

Virtual Stadium for 2002 FIFA World Cup Korea-Japan

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Abstract

This paper describes the short history of the virtual stadium development. The virtual stadium is a virtual reality theater system that provides an audience who cannot attend a game. After the introduction of system components, the results of the real-time image transmission experiments are briefly reported.

Key words: virtual stadium, realistic sensations, application of VR technology, HDTV

1. Introduction

The virtual stadium is a virtual reality theater system that provides an audience who cannot attend a game with the realistic sensations of being at a soccer stadium. Although this system was originally planned in order to bring Federation Internationale de Football Association (FIFA) World Cup games to Japan, it is also expected to provide a new way to enjoy sports games via electronic media other than TV.

Under the sponsorship of Ministry of International Trade and Industry (MITI), a virtual stadium committee was organized for the feasibility study. Table 1 introduces the history of the activities of the committee. Figure 1 shows an original image sketch of the proposed virtual stadium at a very early stage, with a huge screen (approximately 100m by 40m).



Figure 1 Image of Virtual Stadium

The most important keyword of the virtual stadium is “sensations”. In order to synthesize the sensations of being at a specific location, there are several factors that must be considered. First, a wide field of view is the most essential component in generating a realistic visual impression. Second, a high resolution is also important. (For example, we may need to be able to see a uniform number of players.) Sometimes, a stereo image is also very important. However, when viewing scenes of distant places, as in the case of the virtual stadium, this factor can be ignored.

Table 1 History of Virtual Stadium

1995	Japan vs. Korea competition to bring World Cup
	Japan proposed “virtual stadium” concept
1996 Apr.	Informal study group for virtual stadium was organized in HVC (High-tech Visual promotion Center) under the sponsorship of MITI (Ministry of International Trade and Industries)
1996 Jun.	FIFA decided to hold the 2002 World Cup in Korea and Japan
1996 Oct.	The 1st meeting of the study for super-large screen application (Mega-Vision Forum) was organized in HVC as a formal development committee.
1997-1998	Various feasibility studies were conducted
1999	Development of a wide field of view (FOV) camera
1999 Dec.	The First Preview: Demonstration at World Cup Draw
2000	Development of a new zoom lens and 4CCD camera
2000 Sep.	Installation of Mega-Vision at TEPIA
2000 Dec.	Image transmission experiment from National Stadium to TEPIA (Japan-Korea match)
2001 Jul.	Image transmission experiment from Sapporo Dome Stadium to TEPIA via high-speed satellite link (Kirin Cup)
2001 Dec.	Image transmission from Korea to Japan via high-speed satellite link
2002 Jun.	Start of 2002 FIFA World Cup Korea/Japan (from) Yokohama Stadium (Japan), Saitama Stadium (Japan), Dae-Jun Stadium (Korea) (to) International Press Center (Japan)

