Chapter 5
Literature Review of Augmented Reality Application in the Architecture, Engineering, and Construction Industry With Relation to Building Information

Aydin Tabrizi
University of Kansas, USA

Paola Sanguinetti
University of Kansas, USA

ABSTRACT

The rapid development and adoption of AR applications creates numerous opportunities for integrating AR with BIM and improving conventional methods used in the fields of architecture, engineering, and construction (AEC). In this chapter, the current trends in the development of AR applications and the application of AR technologies in the fields of AEC are proposed. Also, the relation between AR application and BIM in the AEC industry with the benefits of this integration and possible issues is discussed. The related examples of BIM+AR are described during the literature review. The authors believe the papers presented in this document cover the latest research trends and developments in the use of AR and its combination with BIM for AEC applications. In the future, it is expected that AR applications will be further utilized in the AEC field to enhance productivity, safety, and efficiency.

INTRODUCTION

Productivity rate in construction industry shows a general pattern of decline in comparison to other industries. This issue influences on performance and efficiency of construction projects by adding unnecessary costs, time, materials, and manpower waste Alwi, Hampson et al. (2002). In dealing with this issue, it is necessary to apply proactive approaches rather than reactive ones through using new method

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and processes in the construction industry. During the last decade, Information and communication technologies (ICT) have been advanced significantly where the application of these technologies could improve the construction industry efficiency to some level (Park & Kim 2012). However, in order to fulfill this task in a larger scale, new methods and processes are required to develop and analyzed. This paper presents a conceptual framework to enhance construction industry efficiency via a comprehensive and proactive mechanism of Augmented Reality (AR) and Building Information Modeling (BIM) linkage. To fulfill this objective, the study begins with an extensive and critical review on AR and BIM separately in order to investigate the efficiency of each technique in the construction industry. Then the study proposes a conceptual framework of AR and BIM combination by investigating this collaboration in the enhancement of construction industry procedure.

BACKGROUND

Augmented Reality (AR) provides the means for intuitive knowledge presentation by enhancing the perceiver's situational awareness and cognitive perception of the real world. Through AR approach, virtual objects can be registered in relation to real objects where these objects can be seen in the same position and orientation of other real objects of the scene, as perceived by the user (Wang et al. 2004). In addition the real objects can be tracked and their 3D shape can be reconstructed from pictures (Azuma 1997).

AR has introduced as a technology which allows the user to see, hear, touch, smell and taste things that others cannot (Van Krevelen and Poelman 2010). It is a technology to perceive elements and objects within real world experience in a complete computational environment. It applies creatures and structures that could be used in daily activities unconsciously through interaction with others such as enabling mechanics to see instructions for repairing an unknown piece of equipment, surgeons to see ultrasound scans of organs while performing surgery on them, fire fighters to see building layouts to avoid invisible hazards and people to read reviews for each restaurant on their way (Feiner 2002). (Wang and Dunston 2007) describes AR as a tool allowing users to work with real world environment while visually receiving displays of additional computer-generated information about the item by superimposition of additional information onto the real world scene. This approach enhances the user's perception of the real environment by showing information that cannot sensed unaided.

It is expected that in the near future, an increase in the use of AR applications will occur due to the advancement of hardware and software. (McKibben and Furlonger 2009) predict that by the end of 2014 approximately 30% of workers will use some form of AR capability and after a long period of technological development and refinement, the implementation of AR applications for the general public will reach its peak. In addition, the commercial market shows a same trend by promising examples such as Project Glass as an R&D program by Google (Goldman 2012) to develop an AR head-mounted display (HMD) for enabling users to experience a truly immersive digital life. ABI Research (Hyers 2006) predicts that by the end of 2014 the revenue from the AR mobile market will reach $350 M and Juniper Research (Holden 2005) predicts that the market for AR services will reach $732 M at the same time. It is widely believed that AR technologies are maturing and that within the coming years they will be broadly adopted by industry.