Research on the Application of Computer Virtual Reality Technology in Tourism Development of Scenic Spots

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Abstract. VR (Virtual Reality) makes it possible to use digital technology to drive the development and revitalization of the cultural tourism industry. Aiming at the shortcomings of traditional virtual tourism system such as weak immersion and lack of interaction, this paper designs and produces a Zhuhai virtual tourism system based on RPG. Secondly, this paper analyzes the functional modules of the virtual tourist attraction system. Finally, this paper uses three-dimensional panoramic technology to realize the development of virtual tourist attractions system from four processes: material collection, material stitching, panoramic roaming, and publishing roaming. The system constructs a virtual three-dimensional tourism environment through virtual reality non-contact sensing technology on the basis of the real tourism landscape. Tourists can experience travel in a virtual environment in advance without leaving home, and then plan efficient travel plans.

Keywords: virtual reality technology; tourist attractions; recommendation algorithm; scenic roaming.

1. Introduction

With the rapid development of network information technology and the advent of the era of virtual reality technology, the Internet, digital technology and traditional industries have rapidly achieved collaborative cooperation and rapid integration, and innovative industrial forms have emerged in many industries. industrial development path. Among them, the tourism industry is particularly significant. Nowadays, more and more tourists choose to travel freely and individually. Combined with mobile Internet technology, the development of tourism industry services tends to be personalized and intelligent. The construction of smart tourism is proposed in the context of this era. Under the Internet digital technology environment, virtual reality MR technology has been widely used in the field of smart tourism. For example, the online Shanghai World Expo and the digital Forbidden City have become models of digital smart tourism [1]. Tourism is Zhuhai's advantageous characteristic industry. In order to build a world-class tourist destination in Zhuhai, it is actually to form a world-class regional tourism brand. Zhuhai's branding originates from the realistic needs of fierce and differentiated competition among international bay areas. Therefore, in the big environment of Internet+, it is of far-reaching significance to use virtual reality technology to develop smart tourism solutions suitable for the development background of this city's tourism industry, and to promote the development of this city's tourism industry. This topic will discuss the use of virtual reality MR technology, based on the tourism resources and characteristics of Zhuhai, to develop virtual tourism product applications suitable for the Internet environment, and propose modern technical solutions that are helpful to the tourism industry.

2. Design of tourism virtual reality system in Zhuhai

2.1. Key Technologies

3D panorama is a real scene virtual reality technology based on panoramic images. Panorama is to stitch one or more sets of photos taken by the camera ring in 360 degrees into a panoramic image, so that users can enjoy an immersive experience in a virtual environment. It is a three-dimensional representation of the real scene. Moreover, the three-dimensional panoramic technology can make

users have a strong sense of interaction and immersion [2]. Users can choose their own angle, zoom in and out arbitrarily, look around, look down and look up like an immersive one. Furthermore, the 3D panorama technology is simple and convenient to produce, has a short generation period, and generates small files, which are suitable for transmission and sharing on the network. Publishing formats are diverse, suitable for various terminal applications. Based on this three-dimensional panorama technology is the application trend of the current virtual scenic spot tourism system.

2.2. System Architecture

Zhuhai is pursuing the integrated development of mechanisms, industries, resources, and services in accordance with the national standards for global tourism construction, and is actively committed to building Zhuhai into a global tourism demonstration area and a world-class tourist destination. All-for-one tourism is to focus on tourist experience, build convenient tourism services at your fingertips, and finally realize the coverage of tourism elements and tourism services in the whole area of Zhuhai. Establishing a sharing platform and mechanism for tourism big data and MICE enterprise big data is an important way to achieve this goal [3]. Tourism big data has become an important direction of tourism competition in the new era, and will become an important driving force for the tourism industry and enterprises in product development and innovation, as well as in the transformation of corporate market strategies, and become a new driving force for the development of tourism economy. Big data technology is the starting point. This paper adopts a mixed method of travel recommendation. The system integrates travel accommodation, restaurants, entertainment items, scenic spots and some other information to provide a unified interface service, which has achieved good results in travel recommendation. The overall framework of the travel recommendation system used in this study is shown in Figure 1.

