Pisco Med Publishing

Design and Implementation of Virtual Interaction in Tangzha Ancient Town

Jiaxin Tang*, Changyong Zhu, Shizhen Zhou

Nantong Institute of Technology Nantong, Jiangsu 226002,China.

Abstract:In recent years, as social and economic progress and living standard of people increases, increasing number of people has financial conditions to relax by travelling, but a host of major cultural tourist attractions are seriously damaged due to natural or human reasons, hence, we are constrained by offline and firsthand travelling experience. The high-speed development of internet technology and continuous improvement of computer software and hardware pave the way for the development and application of virtual reality technology, thus generating a kind of brand-new travelling that is appealed to young man. This article studies the combination of virtual reality technology and cultural tourism resources, taking Tangzha Ancient Town, the first industrial town of Nantong as the pilot.

Keywords:Virtual Reality, Cultural Tourism; Virtual Travelling.

Virtual Reality (hereinafter refers to VR) is a human-computer interface technology that highly simulates human, object and environment in the real world, as well as human's visual, auditory and action behaviors in the environment [1]. A virtual simulation environment is generated by a computer, which enables users to immerse themselves in the environment and to create a sense of being there [2]. Therefore, it is also known as magic mirror technology or artificial environment. This technology covers a variety of subjects, integrating the real world with virtual world through artificial intelligent, computer graphics, sensing and information capture, human-computer interaction, and among others, thus forms a high-tech simulation system that can interact with human beings.

The VR technology has been widely used in various fields. In industrial simulation, a complete simulation system is built by combining user business, data base and data, which can greatly improves the ability of enterprises to collect, analyze and process data and improves the development efficiency of enterprises; in the field of heritage restoration, build 3D model data base (that is digital twin model) according to the information result of data collection, which can recover the endangered cultural relics with high precision and preserve it in a scientific and permanent way, and rise a new level for exhibiting and protecting cultural relics. In the world of teaching, creating an environment of "autonomous learning", which will replace the traditional learning mode of "promoting learning by teaching" with the new teaching mode of acquiring knowledge and skills through the interaction between itself and the information environment. It will not only save costs, but also enhance learning interests, which is a leap in the development of education. Virtual digital campus is also a manifestation of virtual reality in the field of education.

VR mainly relates to computer graphics image processing technology, virtual engine development platform, polygon modeling, computer programming technology, the human-computer interaction technology, and other technologies, in the interaction system development of virtual town, we use diversified computer processing technologies to product this project, which will be described in detail in the paper.

1.Development Requirements of Project

The development requirement of project is to design a virtual travelling interaction system, through which we provide online virtual travelling experience to advertise and promote the tourism attraction, which can facilitate the increase of offline tourism flow.

doi: 10.18282/l-e.v9i4.1692

[1]Zhao Shilan. The Evolution and Development of the Artistic Style of Chinese National Vocal Music[J]. Journal of Liaoning Normal University(Social Science Edition). 2005, 03:81-84.
[2]Lai You. Analysis of the Pluralistic Characteristics of the Development of National Vocal Music Art[J]. Music creation. 2017, 01:110-111.
[3]Wang Min. The concept of national vocal music and its style[J]. Journal of Nanjing University of the Arts (Music and Performance). 2017,04:111-115.
[4]Yu Dugang. Vocal Education[M]. Shanghai Music Publishing House. 2009, 05.

By studying real environment, build a virtual environment that closely resembles real one and interact with virtual surrounding environment, get familiar with the real tourist attractions beforehand, which can serve as a reference for offline travelling, the main functional requirements are as follows:

(1) An overall representation: after entering the system, the users can choose to have a general survey of Tangzha Ancient Town from above and see all the landscapes and features of the town, from which they can have a preliminary impression of it.

(2) control the characters: control the virtual characters created in the system by computer keyboard and mouse, such as character is walking, or running, etc. so that users can browse the virtual ancient town and interact with it.

