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The Edutainment System for Korean Bracket Structures 'gong-po' in the Traditional Wooden Architecture

JiHyung Lee[1], Kyung-Kyu Kang[1], Jae Woo Kim[1]

[1] ETRI, SW&Content Research Laboratory,
218, Gajeongno, Yuseong-gu, Daejeon, KOREA
{ ijihyung, kangk2, jae_kim}@etri.re.kr

Abstract. We present an edutainment system that combines the assembly process of Korean bracket structure 'gong-po' with 3D game. As 'gong-po' is the most complicated part in the Korean traditional wooden architecture, it is difficult for beginners to learn and understand its structure. Most digital heritage systems were not able to support the assembly process of building-components. That is, it is hard for users to study 'gong-po' with those systems. Our system is designed for users to play the game for learning the structure of 'gong-po' and its components in detail.

Keywords: edutainment, digital heritage, bracket system, traditional structure, wooden architecture

1 Introduction

With the fast growth of heritage technology, digital heritage is used in the variety of fields. Existing digital heritage has been made for two objectives: accurate models for digital restoration and simple models for entertainment system like virtual tours [1], [2]. The former's data is too heavy to employ in the education system. The latter one has not possessed the internal building-components. Therefore it has had the limitation to educate users.

The Korean traditional wooden architecture consists of numerous building components. It is hard for users to understand the structure and the assembly process of components. To construct the Korean wooden heritages, it is necessary to mix and match the building components with linkable shapes made by woods, and to assemble by the order of the traditional construction rules.

1 Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.

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Among these building components, the bracket structure 'gong-po' connects between the roofs and the walls. As 'gong-po' is the most complicated part, it is hard for users to comprehend the internal structure by two-dimensional drawings.

We present an edutainment system that combines the assembly process of Korean bracket structure ‘gong-po’ with 3D game. Our system can help user learn easily the structure of 'gong-po' in detail. Our system aims to acknowledge the whole structure of the Korean wooden architecture through understanding the 'gong-po'.

2 Related works

There are many digital heritage works that have been tried using CG technology. It enables to reconstruct simply a heritage building or sites. Even someone provides the virtual tour adding user interaction technology [1], [2].

Recently, the growth of CG and CAD makes the digital heritage contents more rich and more useful, and the focus of digital heritage contents is changed from simple virtual tour to edutainment. H. Cho et al.[3] tried to control heritage contents by their own tangible interface[3]. K. Park et al.[4] and L. Paolis[5] tried to implement the cultural heritage and apply YR technology. P. Kiefer [6] and J. Lee [7] showed the work of applying AR technology.

3 Our edutainment system

The goal of our system is to play the game and learn easily the wooden structure 'gong-po' at the same time. To achieve this goal, we design the edutainment contents and the integrated system, which has 3 advantages.

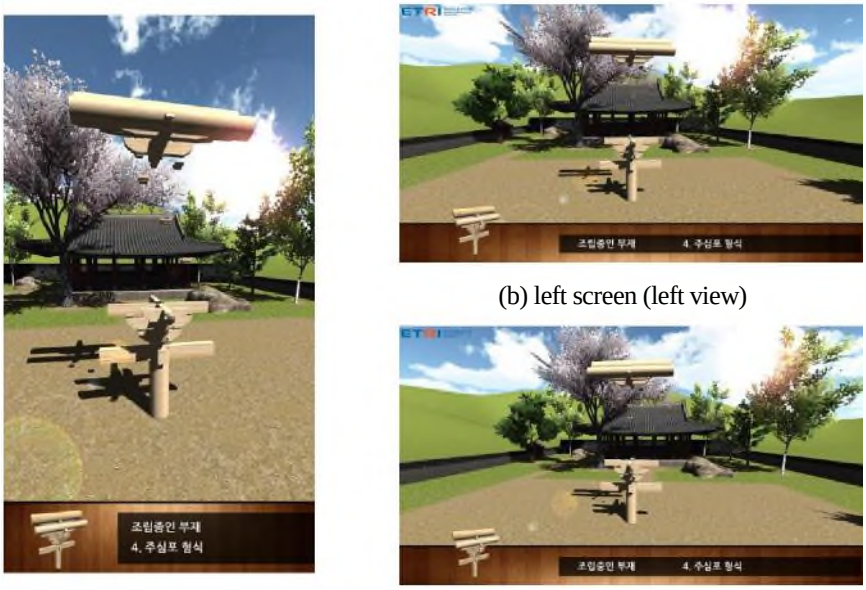
- - Provide familiar edutainment contents that combine the assembly process of ‘gong-po’ with 3D game
- - Consider the audience to have a chance to experience indirectly
- - Customize the contents by user's individual levels

Fig. 1. Appearance of our H/W system

3.1 System design

To improve better understanding about 'gong-po' and user's drastic concentration, we make its own hardware system which consists of 1 PC, 3 screens (displays), and 1 joystick, and is packaged. This package is designed for moving and traveling. Fig. 1 shows the appearance of our hardware system.

