

Chapter 13

Study on an Interactive Truck Crane Simulation Platform Based on Virtual Reality Technology

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ABSTRACT

The modern web-based distance education overcomes space-time restriction of the traditional teaching forms. However, being short of specifically observable and operable experimental equipment makes the web-based education lack advantages in the knowledge learning progress, which needs strong stereoscopic effect and operability. Truck crane is the most widely used crane installed on ordinary or tailor-made chassis with strong operability. This paper introduces a kind of interactive truck crane simulation platform based on the virtual reality technology, on which can complete the simulation experiment of the crane's movement. The framework and working principle of the interactive truck crane simulation platform are discussed in the paper, while landing leg and hook are used as an example to show the motion control mechanism of truck crane components. The interactive truck crane simulation platform uses the browser-based structure, Java3D, virtual reality and Java Applet, etc. to develop a Web3D virtual reality learning environment, which has the advantages of good interaction, strong sense of reality, simple update, less investment and so on. This learning environment can meet the needs that many students study online at the same time, so it has important application in the distance education of mechanical profession and remote training of vocational skills.

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1. INTRODUCTION

The modern web-based distance education (Hara, 2000) overcomes the space-time restriction of the traditional teaching models and realizes lamination teaching by centering on students. It not only has abundant learning resources but also brings the independent learning capability and collaborative learning spirit of students. However, being short of specifically experimental equipment to observe and operate, the web-based education lacks advantages in knowledge learning progress (Khosrowjerdi et al, 2005), which needs strong stereoscopic effect and operability. This problem is the biggest challenges that the web-based education facing, which imposes restrictions on its development. Poor interactions cannot make up for the defects of the web-based education that stereoscopic effect and sense of reality of the animation simulation are not strong. In order to solve above problems, the Web3D virtual reality technology is introduced into the modern web-based distance education (Banerjee, 2002). With strong operability and sense of reality, the Web3D virtual reality technology gets rapid development in web-based education (McCormack et al, 1997).

The virtual Web3D simulation education system is a kind of generation using virtual reality technology, which is suitable for simulation training virtual environment as well (Wei et al, 2013; Shu et al, 2012). Open standards of Web3D allow the delivery of interactive 3D virtual learning environments through the Internet, which can reach potentially large numbers of learners worldwide at any time (Li et al, 2011). In some reference papers, the educational use of virtual reality based on Web3D technologies is introduced. The main positive and negative results are outlined (Chittaro et al, 2007). Web3D simulation-based virtual worlds have been substantially adopted in educational settings worldwide. Since the elaborations on such applications in regard to tourism education are still limited, the application of 3D simulation-based platform has been studied (Hsu, 2012). The prospects for the generation of interactive web-based 3D City Models based on free geo-data available from the Open-Street-Map project are investigated (Over et al, 2010). The virtual reality learning environments for elementary numeracy education using 3D virtual manipulatives has been investigated (Daghestani et al, 2008).

In recent years, 3D virtual reality technology has been growing fast. Java and Java3D API have been used to develop a Web3D virtual reality learning environment (Sun et al, 2008). Combining the B/S mode and characteristics of distributed interaction simulation, a new design based on Java3D technology to improve the remote simulation is provided (Yao et al, 2010). Based on virtual field trips, a teaching using virtual trips laboratory characteristics of the model to design appropriate teaching modules is established, and Java3D is used to realize a virtual field trips prototype system (Hou et al, 2012). The modeling method of the 3D tunnel model with collapsible fractures is detailed studied and carried on programming with Java3D (Hou et al, 2012). Similarly, the author implements Java3D to program the model algorithm, and realizes the 3D tunnel visualization, which provides a new method for building 3D tunnel model in establishing digital mining 3D visualization platform (Tian et al, 2011). The interactive molecular dynamics software for common desktop computers and workstations is presented based on Java3D (Vormoor, 2001). The graphics tool Java3D for three-dimensional scene has been chosen to develop an architectural ceramic product decoration effect three-dimensional display system (Huang et al, 2010). The article describes the coarse shape filters that support the 3D internet-based search engine shape-sifter. The aim of filter is to locate parts already in production that have a similar shape to desired new part (Corney et al, 2002). Experiences and outcomes of the designed three-dimensional terrain environment using Java3D technology have been studied (Jovanović et al, 2009). A talking head oriented

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