

# Industrial Web Portal for Remote Supervisory Control

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## INTRODUCTION

The Web-based environment provides a platform for creating inquiry science projects for students to work out tasks using evidence and resources from the Web. Such projects are typically developed with the help of a user-friendly interface by teams of teachers, post graduate students and researchers. Projects in Web-based environments can also incorporate data collection, graphics, resource sharing, and other built-in components. They are entirely browser-based, meaning that students only need access to a computer with an Internet connection, with no required software other than the Web browser. Student accounts must be created and coordinated.

The Web-based environment, however, can also provide a platform for creating projects based on real-time applications with the goal to demonstrate control models to students who need to perform tasks involving control algorithm design, measurement, modeling and simulation. Examples can be found in implementations such as the Sensor and Measurement Laboratory using the hardware experimental modules and lab stands, interactive multimedia software suite, especially written program modules for experimental data presentation and processing, hardware/PC interface, comprehensive student guides and e-textbooks (Babiuch, 2004; Huba, 2004). The computers may be used to enhance the effectiveness of the work through data acquisition and control software and also to extend its interactive capabilities through the use of the Web pages (Leleve et al., 2003). Some have directed their efforts towards creating learning and training environments allowing students remote access to real experiments, for example, an optical experiment at Stanford University (Hesselink, Rizal, & Bjornson, 2000) and experiments at the Laboratory of Advanced Simulations (Wagnerova, 2004).

## SUPERVISORY CONTROL EVOLUTION

Supervisory control systems were designed to establish stronger integration links with manufacturing plant floor devices, as well as to link other software programs across multiple nodes (Ptak, 1999). They were built upon industry specific platforms and networks. One of the pre-requisites for any company, who wanted to deploy a supervisory control system, was that it had to have a network architect, an engineer with skills to build the communication system. In the traditional remote supervisory control systems a creation of a radio network was required. Such network and applications created for the supervisory control were purpose-built and primarily proprietary. With supervisory systems, manufacturers have taken steps to extract production data from machines and incorporate it into other business processes such as supply-chain planning and inventory control. The problem was, these legacy technologies were usually not based on commercial standards and they presented inordinate challenges for deployment. As the technology matured, improvements in software resulted in better man-machine interfaces. Reports were developed to provide information that was wanted and when it was wanted. Systems got bigger. Industrial technologies profited from the development of powerful microcomputers and Internet/Intranet services that had a profound effect on supervisory control and data acquisition.

## THE DEFINITION AND ISSUES OF SUPERVISORY CONTROL AND DATA ACQUISITION

In the Independent Learning Module for Supervisory Control and Data Acquisition (SCADA), published by the Instrument Society of America, the definition of

SCADA and their elements are found: “SCADA is the technology that enables a user to collect data from one or more distant facilities and/or send control instruction to those facilities. SCADA makes it unnecessary for an operator to be assigned to stay at or to visit remote location in the normal operation of that remote facility” (Boyer, 1993). The SCADA technology is best applied to processes that are spread over large areas, are relatively simple to control and monitor, and require frequent, regular, or immediate intervention. Some other terms require definitions within the area of SCADA. The terms visualization and operation exist as individual fields and both are connected into one as a human-machine interface (HMI). Terms such as program visualization, operator, administrator, worker, executor, and attendant have been defined and used many times (Liguš & Horanská, 2001). The word operator refers to the person who operates, who makes connections to lines (in telephone exchanges), or on the other hand a person who engages in business and it might then have more of the meaning of speculation. In SCADA/HMI there is a need for more of a definition of a person who is in action, produces an effect, exercises influence over the machines, carries out strategic actions, manages, and accomplishes something. On the other hand, the operator could have relatively passive role if we use the word attendant. It means that somebody who is accompanying, waiting, is present, continues to wait, and is perhaps the person who provides a service. Both terms are actually very common, a single person can have more than just one of these roles.

Data is fundamental for any business. As businesses evolve, they need computer architectures that match the patterns of business operation and internal structures. In other words, as human operations change and application systems develop, computer architecture must evolve accordingly. A manager or a supervisor with a client access to Internet can react to changes from any place worldwide and optimize technological process on time. This increases the efficiency and flexibility of operated technologies. These facts only demonstrate how new trends involving multi-tier client-server architectures in a supervisory control substitute for the traditional approaches and how they challenge the Web-based environments. New theoretical knowledge, software, hardware and communication technology bring together the education communities and give them tools for improving existing and designing new ways of education methodology and interaction. Although

the syllabuses may differ, the technical means, software and hardware tools and the experience from working with those are becoming common means for work. The idea of sharing experience over the Web-based labs is not new, so it is just a matter of finding those common means and methods and developing cooperation with future benefits for everyone participating in the networked organization.

### **THE NETWORK ARCHITECTURE FOR A SUPERVISORY CONTROL**

A Web portal can be defined as a site on the World Wide Web that typically provides personalized capabilities to its visitors, providing a pathway to other content. It might be designed to use distributed applications connected via a network and made up of components in separate runtime environments, as well as different number and type of hardware and middleware in order to provide services from several and various sources (Bakoš, 2005; Zolotová et al., 2004). Furthermore, mainly business-driven requirements of portals are that the content must work on multiple platforms, such as personal computers, personal digital assistants (PDAs), cell phones, and so forth, creating two-tier (client-server) or multi-tier architectures.

The essential client-server model is made up of a set of services from servers and client applications that direct tasks. The client and server could reside in the same machine, but act as separate processes. While accomplishing any task, both the client and the server can make requests of one another. Logical layers of client-server systems can be defined into these three parts:

- Applications, user-interface terminals, and data distributed across several remote machines
- Middleware, which provides the interfaces or connection to enable remote machines to work together. Middleware hides the details of the underlying systems software and hardware of particular computer platforms and networks from the applications, so that applications can converse in standard ways across a network.
- The basic platforms, systems and networking software and hardware, which support communications among the different parts of the application

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