A WEB-BASED GIS SYSTEM TO MANAGE AND UNDERSTAND CULTURAL HERITAGE AND SETTINGS

Ayako Fukushima[1] & Yuuichi Shimpkawa[2] & Tatsuo Masuda[2] & Tomohiro Miyashit[2] ,Shigehiko Sakao[1] & Atsushi Sone[1] & Mamoru Shiroki[1] & Dai Kawahara/Japan

Kanazawa Institute of Technology

Defining settings

Defining the meaning of "setting", which we are going to conserve and manage, isn't an easy job since the discussion about defining this idea is going on. In this paper, the authors define "settings" as follows: settings contain physical features as well as non-physical features: physical features include natural landform such as valleys, water body, or forest, as well as man-made features like buildings, bridges, roads, or farm lands. Non-physical features are human activities and eco-systems produced by such activities as farming, fishing, festivals etc. Also, settings have physical and non-physical boundaries: settings may be bounded by the physical or visible boundary such as the area with geographical or geological features. At the same time, the boundaries of settings could be defined by non-physical factors like political or cultural domain. As non-physical and physical features and factors change over time, settings change, transform and evolve accordingly.

Objectives

1 What to Conserve

Non-physical and physical features and factors of settings contribute to and form the significance of cultural heritage. Therefore we aim to conserve not only historic buildings or sites which are seen as core resources of heritage area but also their settings which form significance together with core resources.

2 Why Settings Have Deteriorated

As the major and common deterioration factors of settings, urban development, modernization, economic pressure and rapid growth of the population have been identified.

Beside those factors, the authors recognize that one of the reasons is both of professionals like preservationists or government officials and the public weren't able to "imagine" the future landscape. People were not able to imagine the landscape because, especially during the middle of the rapid economic growth, people were allowed no time to think whether the landscape could be changed or not. Everything was so quickly conducted. The other reason might be that people didn't have a "device" to imagine the future landscape. Some professionals have used 2D paper drawings or 3D paper models, but those things weren't always friendly enough to the public.

To make sure the protection of the landscape in long-term, both of professionals and the public need to visualize their image of what landscape they want to make and conserve for themselves and future generations; people need to figure out what elements of the landscape are important for everyone. Without this process, it would be difficult to assure the conservation of the landscape or settings. Once people have a clear image of the landscape to achieve, there will be a greater possibility that settings will be protected from deterioration or destruction with a master plan and a set of devices.

3 3DGIS as a key to Conserve

Settings seem too ambiguous to grasp and too complicated to manage and conserve. The authors identify one of the keys to understand and manage such thing as the "three-dimensionality" of settings. First of all, we need to understand the relationships among various features and factors which settings have in 3D space.

These days GIS has become more and more popular in the field of conservation and management of cultural heritage as people recognize GIS as the powerful and useful tool to analyze and manage the space. Therefore our project is based on the premise that in most conservation projects a numerous set of data regarding settings, for example paper maps, database sheets, photographs etc., are or will be digitized into the format of vector or raster so that those information can be processed with computers to apply the method of GIS or else. Hence, an enormous set of data are and will be available in digital format in many conservation projects.

4 Objective of the Project

In this paper, the Project Team proposes the web-based

3D GIS system to understand, manage and conserve cultural heritage and settings.

Since 2D maps simplify geographic features, they often allow people to better understand geography. However, when we discuss landscaping or conserving settings, we need the 3D model which represents the real world. 3D models in GIS also possess attribute database in which information of various features or factors of settings are stored.

One of the major functions of the system is 3D landscaping simulation.

The system we have developed is also a device to help involve more people in the process of conservation planning and promote communication and discussion among various stakeholders. Since the system is a web-base, it enables on-line public meetings.

The system and produced 3D models are meant for the use of public outreach as well. It enables people to visually understand the settings in 3D and virtually interact with the space to find out the significance of the settings.

