Chapter 12
Virtual Reality:
A New Era of Simulation and Modelling

Ghada Al-Hudhud
Al-Ahlyia Amman University, Amman, Jordan

ABSTRACT

The chapter introduces a modern and advanced view and implementations of Virtual reality systems. Considering the VR systems as tools that can be used in order to alter the perceived information from real world and allow perceiving the information from virtual world. Virtual Reality grounds the main concepts for interactive 3D simulations. The chapter emphasizes the use of the 3D interactive simulations through virtual reality systems in order to enable designers to operationalize the theoretical concepts for empirical studies. This emphasize takes the form of presenting most recent case studies for employing the VR systems. The first emphasizes the role of realistic 3D simulation in a virtual world for the purpose of pipelining complex systems production for engineering application. This requires highly realistic simulations, which involves both realism of object appearance and object behaviour in the virtual world. The second case emphasizes the evolution from realism of virtual reality towards additional reality. Coupling interactions between virtual and real worlds is an example of using the VR system to allow human operators to interactively communicate with real robot through a VR system. The robots and the human operators are potentially at different physical places. This allows for 3D-stereoscopic robot vision to be transmitted to any or all of the users and operators at the different sites.

VIRTUAL REALITY: OVERVIEW

Virtual reality is commonly known as a 3D projection of a seemed to be real image of the mind. This world of 3D projections is believed to alter what human senses perceive.

Virtual Reality (VR) has been known only in the past few years, but VR has a history dating back to the year 1950s. VR roots started as an idea that would improve the way people interacted with computers. Douglas Engelbart 1960s introduced the use of computers as tools for digital display. Inspired by Engelbart past experience as a radar

DOI: 10.4018/978-1-60566-774-4.ch012

engineer, he proposed that any digital information could be viewed on a screen connected to the computer; data visualisation. In addition, by the early 1960s, communications technology was intersecting with computing and graphics technology. This intersection leads to the emergence of virtual reality.

The emergence of VR served in a diversity of scientific views of VR uses. For example, it is cheaper and safer to train pilots on the ground before real flight. Flight simulators were one of the earliest applications of virtual reality and were built on motion platforms.

COMPUTER VISUALIZATION AND ANIMATION

Computer visualization is being thought of as a new way of how scientists evaluate and explore their data through an interactive human interface. Because of the V R evolution, advances in graphic display and high-end computing have made it possible to transform data into interactive, three-dimensional images. Hence, all the display and feedback devices that make this possible are termed Virtual Environments. Considering the various possible goals of the virtual environments, each provides easier way for scientists to interact with computers.

Interactivity was the mainstay for scientists, military, business, and entertainment.

Therefore, the advances in VR systems were also accompanied by computer visualization evolution to comply with the demand for interactivity. At this end, scientific visualization identified the imagery concept that is to transform the numerical data into images using computer graphics. Scientists can benefit from this conceptual view for compiling the enormous amount of data required in some scientific investigations. Examples of these scientific investigations are fluid dynamics, nuclear reactions, communication models or cosmic explosions.

By early 1980s, creating many of the special effects techniques for visualised data, scientific visualization moved into animation. Animation was a compelling testament of the value of a kind of imagery, 1990s. Meanwhile, animation had severe limitations. These limitations had addressed both cost and lack of interactivity. Once the animation completed changes in the data or conditions governing an experiment could not alter the responses in the imagery. In this context, VR manifests the experience of transforming the data into 3D images through various display devices. This implies building a computer-generated"virtual" world that possesses the following features: a) realism, b) immersion and c) presence. These features provides support for visualising, hearing or even touching objects inside this computer generated environment

Realism

The ever-increasing evolution in computer graphical technologies helped in the rapid change towards using 3D simulations in testing theoretical models. This is important because the lack of the realism factor in 2D simulation leads to the production of an incomplete view of the simulated world. Realism can be defined as geometrical realism and behavioural realism. The former describes to what extent the simulated world has a close appearance to the representation of the real world (Slater, Steed & Chrysanthou, 2002.). The more realistic, an object's representation, and the more realistic views the user gets. The later implies the existence of behavioural signs that indicate interactive responses which cannot be caused by geometric realism but because of the realistic responses and behaviour.

Realism is considered to be important in order to grasp and get a reasonable sense of dimensions, spaces, and interactions in the simulated world. Therefore, for more realistic representations for objects in theoretical models and the virtual world as well as their behaviours in the simulated world,