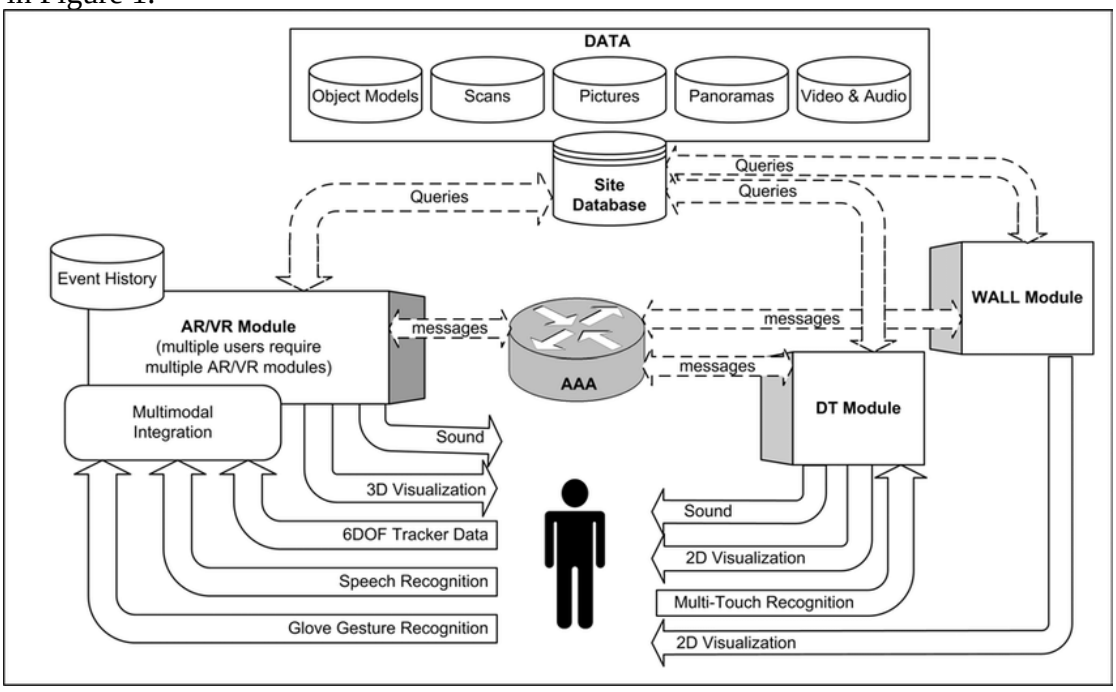


Figure 1. Recommended virtual reality system for tourist attractions in Zhuhai Scenic Area

Design and implementation of cloud computing technology based on Hadoop. The overall architecture is mainly divided into five modules: data collection, data cleaning, data analysis, travel recommendation, and visualization [4]. The cloud computing platform is used to solve the problem of secure storage and processing of large-scale data based on distributed computing. The specific architecture is shown in Figure 2.

