Computer Reconstruction of the Past Objects and Visual Animation of Landscape

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ABSTRACT:

Recording, mapping, 3D modeling and visualization for structures of architectural significance and objects of importance to cultural heritage have been received attention for digital archives or VR museum. With this motive, the authors have been developing an efficient modeling system for recreating historical city. However, reliable descriptions of ancient landscape are currently requested from the viewpoint of environmental archaeology.

This paper reports 3D modeling system for recreating ancient landscape, and shows landscape animation for Cheng-Tou-Shan in China.

1. INTRODUCTION

In general, the structures or objects for virtual reality or digital archives are recreated one by one by operator taking a great deal of time, labor and skill using 3D-CAD system or 3D-CG software. In order to reduce these load, the authors have been concentrating on developing an efficient modeling system. An efficiency of the system was reported in reconstruction of Historical city, Kawagoe (Namatame & Chikatsu, 1999), Hakone Barrier Station (Namatame & Chikatsu, 2001) and Palatitsa Palace, Greece (Sakamoto & Chikatsu, 2001).

On the other hand, reliable descriptions of ancient landscape involved buildings, roads and other objects, are currently requested from the viewpoint of environmental archaeology. In order to reconstruct ancient landscape, not the buildings or objects but the ancient vegetations are important component for reliable descriptions of those days.

From these demands, the modeling system which was developed by authors, was improved for recreating an ancient landscape. After describing the modeling system, the 3D visual animation of ancient landscape for the site of Cheng-Tou-Shan is demonstrated in this paper.

2. CHENG-TOU-SHAN

Figure 1 shows the air photograph for the site of Cheng-Tou-Shan which locate the Yangtze River side in China.

Figure 1 Air photograph of Cheng-Tou-Shan

Cheng-Tou-Shan which was surrounded with clay wall and water ditches is old city about 6000 years ago. Although, it is said that culture of rice started about 12000 years ago in Yangtze River side. It can be supposed that the water ditches were water controll system for culture of rice.

From 1997, International research center for Japanese studies in Japan (Kyoto) has investigated about the 5th Civilization of the world, named "Yangtze River Civilization" was found around the Yangtze River area.

They found some archaeological fortress sites (B.C.7000-3000) from Hu-nan and Hu-bei providences. These fortress sites are so huge, the biggest one is 3km by 4km, and it is understood from Fig. 1 that almost historical monuments were already lost.

3. MODELING SYSTEM

The authors have been developing 3D modeling system for historical city and ancient building. The house models which were previously recreated under historical evidence, are arranged automatically by the system. In particular, the most remarkable feature of the system is flexible modeling function so that archaeological data which were investigated by archaeologist can import directly to the system. Therefore, 3D models can be modified efficiently under cooperation with archaeologists.

Figure 2 shows the basic flow of the system. The goal of this paper is recreating the ancient landscape for Cheng-Tou-Shan site including ancient vegetation. Detail procedures are as follows:

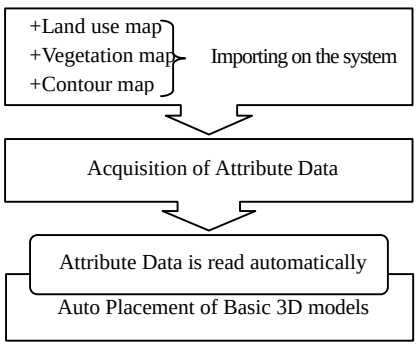

Figure 2 System flow

3.1 House and Tree Models

The house models for the site of Cheng-Tou-Shan were reconstructed previously using 3D CG software under cooperation with archaeologist. Similarly, textures and colors for the models are set simultaneously with modeling. Figure 3 shows the six house models. Furthermore, in order to recreate reliable ancient landscape, representative two tree models at those days were also reconstructed. Figure 4 shows tree models.

Figure 3 House models

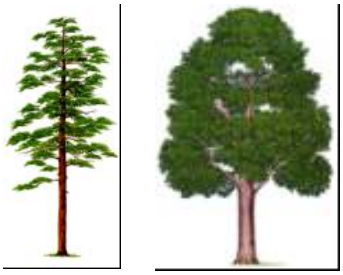

Figure 4 Tree models

3.2 Modeling data

The modeling data such as location, kind and size of the models are needed for automatic arrangement of the models. These data can be acquired from land use map, topographic map and vegetation map. Land use map and topographic map were obtained archaeological survey, and vegetation map was obtained by examination of pollen and sediment.

Figure 5 shows basic flow for acquiring the modeling data in the system. In the system, land use map and vegetation map are

overlapped on topographic map. Thus, location coordinates, kind and size of the models are acquired. Furthermore, altitude data for the models was acquired from topographic map. Figure 6 shows land use map, Figure 7 shows vegetation map and Figure 8 shows topographic map for the Cheng-Tou-Shan site.

