***The Development of a Virtual Tour Interface for a Wetland Park
by Using Unity Technologies***

Tun Hsueh Chan, I-Shou University, Taiwan
Gwo-Long Lin, I-Shou University, Taiwan

Abstract
This research focuses digital interface with content for a virtual tour of a wetland park located in Dashu district of Kaohsiung, Taiwan. The development of the virtual tour commenced with a field survey to investigate in detail geographic and culture features. Next, a series of 3D models including traditional brick-based architectures and landscape were built into a virtual space. In addition, some biological features of the wetland such as birds and plants were added to increase the atmosphere. Reinforced with Unity technology, this virtual park allows users to walk-through within the computer monitor by mean of the keyboard control. The interface demonstrates textures of buildings and the undulating landscape in detail, providing realistic feeling to the users. On the other hand, this interface also includes digitized historical buildings including traditional brick kilns and an iron bridge within the wetland park. With 3D rotatable view and interactive simulation, many users experienced the virtual park and provided positive finding and advises. This has proved this virtual tour interface is an effective form of cultural heritage.

Keywords: Virtual Reality, Unity, Wetland park,

iafor

The International Academic Forum
www.iafor.org

Introduction

There is a wetland park in Dashu district of Kaohsiung. Within the park, a 100-year old brick kiln and the first iron bridge designed and built by Iida Toyoji during the Japanese colonial era in Taiwan. However, the current webpage introducing the wetland park only presents text and images without any interactive experience. Lacking of multimedia interaction, it is not easy to attract visitors, particularly from the younger generation.

Lin Zhaoyu (2010) virtualized Yingge Ceramics Museum with Web3D, exhibiting pottery artifacts and crafts within a realistic virtual interior. Walking through the museum with a computer, movies and animations can be displayed on the virtual wall. His research created the interface for users to rotate objects b 360 degrees and zoom in for detail on mobile devices. This strategy potentially could attract youngsters to wander around exhibitions in the era of online games.

Figure 1. The Current Website for Introducing the Wetland Park

On the other hand, the Google map of this park can only show traffic routes with panoramic views for finding one's way. Users cannot even feel the change of variant latitude and slopes. In some reservation areas, there are even no proper routes, which prevents the Google street car to take panoramic photos.

Katz, Cook and Smart (2011) utilized the Unity 3D browser plug-in for displaying virtual reality content. Felnhofer et al. (2015) indicated that a VR Park can arouse emotion and elicit the attention for students.

Recently, facilities such as HTC vive and Oculus have been utilized as augmented reality (AR) for enhancing experience with realistic 3D content. Through these

devices, Unity visualization for architecture and archeological sites in the form of AR also gained much popularity from younger generations in museums and galleries.

In the light of this, the objective of this research is to construct and provide more realistic online 3D experience with Unity virtual reality. It aims to encourage tourists for visiting the wetland park. Eventually, richer content including historical sites and eco-systems of inside the wetland park could be imported into the Unity package, which could be an educational interface and an online cultural heritage.

Method

Initiated with a field survey, significant scenery spots inside the wetland park were selected for 3D modelling. Next, featured buidings including Sanhe kiln and landscapes were constructed with texture mapping. Afterwards, all 3D elements were combind and edited in the Unity software to produce online browserable Web3D content.

(A)   Field survey

Initiated with a field survey, the research team investigated many critical spots in the wetland park. This park featurs a wetland eco-system and a 100-year old iron bridge from the Japanese colonial period. Shan-he Tile Kiln, which inherited Fujian brick architecture and makes rare and luxurious bricks is also located here. Some pictures showing the textures of path (i.e. brick land and grass land, etc.) and the geographic presence of such features as ponds and bushes were also recorded.

Figure 2. A Collage of Buildings, Textures and Landscapes.

In order to render a lifelike wetland park and create 3D content in detail, many photos must be taken, including surroundimg buildings and even the textures of vegetation. As shown in Figure 1, it is also important to record relevant positions of buildings and

routes. While taking pictures, an ultra-wide lense should be utilized, particularly when the building is too large.

