Research on The Preliminary Design of 3D Virtual Tour Based on The VRML Technology

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Abstract

3D virtual tour is a product of the combination of tourism and information technology development, and building a three-dimensional virtual tour platform will facilitate the future development of the tourism industry. Virtual reality technology has brought about tremendous changes in the tourism industry. Modeling Language VRML, which uses Virtual Reality, turns the rich imagination of people into any model, thus achieving the prediction and simulation of tourist attractions both visually and acoustically. The C/S mode, which has made the system more interactive and the effects in system planning quite well and has created a comfortable and convenient travel environment, has received people’s attention.

Keywords: Virtual Reality, 3D Virtual Tour, Modeling

1. Introduction

The tourism industry as a sunrise industry has got worldwide attention. The tourism industry of our country has been developing for twenty years already and, moreover, has been identified as the national strategic pillar industry in recent years. In comparison with its rapid development, the tourism industry of our country is weak in technical strength, lacking in sense of cooperation, poor in innovation capability, and relatively backward in management is relatively backward, affecting its healthy development. With the rapid development of the Internet, many of the tourist attractions, tourist companies have their information about travel, itinerary, accommodation and so on placed on their homepages for reference. Most of this information is plane information, such as photos of tourist sights and brief introductions. Though the scenery of tourist spots can be seen, yet it is still unlikely to really know about the actual touring contents of the tourist spots. If virtual reality technology is used in virtual tours, it can enable consumers to have a better knowledge of tourist information and, as a reference for consumers before starting their tours, it is bound to bring leisure tourism into a new realm. Only after consumers are motivated to consume will it be possible for them to spend money and for tourist attractions to take the initiative and achieve development in the fierce competitions of the tourism industry. The most valuable significance of the actual business operation of various publicity means like various advertising, TV marketing, and outdoor jet paintings lies in its attractiveness and in arousing the desire of potential tourists to tour the scenic spots. 3D scene simulations in network virtual tourism are achieved with the assistance of computer technology, thus enabling a virtual tourism environment to be built and the operators to travel around the world without leaving home. This new travel experience is becoming a new choice for many travel enthusiasts. Comparatively, the study of three-dimensional virtual tourism by our country is lagging behind. Most of the tourism websites only provide a simple 360-degree panorama, plus photos, videos and texts for illustration. Less expressive and interesting, they are a lot worse than the concept of "online games". Their web services are not detailed enough, with their detailed travel information about destinations incomplete through lack of the remote sensing and real-time monitoring of tourist attractions, thus leaving tourists unable to perceive their landscapes. In foreign countries, the conception and development of 3D virtual tourism began as early as 1995. At present, with virtual theme parks as the representative, a lot of research and development results have been achieved. A U. S. website called "The Second Life", which has four to five million users, can enable visitors to tour famous scenic spots worldwide. A statistics show that 45% of the adult U.S. Internet users have used the function of virtual tourism. The construction of 3D virtual tourism platform is shown to be of great significance to speed up the study of 3D virtual tourism and bring it into line with international standards as soon as possible. The advantage of tourist attraction virtual reality technology can turn potential tourists into ones with a knowledge of tourist
attractions from ones with no knowledge of tourist attractions, and can turn them into ones whose
desire to buy tourist attraction products are aroused from ones who have a knowledge of tourist
attractions. Tourist attraction virtual reality technology can provide very precise, detailed, and practical
information for tourists to the fullest extent, and attract the attention of potential tourists. In the
marketing and application of tourist attraction virtual reality technology, the introduction of tourist
scenic spots include not only simple graphic information but also 3D imaging simulation technology,
man-machine dialogue technology, and GIS technology through the use of advanced computers to
create a lifelike scene area environment for consumers, in which they can ramble freely thousands of
miles away in virtue scenes, select freely their own tour paths, show independently and interactively
the beautiful scenery of tourist attractions from anywhere and from any angle and, with its strong
visual, auditory, and interactive effects, inspire them with a strong wish to pay personal visits to the
sites.

