

## Key Techniques of Virtual Reality for the Development of Digital Tourism Systems

LIU Yuan<sup>1,2</sup>, CHEN Rukai <sup>\*1, a</sup>, Choi Chris<sup>3</sup>, Hou ZhenJie<sup>4</sup>

1 College of Crop Science

Fujian Agriculture and Forestry University, Fuzhou Fujian 350002, China

2 Faculty of Tourism

Jiangxi Science and Technology Normal University, Nanchang Jiangxi 330013, China

3 Hospitality, Food, and Tourism Management

College of Business and Economics, University of Guelph, Guelph, Ontario, Canada N1G2W1

4 School of Information Science&Engineering

Changzhou University, Changzhou, 213164, China

<sup>a</sup> fafu948@126.com

**Abstract** — The use of computer-generated virtual reality worlds in three-dimensional space involves simulating people's vision, hearing, touch and other senses to enhance feelings and perception of scenes and allows users better proximity to reality. The work integrates computer graphics (CG) technology, computer simulation technology, artificial intelligence, sensor technology, latest developments in display technology, and network parallel processing technology to produce computer-aided generation of high-tech simulation systems. The dynamic programming of virtual reality technology to the field of tourism advertising to show tourist attractions, online virtual tours, etc., can get good results. Using Digital Earth platform as the basis for digital tourism, this paper combined the platform with VR technology to carry digital study tourism and related topics, and has important theoretical and practical significance.

**Keywords** -- *Virtual Reality; Digital Tourism; 3D Modeling*

### I. INTRODUCTION

Digital tourism is a tourist information service system based on the network environment, by database technology, decision support systems, network technology, electronic and virtual reality technology at the core of spatial information technology systems, is a combination of economy, tourism and information science and technology, but also a comprehensive science and technology. In fact, digital tourism body is data, software, hardware, models and services, the nature of computer information systems [1]. Digital tourism is a complicated systematic project, from tourism resources survey and evaluation, to tourism planning, landscape design, supporting service facilities, tourism product design marketing, tourism resources and ecological environment protection, related to geology and geomorphology, land use all levels and aspects of transportation, economic, social, ecological, environmental, political, regulatory and other information, the amount of data is quite large [2-3].

Based on the interactive virtual reality immersive environments computable information, participants can most prominent feature is the natural skills of human perception and virtual environments and computer-generated natural interaction, therefore, requested the system can be made in real time on a variety of input reaction [4]. Real-time, through the establishment of a virtual environment really is the core of virtual reality technology. Conduct virtual scene generated in real time and real-time display technology

research support and research results in the form of fusion algorithm to each virtual simulation environment, in order to further achieve realism and presence undoubtedly has important significance [5]. This paper describes the basic theory of virtual reality technology research status and real-time analysis of the main factors affecting the virtual reality system of real-time, real-time generation and display technology scene; and the design of a distributed real-time navigation system VR scene; and Distributed Virtual Reality System scenes compression real-time transmission and display technologies in-depth discussion, and proposed solutions.

Thus the rational use of these data to analyze and provide scientific tourism management developer, effective basis is essential. Digital global platform based on virtual reality technology, with its powerful 3D visualization tools for tourism management and provide a strong support. Virtual reality tours and attractions and augmented reality is becoming a hot new, unprecedented realism to bring people to experience a sense of virtual reality technology based on digital tourism system.

### II. VIRTUAL REALITY TECHNOLOGY OVERVIEW

Virtual reality is a computer and electronic technology to create a new world, a seemingly realistic simulation environment, through a variety of sensing devices, users can according to their own feelings, using the natural skills of the objects in the virtual world visits or operations involved in the event: while providing vision, hearing, touch and other

real-time intuitive and natural perception, and immerse participants in a simulated environment. Simply put, virtual reality is that people can feel the designer thought through visual contact and other information channels the advanced user interface. Virtual reality (VR) a blend of digital image processing, computer graphics, multimedia technology, sensor technology, and other IT branches, which greatly promoted the development of computer technology. VR technology is abstract, complex computer data space into an intuitive, user-familiar things. Its essence is to provide an advanced technology of man-machine interface. It is in an analog mode for the user to create a real-time interaction with physical objects reflect changes in the three-dimensional image of the world, in a lifelike experience vision, hearing, touch, smell and other acts of perception, so that the participants can directly participate and explore virtual objects and changes in the role of the environment, like being in the real world [6-7]. The architecture is shown in figure 1.

