Development of Virtual Reality Tool for Creative Learning in Architectural Education

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ABSTRACT

One of the challenging tasks in engineering education is to bridge the gaps between imagination and real time problems of different engineering areas. The virtual reality (VR) can reduce this gap and also provides clear ideas on the basis of real time problems. The architectural education influenced and goes hand in hand for meeting these crucial challenges using advancements in computer technologies. In this research, we developed a VR tool for improving architectural design education. We explain VR tool as a value addition to the architectural education. The system is based on a general purpose computer, ceiling-mounted projector and passive glasses for Three Dimensional (3D) viewing. The presented work shows that virtual reality technology can considerably progress the efficiency learning by allowing young architects to apply theoretical knowledge to real world problems. In addition, it develops creativity, innovation, communication, problem solving approach, team-working and business skills.

Keywords: Architectural Education, Computer Aided Design (CAD), Three Dimensional (3D) Model, Virtual Reality (VR), Virtual Reality Modeling Language (VRML), Visual C Plus Plus (VC++)

DEVELOPMENT OF VIRTUAL REALITY TOOL FOR CREATIVE LEARNING IN ARCHITECTURAL EDUCATION

Further to the conventional Computer Aided Design (CAD) tools, other digital technology such as virtual reality has provided in regards to architectural education (Abulrub et al.). VR significantly helps young architects to understand principles of architectural design as well as professors to explore the student’s projects to detect hidden flaws. VR can be more useful than traditional methods of teaching. The idea of enriching the knowledge of the real world with a complementary virtual world that deals with virtual graphical representations rather than realistic sites and scenes, opens new per-

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spective for young architects to acquire a better understanding of architectural concepts through a realistic approach.

**AIMS OF RESEARCH**

One reason that it is hard for students to understand and visualize space is the traditional graphic media used to represent and manipulate space throughout the design process is limited. The two-dimensional (2D) static image produced by traditional graphic methods is inadequate in representation. The simulations give people the opportunity to experience mistakes before they are constructed and to learn from the mistakes. Computer hardware and software developed are capable of creating a virtual reality that will allow designers to model, articulate, and animate movement through the design process (Deyin et al., 2007).

VR is of great significance in providing better understanding and visualization capabilities as an effective tool for education in an architectural context, as it allows students to discover fundamental architectural concepts and basic ideas through complete immersion and interaction in virtual environments (Dvorak et al., 2005; Magnenat et al., 2006). Students can perceive different architectural spaces, rather than viewing traditional drawings. VR can assist young architects for:

- Constructing designs;
- Creating walkthroughs and immersive simulations;
- Manipulating different virtual architectural elements.

**MOTIVATION**

VR is currently used to present a range of computer-based systems in which a user can explore hardware and software generated ‘microworld’ that bears some resemblance to reality. Learners must use their imaginations in order to make VR activities effective and stimulate the necessary imaginative processes in a number of ways that do not necessarily require hi-tech devices. Architectural students can benefit a lot from this system for creative learning (Hamada, 2008). Traditional 2D architectural representation is capable only of depicting planar concepts. Virtual reality 3D visualization can easily convey spatial concepts of architecture.

VR offers both opportunities and challenges for the educational sector. VR is a technology that is attractive to student community (Patlakas & Peng, 2012). Computer hardware and software development has made it more feasible to incorporate this technology into teaching strategies. With the increasing demand for innovative in higher education, and with the advancement in 3D visualization technologies, a growing range of teaching and training material can be utilized in virtual environments (Hosny & Kader, 2004). VR technologies can be used as educational and training tool with the advantages of being safe, cost-effective and fully controllable. In addition, virtual environments significantly enhance the learning experience as they provide the virtual learner with realism and interactivity.

**PROBLEM ANALYSIS**

VR technology enables young architects to get a better understanding of a construction plan. Traditional representational mediums such as drawings or clay models are restrictive because of the additional effort needed in visualizing space. Designers have to use more mental effort to translate information from two-dimensional representation to imagine it in a three dimensional space. Visualizing 3-dimensional structures and realizing their spatial relations is a challenge in the use of VR in architectural education (Kamath & Kamat, 2012). Given the above constraints, one of the main goals of research reported in this paper is to develop and enhance an architect’s ability to visualize space.
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