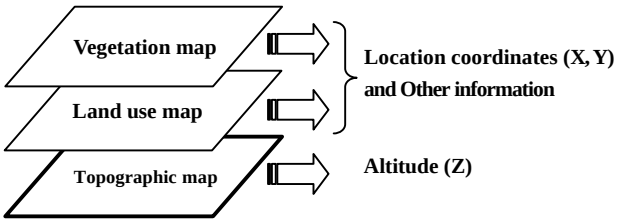

Figure 5 Acquisition of the model data

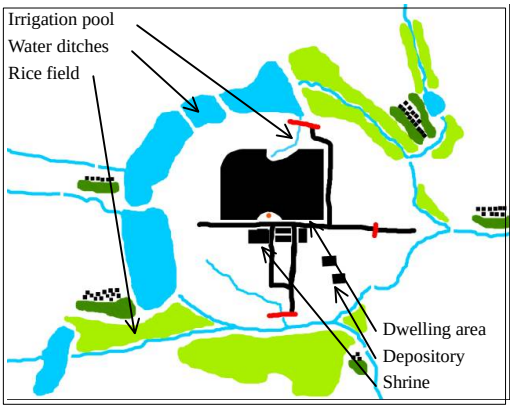

Figure 6 Land use map

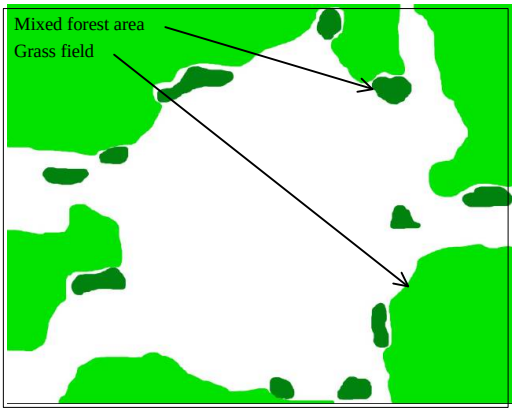

Figure 7 Vegetation map

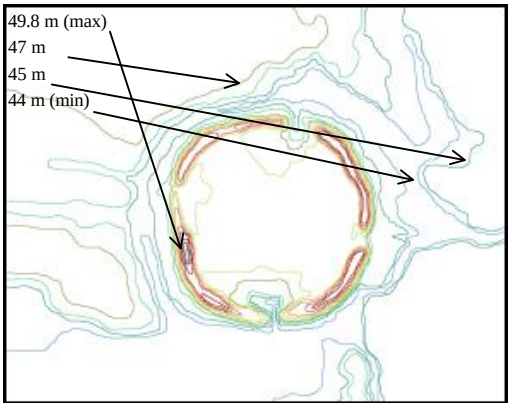

Figure 8 Topographic map

3.3 DEM and vegetation model

In the system, at the first DEM is automatically generated from topographic map. Although, the site of Cheng-Tou-Shan was surrounded by clay wall, and water ditches, these remains were reflected on the DEM. Figure 9 shows the DEM of Cheng-Tou-Shan.

As the next step, in order to recreate an ancient vegetation, the tree models are arranged on the DEM using the vegetation map. Figure 10 shows the vegetation model. Finally, the house models are arranged automatically on the vegetation model using modeling data.

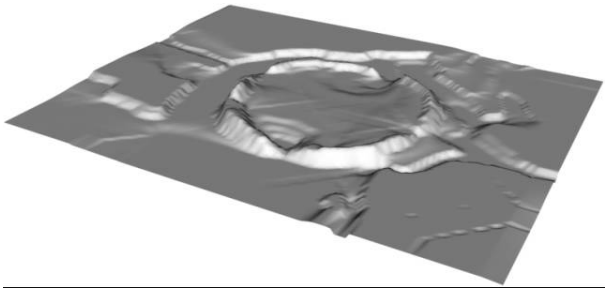

Figure 9 Topographic map

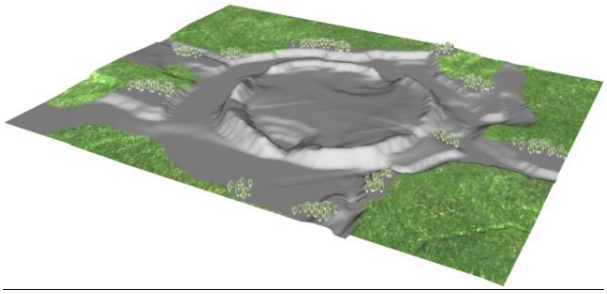

Figure 10 Vegetation model

3.4 Visual animation

After arranging the models, visual animation is created using 3DCG software (3D Studio Max). Figure 11 and 12 shows one of the landscapes for reconstructed Cheng-Tou-Shan Those visual animation not only shows us realistic descriptions of ancient landscape but also gives us information for archaeological items. For example, it can be understood from figure 11 that a community surrounded with soil wall existed, and the community had already irrigation system for culture of rice 6,000 years ago. The house shown in figure 12 is shrine. It

can be supposed that the shrine located at the center of the Cheng-Tou-Shan site was used as a ritual and governmental institution. The inside of shrine are also shown in visual animation.

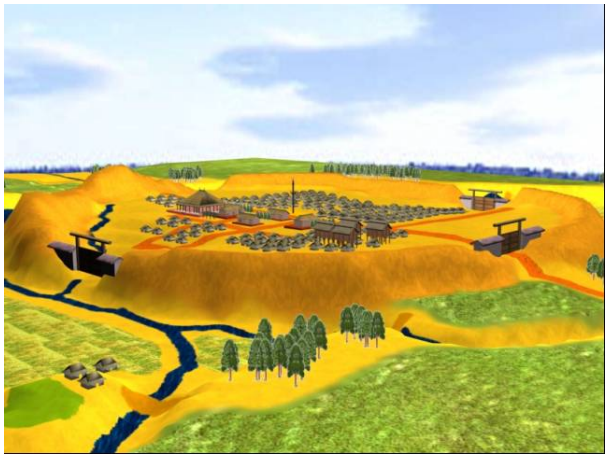

Figure 11 Fly-through view

Figure 12 Walk-through view

4. CONCLUSION AND FURTHER WORK

The modeling system for recreating ancient landscape including houses and ancient vegetation was described in this paper. It is concluded from the landscape animation that the modeling system is efficient method for creating ancient landscape under cooperation with archaeologist Furthermore, the method has ability for applying to other area under customizing representative structures for the area.

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