Using Augmented Reality Technology for the development of Historic Building Teaching Application: A Mackay Culture Course

Kai-Yi Chin
Department of Digital Humanities,
Aletheia University,
New Taipei City,
Taiwan
au0292@mail.au.edu.tw

Chun-Xin Hou
Department of Digital Humanities,
Aletheia University,
New Taipei City,
Taiwan
ah030962@au.edu.tw

Ching-Sheng Wang
Department of Computer Science and Information Engineering,
Aletheia University,
New Taipei City,
Taiwan
cswang@mail.au.edu.tw

Ko-Fong Lee
Department of Computer Science and Information Engineering, National Taipei University of Technology,
Taipei City, Taiwan.
t104599001@ntut.edu.tw

***Abstract*—This study proposes a mobile augmented-reality teaching system focused on historic buildings that enables users to build a deeper understanding of the building structure, features, historical references and era influence while simultaneously exploring the historic site through the interaction effect that combines the virtual and the real. This increases overall interest in architecture and history. In this study, five students will operate the AR system to study how Mackay Culture influenced Tamsui and a satisfaction survey with both the questionnaire survey and an interview will be utilized to determine if participants are receptive to our proposed system and provide feedback on how to make subsequent improvements on our model.**

Keywords- Augmented reality, Historic building, Mobile teaching system, Digital guide system

I. INTRODUCTION

Historic site tour is important for social education. Aside from offering excellent learning opportunities, it conveys the geographic, historical, cultural and artistic meaning of historic sites to cultural visitors through three-dimensional exhibits and leisure activities. In the on-site visits, historic site tours and art exhibitions today, inscription interpretation, tourist guidebooks, and multi-media information systems are often adopted to lead tourists into a specific area to understand the architectural environment. In terms of phonetic guide, extra money must be paid to rent the equipment. In some exhibition halls, there would not be an interpreter unless there is certain number of tourists. Despite that guidebooks can be taken away for further information, tourists often throw them away after the tour; hence, the guidebooks fail to lead tourists to experience the real surroundings of historic sites. Sometimes, tourists are able to visit historic buildings, but they cannot obtain immediate and interactive information about the tour.

Relevant studies have found that users regard the augmented reality-based tour guide as "interesting", 'special", "challenging" and "lifelike" and thus have a stronger intention to take a tour [1][2]. The dynamic *Riverside Scene at Qingming Festival* by Zhang Zeduan (a painter in Song Dynasty) gives tourists the illusion that they were in the Northern Song Dynasty. The interpretation, which integrates digital classics with such media as projectors, Kiosk and mobile devices, offers users more direct access to the information about cultural relics. With the stimulus in different senses, tourists can achieve more efficient learning and acquire more extensive and profound knowledge.

According to some scholars, augmented reality can deepen tourists' understanding of culture and history [3][4]. For instance, it was adopted to re-establish the interior structures of Valencia Cathedral in Spain, so that users can interact with the tourist site and obtain extra information through the visual effects brought by the technology. Therefore, this study applied augmented reality to the Mackay culture in Danshui, so as to deepen learners' understanding of historic sites. This study also hope that our proposed system will be widely adopted in the education of tour guide of historic sites.

II. LITERATURE REVIEW

In recent years, technologies like augmented reality have been widely used in the tour guide of historic sites and museums [5]. Learners were more satisfied with the education system, paid more attention to outdoor environment, and had an intention stronger to take a tour; most of learners showed a positive attitude towards the use of the technology. For instance, Grasset asked learners to read mixed reality books and interact with the virtual objects in the books, so as to enhance their sense of immersion [6]. By combining augmented reality with mobile devices and story books, Tomi and Rambli designed a set of AR mobile story books to facilitate the reading of AR virtual objects [7]. Billinghurst,Kato,Poupyrev made the AR Magic Book, where animation was incorporated into books so that readers would see the virtual animation[8]. Rambli, Matcha and Sulaiman created a set of AR alphabet for pre-schooling children, where the animation about alphabetic letters was used to create an interesting learning environment [9].

As has been mentioned above, many scholars have discussed augmented reality, but most of them emphasized

2161-377X/17 $31.00 © 2017 IEEE
DOI 10.1109/ICALT.2017.7

that it was interesting, but they seldom applied it to the instruction of historic sites. Hence, this study adopts the technology in the tour-guiding instruction of historic sites to reveal the distinctive physical features of buildings, strengthen the spatial concept of the form of historic sites, promote the transformation from two-dimensional graphs into 3D objects, and add the historical chronicle.

III. System Architecture

Figure 1 shows the process of the Mackay Walking Tour Guide APP. On the interface, one can get the information about a building by pressing the AR button and scanning the target. Moreover, the AR information button can present the 3D model of a historic site, so that learners will be able to see the whole form and distinctive features of historic sites. Additionally, the APP also offers videos. Last but not least, the picture collection of the APP shows the surroundings and actual situations of historic sites, so that learners can visit the historic sites all by themselves, which can reduce labor cost and strengthen the interest in learning.

