A VIDEO MONITORING SYSTEM FOR SPring-8 ACCELERATOR TUNNEL

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Abstract

We developed the video monitoring system using web camera for SPring-8 accelerator tunnel. It replaced old system to consist of video cameras and video switchers. The old one was not convenient because a video display and location of cameras were fixed. The web camera is able to move any location if it could connect to a network. Also we can see pictures on any PC and workstation using the web browser.

1 INTRODUCTION

At the beginning of the SPring-8, the camera of radiation safety surveillance, which could only be used in the accelerator tunnel, was not suitable for seeing the accelerator components. The eight sets of camera were installed to monitor the entrance. Another problem was the failure caused by radiation. It occurred frequency.

We built the system for the surveillance of the accelerator components by using of the Web technology.

This monitoring system consists of a CCD camera, the network camera server, which captures the NTSC video signal into a jpeg picture, the http server, which receives a request from a web browser, and the network equipments, which connects these.

There are two kinds of http servers. One of them calls "real-time server"; another server calls “public server”. A common function to these http servers is offering the html files which arrange the picture of the selected camera in one screen, or display it by time-lapse. Thereby, it is not necessary to input an individual network camera server's URL from a Web client.

This system is limiting the authority to decide the angle of a camera, and optimizing load by the functional assignment of two sets of these servers. As for the difference between two servers, real-time server has access restrictions, and public server need to restrict the function. The real-time server's access permission was given to the Web client of a central control room (CCR) by using a firewall. The public server does not raise the load of the camera servers and network traffic.

2 SYSTEM EQUIPMENTS

2.1 CCD camera

The CCD cameras were installed in the tunnel, and it can operate pan-tilt and zoom by remote with a serial line (RS-232C).

We adopted "Canon Communication Camera VC-C4"[1] as the camera. Since the camera is small, it is easy to put the cover it by lead sheet, which prevents from radiation damage.

In this system, 24 cameras are installed in an accelerator tunnel.

2.2 Network camera server

The network camera server capture an NTSC picture into JPEG file, and transfer the file by the http or the ftp protocol.

We adopted "CHUO ELECTRONICS ND-VW04"[2] as the network camera server.

This has the function to control pan-tilt and zoom of cameras from a web browser via serial communication.

This has four NTSC input and two serial line. We connected two cameras to the serve. Other NTSC input will be used temporarily. In this system, the 12 camera servers are installed to the maintenance corridor of the storage ring.

Figure 1: The CCD camera “Canon VC-C4” with lead covers. And the network camera server “CEC ND-VW04”

2.3 HTTP server on Linux PC

2.3.1 Two http servers

The real-time server is accessed from operation consoles at CCR, and it sends a direct picture from the camera servers and controls the pan-tilt and zoom of a camera. There is a limit of number of connection to access to this server from CCR.

The function to save pictures to raid disk was also attached to this server.

On the other hand public server could access from many and unspecified clients of SPring-8 site and it send cached image on a local disk.

This cache is updated every 5 seconds (this can change a setup) for all network camera servers. Even if there are many sessions to this server, any network camera server's load is not affected.

Table 1: Linux http servers' common specifications

Case	2U Rack-mounted
CPU	Pentium III 1GHz x2
Main-memory	512MB
HDD	18GB
Tape drive	DDS-4
SCSI	Ultra-160
NIC	1000Base-Tx1+100BaseT x1
RAID*	18GB x6 (RAID5 Hot swap x1)
OS	Linux/RedHat6.2
httpd	Apache
JAVA servlet	Tomcat

*RAID: Connects with the server only for operation consoles

2.3.2 Software processing of a server

The http server generates the http files with the demands of a web client, and sets parameters to control the camera and the camera server.

The flow of the process for operation is shown in Figure 2, and the class architecture of servlet application is shown in Figure 3.

When a web client uses the real-time server, a network camera server's image data is displayed directly on a web browser. This function is implemented using URL address that the camera servers into the image source (<imag src> tag) of the html file. The real-time server can also show a server push animation by this method.

In the case of a public server, the html file was generated with image source, which specified the cached file on this server.

In addition, it sets the parameters, such as a change interval of a display picture.

There is a function that records the picture of the camera on the RAID disk in the real-time server. The parameters for this function the camera channel, which records a picture, its interval etc, are set from a web client.

