Super High Definition Stereo Image using 4K Projection System

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Abstract

CDF (Concurrent Design Facility) was constructed for the purpose of research and education of system design and management. CDF consists of 4K stereo projection system, two high definition monitors and several graphics computers. By using this environment, user can experience super high definition stereo image based on the computer graphics and the video. In this paper, the system construction of the CDF and some 4K stereo image contents are described.

1. Concurrent Design Facility

CDF (Concurrent Design Facility) was installed at Graduate School of System Design and Management, Keio University for the purpose of research and education of systems engineering. The CDF was designed so that several researchers, designers and managers etc. were able to have presentations and discussions effectively while sharing the necessary information. Figure 1 shows the appearance of the CDF system.

The CDF consists of a 180-inch center screen for 4K projector and two LCD 108-inch high definition monitors placed at both sides. The 4K center screen can be used not only to project the super high definition stereo image but also to project four high definition divided images. Seven dual-boot workstations that can run either Windows XP or Fedora8 and one video server are connected to the 4K screen and LCD monitors. The image sources generated in these workstations can be displayed on the arbitrary screen freely by switching the connection through the matrix switch.

2. 4K Stereo Projection System

4K stereo projection system is a central equipment of the CDF. 4K is a super high definition image of 4,096x2,160 pixels, and it provides more than four times of the resolution of full high definition television image.

In this system, two 4K projectors (Sony, SRX-S110) which are stacked to project overlapped images on the screen are used (Figure 2). The images are projected from the projectors through the linear polarization filters, and the user can see the binocular parallax image by wearing the polarized 3D glasses. The brightness of the 4K projectors is 10,000 ANSI lumen. An acrylic screen (Nippura, Blue Ocean) with large screen brightness was used for the rear projection screen. Therefore, the brightness of the images between 4K projector and the LCD monitors at both sides can be almost same.

As a graphics workstation system to generate 4K stereo image, two host computers (Dell Precision T7400, 2x Quad Core Xeon 3.2GHz) and two graphics engines (NVIDIA Quadro Plex 1000 Model IV) are used.

Figure 1: Concurrent design facility.

Figure 2: Stacked 4K projectors.

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3. 4K Stereo Image Contents

In the CDF environment, the user can experience the super high definition stereo images of the computer graphics and the video. In this chapter, some demonstration contents using the 4K stereo projection system are described.

3.1 Integrated Visualization of Computer Graphics Models

Since the CDF can represent a super high definition image, it can effectively be used as an integrated visualization environment for the design data and the simulation data. In this study, the framework of integrating several data resources into the 4K-based three dimensional visualization space by using the OpenGL fusion technique and the plug-in function were constructed. Figure 3 shows the example of visualizing molecular data using the 4K stereo image.

OpenGL fusion is a technique to capture the OpenGL code from the visualization program and synthesize it into the three-dimensional environment by using the GL-DLL replacement method. On the other hand, the plug-in function is a method to synthesize the application programs that are constructed in the form of dynamic libraries at runtime. By using these methods, the data examined on the side monitors can be synthesized into the 4K environment, and the users can discuss with each other while sharing the super high definition image of the integrated visualization data on the center screen.

3.2 Video Contents of "Okinawa Churaumi Aquarium"

As for the video contents using the 4K projection system, "Okinawa Churaumi Aquarium" is screened. This video was produced for the event of 41st Sony Aquarium 2008 that was held with the theme of "secrets of the ocean – like you've never seen before" during the summer vacation [1]. Okinawa Churaumi Aquarium is an aquarium of the world's largest scale. The fishes swimming in the aquarium were filmed underwater as high definition stereo images, and the audiences can see the three-dimensional scene of various kinds of fishes such as whale shark and manta rays that live in Okinawa's seas as shown in Figure 4 .

In order to film the stereo images of 1,920x1,080 full HD movies, two high definition business use cameras Sony HDC-950 were used, and the filmed images were recorded as HDCAM-SR of the HD digital VTR format using the portable recorder Sony SRW-1. In the demonstration, the high definition stereo video image is up-converted to the 4K stereo image and it is screened using the CDF system.

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[1] 41st Sony Aquarium 2008, http://www.sonybuilding.jp/campaign/aquarium2008/index.html

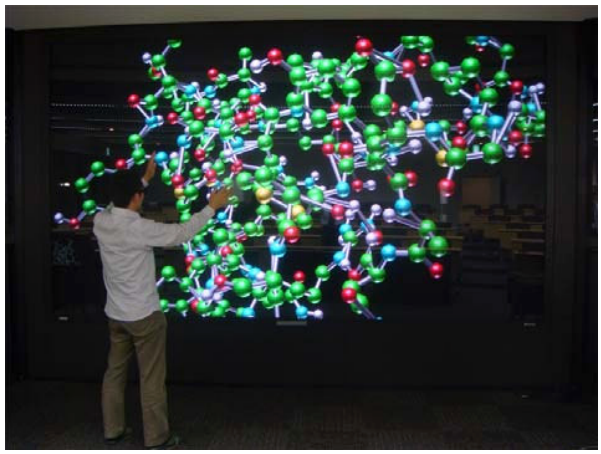

Figure 3: Visualization of monocular data.

Figure 4: Scene of "Okinawa Churaumi Aquarium".