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Research Article

The Application of Virtual Reality Technology in the Coordination and Interaction of Regional Economy and Culture in the Sustainable Development of Ecotourism

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Under the background of the new normal economy, ecotourism maintains a good momentum of development. Therefore, it can be foreseen that industrial integration is an inevitable trend in the development of contemporary industries, and the integration of cultural industries and tourism industries will bring good effects to regional economic development. In order to fully study the impact of ecotourism and its applied technologies on regional economy and culture, this paper proposes research on the application of virtual reality technology in the coordination and interaction of regional economy and culture in the sustainable development of ecotourism. The approach of this paper is to study VR technology in digital tourism and then to evaluate the sustainability of ecotourism and economic culture. The role of these methods is to study the interaction process between the tourism industry, regional economy, and cultural industry. It explores the law of action between the three so as to achieve the purpose of system optimization. Taking Henan Province, China, as an example, this paper discusses the application of virtual reality technology in ecotourism and studies the impact of ecotourism on economy and culture. The experimental results show that the average value of ecotourism-economic-cultural coordination degree in Henan Province is 0.399, and it is urgent to apply virtual reality technology in ecotourism.

1. Introduction

China is a vast land with abundant resources and abundant ecological resources. Protecting a country and its ecological resources has always been an important issue in China's economic and cultural construction. In the Internet age, the development of digital technology and virtual tourism provides new ways and possibilities to solve this problem. Virtual tourism refers to the virtual reconstruction of historical buildings through digital means. This paper focuses on the virtual tourism system based on augmented reality technology. The technology is relatively immature now and has many practical problems. Virtual tours allow Internet users to "tour" the world in their living room using the technology platform provided by virtual reality. Its birth brings new challenges and opportunities for development. The history of traditional tourism and the research on virtual tourism system design have become international hot topics.

Virtual tours of existing tourist landscapes are being developed in many places. The construction of virtual ecotourism can not only promote scenic spots, increase influence, attract tourists but also meet some requirements for visiting tourist attractions. Second, virtual tours can be developed for tourist landscapes that no longer exist or are about to disappear, and these can be reproduced. These digital landscapes are collectible and a natural and effective way to protect, reproduce, and disseminate cultural heritage. Carrying out virtual tours for tourist attractions that have been planned or are under construction but not yet built can play a role in promoting the scenic spots, expanding their influence, and attracting tourists. After the completion of the scenic spot, tourists are officially welcomed for on-site tours.

Virtual ecotourism can also satisfy people's curiosity. Many places will develop virtual tourism systems for places that are currently difficult or impossible for humans to reach. The networked development of the tourism industry can promote the common development of other types of cultural industries and improve the scientific and technological contribution of the cultural industry. Based on the conceptual model of tourism industry integration, the virtual tourism system defines and constructs three tourism industry integration models. Previous studies have analyzed different integration modes of tourism but lack a systematic explanation for the integration process of different integration modes. Different tourism industry integration models have different reasons, processes, and consequences of integration. The integration process model of various integration models can better guide the development of tourism industry integration practice by distinguishing the innovative forms and contents formed by the integration of the tourism industry and actual industries.

The research innovation of this paper is mainly reflected in the construction of the conceptual model of tourism industry integration in theoretical research, and on the basis of this conceptual model, a tourism industry integration model is proposed. The ecotourism industry model has the essential difference and completeness of the concept in the type classification. It reflects the essential differences in conceptual meaning between the different models while covering all integrative and practical phenomena. Secondly, the survey method of this paper breaks the limitation of qualitative analysis in the current tourism comprehensive model survey. Based on the relationship between industry associations, industry alliances, industry clusters, and industry integration, this paper puts forward relevant research hypotheses and tests the integration model of tourism through input rate analysis, joint integration analysis, and correlation analysis.