For 3 screens (top, left side, right side), 42' Full HD TVs are installed. Three-screen display is designed to show 3 synchronized views from different virtual cameras (top, left, right) simultaneously.



(a) top screen (top view)

(b) left screen (left view)

(c) right screen (right view)

Fig. 2. Three-Screens of our System

It can show the game of 'gong-po' assembly process in three-dimensional view, and make the game player (user) and audience feel the realism. While the user plays our edutainment contents watching the top screen, the audience is able to watch and experience the assembly process.

Many people can learn and enjoy by our system at the same time. Fig. 2 shows the 3 screens with 3 different views.

The system supports the joystick for user's interaction. As the installed joystick is very similar to one in the game center, user feels comfortable as he/she is in the game center.

Our system works on PC with Intel i7 4th generation CPU, 8G Ram, and nVidia GeForce GTX 780 graphic card under the Microsoft Windows 7. And our software and contents are developed using Microsoft Visual Studio and Unity 3D.

3.2 Contents like Tetris game

In order to provide easier and more effective method of understanding 'gong-po', we design and embody contents which combines the assembly process of ‘gong-po’ with 3D game.

As mentioned, 'gong-po' has the most complicated structure, and needs to mix and match the building components for assembly. At most of wooden architecture, we got to know the assembly methods that building components had been put down and then put together [8]. Fig. 3 shows the assemble process of 'gong-po' specially 'Min-do-ri'

Fig. 3. The Assemble Process of 'Min-do-ri'

Therefore we consider the contents to combine the put-down assembly with similar game like 3D Tetris. As our digital heritage is mainly focused on 3D domain, it is relatively easy to implement with.

Then, we make the accurate CG models of 'gong-po' which consist of building components based on 2D drawings of real wooden heritages. We prepare 5 different models of 'gong-po' types from the simplest to the most complicated: 'Min-do-ri', 'Cho-ik-gong', 'I-ik-gong', 'Chu-sim-po', and 'Da-po'. These 5 models have different numbers of components and are used at the different types of heritages. Fig. 4 shows the 5 types of 'gong-po'.

(a)’Min-do-ri’ (b)’Cho-ik-gong’ (c)’I-ik-gong’

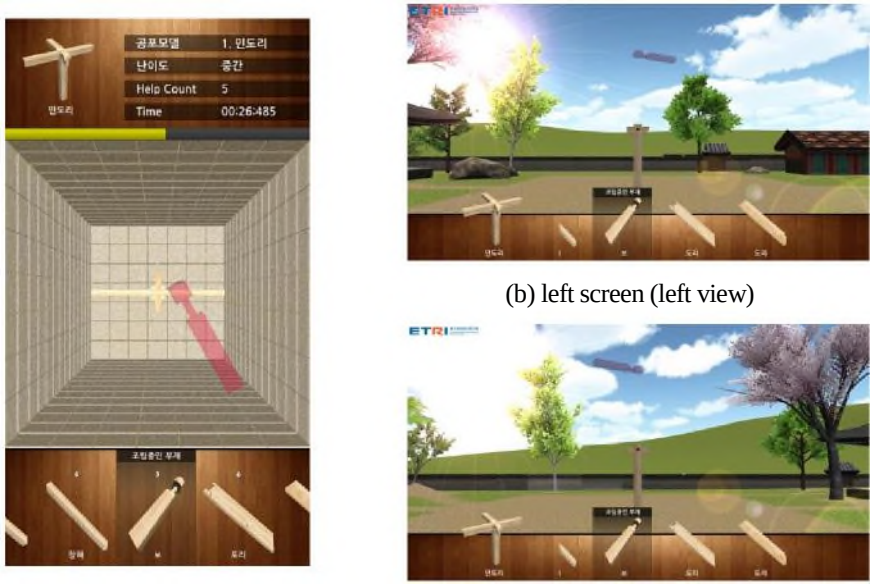
(d)‘Chu-sim-po’ (e)’Da-po’

Fig. 4. Five Types of 'gong-po'

To increase user's interests, our system provides 3 difficulty levels: easy, medium, and hard. The higher is the level, the more attention of user is needed. The user only controls the translation itself according to the guidance in the easy level. In the medium level, the user needs to add the rotation without the guidance. Fig. 5 shows

the game screen-shots in the medium level. In the hard level, the user should manage time as well.

As a result, our contents can support the customized learning with 5 different types of 'gong-po' and 3 user levels.



(a) top screen (top view)

(b) left screen (left view)

(c) right screen (right view)

Fig. 5. Contents Screen-Shots of 3 Screens

4 Conclusion

In this paper, we presented an edutainment application system for Korean Bracket system 'gong-po' in traditional wooden architecture. It provides users to play games to learn cultural meanings and the structure of 'gong-po'.

Usually the user plays our edutainment contents watching the top screen, and someone reports the ambiguity of depth in the top view. Therefore, we are going to improve the system with the three-dimensional display or moving view by Microsoft kinect. We expect that our system will be more helpful in user's immersion.

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