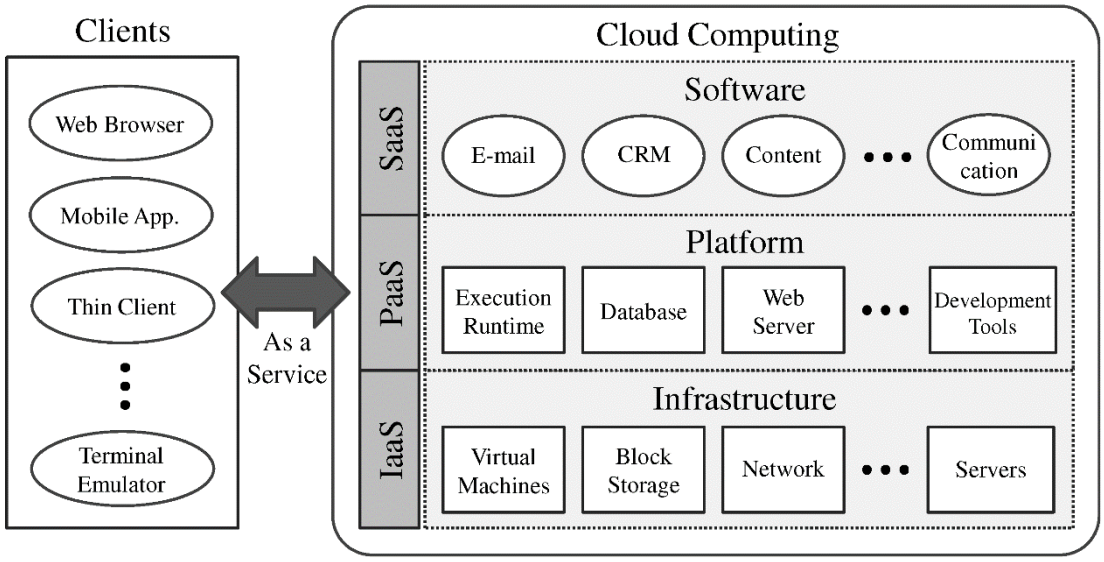


Figure 2. Virtual reality system architecture for tourist attractions recommendation based on Hadoop cloud computing technology

Data collection is mainly realized by crawling from websites or user input, and there are many bad data or missing data in the obtained initial data. To normalize the dataset, the acquired data must be further preprocessed (filtering, linear regression, clustering). Different processing methods are adopted for different situations. For example, a questionnaire is set up during system initialization to standardize user input information; users' interests are grouped and clustered, thereby dividing large data sets into blocks. The data set information mainly includes basic tourist information, tourist transaction records, tourist communities, and demographic information [5]. Due to the huge amount of information and the lack of a unified format standard, it is difficult to deal with it effectively. At present, the effective way to solve this problem is to use ontology, probability and statistics model or vector space model to represent. The ontology proposed by MORENO contains 203 concepts and is organized into a five-layer structure. The first layer contains the main concepts Events, Nature, Culture, Leisure, Sports, Towns, Routes and Viewpoints. Other concepts are related to these 8 concepts through relationships. Probability and statistical models use linear regression, clustering and other methods to analyze the collected tourism information data, calculate the rules of the information, and assign values to the initial states of some variables of the system. The vector space model uses statistical methods to calculate the text model, converts the text into an n-dimensional vector, and uses an algorithm to calculate the weight.

There are four main ways to visualize the results of travel recommendations: lists, sections, maps, and augmented reality. The display of tourism recommendation results can improve tourists' evaluation and satisfaction of the recommendation effect in an intuitive and efficient way. In terms of the content display of the recommended results, the introduction of tourism-related information in major websites basically consists of titles, pictures, URL links, and text.

3. System data collection

3.1. Core technology of data collection

In the construction of panoramic image virtual tourism, the realization of virtual attractions is very critical, and the core technology is the correction of fisheye photos. The correction of fisheye images mostly adopts the latitude and longitude mapping method [6]. It assumes that any point on the spherical surface is P, the longitude of point P is mapped to the horizontal coordinates of the rectangle, and the latitude is mapped to the vertical coordinates of the rectangle, so that the plane map obtained by the mapping of the entire spherical surface is a 2:1 rectangular map, and the hemisphere is a Zhang square diagram (Figure 3). The steps of the latitude and longitude mapping method are:

