CONTROL PANELS MADE ON WEB BROWSER
BY USING ActiveX DATA OBJECTS

R. Kato, T. Igo, G. Isoyama, Institute of Scientific and Industrial Research, Osaka University,

8-1 Mihogaoka, Ibaraki, Osaka 567-0047, Japan

Abstract

Making use of Active Server Pages and Dynamic HTML, we can visually and interactively administer databases residing on other computers. By using this web technology, we are easily able to realize virtual control panels on a web browser.

1 INTRODUCTION

A control system composed only of personal computers (PCs) is being developed for the far-infrared free electron laser (FEL) at the Institute of Scientific and Industrial Research (ISIR), Osaka University [1].

The system has a simple structure consisting of some PCs connected with Ethernet. The software for the control system is designed such that the user interface layer and the device driver layer are connected with a database [2].

On the other hand, by using Microsoft Active Server Pages (ASP) and ActiveX Data Objects (ADO), we can easily realize data access from a client to a database server. Using this technology, we are developing a control system that has virtual control panels on a web browser, for the devices in the FEL beam transport system.

The design architecture and the implementation of this system are described in the following sections.
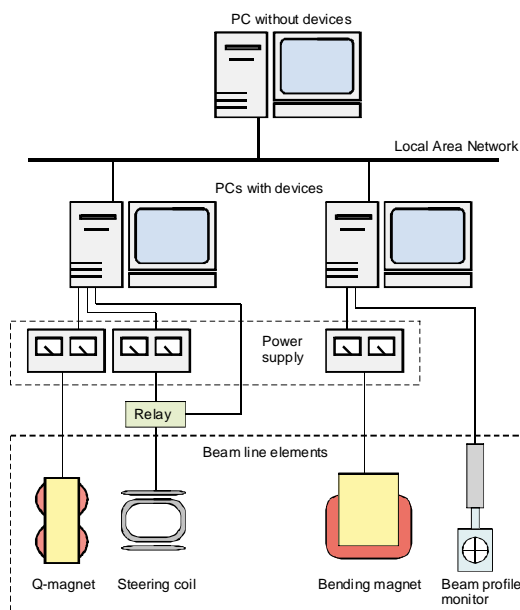
2 DESIGN ARCHITECTURE

2.1 Hardware

The control system is composed of PCs and standard interface modules for them. The PCs are connected in a local area network with Ethernet. Controlled devices in the FEL beam transport system are three bending magnets, six quadrupole magnets, eight steering coils and two beam profiles monitors. The devices are connected to the PCs with analog I/O, digital I/O and GP-IB interface modules inserted directly into PCI or ISA buses of the PCs as shown in Figure 1.

The system can be made inexpensively as we use only PCs and standard interface modules.

2.2 Software

There are three layers in the hierarchical software structure as shown in Figure 2.

1) Device control layer. It is the lowest level and directly controls the hardware, such as interface modules. Device control program reads a numerical value from the database and writes it in the interface module, and reads a present value from the module and writes it in the database.
2) Database layer. It works as a core of the data flow. Device control programs or user interface programs communicate only through the database.
3) User interface layer. It is the highest of the hierarchy and works as an operator console. A user interactively operates the control panels on the screen virtually made by user interface programs.

Figure 1: Schematic layout of the hardware configuration of the control system.
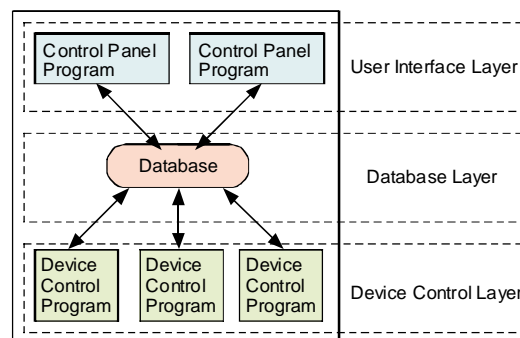

Figure 2: Schematic diagram of the hierarchical software structure of the control system.
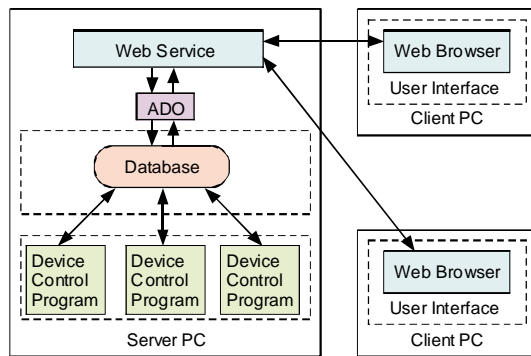
Figure 3: Schematic diagram of the control system by using web service and web browsers.

