





Design of Smart Tourism System in Urban Scenic Spots Based on Computer Virtual Reality Technology

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Abstract. As new mobile Internet technology advances, how to realize virtual tourism has become a hot topic in the research of the tourism industry. In this paper, the design idea and virtual tourism flow chart of an intelligent tourism system based on virtual reality technology is put forward, the design goal of the virtual tourism system is given, the general design idea framework of the virtual tourism information system is put forward, and the presentation layer and data layer of the system are analyzed. The sub-functional modules of the intelligent tourism system are discussed in detail, and the key technologies of the development and design of the system are analyzed. Through the system test, it is found that it can present users with a three-dimensional immersive experience of tourist attractions, provide tourism service guidance for users, formulate a reasonable tourism route in combination with users' needs, and bring users a good experience of the intelligent tourism system.

Keywords: Web; BIM; Wisdom tourism; Virtual system

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1 INTRODUCTION

With the spread and uncertainty of the epidemic around the world, the real tourism model will bring complete hidden dangers to people's social life, and it can no longer meet the needs of tourists at this stage. The application of virtual reality technology in the tourism industry has become the inevitable development of various new technologies at present. It can provide users with very vivid scenes, show users the real scenic spot environment intuitively and vividly, and also bring users a better visual sensory experience, to facilitate users to screen tourism scenes and formulate tourism strategies that are more in line with their own needs. A traditional tourism information system is developed based on a database, including clothing, food, accommodation, transportation, entertainment, and purchase subsystems. As new Internet technology developed, a

traditional tourism information resources gradually have a big difference between the description of scenic spots and the actual situation, which brings a psychological gap for tourists. It focuses on introducing scenic spots and passive propaganda, making tourists have no independent choice, limited information supply, little choice, weak intuition, limited interactivity, and can't realize deep interactive experience. At present, more research has been devoted to expanding the functions of the virtual tourism systems, so that they can not only have a better tour experience but also provide help to tourists during their tour. For example, the virtual tour system of Dunhuang Mogao Grottoes developed in literature is based on mobile devices such as mobile phones and tablet computers, which allows users to point their cameras at the pictures, antiques, and other objects of Mogao Grottoes. The system automatically converts the screen images to the three-dimensional space to which the objects belong so that users can explore and visit the Mogao Grottoes in the virtual three-dimensional space. The system provides a better tour experience by combining virtual and real together. Wang [1] showed 5G and AI-empowered systems for smart tourism. Hu et al. [2] expounded the key technologies, such as 3D modeling, 3D scene optimization, and 3D simulation driving. Nam et al. [3] attempts to emphasize the key features of blockchain technology with the framework of smart tourism, and at the same time put forward suggestions on how technology will develop and influence the industry. Aldighieri [4] has created a network based on Openalp 3D in the region for extremely accurate terrain analysis, integrating geological landforms, geological sites, and paths into multi-disciplinary and multi-scale databases. Chung et al. [5] take traveler readiness and technology acceptance model from the hedonic perspective, aiming at analyzing the relationship between traveler readiness, technology perception of geographical labels, and adoption of geographical labels. This study details how to use advanced 3D scanning and modeling to help virtual display heritage [6]. The stimulus-organism-response (SOR) theory is used to establish a theoretical framework, including the real experience, cognitive and emotional response, attachment, and tourism intention of virtual reality tourism [7]. This research aims to develop a tourism information system based on the android platform by using virtual reality technology. Research and Development (R&D) is used as a research method by applying the ADDIE model in the development process [8]. The purpose of this study is to analyze the perception of intelligent tourism exposed on the Internet, to determine the current situation of intelligent tourism in South Korea, and to put forward the research direction of conceptualization of intelligent tourism suitable for the domestic situation [9]. This research aims to develop a tourism information system based on the android platform by using virtual reality technology. Research and development (R&D) is used as a research method by applying the ADDIE model in the development process [10]. Tinmith system mainly realizes navigation function, and it is used in outdoor games. Users can see virtual monsters in real scenes by wearing the head theft display. Therefore, this paper puts forward the development and design idea of an intelligent tourism system based on virtual reality technology, and realizes the combination of computer technology and virtual reality technology, which can not only effectively make up for the problem of spatial expression, but also better express geospatial data in a clear and objective three-dimensional way, and show users a more realistic space of tourist attractions.