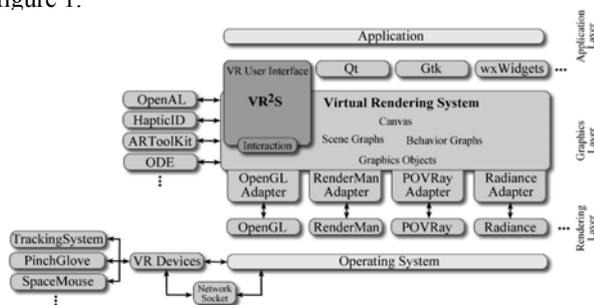


Figure 1. Generic virtual reality software systems architecture.

Virtual reality technology has the following three characteristics.

**Immersion.** Virtual reality technology is based on the human visual, auditory physiological and psychological characteristics, and produce realistic three-dimensional images by the computer user to wear a helmet displays and data gloves and other interactive devices, it will be exposure to their own virtual environment, becomes a virtual environment The one. User interaction with the virtual environment in a variety of objects, just as in the real world, everything is so realistic feeling, there is an immersive feel.

**Interactivity.** Interactive virtual reality system is an almost natural interaction, the user can not only use the computer keyboard, mouse to interact with, and be able to interact through a special helmet, data gloves and other sensing devices. Users through its own language, body movement or action and other natural skills, will be able to objects in the virtual environment to inspect or operate.

**Multi-Sensory.** Since the virtual reality system is equipped with visual, auditory, tactile, kinesthetic sensing and reaction apparatus, so users get visual, auditory, tactile, kinesthetic, and other perceived in a virtual environment, so as to achieve its proximity Habitat feelings.

### III. DIGITAL TOURISM SYSTEM ANALYSIS

Digital Earth refers to the establishment of a global information model that will be on every corner of the planet

to collect information, organize, summarize, establish a complete information model in accordance with the geographical coordinates of the planet and link up with the network. So that everyone on the planet can be fast, complete, and understand the Earth macroscopic and microscopic image of a variety of situations, and give full play to the role of these data. Digital Earth contains a high-resolution satellite images of Earth, digital maps, as well as economic, social and demographic information. Digital tourism is on the specific application of digital earth tourism. Digital tourism should contain digital maps tourist destinations, cultural landscape, natural landscape, tourism facilities (foreign agencies, group travel, hotels, transport, telecommunications, health care, entertainment, shopping malls, etc.) simulation data and models, as well as Graphics variety of tourist service information, tourism resource information and other aspects of data, image data, attribute data, multimedia data, text data, image data, etc. [8]. With the whole society's growing demand for spatial information, spatial information will become a national and global information flows is an important component of spatial information service has gradually developed into one of the most basic information services in today's society [9]. Because of the uniqueness of a regional tourism resources, tourism commodities such as tourism products, tourism services in the consumer be temporal, spatial and other geographic point [10-11], and therefore tourism geographic information reflects the strong geographical attributes. Digital Travel Web GIS technology can be used to realize the tourism geographic information management, analysis, applications and sharing; using virtual technology to achieve a tourist destination scenery, construction simulation, so that people can make a virtual tour to a tourist destination, you can also a variety of travel services for virtual visits. Travel digitizing not only gives new meaning to travel, but also to the sick and elderly tourism and increase tourist satisfaction, breaking the geographical boundaries of tourism, reduce the carrying capacity of tourist attractions. Tourism digitization is any information of tourism, including text, images, sound, animation, etc.

