Research on Digital Collection and Protection of Ancient Pagodas in Liao Dynasty in China

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Abstract: The ancient pagodas in Liao Dynasty are basically pagodas, and their morphological features and artistic features are closely related to Buddhist culture, which conforms to Buddhist ideas and requirements and has a high artistic level. With the continuous development of information technology and surveying and mapping technology, the information retention and protection of ancient pagodas in Liao Dynasty are carried out in a digital way to improve the scientificity and safety of protection. The primary work of cultural relics digitization is to collect data. At present, there are generally three methods to collect cultural relics data and generate 3D models: laser scanning technology, image scanning technology and manual 3D software modeling. After processing the collected data and information, a 3D model of the ancient pagoda in Liao Dynasty was constructed. Compared with the traditional two-dimensional graphics, the 3D model is richer in information and closer to the real living space, which can provide accurate and vivid information for the staff, so that they can clearly grasp the actual situation of the ancient pagoda in Liao Dynasty, such as style, structure and appearance. In this paper, taking the ancient pagoda of Liao Dynasty in China as an example, the digital collection and protection methods of the ancient pagoda of Liao Dynasty in China are elaborated in detail, hoping that the results of this paper can provide reference for related research.

1. Introduction

Cultural relics and historic sites have historical, scientific and artistic values, and are historical and cultural relics and remains left in society or buried underground [1]. The stupa originated in India, and after it was introduced to China by Buddhism in the Eastern Han Dynasty, it was combined with China's inherent architectural form and cultural tradition, and it has undergone great changes and development. The ancient pagodas in Liao Dynasty are basically pagodas, and their morphological features and artistic features are closely related to Buddhist culture, which conforms to Buddhist ideas and requirements and has a high artistic level.

With the continuous development of information technology and surveying and mapping technology, the information preservation and protection of ancient pagodas in Liao Dynasty are carried out in a digital way, which improves the scientificity and safety of protection and enhances the communication and popularity of protection [2]. In this paper, taking the ancient pagoda of Liao Dynasty in China as an example, the digital collection and protection methods of the ancient pagoda of Liao Dynasty in China are elaborated in detail, hoping that the results of this paper can provide reference for related research.

2. Morphological characteristics of ancient pagoda buildings in Liao Dynasty

The structure of the pavilion-style tower in Liao Dynasty is basically the same as that of the early pavilion-style tower, and the floors of the pavilion-style tower and the dense eaves tower are mostly odd, usually with seven to thirteen floors (Figure 1). The dense eaves pagoda in Liao Dynasty is similar in height and volume to the pavilion pagoda, but it has the most floors and occupies an important position in China ancient pagoda. A large number of wooden structure components of the pavilion-style tower were absorbed, which made the whole tower reach a more complex and gorgeous peak. This type of tower continued in the north until the Ming Dynasty and Liao Dynasty.

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The structure of pavilion-style towers in Liao Dynasty is mostly a cylindrical structure with regular octagonal double-ring walls and central columns, with turning stairs at the cloister on each floor and overlapping roofs at the top of the cloister. The tower foundations are all made of stone bars, and the tower body is divided layer by layer from bottom to top, so the structure is reasonable and the overall structure is quite stable.

Figure 1 Ancient pagoda architecture in Liao Dynasty

The combination of styles and shapes of ancient pagodas in Liao Dynasty has good aesthetics, and finally presents a form with harmonious aesthetics in proportion and structure. So far, ancient pagodas in Liao Dynasty have been regarded as wonders by research circles. The decorative construction of pavilion towers in Liao Dynasty is usually more complicated and diverse, and the eaves of Song-style attic towers are usually carved with water chestnut teeth, while Liao-style pavilion towers are carved with masonry. In order to better highlight the wood structure, the carved bucket arch layer is used to set off the flat seat layer of pavilion towers. For example, columns, doors and windows, bucket arches, tile ridges, etc., compared with dense eaves towers, pavilion towers use more wood-like components, but less decorative carvings and patterns. During the Northern Song Dynasty, a large number of buildings were built, which reflected rich and diverse forms. The distance between pavilions and towers was relatively small, and the style of the pot door was obviously different from that of the Liao Dynasty.

3. Digital collection of ancient pagodas in Liao Dynasty

The primary work of cultural relics digitization is to collect data. At present, there are generally three methods to collect cultural relics data and generate 3D models: laser scanning technology, image scanning technology and manual 3D software modeling. For example, the internal space of tombs in Liao Dynasty is limited, the environment is complex, the shooting equipment can't be placed in the shooting position, and lighting is much more difficult than plane shooting, and the lighting of plane shooting is subjective, but the lighting of 3D shooting should be uniform and meet certain indicators, so professional lighting is needed [3-4]. The 3D model obtained by image scanning technology is vivid in color, and can efficiently restore the material of cultural relics 1: 1. It is the first choice for cultural relics observation and texture restoration. Its disadvantage is that the error of 3D printed cultural relics is about 1-2 mm, and the input of high-light reflective materials is unstable, which usually requires manual intervention and modification.

