Chapter 8
Coupling BIM and Game Engine Technologies for Construction Knowledge Enhancement

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ABSTRACT

Interactions and collaboration between parties in construction projects are often characterised by misunderstandings and poor information exchange. Game engine technologies, when employed with building information modelling (BIM), can help address these shortcomings. Quite often, the visualisation capabilities of BIM models are not explored fully partly because of their limited interactive capability. While game engines are powerful in visualisation and interactions in the gaming industry, the literature suggests a lack of understanding of the applicability of the same in construction. This study investigates the potential of the use of game engines in construction practice which culminated in a framework that can guide the implementation of the same in enhancing interactive building walkthroughs.

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1. INTRODUCTION

Construction projects typically revolve around the client's/end-user's needs. Consequently, it is essential that professionals work in collaboration and supply information requirements in the most effective way (Kamara et al., 2002) for the efficient project delivery. The design project phase is sometimes treated as separate from the actual construction process, hence project teams gravitate to work in isolation, leading to conflict and disintegration (Baiden, Price and Dainty, 2006). In addition, certain procurement practices also hinder collaboration thereby contributing to the poor performance of projects (Baiden, Price and Dainty, 2006). The literature suggests that 30% of all construction capital is not employed efficiently for construction purposes due to poor management during projects (Uyen (2003) cited in Nguyen, Ogunlana and Lan (2004)). Poor design capacity and frequent changes are also consistently ranked as the top critical factor causing project failure (Nguyen and Chileshe, 2013). The issues mentioned in the preceding sentences are partly related to lack of project understanding which consequently leads to poor interaction between project teams and to loss of significant data (Serror et al., 2008; Aydin and Schnabel, 2014). Additionally, project team members comprehend the design and complex project information differently, and therefore, visualization methods can better enhance team members understanding of projects.

Integrating BIM technologies into projects, is a new approach to gathering, processing and utilising information across the project activities (Reddy, 2012). BIM is often regarded as a revolutionary tool that would enhance the construction project workflows by improving collaborative working and information exchange throughout the project lifecycle (Abanda et al., 2015; Edwards, Li and Wang, 2015). Conversely, some researchers believe BIM to be primarily utilised as a design tool (Bille et al., 2014; Holness, 2006).

Game applications contain specific 3D features that enable 3D visualisations of building models and offer users the ability to navigate within them and in turn grants the possibility for both professionals and non-professionals to experience the building in operation prior to construction (Barwise et al., 2010; Mitchell et al., 2012). This visualisation experience may also serve to enhance an inexperienced and non-expert client's or end-user's understanding of the project, allowing them to better communicate their feedback to the project team, hence leading to less frequent changes and associated time/cost overruns.

Computer game engines could be used together with BIM to extend the capability of building models into highly interactive 3D virtual environments that could provide interactive construction applications that are beneficial to both professional and non-professional users (Bille et al., 2014; Edwards, Li and Wang, 2015). These game environments offer a highly interactive user experience that allows communication with/and responses from objects within the interface at an easy to learn manner (Yan, Culp and Graf, 2011). There is potential therefore to apply this to provide non-experienced users with the opportunity to visualise the model and interact in an immersive manner, a capability that is not available using the current BIM-based applications (Holness, 2006).

The purpose of this study was therefore to investigate the potential of using game engines in construction practice with a focus on its applicability, benefits and limitations. This also enabled the development of a framework for adopting game engines in construction practice.

2. LITERATURE REVIEW

There are many technologies for enhancing the process of the development of construction projects. Understanding their differences in terms of their application, benefits and barriers is essential when