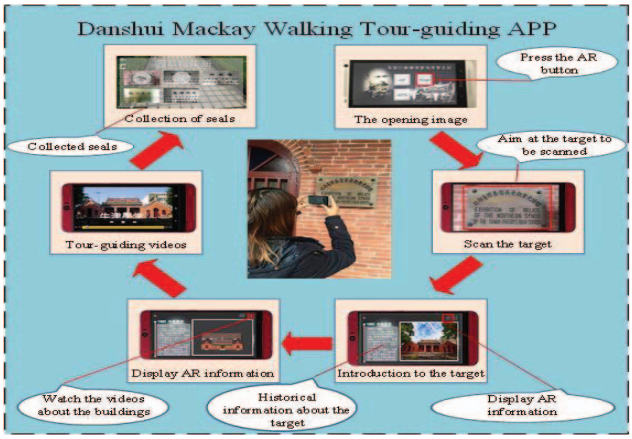

Figure 1. Process of Mackay Walking Tour APP.

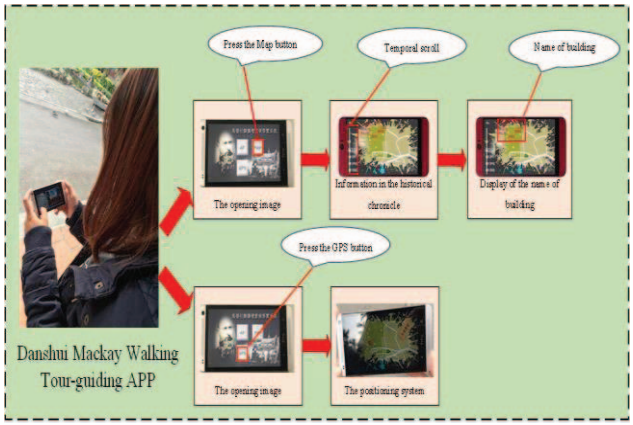

Figure 2. Process of Other Functions of Mackay Walking Tour APP

Figure 2 shows the process of other functions of the Mackay Walking Tour APP. The APP also includes functions like Map and GPS, so that learners can see the maps of historic sites on smart phones. Additionally, the years on the temporal axis can reveal the buildings of different historical periods. The GPS of the system, however, enables learners to locate themselves on the maps. As long as learners reach a target historic site, the positioning point would change in color and inform learners of the destination. In this way, learners can get the historical development time of the building and acquire more accurate knowledge.

IV. Conclusion and Future Studies

This study proposed the Mackay Walking Tour APP, a system different from the traditional tour-guiding system. It collected the information about the Mackay culture and developed a digital tour-guiding system. Moreover, augmented reality was adopted to present the 3D images of historic buildings as well as the distinctive physical features of the buildings. Besides, the Map and GPS enable learners to locate historical buildings and thus enhance their interest in historical buildings and history. In future studies, the English and Korean versions of the description, videos and 3D models will be added, so that tourists from all over the world will be able to use the system.

Acknowledgment

This work was supported by Ministry of Science and Technology of Taiwan under the grant number MOST 105-2221-E-156-007 and MOST 105-2632-M-156-001.

References

[1] Damala, A., Cubaud, P., Bationo, A., Houlier, P., & Marchal, I. (2008, September). Bridging the gap between the digital and the physical: design and evaluation of a mobile augmented reality guide for the museum visit. In Proceedings of the 3rd international conference on Digital Interactive Media in Entertainment and Arts. ACM, 120-127.

[2] Zhang,J,Sung, Y. T,Hou,H. T ,&Chang,K . E.(2014). The development and evaluation of an augmented realitybased armillary sphere for astronomical observation instruction.Computers&Education, 73, 178-188.

[3] Lanier,J. (2001). Virtually there.Scientific American , 284(4), 66-75.

[4] Portales,C,Lerma,J. L,&Perez,C. (2009). Photogrammetry and augmented reality for cultural heritage applications. The Photogrammetric Record, 24(128), 316-331

[5] Naismith, L., Ting, J., & Sharples, M. (2005). CAERUS: A context aware educational resource system for outdoor sites. CAL, 5, 4-5.

[6] Grasset, R, Dunser , A,& Billinghurst , M. (2008, December). Edutainment with a mixed reality book: a visually augmented illustrative childrens' book ,Proceedings of ACE 2008,Yokohama,Japan.

[7] Tomi,A. B ,&Rambli, D. R. A. (2013). An Interactive Mobile Augmented Reality Magical Playbook:Learning Number with the Thirsty Crow. Procedia Computer Science, 25, 123-130.

[8] Billinghurst, M., Kato H., & Poupyrev, I. (2001). The Magic Book: A Transitional AR Interface, Computers & Graphics, 25(5), 745-753.

[9] Rambli,D.R.A. Matcha,W &Sulaiman,S (2013).Fun Learning with AR Alphabet Book for Preschool Children. Procedia Computre Science, 25, 211-219.