In order to ensure the long-term inheritance and development of ancient pagodas in Liao

Dynasty, architectural engineering and digital technology were organically integrated, and many advanced technologies such as image processing and computer vision were introduced. By collecting and processing two-dimensional data, a 3D model of ancient pagodas in Liao Dynasty was constructed, and then various protection work was carried out, which laid a good foundation for the repair and restoration of ancient pagodas in Liao Dynasty [5]. After processing the collected data and information, a 3D model of the ancient pagoda in Liao Dynasty was constructed. Compared with the traditional two-dimensional graphics, the 3D model is richer in information and closer to the real living space, which can provide accurate and vivid information for the staff, so that they can clearly grasp the actual situation of the ancient pagoda in Liao Dynasty, such as style, structure and appearance. Then use CAD software to draw the elevation, front and section of the discharge, and ensure that all lines have the same color, so as to facilitate the subsequent 3DMAX editing.

The scanning work of ancient pagodas in Liao Dynasty mainly consists of two parts: the outside and the inside. In order to obtain a realistic 3D model, it is necessary to obtain as much surface information as possible [6-7]. Firstly, the 3D laser scanning system is placed in the selected position, and the scanning area is observed through the monitor. If the observation effect is not satisfactory, the scanner can be moved to a more suitable position. Then the calibration ball is identified and scanned by Scanwbrks software, and the visual range (that is, the range to be scanned) and scanning accuracy are selected.

Using Parser and Poly Works to mosaic and preprocess the point cloud. The scanned point cloud data is converted by Parser software and stored in the converted file. It should be noted that if coordinate conversion is needed, it needs to be set before parser conversion. The preprocessing work after point cloud data mosaic is mainly to remove some incorrect data and obtain valid data.

When 3D modeling is carried out, the automatic segmentation processing tool provided by the system software can be used to extract a part from the scanned point cloud image to form an object or a part of an object for automatic matching. After 3D modeling is completed, the representation can be sectioned in any way [8]. Horizontal cutting can produce the plan of each layer in the traditional sense, and vertical cutting can output the profile. The point cloud model can also be exported and imported into traditional computer-aided drawing design software and GIS software. The specific workflow is shown in Figure 2 below:

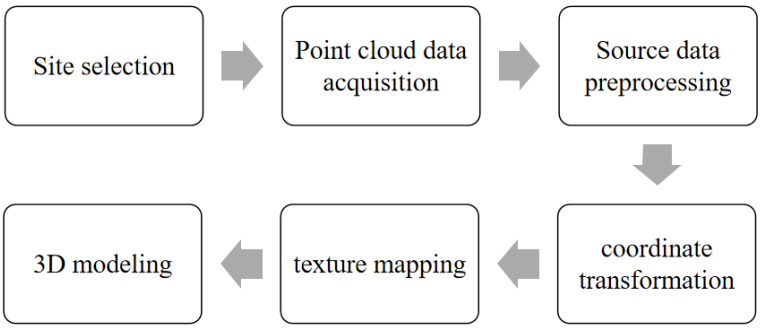

Figure 2 Workflow of 3D laser scanning system

After the above processing, the fusion point cloud model of the ancient pagoda is obtained (Figure 3).

After preprocessing and splicing the 3D point cloud data of the ancient pagoda, a 3D model composed of triangular surfaces is generated by the IMMerge function module of PolyWorks. It can be imported into traditional computer-aided drawing design software and GIS software. For example, both AutoCAD and ArcGIS can read point cloud data, which can be used for subsequent work such as measurement, database establishment and statistics.

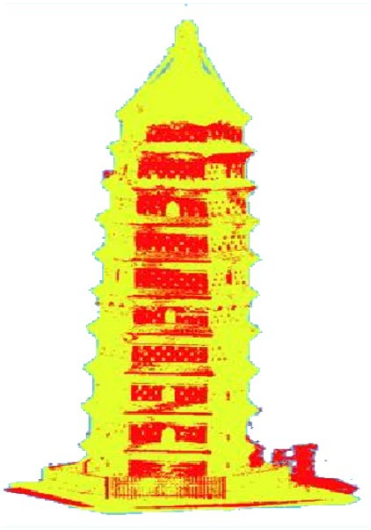

Figure 3 Fusion point cloud model of ancient pagoda

4. Digital protection of ancient pagodas in Liao Dynasty

4.1. Establishing database of ancient pagodas in Liao Dynasty

A complete database of ancient pagodas in Liao Dynasty needs not only the attribute information of ancient pagodas in Liao Dynasty, but also the spatial location information, so it is usually necessary to establish a corresponding database according to these two requirements. Among them, the spatial database is mainly composed of two-dimensional maps, laser scanning maps, photos of ancient pagodas in Liao Dynasty and other spatial data. The spatial data of ancient pagodas in Liao Dynasty is more suitable for the logical requirements of computer system management, storage and processing, and can convert various data information such as statistics, graphics and influence of ancient pagodas in Liao Dynasty into a format suitable for computer storage according to a specific structure.