2 VIRTUAL TOURISM STATUS

Virtual reality (VR for short) was put forward by Lanier, founder of VPL Company in the United States in the early 1990s. It refers to the technology of a three-dimensional interactive interface generated by computer graphics processing system and display technology, in which the three-dimensional environment generated by the computer is called a virtual environment. As a new human-computer interaction interface, virtual reality can not only immerse users in the virtual environment generated by computers but also provide direct interaction methods between users and the virtual environment. By using virtual reality technology, users can control the virtual environment through gestures, language, and other commands, and make it change accordingly, thus establishing the real-time interactive relationship between users and the virtual environment, and making users feel immersive. The international research on digital tourism is mainly carried

out as an integral part of other studies, in which the continuous progress of technology is an important prerequisite. With the continuous development of GIS, RS, GPS, and virtual reality technology, more and more countries, regions, and enterprises begin to apply these technologies to tourism. Especially some developed countries, such as Europe and America, have always dominated the world's more advanced science and technology. For example, Esri Company of the United States, which is famous for its products such as ArcGIS and Erdas, Google Company of Google Earth, and Microsoft, which is gradually involved in this industry, etc. These technologies are the basic technologies for the development of digital tourism. Digital tourism is generally regarded as the abbreviation of tourism information systems. Since 2001, technology such as electronic maps has been maturing, which has accelerated the digitalization of tourism information. The corresponding tourism management system has been developed for tourism enterprises and government departments, which has realized the digital management of tourism resources and tourism statistics. Combined with Internet technology and mass storage technology, At present, Google Earth and Virtual Earth 3D based on Internet technology have been widely used. As shown in Figure 1, the existing problems of people in traditional tourism are given.

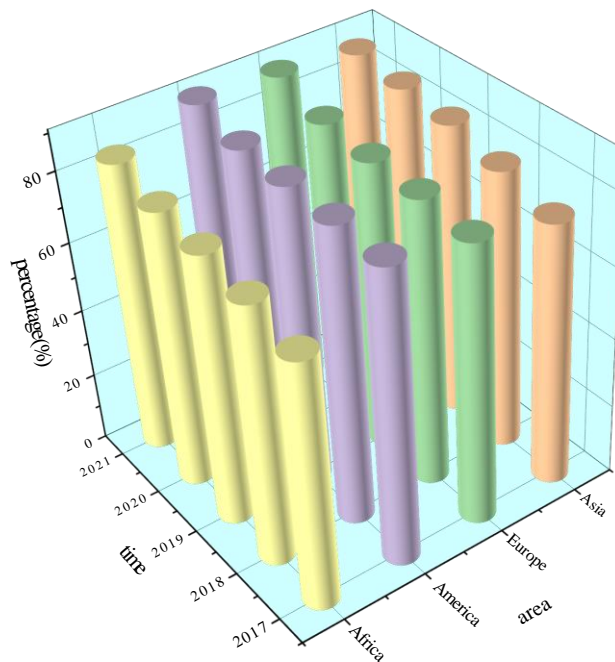


Figure 1: Virtual tourist attractions.

Summarize the main characteristics of foreign digital scenic spot tourism development recently: (1) The combination of two-dimensional information and three-dimensional space technology, and the combination of virtual scenic spots and realistic visualization. Two-dimensional information technology provides query and access to attribute information, navigation information, route query, and terrain information; Three-dimensional technology provides an intuitive expression of tourism resources, specific spatial information, and the appearance of ground objects, and realizes the two-way expression of virtual and real. (2) Incorporating the expression of satellite images, satellite images have good visual effects and a strong sense of reality, which can give people more sense of real experience and immersion. Combining high-resolution satellite images with tourism makes tourists' understanding of scenic spots not only limited to picture browsing and tedious text description but also can feel the brand-new visual impact brought by the real geographical

environment. (3) The public with strong interaction between virtual and real can be on the scene of tourism activities, build landscape models and make their landmarks. Visitors can update data in real-time, and provide people with the latest virtual reality scene information. Self-made landmarks of scenic spots can be used to query spatial information, attribute information, and other tourism-related information. Two-dimensional pictures are modeled by three-dimensional, and two-dimensional information is superimposed with three-dimensional models, which enhances immersion and interactivity. In China, the research direction of virtual tourism is mainly concentrated in the fields of tourism service information systems, tourism planning and management information system, framework construction and technical realization of tourism e-commerce and digital tourism system. However, the current digital tourism system is professional and only suitable for a few people to operate and use, which is not conducive to popularization and popularization. High cost, low efficiency, and can't meet the personalized needs of digital tourism.

