Remote Console System Using JAVA Applet for High Energy Accelerator Components at the Photon Factory

Noriichi KANAYA, Seiji ASAOKA and Hideki MAEZAWA
Photon Factory
High Energy Accelerator Research Organization (KEK)
1-1, Oho, Tsukuba, 305, Japan

Abstract

A Remote Console System for the accelerator components has been designed and implemented using Java Applet for high-energy accelerator components at the Photon Factory. When one of the accelerator components malfunctions during operation of the accelerator, it is important to be able to inspect the faulty component at the vicinity of the accelerator in order to recover the accelerator as fast as possible. Thus, the Remote Console System has been implemented using Java Applet particularly for monitoring components and Ultra-High-Vacuum pressures of the twenty-two synchrotron radiation beam lines and the 2.5 GeV storage ring. As a result, even portable laptop personal computers and PCs can provide control information in 3D images plus the same information as those on the heavy consoles at the control room. The Remote Console System on a WWW browser that allows analyzing operation of the synchrotron radiation beam lines at any place without directly accessing the control room is discussed.

1 Introduction

Consoles in the control room for high-energy accelerators generally tend to be large and heavy displays, X-terminals and workstations. If there is a failure in the accelerator, it is useful to be able to locate a faulty component in the field, i.e., at the vicinity of the accelerator. Particularly, there are a number of users for a synchrotron radiation facility who use an intense photon beam for their experiment at the same time. Shutting down the accelerator caused by a malfunctioned device should be avoided as much as possible, even for a half day.

In addition to normal operational data regarding the accelerator, functionality for capability of dealing with three-dimensional (3D) graphic image is expected for analyzing the operational data in the field.

2 System description

The Remote Console system comprises an applet on World-Wide-Web (WWW) browser, a proxy server on an SGI workstation, and the operation server running on the control computer VAX/VMS.

In addition to Java's capability, due to its tight network-security mechanism than CGI, the Java Applet was chosen as the implementation language for the system. Needless to say, the Remote Console System can be utilized on any WWW browser that supports Java Applet.

When invoked, the WWW browser initiates, in principle, the Remote Console System from the proxy server on the SGI workstation through the network. The Remote Console System then fetches operational information and control data from the server on the VAX/VMS workstation, across the network that controls the synchrotron radiation beam lines [1]. The Remote Console System then displays the operational and control information on the WWW browser as the console screen.

The VRML (virtual reality modeling language) is known as the standard language that is widely used for displaying three-dimensional graphics (3D) and images. The 3D graphics images can be interactively moved/panned on the screen from a different viewpoint by dragging the mouse. Some World Wide Web browsers support VRML.

After being loaded, the Remote Console sends a request to the proxy server on the SGI workstation using a socket communication. The packet includes a list of components and time information to be concerned. Upon receiving a request, the server executes a SQL statement to connect the on-line Oracle database [2] which is running on the VAX/VMS. The communication between the two servers is done through an SQL*Net driver. Due to the security restrictions of the WWW browser, the Applet is not allowed to make a direct link to the host, i.e., to the Database on the VAX in this case, except for the host from which the Applet is loaded. Thus the server works as a proxy server.

Once the connection is established, the server executes SELECT statements associated with the request submitted by the Remote Console. After retrieving and collecting operational data of the accelerator components from the Database, the server generates a 3D-image file in VRML V.1.

The Remote Console on the browser is waiting for the completion of creating an image by the proxy server. After a completion message is sent back to the Remote Console from the server, it starts loading the 3D-image file from the server. Since the Java Applet does not directly load a VRML file in principle, the Remote Console executes an HTML code to load the 3D-image file. Usually, the size of the image file exceeds 6 Mbytes, containing the operational data of twenty-two beam lines and pressure data of the storage ring and beam-current data, and it takes a few minutes to load.

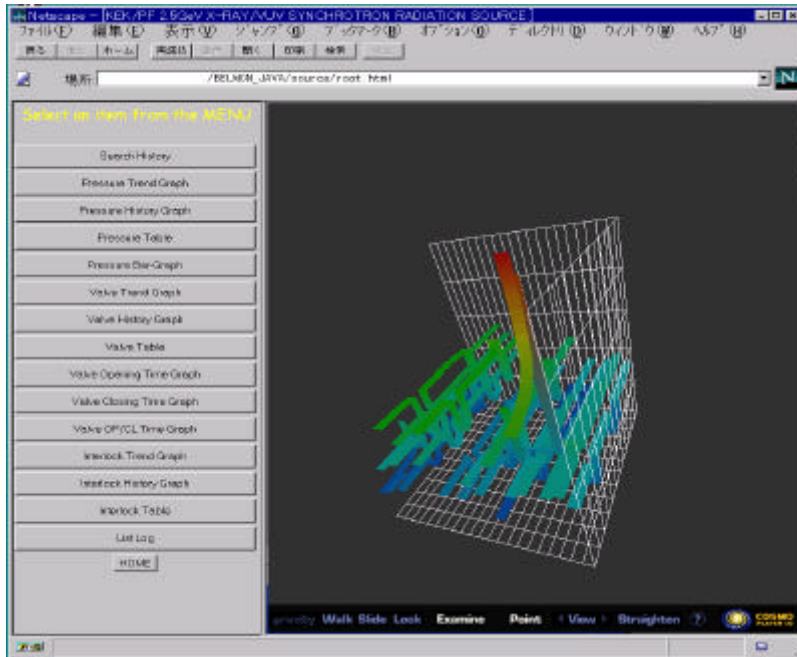Figure.1 shows a 3D image representing a fatal deterioration that occurred downstream of a beam line. It