2. An overview of 3D virtual tours

Virtual Reality (VR) is also referred to as reality technology and virtual environment. It is a virtual
world created through the use of advanced modern computer technology which closely resembles the
real world but again transcends time and space, and is a harmonious interpersonal environment which
users can immerse themselves in and have control over at will. The technology based on 3D computer
graphics technology, multifunction sensor interactive interface technology, and high-definition display
technology is the high-tech technology which has been brought into existence and application in the
last few years. Generated through computer simulation, it is a virtual environment which has visual,
auditory, tactile and other sensory simulations. Users can experience it and conduct a series of activities
in virtual environments through certain devices with Multi-Sensory, Immersion, Interactivity, and
Imagination functions. Virtual reality has three characteristics: Immersion, interaction and imagination.
Immersion refers to the fact that people immerse themselves in virtual environments and feel in the
same way as they do in real environments. Interactivity refers to the fact that people do not receive this
experience passively in virtual environments but can change the contents of how it feels through their
own actions. Imagination refers to the fact that virtual environments are conceived by man and so they
can be used for achieving certain goals.

Virtual tour theory was first introduced as early as 1995 by Hobson and Williams. They believe that
in the future people can create virtual tour landscapes to achieve a complete travel experience. In 1999,
Bristow also introduced a similar view and made a study of the design theory of the virtual tour system.
The research on virtual tours was conducted in our country relatively late. In 1999, Qiu Weiting from
Ningbo Broadcasting University had a paper "The joys and worries of virtual tourism" published in
Journal of the Science of Tourism and made a preliminary specification of the advantages and negative
effects of virtual tourism. In 2001 Xu Suning et al introduced the definition of virtual tourism. In 2006
Liu Enbo defined the network virtual tour concept from the perspective of network platforms and gave
a detailed description of the way to tour. From the day virtual tour came into being up to the present,
scholars and experts from various countries gave a brief account of the definition of virtual tourism
from different angles, which, to sum up, can be divided into two kinds either in a broad sense or in a
narrow sense. Virtual tourism in a broad sense refers to the process in which tourists obtain travel
information in a non-immersive way while virtual tourism in a narrow sense refers to the process in
which real landscapes are simulated by surrealistic means to create virtual tour environments to give
virtual travel experience to tourists.

At present, what is thought of as the virtual tour system is roughly divided into four categories: the
immersive virtual reality system, the desktop virtual reality system, the enhanced virtual reality system,
and the distributed virtual reality system. What is most widely used in our country the desktop virtual
reality system, which is characterized by the fact that personal computers are applied, that
recommended equipment are realized immediately, that it is simple in structure, and that it is
inexpensive and easy to popularize. But its weak points are also obvious, which find expression in the
fact that it is not highly immersive and that users are vulnerable to outside interference. With the
development of science and technology, however, there is a trend towards the development of the
immersive virtual reality system and the distributed virtual reality system in the application of virtual
tourism system.
3. An overview of VRML Technology

3.1 Concepts of VRML

VRML (Virtual Reality Modeling Language), that is, the Virtual Reality Modeling Language, is a modeling language in which real world scenes models or the fictional scene models of the 3D world are constructed. As the mainstream language in which 3D interactive websites are produced based on WWW on the Internet, VRML is in essence not only a web-oriented and object-oriented language but an interpreted language as well. It is a cross-platform language, in which 3D web pages can be released. Users can participate in explorations when browsing, and can get an experience which is more natural than one from ordinary webs in such aspects as interactivity, dynamic effects, and continuity. The object of VRML is called the node. Collections of sub-nodes can form complex scenes. Nodes can be multiplexed through examples, and dynamic virtual worlds (virtual world) can be created immediately after endowing them with names and defining them.

3.2 Operation principles and characteristics of VRML

3D scenes are described using text information, transmitted on the Internet, and interpreted by the VRML browser on local computers to generate 3D scenes. Standard specifications for interpreting and generating are the specifications for VRML. Figure 1 is the implementation process of VRML files. The mechanisms of VRML allow it to develop very quickly in network applications. The information described by texts is transmitted more quickly on the web than graphic files are, so direct transmissions of graphic files on the web are avoided to switch to transmissions of text description information of graphic files, and complex processing tasks are turned over to local computers, thus reducing network loads. Like HTML, VRML, which uses the ASCII text format to describe the world and get linked, guarantees its universal use on a variety of platforms. At the same time, it also reduces the amount of data, with the result that it can also be achieved on low-bandwidth networks. As a standard, VRML cannot meet the needs of all applications. Some applications want it to be more interactive. Some want its picture quality to be higher. And some want VR worlds to be more complex. These requirements are often mutually constrained and, at the same time, are constrained by user platform hardware performance. Therefore, VRML is scalable, that is, its own objects and their properties can be defined in accordance with its needs and browsers can be enabled to explain this kind of objects and their behaviors through such ways as Java languages.

