto 65,535 tasks. My SQL can be integrated with this OS to create embedded database. A web server is to host websites and delivers web pages to clients. The general purpose web servers compose of an operating system, the web pages and a huge amount of memory and special hardware. Digital data acquisition is done by ADC. ADC stores the measured data in external memory in which the memory acts as a database during web server mode. ARM Cortex A8 Processor is directly connected to Ethernet service and RS232 Communication parameter. The Ethernet interface that connected to the ARM predicts the remote signals and exchange the data through reliable communication protocol and control the remote devices through PC. ARM Processor has internal I2C master slave protocol. Due to the availability of I2C, it has the ability to communicate with any other peripherals. This system has LCD camera to monitor the measured parameters.*

Keywords— *Interactive data acquisition and control system (IDACS), QNX Neutrino Operating system (QNX Neutrino RTOS), Embedded ARM cortexA8 Processor, Embedded web server.*

Introduction

Generally DACS works by digitizing the analogue signal and sending the combined digital information for both lines over the same copper pair between the exchange and the pole. The cost of the equipment is significantly less than the cost of installing additional copper pairs. Data acquisition and processing plays an important role in the area of modern industries, and the performance requirements like the system precision and size vary according to different application areas. This paper approaches a new system contains inbuilt data acquisition control system with online interaction by the help of ARM cortex A8 Processor . It makes the system more reliable and avoids more complication. The efficiency of the previous system is quite low was discussed [1].

The design of very fast data acquisition in plasma discharge application was discussed in [2]. The concept of Linux operating system is discussed in [3] it is the popular choice for many embedded real time applications and PC systems. In [4] advanced traffic survey mechanism uses data collection process for post processing of vehicle's position. Signal conditioning is the major part of any data acquisition unit. High level integration architecture was discussed in [5]; it allows signals to be conditioned, simultaneously acquired according to the external clock and triggers processed and transferred data to real time servers and the simplest design of data acquisition system is detailed in [6].The design of flexible and networked data acquisition architecture was approached in [7], where the software resources are stored in local memory to avoid the level of resource usage and increases system's efficiency. This system process the client based on dynamic manner by server response and it maintains separate data base with DAC controller.

Signal measurement from astrophysical sources is described in [8]; where the shared memory and internet protocols are used for data handling and process from remote users. It was developed with Global Positioning System (GPS) and environmental monitoring system. Similarly depends on industry and its location General Packet Radio Service (GPRS) also used for data transmission through on-line. But this paper doesn't use GPRS and GPS systems for data uploading into internet. It reduces the system complexity and effective for all kind of real time applications. Every real time embedded system should be run by real time operating systems. Even a small 8-bit microcontroller has the portability with RTOS is developed in [9].

In this paper Real time Linux Operating system is ported in ARM9 processor. This RTLinux RTOS is very effective for many embedded applications [10]. All processes are allocated with essential resources and associated with reliable scheduling algorithms and internet protocols followed by ARM processor. This miniaturized setup reduces the complexity & size of system.

I. HARDWARE DESIGN OF THE SYSTEM

ARM Cortex A8 processors used in applications that have high- compute requirements, run rich operating systems and deliver interactive media and graphics experience from the latest technological mobile internet must-have devices such as handsets and ultra- portable smart books to automotive infotainment systems.

ARM processor is the heart of this system, every client can access the industry directly through the embedded web server. IDACS shows Intelligent Data Acquisition and Control System. IDAC system contains ARM Cortex A8 which is loaded with RTOS (QNX Neutrino). It can handle DAC and Web server simultaneously as parallel tasks. And it can control the industry machineries by the control instruction sent by client via embedded web server. During signal measurements analog to digital converter is very important, because almost every external source is giving analog signal only. While converting these analog to digital processor has to handle asynchronous interrupts.