Into digital language to computer processing. Tourism digitization major attractions including spatial information and digitization, tours information digitization and digital tourism management information attribute information. Different types of users have different needs for information. Digitized travel service information. Tourists need to understand a wide range of tourist destinations, to determine their travel plans based travel service information. This information includes the tourist destinations of customs, history, culture, local products, folk festivals, food culture, scenic introduction. For information in addition to a traditional graphic description, but also calls broadband multimedia performance means, so that visitors get an intuitive feel.

Digital tourism management information. Travel managers need to collect, edit and manage tourism spatial information, access to the latest data (such as the construction of new tourism resources or facility information) in order to assist all types of tourism research,

product design and planning. Tourism management information includes various tourism resources quantity, quality, capacity and distribution of information, data concerning aspects of topography, soil type, climate, vegetation, land use change, as well as analysis and evaluation of the results of such information, and various types of thematic maps showing the form of statistical analysis, such as charts, numerical grading maps. Analyze the relationship between individual characteristics and spatial combination of tourism resources.

Digitized tourism spatial information according to the geographical scope of the study and executive level, the national tourism resources can be divided into four, namely: national tourism resources, provinces (municipalities) in tourism resources, tourist cities, scenic / landscape. Macroscopic characteristics partition mainly on the first two levels of study, a higher degree of data generalization, after the partition coverage levels gradually reduced, the topic further refinement, the region features more expressive.

#### IV. THE 3D MODELING TECHNOLOGY IN VIRTUAL REALITY

The establishment of the virtual environment is the core content of virtual reality technology, modeling environment purpose is to obtain the actual 3 d environment of 3 d data, and according to the needs of the application, use for 3 d data to establish the corresponding model of the virtual environment. In the virtual scene, virtual objects subject, which is a virtual representation through modeling. The key scene virtual object is a virtual three-dimensional modeling, the first condition is a three-dimensional interactive user experience flow. Typically, the virtual objects in the scene modeling methods include: geometric modeling, image modeling, graphics and geometric modeling combined method.

Geometric modeling. Geometric modeling usually two ways: using the associated process modeling language. OpenGL, etc. with OSG, VRML Java3D, and so on. This method is mainly for virtual reality technology features and writing, programming convenience, high efficiency; 2) use a common software modeling tool for modeling. Such as 3 ds Max, AutoCAD, sketch, open the inventor, and so on, users can interactively create geometric objects. Overall, the modeling software can be divided into three categories: polygon (polygon), NURBS modeling and three-dimensional geometric structures (CSG), shown in Figure 2. No matter what kind of modeling tools, mathematical modeling methods main principle is basically the same.



Figure 2. Case study for geometric modeling.

Image modeling. Due to geometric modeling real physical objects are often more complex, cost modeling, such as real-time rendering slow shortcomings, and waste a lot of manpower and material resources, using images instead of traditional geometric modeling is widely used, namely image modeling and rendering techniques. Image modeling refers to a series of images obtained in advance to represent a scene or solid object shape and appearance, a new image synthesis is based on a combination of original and appropriate handling a series of images, shown in Figure 3. Image modeling related technology are mainly two: 360 ° and 720 ° panoramic modeling object modeling ring technology.



Figure 3. Case study for image modeling.

Geometric modeling and physical modeling combined, can be partially virtual reality "look real, moving up the real" features, and to construct a real world to simulate realistic virtual environment, you must use behavioral modeling. Behavioral modeling process described object movement and behavior. If the geometric modeling is the basis of virtual reality modeling, behavioral modeling is truly reflect the characteristics of virtual reality. Objects in a virtual environment such as no actions and reactions, then the virtual environment is not viable, for virtual reality users do not have any sense. Virtual reality is essentially a simulation or refraction of the objective world, virtual reality model is representative of the objective world of objects or object. The objective world objects or objects in addition to features such as apparent outside shape, texture, but also has a certain behavior or abilities, and subject to certain objective laws. As reflected in the autonomy of the characteristics of virtual reality, in addition to the mathematical modeling of the physical characteristics of object motion and direct response to user actions, we also can establish independent user input object behavior model.