(3) Interaction information: interaction information includes the pictures, characters, voice frequency, and video in the system, such as the history introduction of architecture, which makes the users carry out related interaction operation, increasing the sense of immersion.

(4) Collision detection: use the physical engine in Unity3D to set the rigid body property, so as to ensure that the virtual character will not pass through the building landscape.

(5) Map navigation: set a small map in the top right corner to keep users from getting lost in a virtual environment.

(6) Three-dimension modelling: by means of three-dimensional model, the key buildings of Tangzha Ancient Town, such as the modern industrial remains, will be displayed, and try to stay the same with the actual buildings.

2.Key Technology Analysis

(1) Production technology of 3D model

The 3D model in the scene mainly uses Maya to produce. We produce the ancient town and the surrounding environment into a 3 d data model with polygon modeling method, due to the big construction load, some similar or irrelevant architectures can be imported into material to shorten the development cycle, and after the test, control the precision of the model to ensure a smooth operation of the system.

(2) Virtual interaction technology

With the help of Unity3D engine platform, use C# language to compile corresponding module functions. Meanwhile, Unity3D also comes with many API interface calls. Take advantage of software to render a realistic environment, and finally connect with the wearable device, so that users can interact with information and have an immersive experience.

3.Create a Virtual Environment

The 1895 cultural and creative garden in Tangzha Ancient Town was built based on the historical industrial relics of Tangzha, in which there are still some old industrial sites, such as Dacheng textile factory and Guangsheng oil factory, and so on. The architectural model production of this project mainly relies on Maya2015 version. After the completion of model, import it in the Unity 3D for scene construction and interaction. The whole process is according to the following sequence: field survey and shooting - terrain and architecture analysis -3D model drawing. In the process of creating virtual scenes, first build model one by one, and finally integrate them into a building complex, see the **Figure 1-1**:

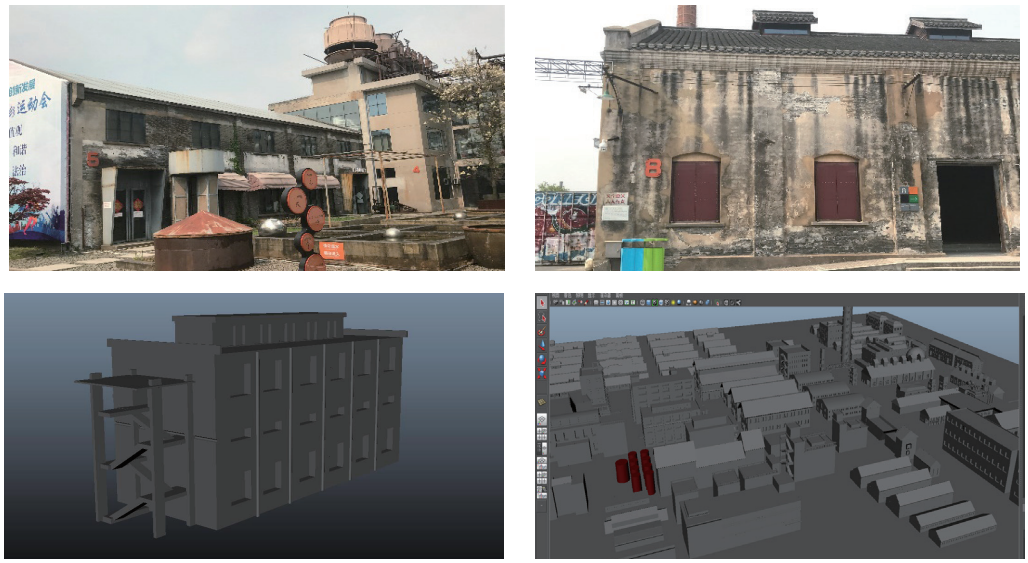

Figure 1-1 real architecture and 3D model

The mapping is a layer of "skin" pasting on the surface of the architectural model, for the purpose of shaping 3D model [3] in a better way. An outstanding system is developed based on delicate 3D model, and the proper mapping will make the model more true to life and stereoscopic, Therefore, a good system model is formed by the combination of delicate model and excellent mapping, with the lemut material as the main material to have a moderate reflection effect.