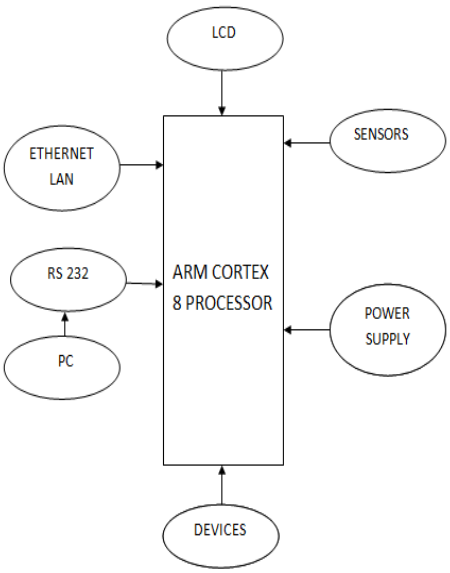

Fig. 1 Hardware Architecture of IDACS System

A. IDACS Design:

Generally ARM cortex processors contains many devices like smartphones, mobilecomputing platforms, digital TV ,LCD, Ethernet interface, etc. Ethernet LAN is used in order to access embedded web server. The I/O channels are used to store and control the signals. I/O channels selects many signals like electrical, nonelectrical signals. The temperature and light parameters are measured by using appropriate sensor. The output of the sensors is given to analog to digital converter (ADC). The analog signals obtained from sensors are converted in to digital format by using ADC. Digital signals are stored using ADC. Two forms of infra red sensors are used to perform in and out operation. The result is displayed on the LCD. The hardware architecture of the IDACS is shown in Fig 1.

The online intelligent 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. Each I/O channel can select a variety of electrical and non electrical signals like current, voltage, resistance etc., Digital acquisition are done by special ADC. The measured data are stored in external memory in which the memory is act as a data base during web server mode. ARM processor directly supports the Ethernet service and RS232communication. Hence the data has been stored and controlled by some other PCs or network via RS232 & Ethernet. ARM processor has internal I2C module. So it has the ability to communicate with any other peripherals. I2C is used to interface a number of devices to the processor using master-slave protocol. Each device is given unique address of 7-bits or 10-bits and hence 128 or 1024 devices can be connected on to the bus.

II. SOFTWARE DESIGN OF THE SYSTEM

A. QNX Neutrino

The QNX Neutrino RTOS is a full featured and robust OS that scales down to meet the constrained resource requirements of real time embedded systems. It is so reliable because it is a true microkernel operating system. It supports a number of processors such as ARM, MIPS, Power PC, SH-4, Strong ARM , x86 and Pentium. It provides an excellent Integrated development Environment. It has support for C, C++ and java languages and TCP/IP Protocol stack. Under QNX Neutrino, every driver, protocol stack, file system and application runs in the safety of memory- protected user space, outside the kernel.

A QNX 4 file system may be an entire disk (in the case of floppies) or it may be one of many partitions on a hard disk. Within a disk partition, a QNX 4 file system contains the following components: loader block, root block ,bitmap blocks, root directory *and* other directories, files, free blocks, etc shown in Fig 2.

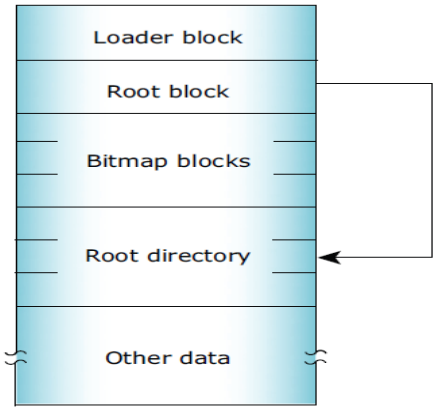

Fig.2 QNX 4 File system structure

B. TCP/IP QNX Neutrino

Industry standard BSD socket API includes optimized forwarding code for additional performance and efficient packet routing when the stack is functioning as a gateway. Enhanced NetBSD stack with IPsec and IPv6 includes all the features in the standard stack, plus the functionality targeted at the new generation of mobile and secure communications shown in Fig 3. This stack provides full IPv6 and IPsec support through KAME extensions, as well as support for VPNs over IPsec tunnels.