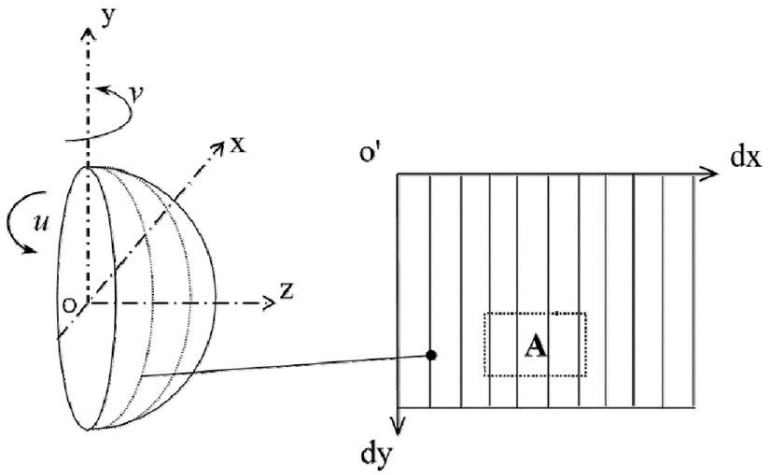


Figure 3. Longitude and latitude map

1) Calculate the coordinates of any point (x, y) on the unit sphere on the fisheye image according to the isometric imaging model of the fisheye. Their relationship is as shown in Equation (1), Where f is the focal length, in practice, the unit sphere radius is taken as the f value, and θ and $\varnothing$ are spherical coordinates;

$$\begin{aligned} x &= f\theta\cos\varnothing \\ y &= f\theta\sin\varnothing \\ \sin\theta &= \sin\alpha\times\sin\beta \\ \sin\varnothing &= \left(\sin\alpha\times\sin\beta\sqrt{(\sin\alpha)^2\times(\sin\beta)^2+(\cos\alpha)^2}\right) \\ \cos\varnothing &= \left(\cos\alpha\sqrt{(\sin\alpha)^2\times(\sin\beta)^2+(\cos\alpha)^2}\right) \end{aligned} \tag{1}$$

2) Establish the coordinate point $P(x', y')$ on the latitude and longitude map and its corresponding spherical coordinates on the spherical surface. It can be calculated by relational formula (2), where f is the same as formula (1), and α and β are the spherical coordinates corresponding to P;

3) Finally, the relationship between the fisheye photo and the latitude and longitude map is established using the spherical coordinates as an intermediary [7]. Use formula (3) to convert $(\theta,\varnothing)$ and (α,β) to each other. Their relationship is shown in Figure 4. After the above transformation, the fisheye image can be corrected into a square image.

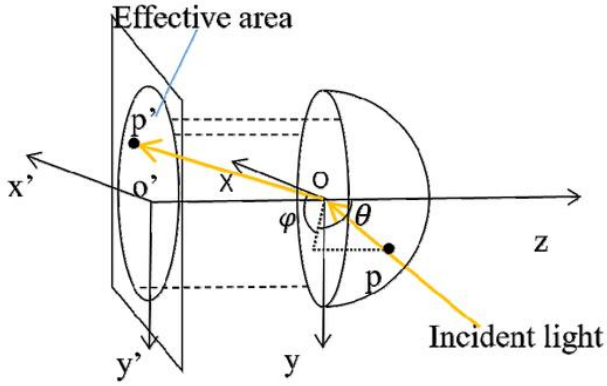


Figure 4. The relationship between the latitude and longitude map and the angle of the fisheye image

3.2. Attraction data collection

The collection of panoramic images mainly includes photos of scenic spots, maps of scenic spots, toilets, banks, restaurants, hotels and other materials on tourist routes, as well as audio explanation materials of scenic spots and text introduction information of scenic spots. The system provides tourists or users with information about the scenic spots, including the type of scenic spots, historical and cultural background, combined with local humanities and customs [8]. During the tour, they can enjoy both the scenery of the scenic spots and the cultural influence. Baidu Map provides location information search function, provides basic map display function, search function, and positioning function, which is convenient for user route navigation, search destination and current location confirmation. Adding hotel transportation services directly into the system can provide users with integrated services, so the system can provide users with full service, saving the trouble of searching and ordering other software. According to the location where tourists arrive at the scenic spot, we provide users with a real-time tour guide mode for the scenic spot, where they can enjoy the explanation of the scenic spot and the planning of the tour route.