In order to make the digital model and the real environment look alike, use UV splitting technology to conduct UV splitting on the 3D model. UV is the texture coordinate information of the surface of object, and the position of object mapping can be determined by UV. Four mapping methods of UV are used in this project, they are respectively are: spherical mapping, planar mapping, cylindrical mapping, and automatic mapping, see the **Figure 1-2**.

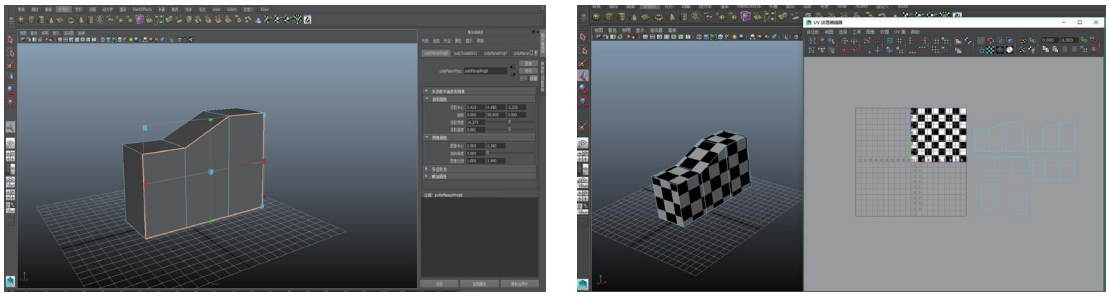

Figure 1-2 building model of planar mapping

This project abound in UV splitting technology, when using this technology to produce corresponding mapping, we need to abide by the principles: if necessary, try avoid UV being overlapped; by dividing fewer UV blocks to minimize the UV joints, which can also reduce the mapping connection work in the later stage; The joints should be arranged in places where the structure changes greatly, the appearance of different materials is different, or the camera and vision cannot reach (or unnoticeable). Check the checkerboard squares strictly after production to ensure that the mappings are not stretched or dislocated.

Implementation Process of Interaction

In the 3D animation software, after completing the creation of the entire virtual scene, export .Obj file of model in Maya2015 software, import the exported file into Unity3D, and complete the model conversion between different software, as **Figure 1-3** shows.

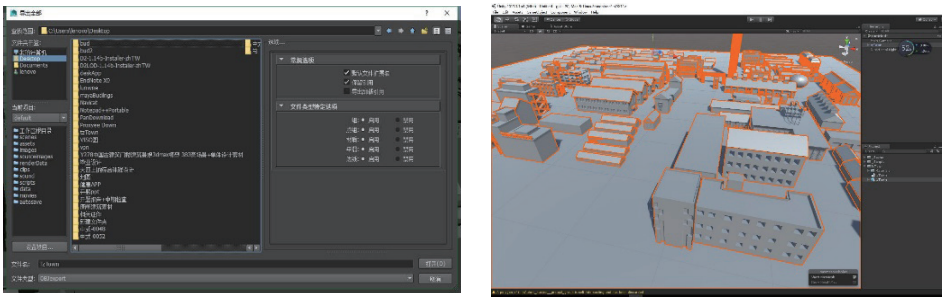

Figure 1-3 Interoperability between software

In the Unity 3D software, import standard resources package and set up the first-person character scenario. First-person is the best choice for immersive experience. In this mode, users have a strong sense of immersion, and they see and perceive directly through the senses, but it also makes some users feel dizzy, and using first-person can enhance the users' subjective feelings. In the Unity 3D, a first-person character controller is packed and available for developer, the developer just needs to import it into standard resource package, find the FirstPersonController module in the Prefabs that under the file of FirstPersonCharacter in the resource package, then drag it into the scenario and adjust its scaling. Control the walking direction with W, A, S, D, jumping with space key and the visual angle with mouse.

