Web-based data acquisition

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Abstract: The research work on Web-based long-distance data acquisition (DAQ) is valuable for application to tele-detection machine faults. With an expert system for machine fault detection, faults in a distant located machine can be diagnosed through the internet. The distant user logs on to the expert system Web page, fills in the requirements, and starts-up the diagnose process. The system then connects to the DAQ server that is installed in the machine, samples data required for diagnoses through the internet, and sends back diagnose results. In such a long-distance system, Web-based DAQ plays an important role by automatic sampling and transferring of data through the internet. We have built an experimental data acquisition system using a National Instruments AT-MIO-16E-10 board running under Ch language environment. In this experimental example, the user can acquire data online. The principle of this experimental method is introduced in this paper. A detailed programming technique is described with an example.

Key words: Data acquisition, Internet, Object-oriented, Long-distance data acquisition system (DAQ)

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INTRODUCTION

With the fast development of the internet technology, users are faced with the requirement of long-distance data acquisition (DAQ) through the internet (Zhou et al., 1999). For instance, if there is experimental equipment already mounted locally, experts or technicians working for away may need to acquire data from this equipment during their researches. Without internet, they have to go to the local source and recorded data and bring the data back for researches, which is sometimes very inconvenient and even impossible. Use of internet, we can make long-distance DAQ on-line simple, easy, and cheap. Web-based DAQ is the understructure of the machine automation. 2001 NSFC (National Natural Science Foundation of China) Projects Guide lists this topic as one of the recommended research areas in machine automation (NSFC, 2000). The general case of Internet-based data acquisition is that the user logs on to the data acquisition Web page in any Internet browser. Then the user is asked to select or fill in the DAQ parameters such as sample channel(s), gain(s), sample frequency, scan frequency, total sample amount, etc., according to requirements. After the user checks out, Web-browser will send these messages to the Web-server. The Web-server then codes these messages and sends them to a data acquisition (DAQ) server, to which the data acquisition board is connected. The DAQ server decodes messages, sets up the DAQ board according to parameters and starts the acquisition process. When the process is finished, the DAQ server sends back the sampled data to the Web-server, which then displays the sampled data on screen for browser in chart or data form, or saves it as a file for user. The sketch map of the system is
There are some strong points in this architecture. First at all, it is Web-based. Any user who can reach internet can use it to execute long-distance data acquisition. This technique can be expanded greatly in many areas. For instance, a Web-based expert system can use it directly to tele-diagnose machine faults. Second, it isolates the user from the data acquisition server, where some hardware is installed. This is safe for the equipment, as incorrect hardware setup will lead to error result or even harm the equipment. Isolation of the user from hardware will protect the equipment. Finally, the architecture is friendly to different users with certain level of competence in working with computers. The hardware setup procedure was programmed by an expert in this domain. All general users need to do is to fill up the parameter form, check out the check box in the Web, and write their own application programs. Within industrial production development, such a separation of concerns is crucial for system improvement.

Inside this kind of system, there are several technical issues that need to be solved. The first one is the CGI programming technique. Web-browser uses it to acquire the information that the user checks out and transfers these messages to the Web-server. The acquired results are sent back and displayed in the Web-browser by CGI programming. The next technique used in this system is the Internet programming, or WinSock programming. It builds the connection between the Web-server and the data acquisition server. It is used to send the DAQ command and transfer the sampled data. The last technique used in this area is the suitable DAQ method, which implements the exact data acquisition.

The individual techniques mentioned above are all ripe technologies, but their integration together will give rise to the crucial issue of absence of an integration environment for the software.

The Web-based DAQ system has many requirements. First, the script characteristic of language is most significant in Internet programming. Next, the language should probably be an interpreting language. During the execution of an application through Web, it is inconvenient to re-compile and re-link the code needed. It is strictly required that the task can be executed immediately. Generally the Web-browser, Web-server, and data acquisition server, are located in different place or even different computer platform. It is hard for the user to compile these application programs in different machine. Finally, it should be compatible with normal engineering computing languages. So a great number of existing libraries and engineering toolboxes can be called by the application. In addition, some open-architecture equipment vendors like National Instruments deliver device drivers and application codes written by VB or C. Compatibility with these kinds of language will enhance the utilization ability.

This paper describes the details for realization of data acquisition through the Internet. In our experimentation, a data acquisition board model AT-MIO-16E-10 from National Instruments was used as hardware of the data acquisition system. National Instruments products were chosen because they are popularly used in many industrial automation systems. The National Instruments deliver all of the device drivers and application programs coded by C or C++. The Ch language is used as software integration environment. It is an open architecture integration language environment used for integration of mechatronic systems for agile manufacturing (Cheng, 1995; 1996a), and is an extension and enhancement of the most popular Unix/Windows/C computing environment. As a superset of C interpreter, Ch retains C’s low-level features for interface to hardware. Based upon the concept of shell programming, the Ch integration environment is open, modular, and scalable. Functions, commands, and