In September 2008, the Huangshan version of the 3D simulation digital city system was officially put into use. Huangshan 3D Simulation Digital City is a digital city network platform independently developed by Huangshan City, a geographic information system, It has remarkable online browsing, the high-speed query of massive tourism data, accurate route, rich interaction, and so on, and provides more effective and convenient solutions for citizens and tourists to live, make friends, entertain, work, ride and travel. In short, China's research on virtual tourism is relatively backward. Most of the main contents of local tourism websites introduce local cultural landscapes, historical sites, landscapes, etc. through words and pictures, and the amount of information is small. It is difficult for tourists to get more tourism information through pale language. Professional tourism websites mainly engage in tourism intermediary and e-commerce business, and more focus on promoting consumption and circulation, ignoring the intuitive publicity and display of tourists. The reason is that China's tourism started late, Chinese people are relatively unfamiliar with the concept of digital tourism, and virtual tourism itself is in the stage of exploration and improvement. There are also some professional websites for virtual tourism in China, such as "Looking Around Four Sides". However, most of the developing technologies of virtual tourism are still based on panoramic image technology, and relatively few of them are combined with virtual reality technology. With the continuous expansion of the tourism industry and its increasing proportion in the gross national product, the development and promotion of popular virtual tourism systems will become an inevitable trend. The development and application of virtual tourism and digital scenic spot platform will bring a win-win situation to management departments, tourist spot operators, and tourists. Virtual tourism and real tourism are not necessarily opposites, not substitutes for each other, but complement each other. Virtual tourism is more convenient than real tourism and can provide richer content, but the experience of landscape is weaker than real tourism. However, virtual tourism is gradually recognized by tourists because of the interactive way between virtual tourism and real tourism in experiential marketing, integrated destination information, online booking and consumption, and virtual display of hotel products. Especially in the epidemic society, people need to take protective measures and keep a safe distance from other tourists in real tourism. Such a complicated mode will greatly reduce the pleasure and pleasure of tourists in tourism. However, virtual tourism obviously won't have such a problem, so from this perspective, virtual tourism will become the tourism way people choose. Figures 2 and 3 show the comparison between real tourism and virtual tourism. It is found that in the past five years, the proportion of real tourism has gradually decreased, while the proportion of virtual tourism has gradually increased, which shows that the importance of virtual tourism has become increasingly prominent.

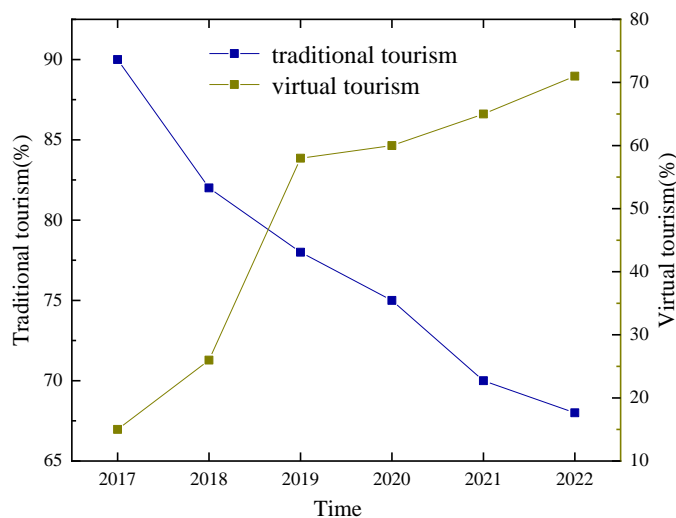


Figure 2: The rate of different tourism.

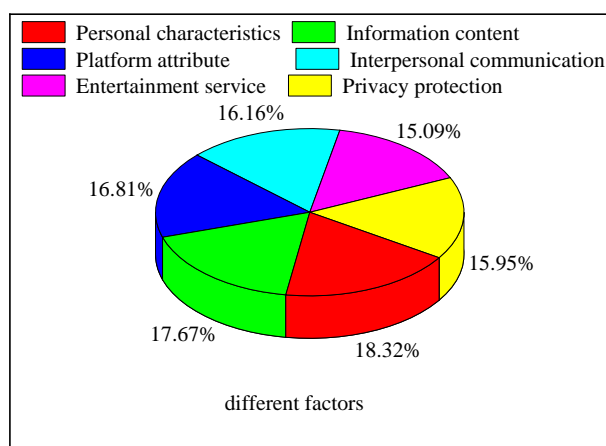


Figure 3: The proportion of virtual tourism factors

3 VIRTUAL DESIGN FLOW CHART

The design process of virtual tourist attractions in this paper is shown in Figure 4. In this system, firstly, the three-dimensional data and image information of scenic spots should be collected, and the database of three-dimensional scenic spots should be established. Then, the database and modeling software are used to model the terrain and landscape of the scenic spot, and then various functional modules are added to the model to simulate the three-dimensional virtual scene of the scenic spot.