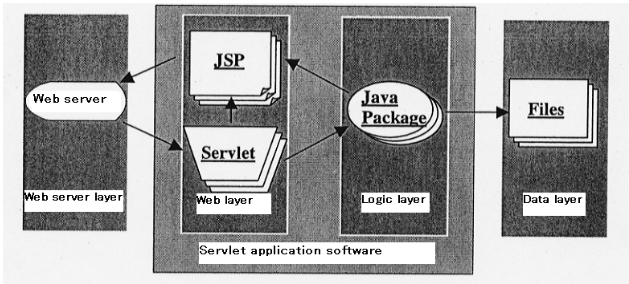

Figure 3: The class architecture of servlet applications

3 CONSIDERATION OF RADIATION

The lead cover is attached to the camera (2.1 Figure 1). We used a 0.5mm thickness of lead sheet in order to

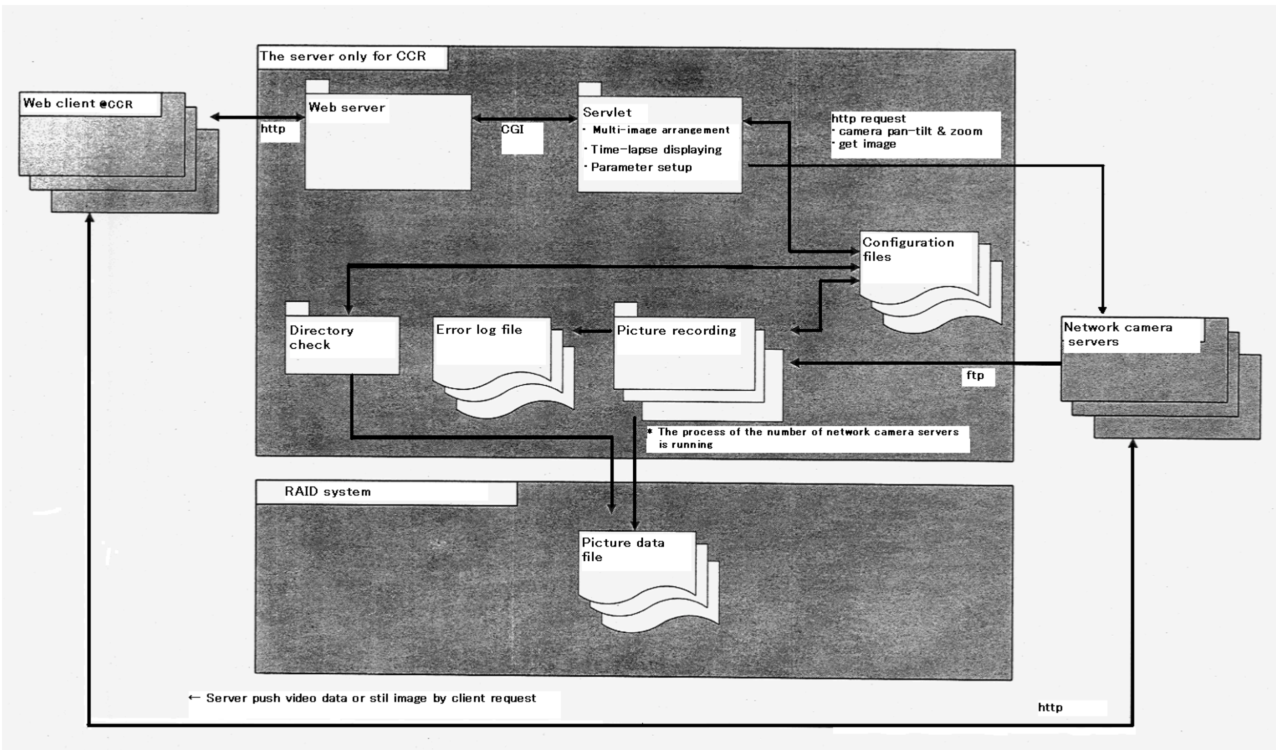

Figure 2: The flow of process

minimize a weight of the movable part, and 1mm thickness for other part.

The data of EEPROM was volatilizing under the strong radiation. EEPROM is near the lens and another one is inside a base stand.