System test

According to the requirements, we finish the development of system, then we conduct a systematic test on the system to check the practicality and fluency of system and discover the deficiencies in the system in time and modify them, see the chart 1-1.

Table 1-1 data tested by system

Tested function	Test procedures	Expected result	Result	Problems
Login and register	Test its login and registration functions	Can login and register normally	There are some mistakes	Some troubles in the database connection
Experience scenario in the first and third person	Browse the scene in first and third person, and switch person mode by pressing V key	Switch person smoothly and brown the scenes in a correct way	Meet expectation	None
Information interaction	Users trigger different interaction modules to display different information	Can display the information normally, with no problem in interaction	Meet expectation	None
Scenario transition	Can switch different scenarios	can switch normally without halting, have transition scene	Meet expectation	Transition scene interface is too monotonous, need to improve

Multimedia interaction	Switch different scenarios can see different interaction information	Music if different with different background, can display some videos or panoramagram	Some shortcomings	The background music is too high and the video bounce delay is high
Physical collision	The character bump into the building in the scenario	The character cannot pass through architecture or other models	Meet expectation	Nome
Transition of interface	Switch between test interfaces	Switch smoothly and normally	Some mistakes	The UI interfaces are blocked sometimes, so the input operation cannot be carried out

It can be seen from the above table that the system is generally operating well, with some minor errors and deficiencies, the details are as follows:

(1) UI interface is too simple and crude, need to be designed one more time, such as design button types, header style and interface background.

(2) There is an abnormal condition with connecting the database when logging in and registering.

(3) The transition pictures are simple while switching the scenarios, the scenario switch is a little bit delayed.

(4) There is a delay in multimedia interaction, and the background music is so high that need to be adjusted.

(5) While switching UI interface, some UI modules are blocked which resulted in failing to input and click.

System Optimization

(1) Networking is required when running the system for reading and inputting data.

(2) Reduce the number of faces in the 3D model, and try to use the low-face model to reduce the calculating load of the computer

(3) Integrate all the models that can be integrated in Maya and reduce the number of models in Unity scenario.

(4) Simplified mapping, reduce the previous mapping precision from 2048*2048 to 1024*1024, display the details of architecture by discovering mapping.

(5) By reducing the definition of interactive video, reduce relatively the quality of interactive pictures.

(6) When switching scenarios, use asynchronous loading mode to reduce the utilization quantity of system resources.

(7) Since the switching of UI interface involves fewer components and less information, we will not change the module Alpha (transparency) and use SetActive () to switch off or hide module (even the transparency of former is 0, its module UI is still available, according to the principle that the priority of subset is larger than its superset, there is shielding effect; after the latter switch off the game object, in which the UI modules will be discarded as unable to be used, and the code is wrong.), directly put the two in different scenarios and load and switch synchronously.

It is not hard to see from the whole project development cycle that the pattern of the "VR + travelling" can address the contradiction between the limited time and energy in people and limitless scenic spots [3], meanwhile, the virtual interactive tourism significantly protect the architectural heritage which bear and carry the historical and cultural information, and it is of great significance for such a program that highly combines science and technology with architectural art to promote tourism cultural resources and inherit traditional culture.

Reference

[1] Wang Hongfei. Research on the application of three-dimensional panorama roaming technology in tourism industry [D]. South China University of Technology, 2013

[2] Liu Peilin. Virtual reality and network presentation of tourism characteristic town [J]. Journal of Tourism, 2008,33(06):3-5.

[3] Qie Sai, Ding Bin. Application of virtual reality technology based on Unity3D in science popularization activities [J]. Robotics Technology and Application, 2012 (06) : 25-27.