VRML files can include four main ingredients listed as follows: the VRML file header, prototyping, modeling and scripting, and routing. Not all files include these elements. What is a must is the VRML file header. An RML file ends in the extension .Wrl or .Wrz, which signifies that this is a file with VRML space. The modeling method frequently adopted by VRML is the use of visual editors. It avoids some problems that arise in the direct use of text modeling, such as its inability to generate complex scenes. A prominent advantage of these tools is that they are very convenient to use. It does not need a large number of commands to be entered manually. And the functions to be achieved by a large number of procedures can be fulfilled only by dragging the mouse gently. A few common visual editors are Cosmo World 2.0, Paragraph’s the Virtual Home Space Builder, Home Space, Caligari's Pioneer, Virtus Walkthrough Pro and 3-D Website Builder, etc.
3.3. Advantages of VRML

(1) Platform independence
   Based on the formation of ASCII characters, VRML is designed to platform-independent. And a
   VRML file which is transmitted on the Internet can be applied on a variety of platforms through the use
   of VRML browsers or related plug-ins.

(2) VRML browsers
   VRML files can use ordinary browsers with plug-ins installed in them. Browsers used for special
   purposes like Cortona are stronger in function. Most of the browsers provide an operator interface for
   users to change the viewpoint and walk in many directions.

(3) Convenient to generate 3D geometries
   In addition to basic modeling, VRML also provides some advanced modeling methods to facilitate
   the creation of complex 3D models. Meanwhile, it also has standard interfaces with a number of 3D
   drawing software, such as AutoCAD, 3DMAX. And assisted by these software, more complex models
   are created and generated and then are exported in * wrl file formats.

(4) Use Script nodes and JavaScript scripts to extend functions
   If the advantages of Java programming in the Internet environment are combined with those of
   VRML in virtual reality scene structures, virtual systems which are highly interactive and complex can
   be developed.

4. The design of tourism platforms

4.1. Main functions

   The function of the VRML-based virtual tourism system is to provide a virtual tourist scene for
   users. The system can be designed in three modules.
   1) Introduction of the system. It mainly introduces the location of virtual tourist attractions, their
      levels, their features, and their culture and history.
   2) Roaming of virtual scenic areas. As the core of the entire virtual tourism system, the modeling of
      virtual scenes is the key. It includes the establishment of virtual models, the interactive design of
      virtual scenes and so on.
   3) Online exchanges. By building exchange platforms, users can exchange ideas about the related
      problems encountered in the process of their visits and can also write down their views about the
      improvements required of the system.
4.2 The design of the framework

In this paper, the C/S mode is adopted. In this mode, the server provides VRML files. Customers downloaded the files they want to access through the network and visit the VR worlds described in the files through the browsers (Viewer) on local platforms. That is to say, VRML files contain the logical structure information of VR worlds and the browser get many VR functions fulfilled according to these pieces of information. This is the access method adopted when unified description information is provided by the server and VR worlds are established by separate client computers. As browsers are provided by local platforms, VR platform independence is achieved. Servers are used to store the data needed by virtual roaming systems including interactive systems, related information of tourist attractions, and VRML script data. VRML script data includes various source programs of virtual roaming systems. Users can download various source programs through the network and install VRML plug-ins in their browsers, namely 3D virtual scenes can be visited and interaction can be achieved in virtual scenes by using mouses and keyboards. Figure 1 below are the design steps of VRML-based 3D virtual tour platforms. Interactive systems are achieved through exchange forums. And bridges to natural exchanges are built to solve the problems encountered during their visits.

![Diagram of the design steps of virtual tour platforms]

4.3 The main technologies of 3D virtual tours

(1) Remote sensing technology. In the process of the virtual reconstruction of tourism landscapes, the establishment of the 3D models of landscapes has the need to rely on remote sensing technology. The aerophotogrammetry technology, especially digital photogrammetry technology, can provide a
series of important data: 3D reconstruction models of tourism landscapes, digital elevation models and digital orthophotos. The use of multispectral images can distinguish vegetation in the features from man-made landscapes. Laser scanners are used to measure feature surface geometry relationships and obtain high-precision digital surface models. Besides, the method of combining control point positioning in photogrammetry and topographic surveys can also be used in order to obtain more detailed information of features.

