IDEA GROUP PUBLISHING
701 E. Chocolate Avenue, Hershey PA 17033-1117, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com
ITB7285

Chapter XXI

Use of the Frame Synchronization Technique to Improve the Visualization Realism on the Web

Jiung-Yao Huang
Tamkang University, Taiwan

Along with the popularity of the World Wide Web (WWW), merging the virtual reality technique into the WWW environment is a popular area of research in recent years. The emerging of the VRML standard is the result of such effort. The panoramic image viewer is another achievement of this type of research. However, these two types of browsers have their own merits and faults, and these differences are revealed in the discrepancy of their respective user interfaces. This chapter presents a frame synchronization technique so that the display on the VRML browser can harmonize with the picture of the panoramic image viewer.

This chapter first presents an in-depth full comparison of these two browsers, and then draws out the issues that are essential to synchronize the frame displays on these two browsers. The equations and mechanisms to enable such synchronization then follow. Finally, the frame synchronization mechanism that was implemented with experiments to demonstrate its effectiveness is also given. The frame synchronization mechanism provides a simple yet effective method to increase visualization realism inside the virtual world without sacrificing the freedom of navigation.

This chapter appears in the book, Distributed Multimedia Databases: Techniques and Applications by Timothy K. Shih.

INTRODUCTION

Virtual reality is the technique to integrate and coordinate the display of sound, image, computer graphics, video, text and real-time control within a system so that the user can navigate and, hence, immerse himself in the presented synthetic world. Conventionally, the virtual reality system requires a high-computation power computer as its work platform. With the popularization of the Internet and the Web, two different types of virtual reality systems have been designed and widely used in recent years. One is the geometrical-based browser (Huang, Fang-Tson and Chang, 1998; VRML97) and the other is the panoramic image viewer (Chen, 1995; McMillan and Bishop, 1995). The geometrical-based browser employs three-dimensional geometrical objects to construct a virtual world. The user can freely navigate the virtual environment and manipulate objects inside the virtual world. Since VRML97 is the standard scene description language to describe geometry-based virtual worlds on the Web, we use the VRML browser to refer to the geometrical browser in the rest of the paper. Contrarily, the panoramic image viewer first uses a camera to take a sequence of scenery pictures and then stitches them together to produce a photo-realistic virtual world. The user of such a viewer can only move to the predefined position where these pictures were taken, and observe the virtual world from the viewpoint of the camera.

Although both the VRML browser and panoramic image viewer aim to provide the illusion of the virtual environment on the Web, the two systems take different means to achieve the goal. The VRML browser supports freedom of navigation with sacrificing the frame quality and performance whereas the panoramic image viewer does the opposite. Since the VRML browser and the panoramic image viewer use different techniques to compromise between freedom of navigation and realism of the synthetic world, both browsers have their respective advantages and drawbacks. Different kinds of research has progressed over the years to preserve the freedom of navigation as well as scenic realism by even up scarcity and superabundance from both VRML browser and panoramic image viewer.

A mixed-reality technique is the result of such research and Milgram (1994) presented a survey of such a technique. The mixed-reality technique attempts to unify the VRML browser with the panoramic image viewer into a single window. The current research on the mixed reality involves two extremes. One is called augmented reality and the other is augmented virtuality. The augmented reality has been a popular mixed-reality research for several years. The purpose of the augmented reality technique is to compose computer-generated objects into the real world image (Feiner, MacIntyre and Seligmann, 1993; Tuceryan, 1995; Chiang, Huang, Wang, Huang, Chen, Hsieh, Chen and Cheng, 1997). With this augmented-reality technique, a realistic artificial environment can be easily created to deceive the human vision, and this technique is often used in the movie production industry. On the other hand, the augmented-virtuality technique integrates the image of a real object into the synthetic virtual world (Tamura and Yamamoto, 1998; Metzger, 1993). The simplest example of this technique is to paste the photo of a real image onto the surface of a virtual object, called texture mapping. However, the texture mapping alone can not realistically emulate a photo-realistic virtual object. To solve this problem, the augmented virtuality technique first photographs a series of pictures of a real object from various viewpoints, called imaging object, and then composes these pictures onto the geometrical synthetic world. When the user is navigating the virtual world, the picture of that imaging object will be interactively displayed according to the current viewpoint of the user. However, as the panoramic image viewer and the VRML browser use entirely different approaches to support