(B)   The Virtualization of Buildings

Figure 3. Digitized iron bridge

There are several buildings scattered around the wetland park. The research team visualized these buildings by 3D modelling with Solidworks, Creo and Rhino software according to the abiltities of different students. These 3D models were then converted to FBX files as Unity 3D assets.

In this park, there are two parallel bridges include the 100 year old bridge and the new one for continuing the railway installation.The old one, designed and built by Iida Toyoji in the Japanese colonial era, is damaged and revealed a sense of nostalgia. The research team acquired a 2D layout and then digitized this bridge with Rhino 3D.

Figure 4. The Digitized San-he Kiln

In addition, San-he Brick Kiln is the most significant building in the park, which was constructed using thousands of bricks. Initially obtaining the 2D layout from a bird's-eye view, the structure and the height of buildings were extended up according to the ratio represented by pictures.

Douglas Cawthorne (2010) in De Montfort University has utilized 3D scanning for virtualization of the archeological site of ancient Roman Leicester. His research has successfully provided realistic 3D experience for Reminiscence tourism.

In this research, while creating 3D models with complex geometries such as some sculptures in the park, hand-held scanners (e.g. cubify sense, structure 3D) were utilized for digitizing the objects. They were then imported into Geomagic software for re-topology and reducing surfaces. Figure 5 represents the process.
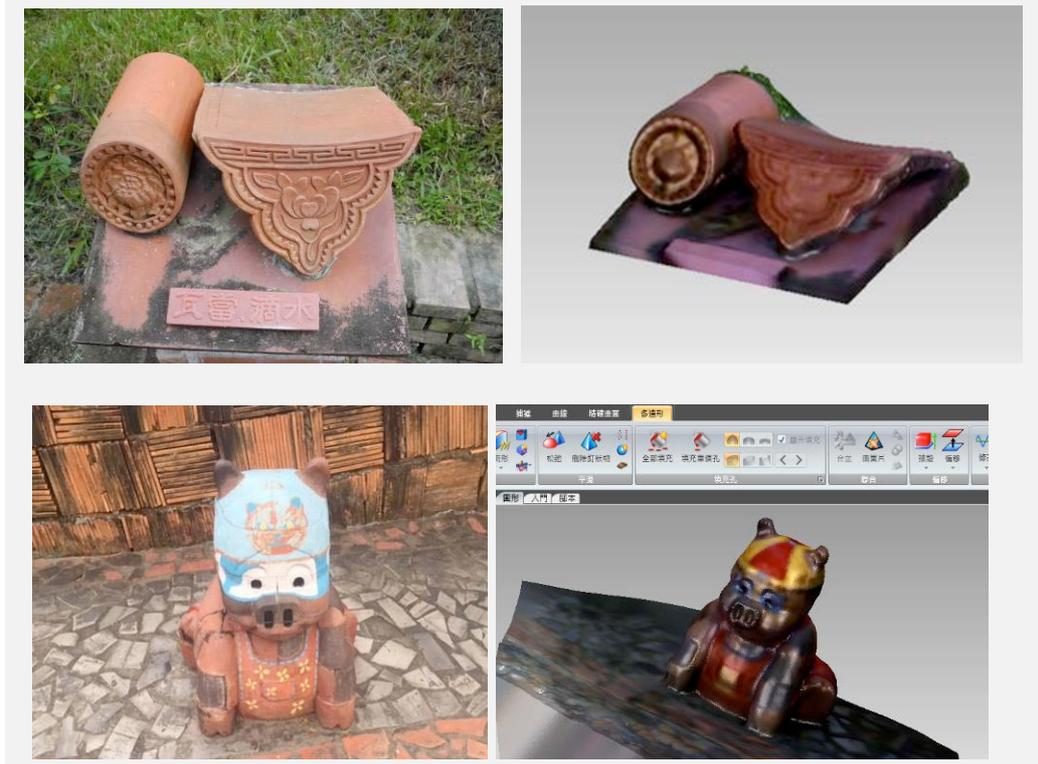
Figure 5 The Digitized Statues from San-he Kiln