The QNX TCP/IP suite is modular for example, it provides NFS as separate modules. With this kind of modularity,

together with small sized modules, embedded systems developers can more easily and quickly build small TCP/IP capable systems.

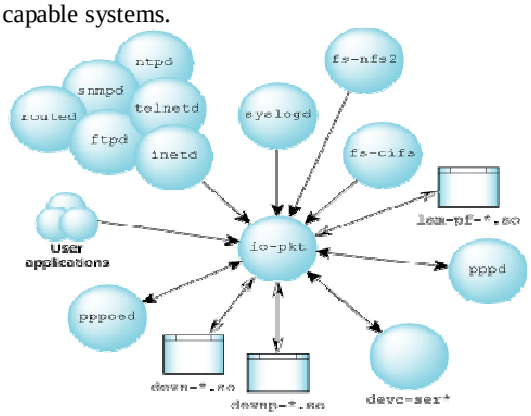

Fig.3 Architecture of io-pkt suite and its dependents

III. EXPERIMENTAL RESULTS

The results obtained from the fig shows that the single ARM Cortex A8 Processor Board control and co-ordinates the entire operation carried out inside the industry. With the help of local browser the clients can access datas easily anywhere inside the industry. The simulation results are shown in fig 4 and 6.

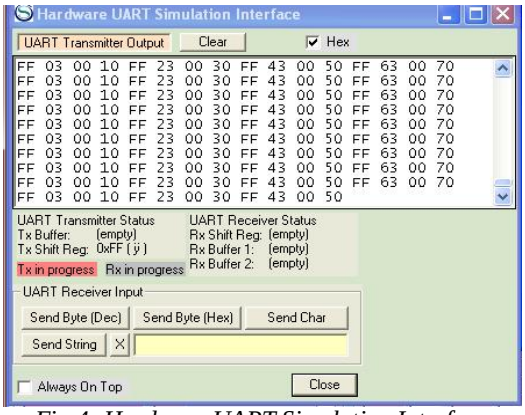

Fig 4: Hardware UART Simulation Interface

Fig. 5 ARM friendly board

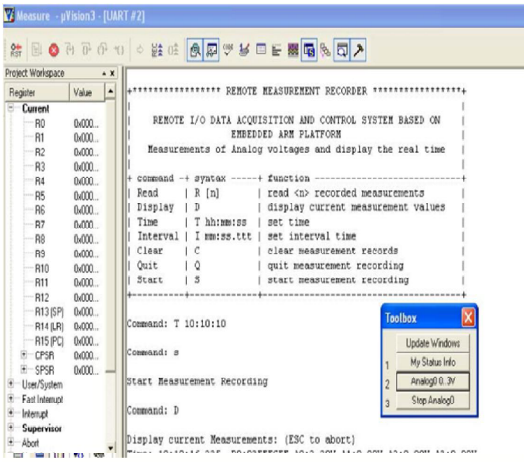

Fig . 6 Simulation result of ADC

IV.CONCLUSION

Nowadays Clients can easily access the data from LAN through Web browser with the help of DACS. Embedded web server mode is used to share the data with clients in online. ARM Cortex A8 Processor can adapt to the strict requirements of the data acquisition and control system such as the function, reliability, cost, size, power consumption, and remote access and so on. DACS mode to acquire the signals and control the devices remotely.

With the rapid development of the field of industrial process control and the wide range of applications of network, intelligence, digital distributed control System, it is necessary to make a higher demand of the data accuracy and reliability of the control system.

These operations are efficiently carried out by QNX Neutrino real time operating system. This system can be widely applied to electric power, petroleum, chemical, metallurgy, steel, transportation, Electronic & Electrical industries, Automobiles and so on.

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