(2) Virtual Reality (VR) technology. Virtual Reality (Virtual Reality) technology is a product of image technology, sensor technology, computer technology, network technology, and human-computer dialogue technology combined. Based on computer technology, it provides users with human-computer dialogue tools by creating a 3D visual, auditory and tactile environment and interoperates with objects in virtual environments. It can also provide users with a sense of the scene and multi-sensory channels and explore an optimal form of interactive interface depending on different application purposes. The use of virtual reality technology allows participants to experience various immersive feelings in virtual scenes. Users can not only immerse themselves in virtual environments but also query, browse, and analyze objects in virtual scenes, and make decisions. Beautiful panoramic photos are attainable by the VR-based 3D panoramic technology. They show beautiful tourist attractions in scenic areas. Visitors can touch the screen to design personalized tourist routes and exchange information and experience with online visitors. Interactions in virtual scenes fall into two kinds: 1) VRML sensor-based interaction: the actions of viewers in scenes decide that sensors can be divided into two kinds. One is a touch sensor, and the other is perception sensor. ① Touch sensor-based interaction. When browsing a scene, users employ the main input device, mouse, to conduct operation. At this time, a sensor detects various operating actions of a mouse by a user, like actions of a single mouse click, pointing and dragging, and so on, so that a scene can react accordingly. Nodes which describe this kind of sensors include the TouchSensor node, the Planesensor node, and the Spheresensor node. ② Perception sensor-based interaction. When a user browsing a scene, the viewer get a certain contact with certain objects in the scene. This type of detectors enables viewers to interact with objects by detecting the level of proximity and their corresponding responses. Nodes which describe this kind of sensors include the VisibilitySensor node, the ProximitySensor node and the Collision node. 2) VRML-based Script node interaction: VRML introduces Script node and provides application platforms for external editing languages such as JavaScript and Java, which greatly expands its own dynamic interactive capabilities. Its implementation ideas are: that specify some event processing Java program codes or scripts of JavaScript in the Script node, then submit the results returned in program calculations to output events of the Script node, and again pass the event to related domains of a certain object in a scene through ROUTE TO to achieve the purpose of changing the scenes. Or directly allow third-party programs specified in the Scrip node control of VRML scenes. Figure 2 below is an effect diagram of 3D virtual tourist attractions established by using VRML.
(3) GIS technology. GIS provides landscape maps in 2D digital images and the information of 3D models. Meanwhile, GIS relies on object-oriented database management systems OODBMS to provide the means for the massive database of management, storage and virtual scene maintenance. In order to achieve the purpose of 3D GIS data visualization, Kofler (1998) designed and implemented a tiered, 3D object-oriented database model. It enables you to access spatial data quickly, supports multi-user access, thus enhancing the effects of a user’s roaming in virtual scene spaces. In addition, VR-GIS technology, the product of VR and GIS integrated, uses Virtual Reality Modeling Language (VRML) technology to get GIS information implemented on PCs and GIS spatial analysis and query functions added to virtual environments, and provides GIS users with interactive user interfaces and object management elements inherent in networks. And spatial intelligence bodies serve as the GIS system, namely Cyber GIS, to constitute modules in virtual scenes. It can automatically accept instructions described in advanced languages by users. The use of it possesses the ability to perceive and the skill in acting on virtual scenes. And through its interaction with other spatial intelligence bodies, users are enabled to find the information required in virtual scenes.

5. Conclusions

China's tourism industry is experiencing a stage in which the industry is upgrading itself from scale to benefit, from quantity to quality, and from being intensive to being meticulous. There is a considerable gap between China and many other world tourism powers in many aspects such as the integration of resources, marketing tools, and competitiveness of enterprises. If the successful leap from a big tourist country to a tourist power is to be achieved, advanced marketing technology, scientific management methods, and new development concepts are to be adopted to promote the rapid and healthy development of the tourism industry. Virtual touring is an important pillar for the development of tourism. The 3D virtual tour platform is characterized by its autonomy, interactivity and convenience. It integrates the functions of tourism websites effectively, and the links in three-dimensional scenes are a very effective way of interaction. Through the clicks of the mouse on the links, users are free to browse whatever tourist attractions they want to see, inquire about their basic information, comments and multimedia information. With the platform, an integration of e-commerce, visitors can, when they are satisfied, book tickets and hotels directly without the need to use other links. Reducing the complex steps means increasing the chance for tourists to travel. The 3D virtual tour platform, in which people-oriented ideas are embodied, is an important manifestation of tourism maturity.
6 References