The position where a camera breaks down or not was divided clearly. Then, we measured the strength of the radiation along the accelerator tunnel. The measurement used the glass dosimeter to attach the wall in the storage ring at intervals of 1.5m, and was operated an accelerator for 68 hours.

We got a result that the radiations near bending magnets were extraordinarily strong than other positions. The crotch and absorber, which synchrotron orbital radiation hits, are the sources of radiation.

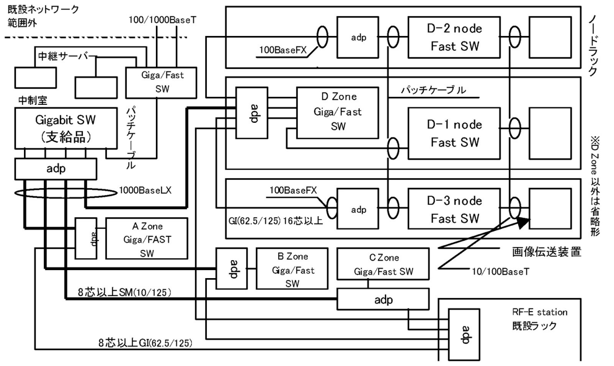

Figure 4: The network of the system

We select a position of the camera to minimize the radiation damage (Figure 5). We moved the camera position at higher radiation to lower radiation. Consequently, there was no failure of the camera by radiation.

6 ACKNOWLEDGMENT

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7 REFERENCE

[1] http://cweb.canon.jp/Product/vsl-com/gazo/vc-c4.html

[2]http://www.cec.co.jp/CEC/products/net/netdev/nd-vw04/

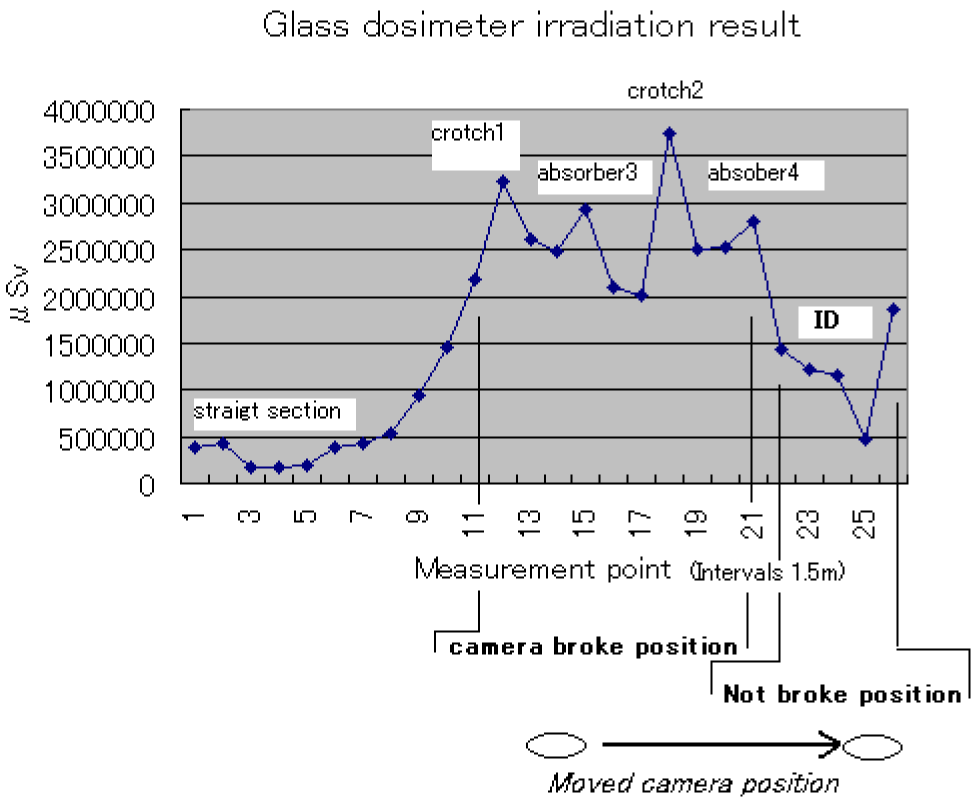

Figure 5: The radiation mesurement