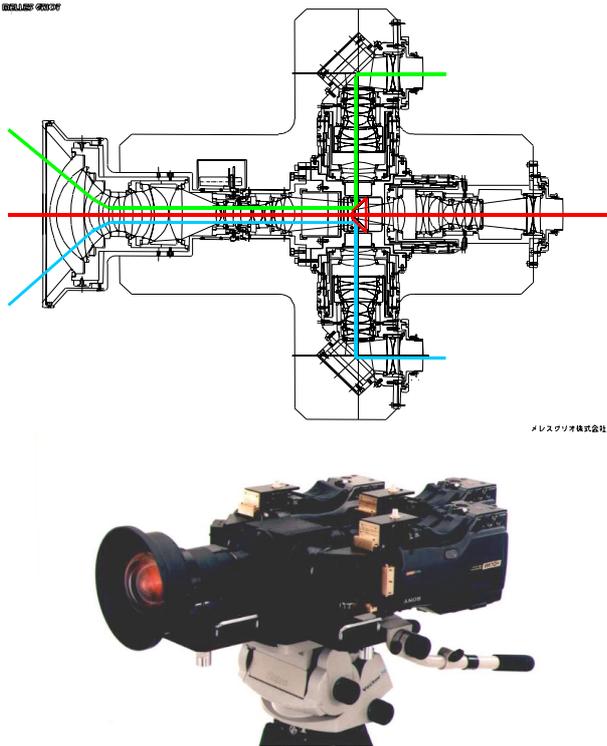


Figure 2 First prototype of Camera

2. System Components

In order to capture high-definition images of the entire

soccer field, we need to develop a special camera with a wide field of view (approximately 100 degrees) lens. Figure 2 shows the first version of a specially designed camera with a wide-field-of-view lens. It consists of three HDTV cameras with a single lens system to avoid any distortion in the image. A specially designed prism is used to split the images and distribute it to the three HDTV cameras. This system supports a field of view of 100 degrees. (Figure 3)

Based on the knowledge gained using the first version, a second-version camera was developed. The second-version camera has a new lens system which supports a zoom function (from 90 to 50 degrees FOV (field of view)) and auto iris control. In addition, each camera has one CCD camera to increase the resolution. Two CCD cameras are assigned for the green signals (G1 and G2) and are a half pixel offset from each other. This gives higher resolution green signals.

Using three video projectors, a re-integrated wide-view high-definition image can be projected onto a very large screen (3m by 18m or more), and thus generate a sense of space as if the viewer were present at a soccer stadium. In order to integrate the image components seamlessly, a seamless video processor which adds an overlap margin to each of the image components and an edge blender which can remove the connection lines from the overlapped image are newly developed. Figure 4 shows the large screen display used in the experiments.

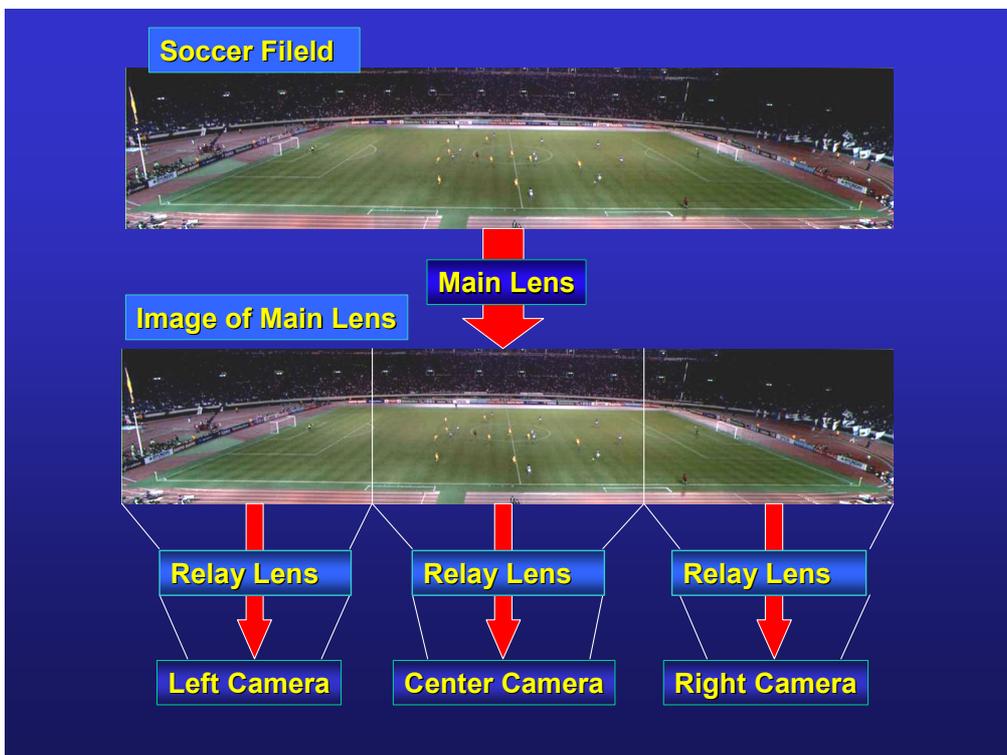


Figure 3 Field of View (100 degrees)

3. Real-time Image Transmission Experiment

We conducted the first real-time image transmission experiment in December of 2000. We transmitted images of the Japan-Korea match held at Yoyogi National Stadium to TEPIA (hall for Ministry of Economy, Trade and Industry (METI)-sponsored technology exhibition).

