EDITORIAL: SPECIAL ISSUE ON VIRTUAL AND AUGMENTED REALITY IN DESIGN AND CONSTRUCTION

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1. SUMMARY

Virtual Reality (VR) and Augmented Reality (AR) are exciting technologies that offer considerable potential benefits in all stages of the Architecture, Engineering and Construction (AEC) process, from initial planning and conceptual design to facility management and operations. VR and AR allow people to visualize and interact with a building or infrastructure design and construction process in the early stages of design, and allow for improved communication and innovation within projects.

The papers in this special issue are focused on research and educational initiatives for using virtual reality, augmented reality, and interactive media environments for improving the design, delivery and educational efforts in the construction industry.

Readers of this special issue may also be interested in other previously published papers in the ITcon Journal focused on these topics with particular note of a special issue edited by Kalle Kahkonen in 2003 titled Virtual Reality Technology in Architecture and Construction[1].

2. PAPERS IN THIS SPECIAL ISSUE

This special issue contains ten papers focused in three topic areas: Augmented Reality, Virtual Reality and interactive media environments.

1. Augmented Reality Papers

The first AR paper is titled Camera Constraint on Multi-range Calibration of Augmented Reality Systems for Construction Sites by Do Hyoung Shin and Wonjo Jung. This paper discusses system accuracy issues related to multi-range AR systems for use on construction sites.

The second paper by Xiangyu Wang and Ning Gu titled An Empirical Study on Designers' Perceptions of Augmented Reality within an Architectural Firm is focused on the implementation of AR for improving collaboration in design firms. Instead of focusing on the technological issues, this paper presents important perception data collected from interviews of design firm practitioners related to their potential use of AR.

2. Virtual Reality Papers

There are six papers in this issue that focus on virtual reality, 3D virtual worlds, or modelling issues associated with virtual reality. The first paper is titled Augmentation of Real-time 3D Virtual Environments for Architectural Design Formation by Rabee Reffat. This paper presents a system titled Interactive Architectural Modeling in

[1] Available at http://www.itcon.org/cgi-bin/special/Show?_id=2003vr&sort=DEFAULT&search=&hits=21

Virtual Environments (IAMVE) which enables designers to more effectively create architectural models in 3D virtual environments by providing 3D content libraries in the virtual environment, allowing designers to maintain object properties, and maintaining constraint based object rules within the environment.

General-Purpose Construction Simulation and Visualization Tools for Modeling and Animating Urban Vehicular Traffic Operations by Brian Timm and Vineet Kamat, presents an innovative use of a virtual reality based simulation tools designed primarily for construction operations to model and visualize traffic operations. The authors show that the construction simulation and visualization tools have a broader application within the industry.

Virtual Worlds as a Constructivist Learning Platform Evaluations of 3D Virtual Worlds on Design Teaching and Learning by Leman Gul, Ning Gu, and Anthony Williams is the first of several papers which address the application of virtual reality, and virtual worlds, for use in education within the Architecture, Engineering, and Construction (AEC) industry. This paper analyzes learning and teaching features within 3D virtual environments, along with their impact on cognitive processes and core skill development when learning in a virtual world such as Second Life or Active Worlds.

A Study of User Perceptions of the Relationship between Bump-mapped and Non-bump-mapped materials, and Lighting Intensity in a Real-time Virtual Environment by Jason Breland, Mohd Fairuz Shiratuddin, and Kevin Kitchens addresses the impact of using bump-mapped materials in real time 3D virtual environments to create a greater sense of realism. This paper also includes video files to better illustrate the different 3D environment characteristics which is the first paper in the ITcon Journal to include archived media files.

Implementation and Evaluation of a VR Task-based Training Tool for Conveyor Belt Safety Training by Jason Lucas and Walid Thabet is focused on the use of virtual reality for employee training which promises to be a very valuable use for virtual reality in the future.

Nashwan Dawood and Sushant Sikka in Measuring the Effectiveness of 4D Planning as a Valuable Communication Tool show data which supports the use of 4D modelling as a tool to communicate construction sequence information in a virtual model.

3. Interactive Media Environments Papers

This special issue concludes with two papers which investigate the use of interactive media environments and their application in education. The first paper, Emerging Technologies in a Tele-collaborative Design Studio between Penn State and Carleton University by Katsuhiko Muramoto, Michael Jemtrud, Sonali Kumar, Bimal Balakrishnan, and Danielle Wiley, describes results from an innovative design studio course delivered using distributed communication technologies in interactive media environments at two universities. This paper may provide a glimpse of the future of design studios coordinated between multiple universities.

The final paper, Lessons Learned from the Use of Interactive Workspaces for Student Team Design Project Meetings by Mohamed Issa, Jeff Rankin, John Christian, and Evan Pemberton, presents user survey results from students who used the Interactive Collaboration Laboratory (ICL) at the University of New Brunswick (UNB) for design project meetings. The results show both benefits and challenges that need to be addressed when working in an interactive workspace.

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