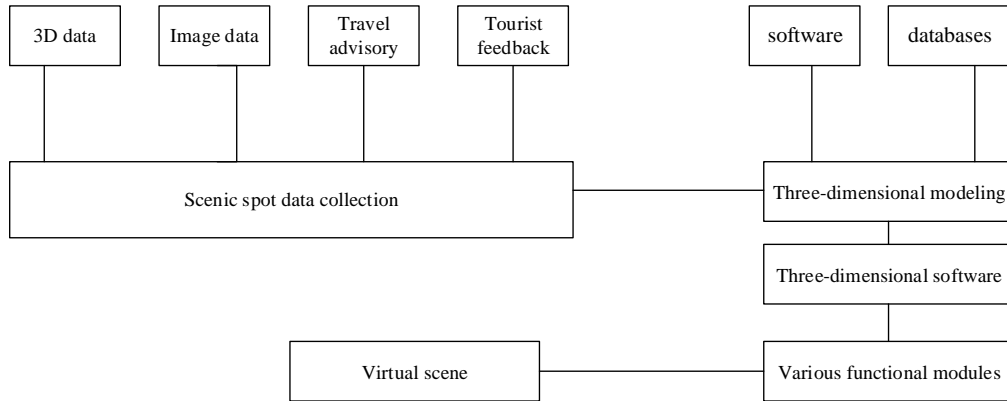


Figure 4: Flow chart of virtual system design.

First of all, we need to collect three-dimensional data, image information, comments, and feedback on scenic spots, and establish a database of three-dimensional scenic spots. Then, the computer software and the collected three-dimensional data are used to start the three-dimensional modeling of the scenic spot, and then various modules are injected into the model to enrich the content of the scenic spot and make the model more realistic. Among them, the design of the scenic spot model adopts Revit software from Autodesk Company, which can realistically render the real scene of the scenic spot and give visitors a good sense of experience. Compared with other modeling software, Revit has great advantages in accuracy and rendering effect. What's more, Revit models can be exported in a variety of formats, the most common one is CAD graphics format, which can cooperate with CAD to achieve the best modeling effect. But can also be shared with other types of software, and has good compatibility. Due to these advantages of Revit, Revit has developed vigorously in the construction industry at present and has been widely used, penetrating related fields such as HVAC, geotechnical, structure, prefabricated buildings, roads, and bridges, water supply, drainage, etc. The three-dimensional real-life model has an absolute coordinate datum because of the introduction of external orientation elements and ground control points. BIM is mainly used for information management of building scale, without absolute position reference, and coordinates are often expressed in a local coordinate system. The superposition of models can be achieved by manual registration. Considering the precision and accuracy of spatial calculation and analysis in GIS, the position, posture, and elevation of the BIM model need to be carefully calculated, so it is necessary to unify the coordinate datum of BIM and real-life 3D model by coordinate transformation. The Revit model shows the architectural design scheme, and the real-life 3D model restores the topographic features at the time of image acquisition without taking into account the topographic changes brought by the construction. If the model is directly superimposed according to the coordinates, there will inevitably be overlap and occlusion, which cannot be perfectly matched. Therefore, it is necessary to consider the terrain changes caused by the construction, and deal with the model connection area. Figure 5 shows the development of Revit in recent years.

3 DESIGN OF VIRTUAL TOURISM PLATFORM

3.1 Demand Analysis of Virtual Tourism Platform

With the advent of the era of big data, informatization has gradually entered people's lives. Virtual tourism is the product of traditional tourism industry informatization, which can release tourism

information in time, serve tourism resource management departments, tourist places, tourist routes, and tourists, and realize information sharing.