(C)   Arrange topography and position buildings in a virtual space

The Unity 3D gaming engine is used to create undulating terrain, trees and rocks as well as vegetation and rivers as shown in Figure 6. Texture for the walk path and ground can be attached for more realistic feeling in Figure 7. A variety of weather effects such as fog and sunset themes for richer visualization were inputted for more fun.

When placing buildings in the Unity engine, satellite-based topography should be compared simultaneously for precise location.

After all the items inside the Unity theme, an .exe file can be the output for operating in a Windows-based computer or laptop. An APK file can also be output for Android devices.

Steps above should be repeated back and forth many times for optimizing performance and creating a realistic user experience.
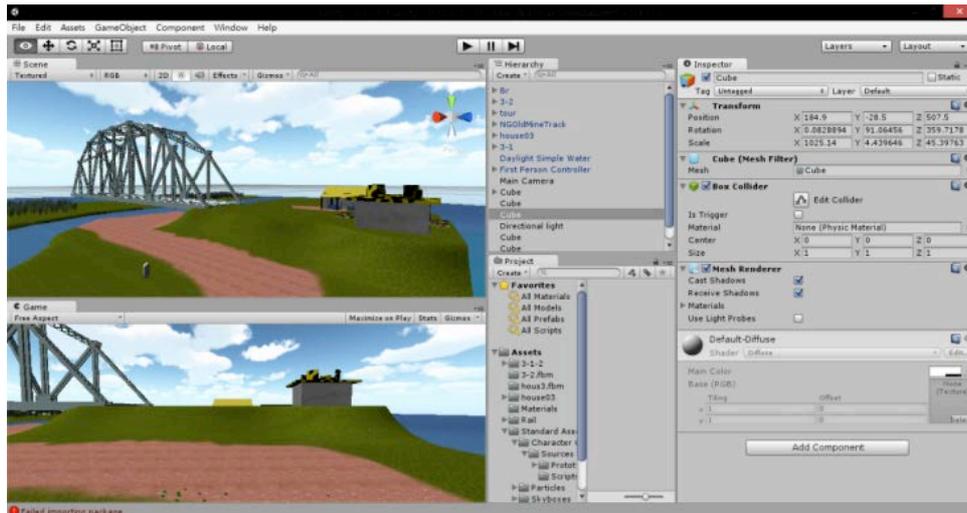
Figure 6. create terrain and vegetation
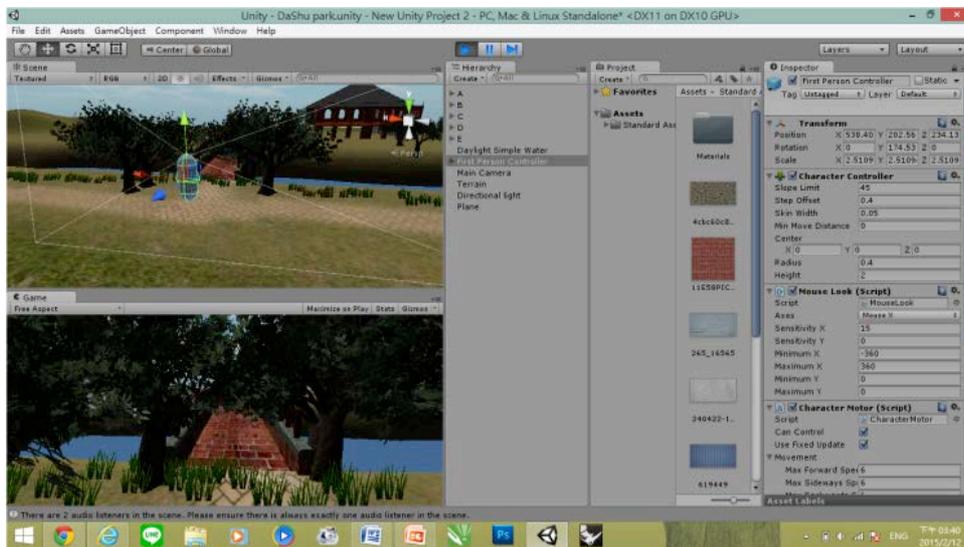
Figure 7 . Changing Textures for the Path

