www.itcon.org - Journal of Information Technology in Construction - ISSN 1874-4753

EDITORIAL: SPECIAL ISSUE ON USE OF GAMING TECHNOLOGY IN ARCHITECTURE, ENGINEERING AND CONSTRUCTION

PUBLISHED: January 2011at http://itcon.org/2011/1
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REFERENCE: *Editorial – Special issue on use of gaming technology in architecture, engineering and construction, Journal of Information Technology in Construction (ITcon), Vol. 16, pg. 1-2, http://www.itcon.org/2011/1*

1. INTRODUCTION

The rapid development of World Wide Web and the dominance of networked computers for information transfer and communication have enabled the rise of online computer games. Gaming technology is getting matured with more user-friendly interfaces and various hardware platforms including handhelds devices that enabled the gaming applications to broaden its scope in various sectors including Architecture, Engineering and Construction (AEC). As a result, gaming technology offers significant benefits in the AEC disciplines from 3D walkthroughs, interactive visualisation, through virtual collaboration, design and planning to education, training and simulation. The special issue is aimed to provide insights into the use of gaming technology in AEC and includes nine papers with authors representing institutions in Australia, Canada, Korea, Taiwan, UK and the USA.

1. PAPERS IN THE SPECIAL ISSUE

The papers in the special issue focus on the use of game engines and gaming techniques in AEC. The first paper by Juang *et al.* presents the utilization of game engines in physics based simulations with an example of forklift scenario. They demonstrated the use of Blender game engine to efficiently develop physics-based simulations and discussed several advantages of developing a game engine-based construction simulation such as easier development, shorter development time, higher graphical quality, more stable simulation, and better real-time interaction. ElNimr and Mohamed present the utilization of gaming engines in the development of a simulation driven visualization framework based on High Level Architecture (HLA) standards. Two game engines, TrueVision3D and Blender with different architectures were utilized in two different implementations to evaluate their effectiveness. They found that TrueVision3D integrated more naturally with the distributed simulation infrastructure but relies heavily on programming skills; and Blender is more effective in representing simulation interactions through 3D visual behaviours as it provides the ability to use a graphical user interface to generate the required behaviours with minimal coding.

The utilization of a 3D game engine, the Torque Game Engine as the underlying tool for a design review system is discussed by Shiratuddin and Thabet. The game engine is used as the enabling tool for the development of design

review processes while a virtual environment is used as the medium for design review. The Virtual Design Review System (VDRS) is developed by creating the assets and the assembly of the virtual environment, and then modifying existing functions and introducing new functionality through programming of the 3D game engine in order to support design review in a virtual environment. Authors also discussed the underlying strengths of 3D game engines such as real-time 3D rendering, real-time walkthrough, interactivity, multi-participatory, lighting and collision detection for the development of VDRS that offers support for database integration, real-time collaboration across network, 3D object manipulation, parametric input, and organization for 3D objects. Similarly, Torque Game Engine is utilized by Lin *et al.* for developing a game-based approach to evaluate a safety inspector's training and role on a construction jobsite. They conducted a pilot study to explore the opportunities and limitations of 3D video game technology in construction safety education course. The results showed that with the use of gaming technology, students increased their learning interests, enjoyed the learning process, and were motivated to refresh their knowledge in construction safety.

Kumar *et al.* present a framework for scenario-based design reviews of healthcare facilities and implemented the Experience based Virtual Prototyping Simulator (EVPS) using a 3D game engine, Unity. EVPS allows the design reviewers and end-users to directly experience and interact with the design prototype. Design information workflows were also developed to transfer 3D geometric content of the healthcare facilities from various BIM authoring tools to the Unity game engine. The interactive simulation-based parade game developed by Han and Park shows the impact of managerial reactions to workflow variability. The game incorporates managerial decision making processes and highlights trade-offs associated with managerial decisions. The application of the interactive parade game showed that it can successfully help students to actively participate in the learning processes and to gain a deeper understanding of the dynamics of construction production systems.

Dickinson *et al.* review the background of using interactive technology in construction trades training and discuss the game-based trench health and safety. They present the observations taken from the developers, teachers and students and lessons learnt from the game development and classroom deployment. Initial findings indicate that serious games offer engaging and innovative medium for delivering training to students who are more comfortable with hands-on learning. Salim *et al.* introduce the notion of form fostering i.e. the novel design approach for interacting with parametric models in the embodied virtuality and present the experiments with the use of a wii remote, an arduino processing board, servo actuators and a camera. They present their UbiMash software platform as a generic and open interoperability tool for designers to connect any physical devices with CAD software. Isaacs *et al.* discuss the gaming technology to improve the presentation of sustainability information in 3D urban models. They outline a platform based on gaming techniques to model social, economic and environmental indicators to provide an interface that presents a 3D interactive virtual city. Their findings showed that the virtual environment is a useful medium to communicate the interdependent nature of sustainability indicators and to compare and contrast opposing planning scenarios.

2. ACKNOWLEDGEMENTS

We would like to thank Profs Bo-Christer Björk and Žiga Turk for their support and assistance. We also wish to thank all the reviewers and authors for their contribution to this special issue.