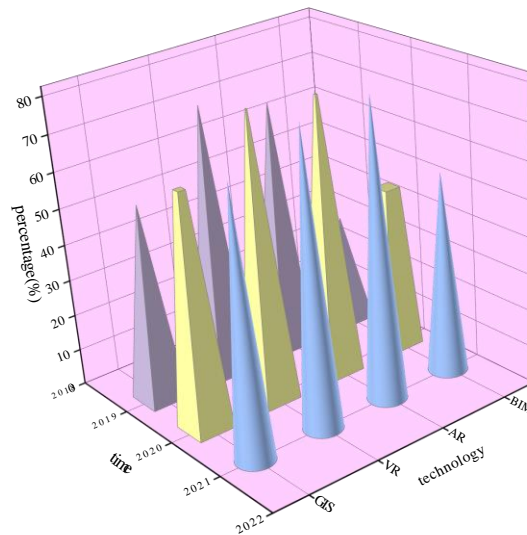


Figure 5: BIM application rate.

A virtual tourism system is a system platform to realize the information network release of scenic spots. On this platform, tourists can know the resources, geographical location, traffic flow, nearby transportation, accommodation, and other related information of scenic spots in time, which provides a reliable basis for tourists to make wiser choices. At the same time, tourism products can expand the popularity of a scenic spot and become a scenic spot for online celebrities. The functional diagram of the virtual platform is shown in Figure 6. A virtual tourism system is an information system that can provide geospatial information, attribute information, and multimedia information related to tourism. This platform can realize the input, storage management, publishing, and sharing of all kinds of tourism-related information, as well as common GIS functions, such as destination query, layer control, roaming, and so on.

Among them, the destination query function can search the address (latitude and longitude coordinates or place name information) input by the user; Basic layer control, realizing the display and hiding of tourism-related layers; Basic scenic spot browsing functions, such as zoom-in, zoom-out, roaming, thumbnail, etc. View the digital photos of the scenic spot, and reflect the beauty effect of the scenic spot from all angles. Add landmarks, and mark the locations that network users are interested in on the platform; User-defined roaming path can realize roaming function, auxiliary browsing function, and sunshine time control of the tourism that users are interested in.

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3.2 Overview of the Overall Design of the Virtual Platform

The virtual scenic spot platform is composed of several functional units, each of which is developed independently through the mutual transmission of parameters, and finally combined to form a unified organic whole, thus realizing the system requirements and design. Therefore, it is

necessary to define the design principles of the platform, and structure and functions of the platform.

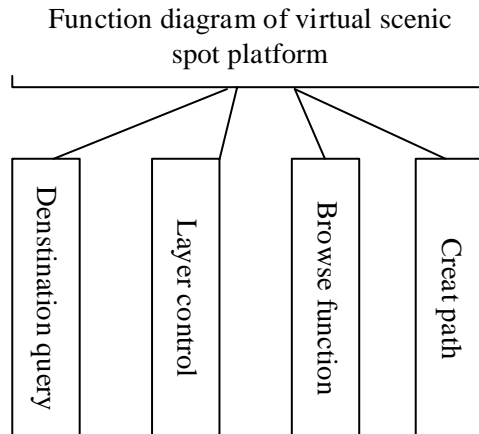


Figure 6: Structure diagram of virtual scenic spot platform.

3.3 Overall Design Principles

The platform design of digital tourist attractions needs to consider both functional and non-functional requirements, such as system stability, security, scalability, interface friendliness, etc. Therefore, the design of this system follows the following principles:

(1) the principle of systematization and modularization. The whole platform is divided into different modules, each module is independently developed and tested, and the parameters can be transmitted to each other. Finally, it is integrated into an organic whole according to system. For example, in the scenic spot tilemap data visualization system, the spatial information maps of common tourist spots are studied separately, such as the simulation methods of shortest path and crowded people, and the real-time scenic spot information data [9] is obtained through analysis alone. Finally, the two are integrated to form a dynamic scenic spot display based on real-time tourism information.

(2) practical principles mean that the design and development of a digital tourism platform can solve practical problems for users and meet their actual needs. On the one hand, the scenic spot spatial data visualization system can satisfy users to query real-time scenic spot information, browse special scenic spot phenomena and query the visualization effect of scenic spots; on the other hand, it can provide users with the prediction of the future scenic spot information situation, and ensure that users can make appropriate arrangements for self-help tourism safely and normally.

(3) the principle of humanization; first of all, the digital tourism platform should be easy for users to operate, so the menu bar should be designed. Secondly, the operation of the platform should be reliable and have the ability to save strong errors. For example, when the user does not operate properly, a prompt box can pop up to give the user relevant help information, to facilitate the user to make the system handy.