#### V. THE APPLICATION OF 3D MODELING IN VIRTUAL REALITY FOR DIGITAL TOURISM

Combining the virtual reality technology and network technology can achieve online virtual tourism. Virtual tourism is the use of virtual reality technology for simulating real world scenario, the user can obtain the continuous space information and able to interact with virtual environment. Virtual tourism is based on the object, on the basis of model library and database, through the virtual reality technology of

man-machine dialogue tool, it includes the simulation of construction, the view of the simulation, the simulation of the services. Applying virtual reality technology to the digital tourism system, realize the online virtual tourism is the main purpose of this article research. In this paper, the research contents including the composition and function of the digital tourism system, the realization of the digital tourism virtual tourism techniques and algorithms, etc. This article USES the image-based virtual reality technology to build tourism virtual space, focusing on the image matching algorithm, the construction of virtual scene model is studied.

In this paper, a new construction process, structural optimization, structural optimization, site optimization modeling the entire process, and separately, the system on-site scheduling, reduce the amount of data processed each time, short time process data, real-time scheduling system to improve the site. By applying improved algorithms, improve scene entities (such as trees, buildings, etc.) the accuracy and speed of the display, so that the whole scene look more realistic, real-time interaction to achieve the desired effect. The system's development goals, the system shown in Figure 4.

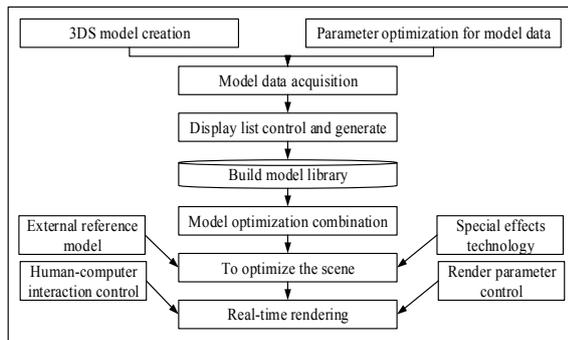


Figure 4. The application of 3D modeling of virtual reality for digital tourism.

3ds model creation module is the foundation of the entire system, including geometric modeling and physical modeling. Model parameter optimization module, data model, optimized data access code. Parameter optimization model data module, extraction system given 3 ds 3 d data file. Displays a list of control and generation module, the design of a scene based on user needs to display a list, based on the size of the system scenario, composition and hierarchy, control the display range in the form of a list of integer index displays a list of the index tree. Model library module, after 3 ds model displays a list of sectors according to the site's database, set the document. Model optimal combination: according to the actual needs of the actual structure of the model, as well as system optimization parameter extraction and model libraries and lists key information display, combinatorial optimization model. External reference model outside the education system, introduced some form of change or fluctuation in the form of relatively minor rules that require relatively modest level of detail of the model. Special effects technology modules for implementing special effects scenes. Interactive control module, the user 3 d "Avatar" and the operating entity

information to determine the position and angle. Real-time rendering module, optimize integration scenario model.

#### VI. VIRTUAL REALITY TECHNOLOGY IN DIGITAL TOURISM

Comprehensive digital tourism system should be a huge and comprehensive system, including the tour operator is an integrated management and service system, so digital tourism system comprises at least two parts, namely the travel experience digitization, tourism management digitized. The important role of virtual tourism system is to provide a real showcase for tourists, so as to achieve the purpose of its attractions, so the system can also be called a virtual tour virtual tour network display system, its purpose is to provide visitors with the landscape through the network Virtual experience.

The use of virtual reality technology can be implemented in digital tourism initiative roaming, interactive, virtual tour system using 3dsmax modeling and rendering, making a relatively realistic movie about the size of interest roaming 50MB (in order to make this project a Ministry attractions roaming, for example), the current domestic network transmission speed, the realization of real-time network Quick View is very difficult, it must be a special player or compression only - to achieve the desired transmission effect, as opposed to using 3dsmax modeling and render scenic film structure, the use of VRML technology can achieve better network interaction, and the file smaller. As shown in figure 4, virtual tourism network system, can provide real-time roaming the page to the tourists, and can be downloaded for tourists more real virtual scene, will make the virtual reality technology for digital tourism play a more effective real experience and publicity. Virtual tour guide can be used in a web based VRML robot simulation, and the use of speech recognition system based on template matching method, implement roaming and guide interpretation, and so on..