This structure makes it easy to develop programs in a distributed control system connected with Ethernet and enhances the flexibility and extendibility.

We are developing the two types of control system. One is the system based on a shared database model. For this, a database file residing in a PC is shared among several PCs with Microsoft file sharing service. Using this service, control panel programs on the other PCs can access the data through the network in a similar way that those in the PC with the database do [2].

The other type is the system making use of database access service on the web server. We can easily give access from a web browser to a database on the web server by using Microsoft Web Services and ADO. In this case, we do not need the control panel programs described with programming language and compiled to executable files. A web browser works as a user interface instead of the programs as shown in Figure 3.

The implementation of the later system is described in the next section

3   SOFTWARE IMPLEMENTATION

Microsoft Windows NT 4.0 or Windows 98 is used as an operating system of PCs, so that we can make use of various developing tools and applications commercially available, such as Microsoft Visual BASIC, Borland Delphi and Microsoft Office.

3.1 Web Service and Web Browser

Microsoft Personal Web Server 4.0 is used as web service software on the PC with the database. It works on Windows NT 4.0 Workstation and Windows 98. A web browser is used as a user interface. Taking account of compatibility with Visual Basic Script (VBScript) used in ASP files, Microsoft Internet Explorer 4.01 is selected.

All parameters of the devices are interactively input into the database with the web browser. The horizontal and vertical positions of the devices on the control panels are input not numerically with keyboarding but graphically with drag and drop using a mouse, which is the function of dynamic HTML of the web browser

3.2 Database

Microsoft Access is used as database management software. Since a product on the market is used as the core of the control system software, the reliability of the whole system is improved.

The database administers names and ordering numbers of devices, names of host computers which control the devices with interface modules, names and channel numbers of the modules and so on. Furthermore it administers the arrangement of the components displayed in virtual control panels on the web browser.

4 SERVER AND CLIENT SCRIPT

Figures 4 and 5 show the flow and processing of the data between the server and a client.

4.1 Data Flow from Server to Client

An ASP scripting engine on the web server reads an ASP file and executes server scripts described between <% and %>. These scripts are acquisition of database
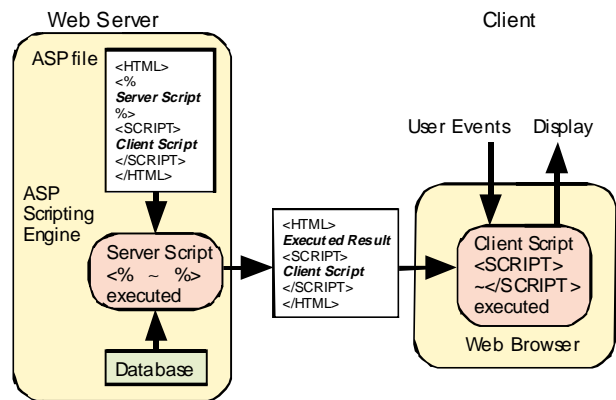

Figure 4: Schematic diagram of the data flow from the web server to the client.
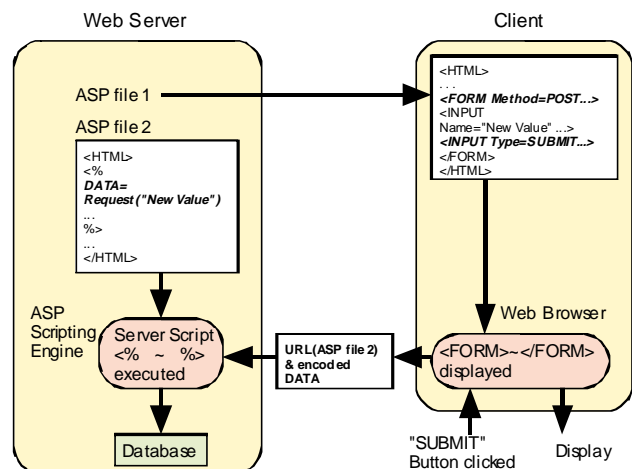

