Chapter XIV

Virtual Reality and Augmented Reality Applied to Simulation Visualization

Claudio Kirner, Methodist University of Piracicaba, Brazil

Tereza G. Kirner, Methodist University of Piracicaba, Brazil

Abstract

This chapter introduces virtual reality and augmented reality as a basis for simulation visualization. It shows how these technologies can support simulation visualization and gives important considerations about the use of simulation in virtual and augmented reality environments. Hardware and software features, as well as user interface and examples related to simulation, using and supporting virtual reality and augmented reality, are discussed, stressing their benefits and disadvantages. The chapter intends to discuss virtual and augmented reality in the context of simulation, emphasizing the visualization of data and behavior of systems. The importance of simulation to give dynamic and realistic behaviors to virtual and augmented reality is also pointed out. The work indicates that understanding the integrated use of virtual reality and simulation should create better conditions to the development of innovative simulation environments as well as to the improvement of virtual and augmented reality environments.
Introduction

Simulation visualization aims to convert data and behavior of a system being simulated to user-friendly, understandable information. Using this information, the user can analyze the system and make decisions about the real system, related to dimensioning, parameters, behaviors and other system features.

In a first stage, the great amount of data generated by simulation was hard to analyze. With the use of multimedia, results from simulation were converted to graphics, like 3-D charts and other representations, showing colors, sizes and 2-D animations, simplifying the data analysis. However, the screen size imposed restrictions to the data amount that was possible to be visualized. Virtual reality applied to data visualization broke the limit of screen size and let the user view data in 3-D environments generated by computer. Besides the advantage of spatial view, people now can represent objects as they really are. In multimedia environments, the objects were represented by symbols, such as buttons, menus, icons, and so forth.

Virtual reality allows the user to analyze data and see the behavior of an installation being simulated, represented as a 3-D model.

The main difficulty of virtual reality is placing the user into the virtual environment, so that he/she can navigate, inspect and interact with the simulated environment. There are two ways to solve this problem:

- Using an avatar, like an intelligent agent, who knows the virtual environment and is able to receive commands from the user and execute actions in the virtual environment. In this case, it is necessary to use multimodal interactions and artificial intelligence in the virtual reality environment.
- Using augmented reality, which allows bringing the virtual environment to the user space, where he/she dominates and does not need special devices to interact with virtual objects. However, the use of multimodal commands is recommended, since the user uses the hands to manipulate objects and requires another way, like voice, to issue commands to the system, such as grab, release, and so forth.

In this way, this chapter discusses how virtual reality and augmented reality can be used to support simulation visualization, analyzing hardware and software aspects in each case. It emphasizes interaction techniques, since this subject is essential in the decision-making process.

Although the simulation visualization is the main focus of this chapter, it also makes considerations on the use of simulation in virtual and augmented reality environments, giving more realistic appearance and behavior to them.

This chapter also presents case studies on the application of virtual and augmented reality in simulation environments.
Artificial Neural Network Modelling for Waste: Gas and Wastewater Treatment Applications
Computational Modeling and Simulation of Intellect: Current State and Future Perspectives (pp. 224-263).
www.igi-global.com/chapter/artificial-neural-network-modelling-waste/53308?camid=4v1a