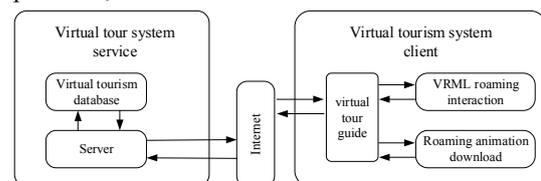


Figure 5. The digital tourism system structure based on virtual reality.

All the tourism enterprises will be collected in accordance with the requirements of the original image sequence is input into the system, using earlier in this article puts forward the splicing process to generate cylindrical panorama stitching algorithm, and then in the space according to the panorama viewpoints accordingly the location of the relationship between link building, and transition in the middle of inserting images, so as to generate tourism virtual scene. Roaming controller is realized by using Java Applet, it can according to user instruction scheduling of virtual scene in the panorama, and can be embedded in web pages, so users can do on the Internet virtual tourism. The virtual reality technology and Java technology, and Web database technology combined can

achieve a virtual tour on the Internet. Virtual tour is divided into virtual scene to build tourism and travel virtual scene roaming in two parts, shown in Figure 6.

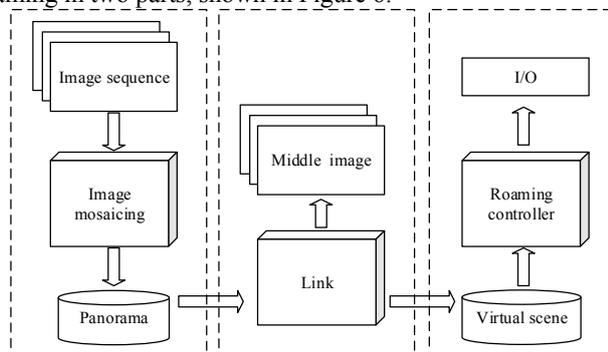


Figure 6. The model of the digital tourism system based on virtual reality.

Build tourism virtual scene, first from the tourist attractions to the original image stitching process to get a panoramic image sets, using the stitching algorithm for the fourth chapter puts forward the improved algorithm. System can complete image mosaics of images, loaded to cylindrical projection image automatically or manually specify the feature extracting area and image matching, finally complete the panorama generation. Users can first loading pictures as resources in the system, the load of resources can be cylindrical projection, and image matching; Can choose according to the result of the match after save, or to give up the operation, to match; After the stitching on the stitching results can be stored.

## VII. CONCLUSION

Tourism is a new growth point of national economy, information technology is the trend of social development, the combination of the two is not only important social significance, but also has great commercial potential. Digital tourism system is an information application systems, this paper analyzes the digital tourism system and the overall design, and from the perspective of the application of virtual reality technology to provide some of the technical solutions for tourism information.

Tourism as a dominant force in the green economy, more and more attention and investment community, has gradually become a new economic growth point, digital technology leapfrog development is the trend of social development, will gradually mature virtual reality the combination of technology and tourism is not only important social significance, but also has great commercial value. Digital tourism system is a complex system of information management services, paper digital tourism system needs analysis and a virtual tour of networked display system was architecture, while the design completed 360 / phantom imaging system, and from the virtual reality technology

angle of application virtualization provides for the tourism part of the technical program, in order to achieve digital tourism virtual tours and virtual modeling to improve the speed, ideal browsing effect, and true feelings show, Virtual Reality Based on VRML main tool of learning and research-based framework VRML virtual tour system, the use of conventional digital photo viewing tourism scene, promotional products, using textual explanation of the way, with a certain sense of reality, but in the interaction immersive virtual reality far behind in technology, with the advent of virtual reality technology, will reshape the new pattern of digital tourism. Virtual reality technology used in digital tourism system, the establishment and improvement of digital tourism functions to meet the needs of visitors to the virtual experience, will open a new page for the digital tourism, the tourism industry to bring broader economic outlook.

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