4. Scenic spot recommendation algorithm design

D_1 is the preprocessed tourist travel plan data. The algorithm mines association rules from D_1. We prune the frequent itemset in the mined association rule set through historical data. In this paper, the pruned association rule set is verified by Bayesian network [9]. At this point, we get the optimized set of association rules. In this way, a personalized travel plan recommendation plan is formulated. where Algorithm 1 will call Algorithm 2.

Algorithm 1: Bayesian personalized association rule recommendation algorithm

Input: D_1

output: S_b

Begin:

1) In this paper, the tourist travel plan data is obtained after preprocessing and denoted as D_1.

2) According to the *Apriori* algorithm, we set the support degree $Support_de-gree$ and generate k itemset. We obtain frequent itemset $S_i, S_x \in S_j, k \in [1, n]$ to be recommended to tourists through *Apriori* algorithm. n is the number of items.

3) User *user* historical data is recorded as *Huser*. We combine *Huser* and call $\Pr une(S_j, Huser)$. We perform personalized semantic pruning on S_j and output $S_R = \{S_r \mid S_r \in S_i\}$.

4) If S_R satisfies the set requirements of k item set, go to step 5), otherwise go to step 2). until the k itemset requirements are met.

5) We construct a database D_2 of tourism plan records reflecting tourists' interest.

6) We take S_R as the input to the *Bayes* algorithm. We run the *Bayes* algorithm to output $S_b, S_b = \{S_y \mid S_y \in S_i\}$ sorted by visitor reading interest.

7) $\mathrm{Re}turn(S_b); S_b$ is the recommended solution.

End

The algorithm works on the itemset mined by association rules. The algorithm uses historical data to prune it. At this time, the data that is less consistent with the historical records are filtered and removed. Itemset are compared to historical records when calculating goodness of fit. Then we prune data that is below average.

Algorithm 2: Personalized Pruning Algorithm $\Pr une(S_j, Huser)$

Input: $S_j, Huser, S_x \in S_i;$

Output: $S_R, S_R \in S_i;$

Begin:

1) $num = count(S_i); num$ is the number of items in the frequent itemset.

2) $For\ \omega = 1; num$

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3) $N_1 = total(S_\omega); S_\omega = \{S_x^\omega\}, S_x^\omega \in S_x$.

4) $N_2 = count(H_{user}); N_3$ is the number recorded in H_{user}.

5) $N_3 = N_1 / N_2$.

6) $N_4 = num / count(H_{user})$

7) Records with $if\ (N_3 < N_4);$ less than average are pruned.

Remove S_x from $DeleteS_\omega; S_i$

8) $\mathrm{Re}turn(S_R)$

End

Among them, N_4 is the selected threshold.

5. Conclusion

With the development of virtual reality technology, the need for reality technology to become more and more popular, virtual reality tourism will become a new hot spot in the tourism industry. Due to the defects of the domestic virtual tourism system in the form of restoration of scenic spots, the interaction of the tourism system is not strong, and users can only passively accept the boring display of scenic spots pictures in the tourism system, but cannot actively conduct in-depth interaction and interaction with scenic spots. Exploration, which greatly reduces the attractiveness of the travel system to users. This paper designs a tourism virtual reality system in Zhuhai Scenic Area. Through the interaction between tourists and the system, the lack of alienation and lack of emotion in traditional virtual tourism can be reduced, and the convenient interaction and entertainment mode of virtual tourists can be realized, and the sense of participation of tourists can be improved.

Acknowledgments

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