Digitalization of cultural relics is to deeply integrate a large number of basic data of cultural relics such as words, images, audio and video materials, and establish a huge database. On this basis, panoramic shooting and 3D data reconstruction are carried out to form a virtual 3D image, which expands the display of cultural relics from entity and static to virtual and dynamic. Realizing the digital exhibition and management of cultural relics and historic sites can not only make people obtain historical and cultural resources more intuitively, but also provide data support for further study of history and culture, retrieval and development of cultural relics display system [9]. Common data types include 3D model data or point cloud data obtained by laser scanning technology. Statistical data is mainly composed of raster data, such as data information obtained by laser scanning technology.

According to the actual needs of the protection of ancient pagodas in Liao Dynasty, this study involves many attributes. It includes the corresponding attributes of spatial data, such as building area, material, location, size, social and historical situation, etc. It also includes other attribute information, such as literature information, historical and cultural information, etc. With regard to the concrete model realization of the spatial database of the ancient pagoda, the ancient pagoda can be divided into blocks to realize the attribute query of specific points, surfaces and bodies. The specific system architecture of spatial database can take SQL Server as the database platform, and integrate Auto CAD, 3D and other data with Arc object by. net technology, so as to realize the storage, management and display of spatial data in a unified operation interface.

4.2. Monitoring of ancient pagodas in Liao Dynasty

The ancient pagoda in Liao Dynasty is an important carrier of human civilization and a valuable and non-renewable historical and cultural heritage resource, and its protection has always been highly valued by all walks of life. In the process of protecting the ancient pagodas in Liao Dynasty,

whether it is for maintenance, scientific research, cultural exchange or publicity and display, one of the important and basic links is to obtain its true information comprehensively. Most of the ancient pagodas in Liao Dynasty have complex architectural structures, especially some components show quite rich spatial structure forms, and these remarkable spatial characteristics are precisely the key data that need to be fully recorded in digital protection work. During the scanning process, the relative positions and control points of each scanning station should be recorded and sketched, so as to further process the data, and the scanned data should be viewed in time. If missing data or obviously wrong data are found, supplementary scanning should be carried out.

Through the study of the structural system and components of the ancient pagodas in Liao Dynasty, it is found that one of the most remarkable features of the ancient pagodas in Liao Dynasty in China is the modular system and stereotyped architecture. The size and modulus of each component have a certain proportion and relationship, and BIM technology can provide technical support for the parameterization of ancient pagoda components in Liao Dynasty. Establish a single component BIM software family, analyze each component, convert the external structure of the component into a numerical value, analyze the numerical value, get a relational expression to formulate it, and parameterize each dimension based on the bucket mouth. Pay attention to the reference line when establishing a single component [10]. Different types of components are divided into special types and ordinary types, and different model reconstruction methods are adopted for different types of components, which greatly saves modeling time and ensures the high accuracy and authenticity of data.

In order to ensure the accurate and scientific analysis results, we can input the relevant data into the information system, establish a digital model in the virtual environment, make a scientific comparison and effective analysis with the composition of historical buildings, effectively integrate the model data with historical data, finally establish a complete evaluation system, summarize the details of the construction project, and then formulate a reasonable protection and restoration plan.

5. Conclusions

The combination of styles and shapes of ancient pagodas in Liao Dynasty has good aesthetics, and finally presents a form with harmonious aesthetics in proportion and structure. So far, ancient pagodas in Liao Dynasty have been regarded as wonders by research circles. With the continuous development of information technology and surveying and mapping technology, the information preservation and protection of ancient pagodas in Liao Dynasty are carried out in a digital way, which improves the scientificity and safety of protection and enhances the communication and popularity of protection. Taking the ancient pagoda of Liao Dynasty in China as an example, this paper expounds in detail the digital collection and protection methods of the ancient pagoda of Liao Dynasty in China. Traditional protection technology can no longer meet the needs of sustainable development of ancient pagodas in Liao Dynasty. The government and relevant departments should constantly raise their awareness of innovation, actively introduce digital technology, do a good job in surveying and mapping ancient pagodas in Liao Dynasty, and build a database of ancient pagodas in Liao Dynasty, so as to ensure the development of all work and make it accurate and scientific..

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