(4) The principle of manageability and scalability. The development of a digital tourism platform needs to consider whether it is convenient to manage and expand in the future, that is, the platform design should not only meet the needs of customers but also fully note the future needs of users. With the growth of data, the number of users, and the expansion of the application scope of the system platform, the performance of the system platform should be maintained well.

4 GENERAL FRAMEWORK OF THE SYSTEM

4.1 General System Architecture

At present, the application of the Web in system development and design is more and more popular among many enterprises, but the traditional Web design has many shortcomings, which need to be further optimized, such as page attraction, server fluency, information protection, and virus resistance, and browser communication. At present, so many problems have made many consumers lose patience and can't meet users' experience needs. Need, and the popularity of the Internet, can better solve the shortcomings of the traditional part of the Web, update the traditional design, and have a multi-functional experience for users to enjoy complex interaction and zoom in and out of the map during use. The system design in this paper can be divided into two layers, which are implemented by the client and data server, as shown in Figure 7.

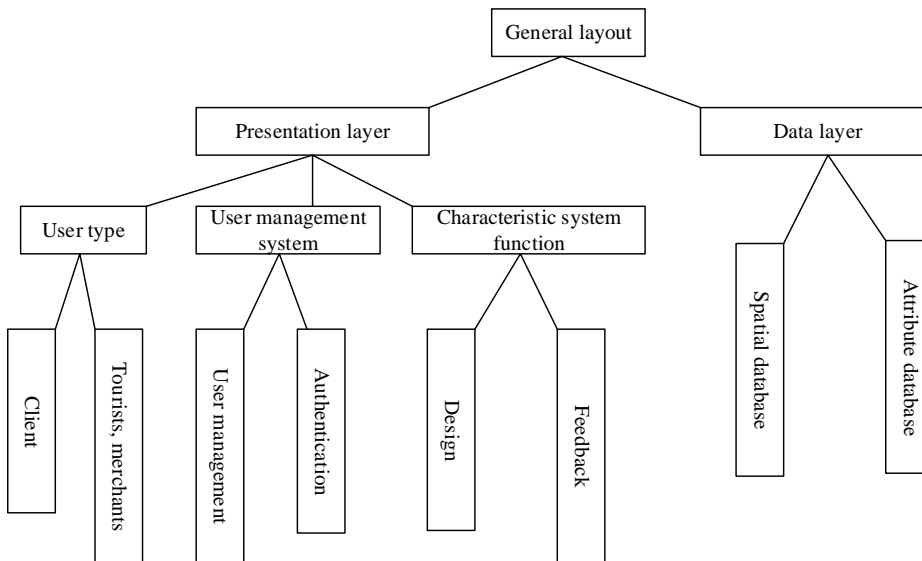


Figure 7: General architecture of system development.

4.2 Each Structural Layer of the System

(1) Presentation layer

The realization of this layer technology calls Flex SDX toolkit and uses Arc GIS Server Flex API to complete the system interface design, including the interface functions of geographic positioning, route selection, etc., and simultaneously combines the scenic spot virtual reality technology to provide users with the virtual tourism experience effect in the system application.

(2) Data service layer

This layer is based on SQL database and Arc SDE technology, and designs data services for integrated storage and management of space, attributes, and other kinds of data. The design of this data service layer is realized by the GIS server and commercial server, in which the GIS server mainly manages the spatial and attribute data properly. After the GIS server successfully receives the related processing tasks of the Web server, it uses the related components in the GIS server to provide various functions, successfully extracts, analyzes, calculates, and processes all kinds of data, and finally transmits the processing results to a Web server, and feeds back the corresponding page contents to users. The business server is mainly used as a request to provide

spatial data, and stores the personal data of enterprises in the business database to realize the management and maintenance of the database system.

5 CONCLUSIONS

In this paper, by designing a smart tourism system based on 3D Web GIS and BIM modeling technology, and virtual reality technology, the realization of smart tourism has become the inevitable trend, and it is also an indispensable and important component of building a smart city. Because it involves a wide range of tourism information, it is necessary to comprehensively consider all aspects to meet the tourists' behavioral needs. In the design and development of the intelligent tourism system based on virtual reality technology, the virtual flow chart, system platform design, and general framework design are considered comprehensively, and it is proved that it can present users with a three-dimensional immersive experience of tourist attractions, which is a good experience of the intelligent tourism system.

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