Background and Project Site

1 Background

Since 2003, Kanazawa Institute of Technology (KIT), with the cooperation of Keio University and Shibaura Institute of Technology, has been conducting documentation surveys of the historic districts in the city and surrounding areas to set up a GIS system to archive cultural heritage of this region. The other project has been carried out by KIT to document the group of temples in Udatsu-yama historic district.

The collaboration project by KIT and CAD CENTER CORPORATION (CCC) is conducted in relation with those two preceding works.

2 Project Site

The project site is as illustrated in Figure 1. The site contains the downtown of Kanazawa City and surrounding residential neighborhoods. The site of Kanazawa Castle is in the center of the project site. Kanazawa, as the old capital of the ancient province of Kaga, prospered for 280 years since 1583. Kanazawa is rich in cultural resources.

Within the entire project site, we set the focal area which retains historic fabric and landscape well. The focal area is shown as bounded box in the Figure 1. This area is called Udatsu-yama, which is known for a number of temples densely located in this area (see Figure 2). There exist many historic dwellings (called Machi-ya) in this area, too. Because the Udatsu-yama district locates on the edge of the mountain, complex landform is the important factor to characterize this area.

Outline of the system

1 The Functions of the System

The system is designed for public use including people who are not pro users of computers. Its functions and operations must be simple enough so anyone can use it. The required application for users is Microsoft's Internet Explorer. The 3D-GIS engine is embedded within "UrbanViewer for WebTM", which enables to view 3D digital maps and use some other 3D-GIS functions.[4]

2 3D Virtual Space

The created digital models are designed for Virtual Reality (VR). We defined the meaning of VR as follows: unlike Computer Graphics animations or static CG images, users can freely interact with models: they can move, rotate, fly over or walk through the model in real-time. These VR models are distributed through the internet with the employed engine.

The virtual space we create has two major components: terrain and geographic features such as buildings.

The terrain model is created based on the digital terrain data of 10m mesh (see Figure 3).

The buildings in the entire area are automatically arranged on the 2D vector map. The shape and texture of those buildings use several types of pattern models retrieved from the database library (see Figure 4). We apply those pattern models since the required accuracy and quality in the entire area are not that high. When users view the entire area, they can fly through but not walk through and view models in close distance.

The focal area is created separately. In this area, users can walk through the space freely. Because of that, the buildings in this area need finer details and better textures compared with models in the entire area are modeled individually (Figure 5).

3 Databases

A database containing various types of information is stored in the system. If any analysis is necessary, a project administrator will bring the original data into the commonly

used GIS software such as ArcGIS and make analyses there. Analysis results can be brought back to and shown in the web 3D-GIS system we have developed.

It is also possible to do some analyses in the developed system on the internet.

The point we have to stress here is that the system is not designed for the GIS professionals to use for analyses but rather for the public to use it as a simple communication tool. So during the system design process, we concluded that no high-level analysis tools are necessary for this system.

4 Layers of the space

The system allows to store more than one layer. Users can view and switch from one to another.

Generally speaking, when people discuss landscaping or any alteration of the space, the simulation of the planned image is made with paper-3D models, hand-drawing images, static CG images etc.. In the developed system, if you make the layer of the planned model along with the current model of the space, those two layers can be switched from one to another for real-time comparison.

In Kanazawa project, we created the layer of current view of the space as well as the past cityscape(Edo Period)restored from the academic research by KIT. We created the past model because every landscape conservation project must be based on the understanding of the past.

5 Tools for Communication

We created fewer functions or tools for this system intentionally since a bunch of icons of those functions, the recent applications have, don't make users feel comfortable to use the system. Users rather feel like being stay away from such complicated stuff.

Yet, some functions greatly help users communicate and interact with each other. One of them is the comment function (electronic Bulletin Board). Landscaping or conservation projects must be discussed and agreed by the stakeholders. We developed the comment function since on-line communication doesn't require participants to gather at the certain time and place. However, on the other hand, direct discussions among users don't happen in on-line system unlike the off-line public meetings. The comment function is to solve this issue. Users can leave comments on or questions about proposed conservation plans on the 3D virtual space. Other users can view those comments left in the virtual space and make feedbacks if they wish.