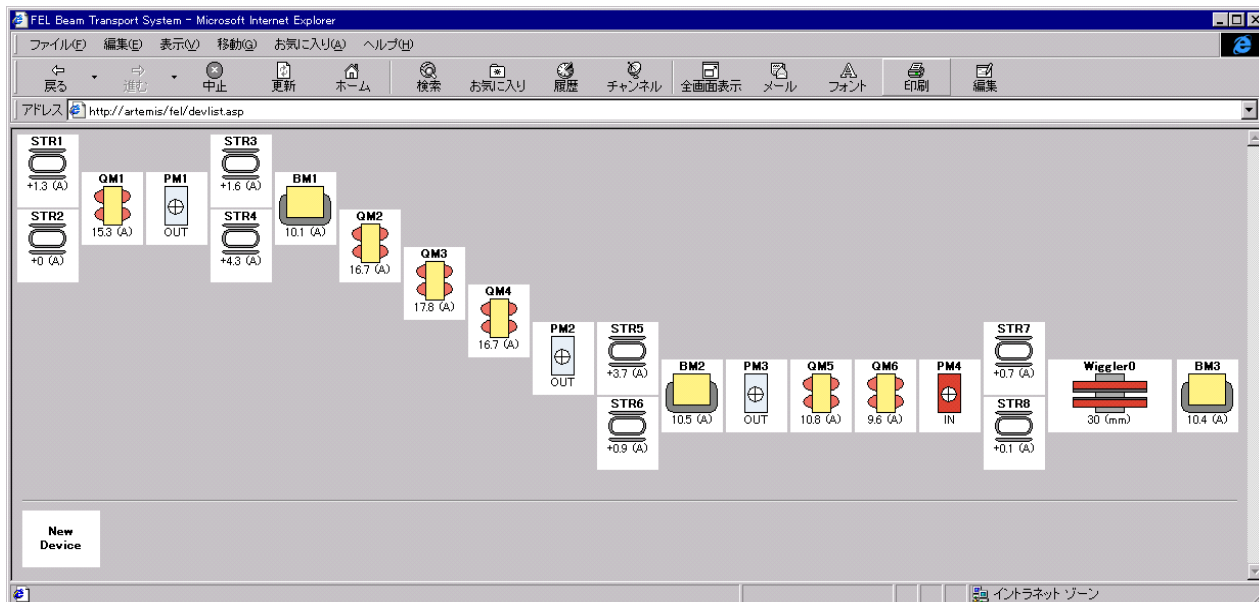Figure 5: Schematic diagram of the data flow from the client to the web server.

Figure 6: Example of the control panels made on the web browser. Positions of items on the window correspond to the practical arrangement of devices of the ISIR-FEL beam transport system.

objects, and opening and closing the database file. Results of execution are output into the ASP file as text and HTML tags, and then the file is sent to the client. The web browser displays text and graphic images on the screen except client scripts. When user events occur, such as a mouse click, the browser executes client scripts described between <SCRIPT> and </SCRIPT>. Results of execution are displayed.

4.2 Data Flow from Client to Server

If there is <INPUT> tags between <FORM> and </FORM> in the ASP file sent from the server, data input is prompted on the screen. When the user click the "submit" button, input data is encoded and sent to the server with location of a new ASP page. The scripting engine on the server reads the new ASP file and executes server scripts in it. In these scripts, values of parameters on the database are renewed.

5 CONTROL PANELS
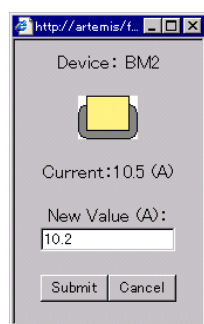
Figure 6 shows an example of the control panels. It contains three bending magnets, six quadrupole magnets, eight steering coils, four beam profile monitors and one wiggler magnet. By double clicking an item of the panel, a new control panel for the clicked device appears as shown in Figure 7.

In this system, positions of items on the browser are administered by the database. Therefore rearrangement of devices on the control panel is very easy. By dragging the item labeled "New Device" in the lower left corner and dropping it above the horizontal line, a new device can be registered in the database. Similarly, by dragging a registered item and dropping it below the line, the device can be deleted from the database.

As a conclusion, the control system has flexibility for rearrangement and future upgrade.

REFERENCES

[1] R. Kato, S. Okuda, Y. Nakajima, G. Kondo, Y. Iwase, H. Kobayashi, S. Suemine, G. Isoyama, "Oscillation at wavelengths from 21 to 126 ˚m on the ISIR FEL at Osaka University," Nucl. Instr. and Meth. A407 (1998) 157-160.
[2] T. Igo, R. Kato, G. Isoyama, "Control system based on PCs for the ISIR-FEL at Osaka University," ibid.

Figure 7: Example of the control panel corresponding to the each device.