Figure 8. The Views by Day and by Night

The hyper-realistic Unity-based virtual park was built thereafter, revealing different atmosphere. In addition to buildings, large sculptures were also built and visualized as shown in Figure 9.

Flocking birds (Figure 10) and ducks within the park were created though acquiring similar models from Unity asset stores and other online repository system to provide a more lively and vivid environment.

Figure 9. A Sculpture inside the Park

Figure 10. Flocking Birds in the Wetland

(D)   Follow-up testing

The set of Web3D contents were then exhibited and reviewed by local residents. Feedback wase then summarized for future improvement for achieving a realistic virtual tour.

Several meetings with gatherings of villagers and tourists were hold for discussing the virtual park and testing its usability. The Unity 3D park was projected on a TV screen, and participants could use keyboards to control the movement inside. Feedback was then collected to improve the future work.

Villagers suggested the visualization of birds and plants could be useful for educational use if some text information can be provided inside the theme. Moreover, if time-lapse cameras can be installed surround the park for streamline broadcasting in the virtual park, these natural inhabitants can be recorded and broadcasted. This could amplify the uniqueness of wetland ecosystem for online users.

Youngsters who play online game more often indicated the importance to show the aerial view as the map on the corner of the screen. This could help finding one's and prevent one from becoming lost in the virtual park. Elderly who do not use computers regularly were happy to learn and use mobile devices for rotating and reviewing the virtual park.

Conclusion

This research has digitized a wetland park with Unity technologies, which provide a photo-realistic walkthrough experiences for online users. Natural creatures and plants inside the park were digitized and animated for more interactions. The digitized architectures and sculptures can be viewed in 360 degree through mobile devices, which may play the role of time-capsule in this era once these building being demolished in the future.

As the first Unity-based virtual reality project carried out in the Wetland park, this unique Geographic Information System (GIS) has raised awareness for visitors and local residents.

Evntually, the Unity file will be installed in navigation machines at the information center and several noticeable places for guiding tourists. It could also be a 3D online game that attracts youngsters and visitors globally.

Acknowledgements

References

Anna Felnhofer, Oswald D. Kothgassner, Mareike Schmidt, Anna-Katharina Heinzle, Leon Beutl, Helmut Hlavacs, Ilse Kryspin-Exner, (2015) *Is virtual reality emotionally arousing? Investigating five emotion inducing virtual park scenarios,* International Journal of Human-Computer Studies, Volume 82, Pages 48-56, ISSN 1071-5819.

Cawthorne, D., Watson, G. and Hugill, A. (2010) *Virtual Roman Leicester (VRL): An interactive Computer Model of a Romano-British City.* The XXXVIII Annual Conference on Computer Applications and Quantitative Methods in Archaeology, CAA 2010 - Fusion of Cultures, Granada, Spain, Fco. Javier Melero & Pedro Cano (Editors). 6-9 April 2010.

Lin, Zhaoyu (2009) *Investigating the potential of on-line 3D virtual environments to improve access to museums as both an informational and educational resource.* Ph.D. Thesis, De Montfort University, Leicester, March 2009.

N. Katz, T. Cook and R. Smart (2011) "Extending Web Browsers with a Unity 3D-Based Virtual Worlds Viewer," in *IEEE Internet Computing*, vol. 15, no. 5, pp. 15-21, Sept.-Oct.

Contact email: allenchan@isu.edu.tw