Digital photos or drawings can be uploaded to the 3D virtual space as well.

Proposed Uses

This section sums up several examples of uses of the system.

1 Simulation of Landscaping

Because of the advantage of VR, the system works efficiently for the landscaping project. The VR model is realistic enough for the non-professionals to visually and spatially understand the proposed plans. Layering helps people compare and consider the plans easily.

2 On-line Communication for Conservation Project

The advantage of on-line communication is its convenience. Modern lifestyles don't always allow people to spare time to attend the public meetings held at the community center or else. On-line participation enables people to participate in the project at home, office or wherever with a normal-spec computer and the broadband internet access. We believe it's worth experimenting to hold both off-line public meeting and on-line web3D-GIS communication for the same project.

There are some other preceding researches on the web-based Bulletin Board systems for urban planning. Most of them use 2D vector maps instead of 3D VR models. Though 2D maps are useful in many aspects, 2D maps can't enable landscape simulation. The system we have developed is significant in terms of enabling both web-based communication and 3D landscaping in one system.

3 Cultural Heritage Management System

The developed 3D-GIS system is suitable to manage the space. The 3D models used for landscaping and the on-line public meetings can be used for the management by heritage managers and other people concerned. Hence, it's cost effective. 2D digital maps can be added to the system and switch from 2D to 3D as necessary. Some people think that 3D fine data is not necessary when the data is used internally by local managers. However, since the 3D data is easy to understand, it helps other officials in the relevant divisions understand the discussed space and issue. If managers need to perform any GIS analysis of the data, the 2D or 3D data can be analyzed with the commonly used GIS software.

4 Public Outreach

The 3D model placed on the web is a very good material for the public outreach. Users can not only have virtual tour

of the space but also discover the stories or significance that place possesses. To achieve this, heritage managers need to put the information or stories that they like to tell users, and design the smart way of streaming data. This public outreach can be done on the web, of course.

Conclusions

Now we need to come back to the original issue: how can we manage and conserve the "Settings" with this system?

In the first chapter, I described one of the factors of deterioration of settings: that is the lack of imagination of the space. The system allows people share the clear image of the space and offer good materials for discussion.

The active discussion and communication are critical for planning, too. The authors designed a device to involve more people using the web and the simple interface and operation.

To sum up, the developed system is to help planning, visualization and communication for conservation of the heritage and settings.

The system is supposed to be experimented for the landscaping simulation and conservation planning of the Udatsu-yama district by Kanazawa City and KIT. After the test use, we will re-examine the system and develop it further to make it better one.

Special thanks to Kanazawa City, who kindly offered various data for our project.

Abstract

Significance of cultural heritage is often inseparable from their settings, or significance often reside in settings. Settings contain physical features as well as non-physical features: physical features include complicated natural landform such as valleys, water body, or forest, as well as man-made features like buildings, bridges, roads, or farm lands. Non-physical features are human activities and eco-systems produced by suck activities as farming, fishing, festival etc. How can we manage and understand such complicated space as "settings"? One of the keys is the "three-dimensionality" of settings. We need to manage and understand settings and the relationships among various factors which settings have in 3D space.

Our project team developed a web-based 3D GIS system to manage and understand settings. The system allows data analysis to be done in 2D or 3D GIS system. Heritage managers can freely move around 3D space and check analysed data in 3D space to manage the area. The system is also meant to be used for public outreach. It enables people to visually understand the 3D space and virtually interact with 3D space to find out the significance of the settings.