Fig.1 3D image in VRML on the Remote Console showing a fatal pressure
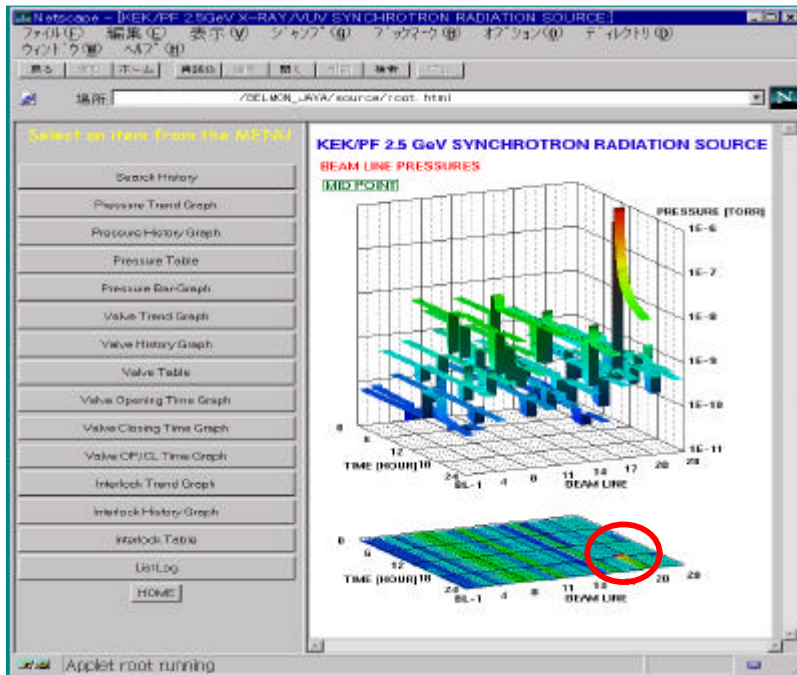rise downstream of a synchrotron radiation beam line.

Fig.2 Psuedo-3D image on the Remote Console showing
the same fatal pressure rise as in Fig.1.

takes more than five minutes to generate the 3D graphics image on the PC/notebook running WindowsNT V.4.0. The plug-in used for this system is the SGI CosmoPlayer V.1.0. However, by closely and precisely viewing and rotating the 3D image from different viewpoints and distance, the Remote Console allows locating which part of the component is now malfunctioning in detail. By using the Remote Console System, it was found that, fortunately, the computer of automatic Ultra-High-Vacuum protection system [3] could protect the UHV of the storage ring.

Figure. 2   shows a pusedo-3D image generated by the

Remote Console in the same way, except for the fact that the image format used was in the GIF format. The image has only 45 Kbytes in size, and can be loaded and generate its image on the screen within one minute. The light spot in the circle of the Fig. 2 indicates a fatal pressure rise. Since the viewpoint is fixed, there is no way to interactively deal with the image to precisely locate which part is malfunctioning.

In addition, there is another query server on the VAX in which all operational data and present status of the accelerator component are mapped on the shared area (global-section in VMS terminology)[4]. The Remote Console can collect present operational data of the accelerator components by querying the VAX through the server. The server on the VAX simply replies operational data to the server on the SGI workstation.

The Java environment is still evolving and growing rapidly. Since as of 1997 not all WWW browser supports Java RMI (Remote-Method-Invocation), we have implemented the Remote Console using Java Applet and the socket mechanism. This communication layer will be replaced with RMI. The one-line Database system will be ported to a UNIX workstation that supports pure Java. The communication between the server on the SGI and the Database will be replaced with a Java thin-driver that supports direct OCI (Oracle-Calling-Interface).

3 Conclusion

The Remote Console System for accelerator components using Java Applet for high-energy accelerator components has been discussed. The system can obtain operational information of the accelerator components either in 3D images or psuedo-3D images to allow inspecting the faulty accelerator component not in the control room but in the field.

References

[1] N.Kanaya, S.Sato, S.Asaoka, T.Koide and H.Maezawa, PAC'90 Vol.29,pp.227-232,1990.

[2] N.Kanaya, S.Asaoka and H.Maezawa, Proc. Of PAC'97, Vancouver, Canada, Mar. 1997 (in press).

[3] N.Kanaya, S.Sakanaka, S.Sato, T.Koide and S.Asaoka, IEEE Trans. on Nucl. Sci. Vol.37, No.1,pp.2-6,Feb, 1990.

[4] N.Kanaya, S.Asaoka and H.Maezawa, Proc. of HEAC'92 Hamburg, Germany, 1992.