The purpose of this experiment was to check the functions of the entire system including image capturing, image transmission, and image display. For this reason, the distance between the capture and display sites is less than 1 km. We used an optical link to simulate the image transmission link.

During the experiment, the entire system functioned very satisfactorily, and the majority of the participants were satisfied with the overall design of the system. These results convinced us that the basic design of the virtual stadium works satisfactorily.

The second real-time image transmission experiment was conducted on July 1st of this year under the sponsorship of Ministry of Public Management, Home Affairs, Posts and Telecommunications as well as METI. Images of the Kirin Cup match held at Sapporo Dome Stadium were transmitted to TEPIA. For this experiment, a satellite communication link was used for the first time (Ka-band satellite link).

This time, the system also worked very satisfactorily. However, we found that the Ka-band satellite link was unstable. To function as a back-up, a Gigabit optical link was found to be very helpful.



Figure 4 Real-time Transmission Experiment

4. Until 2002

By the time of the FIFA World Cup competition in 2002, we need to have completed a full-scale experiment between Japan and Korea. The system configuration is as shown in Figure 5. Currently, it is planned that a number of games held in Korea (perhaps at Tae-jun Stadium) will be transmitted to the International Press Center in Japan.

The remaining problem is nontechnical. Whether we can make this system available to the public is still under discussion with the FIFA and related organizations. Several copyright issues must be considered to realize this idea.

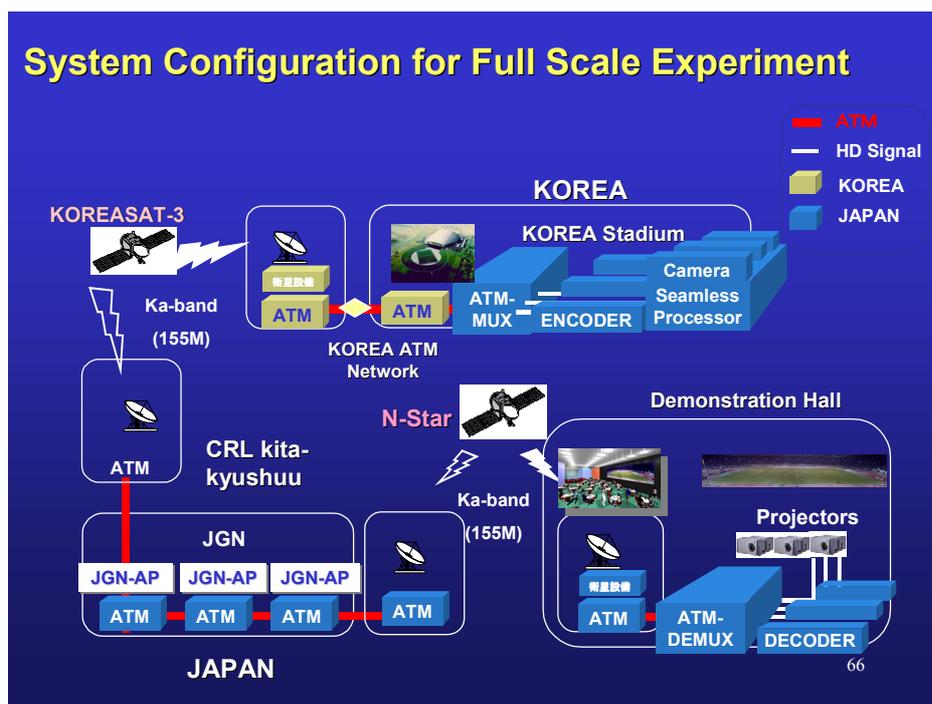


Figure 5 System Configuration for Full Scale Experiment