References

1.Wilfried LIPP, CHANGING THE SETTING CAN MEAN CHANGING THE IMPACT THE CASE OF VIENNA, ICOMOS News Vol.15. No.1, 2005; Yukio NISHIMURA, RETHINKING THE NOTION OF SETTING IN CHANGING LANDSCAPES, ICOMOS News Vol.15. No.1, pp.12-13, 2005.
2.This Udatsu-yama project is contracted to KIT by the Board of Education of Kanazawa City.
3.53 temples exist in Udatsuyama-District.
4.This engine is developed by CAD CENTER.
5.Tohru OHBA, An Experiment on the Discussion between Citizens and City Officials Using an Electronic Conference System with WebGIS, Theory and Application of GIS, Vol.13, No.1, pp99-106, 2005.

A WEB-BASED GIS SYSTEM TO MANAGE AND UNDERSTAND CULTURAL HERITAGE AND SETTINGS

Ayako Fukushima[1] & Yuuichi Shimpkawa[2] & Tatsuo Masuda[2] & Tomohiro Miyashit[2] ,Shigehiko Sakao[1] & Atsushi Sone[1] & Mamoru Shiroki[1] & Dai Kawahara/Japan

Kanazawa Institute of Technology

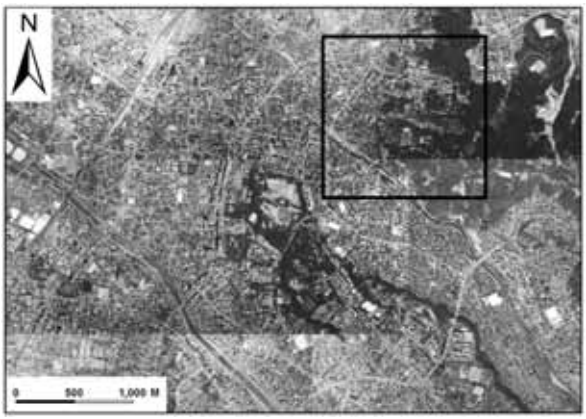

Fig.1 Project Site, Kanazawa City and Surrounding Areas

Fig.2 Current View of Udatsu-yama District

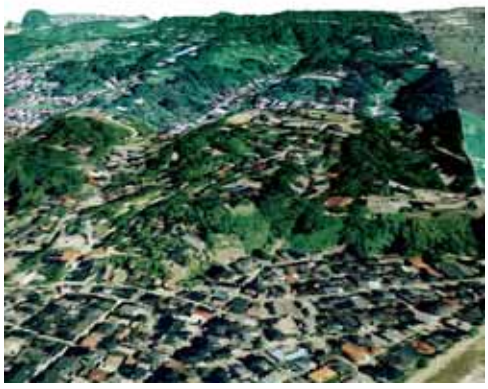

Fig.3 Landform on the web3D-GIS

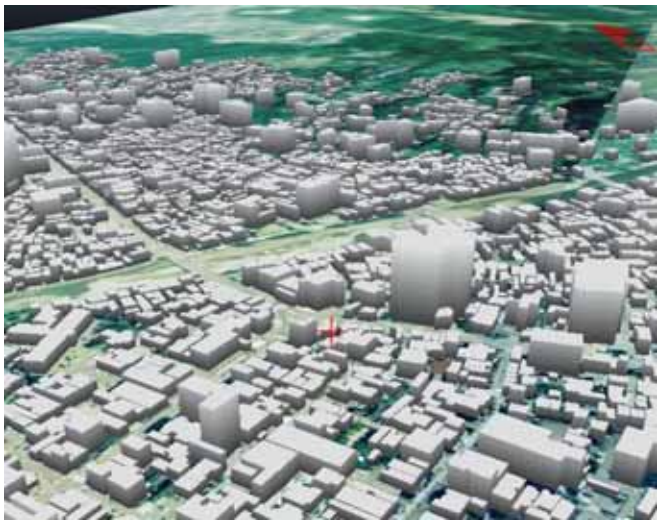

Fig.4 Cityscape of the Entire Area on the web3D-GIS

Fig.5 Streetscape of the Focal Area on the web3D-GIS