2. Related Work

With the increasing contribution of ecotourism to the economy and culture, more and more scholars are studying ecotourism topics, including VR technology for virtual tourism. Appel *L* developed the CVRRICULUM program, which plans to recruit teachers to adapt traditional written assignments to a VR format. He used mixed methods to collect data from 4 teachers and 20 student participants. Despite the many benefits and affordances of VR, widespread adoption in postsecondary education has been limited. And there is still a gap in providing detailed guidance for implementing the technique in the curriculum [1]. Arnoni *J* aims to investigate the effect of nonimmersive virtual reality as an assisted rehabilitation on the functional range of motion and gait in children with mild unilateral cerebral palsy. He randomly divided 22 cerebral palsy patients into two groups through random, controlled clinical trials and other methods. Experimental results show that VR therapy can effectively help children with cerebral palsy recover [2]. Lee H S used the conceptual framework of the sustainability of the Ramsar wetland ecotourism site in South Korea as an evaluation index and made a list of measurement variables based on the index. He believes that economic sustainability is divided into economic effects of creation and effects related to protection, and ecotourism and its technologies can effectively improve the economic level of the region [3]. Anuar A uses a semistructured interview method, based on three travel agencies, using a purposeful sampling method to select respondents based on travel agencies with ecotourism packages. He studies the impact of VR equipment on ecotourism and travel agencies and assesses the readiness of travel agencies to face VR equipment [4]. Carvache-Franco *M* analyzes the motivation and segmentation of ecotourism demand based on functional theory. He fielded 386 questionnaires in Ecuador's Machalilla National Park. He analyzed the data using factor analysis and nonhierarchical segmentation and concluded several dimensions of ecotourism motivation [5]. Allegretti uses the theoretical framework of social, cultural, and rural geography to study the integration of rural, pastoral, and urban economies. By analyzing the economic and cultural value of ecological resources, he pointed out a way to combine urban and rural areas based on ecological tourism resources [6]. Young-Chun is based on recent humanistic research on history, politics, social affairs, and religion. He believes that it is necessary to link the tourism industry with the regional economy and link the ecological environment with economic growth opportunities [7].

3. Application Methods of VR in Ecotourism

3.1. Image Processing Module in Tourism. The image processing module is to process the real scene image obtained by the camera. It correctly identifies the scene from the prestored standard library, so the technology mainly involved in the image processing module is image recognition technology. Generally, the captured images will not be affected. Because in the process of image processing, due to the shooting time, shooting angle, natural environment, differences in the use of different sensors, and the defects of the sensor itself. This makes the images all affected to varying degrees. Image quality is only disturbed by noise but can also cause severe grayscale and geometric distortions. The purpose of recognition is to overcome various interferences and find the same name point between two images in this case. Therefore, how to make the recognition algorithm with high accuracy, fast speed, robustness, and strong anti-interference has become the research direction of researchers [8]. From the perspective of the existing image recognition technology, it mainly includes two categories: grayscale-based image recognition technology and feature-based image recognition technology.

The four traditional grayscale-based image recognition algorithms are introduced in turn as follows: The size of the image S to be tested is $M \times N$, and the size of the template image T is $m \times n$, where $M > m$ and $N > n$. During image sorting, the template image T is placed and moved to the top of the image under test. The size of the $m \times n$ area covered by the template image on the measured image is called the

subimage S_w. Here (u, v) is called the reference point, the upper left pixel coordinate of the subimage S_{uv} of the image S under test. The value ranges of u and v are $1 \le u \le M - m + 1$, $1 \le v \le N - n + 1$.

The absolute difference algorithm is a classic matching and recognition algorithm based on image grayscale correlation. The algorithm can be defined as follows:

$$d(u, v) = \sum_{i=1}^{m} \sum_{j=1}^{n} |S(i + u, j + v) - T(i, j)|. \quad (1)$$

Among them, d (u, v) represents the coincidence value of the similarity function of the reference point (u, v). When d (u, v) takes the minimum value, it is considered to be the best coincidence point. This method is relatively easy but sensitive to noise. As the signal-to-noise ratio increases, the recognition rate gradually decreases.

The principle of the absolute balance search method is to use the grayscale difference between the template image and the test image in the search area to measure the correlation between the two. The grayscale difference calculation method of this algorithm commonly uses three methods: minimum mean square error function (MS), minimum mean absolute value function (MA), and maximum pixel difference classification (PD) [9]. The matching algorithm is as follows:

$$\begin{aligned} \mathrm{MS}(u, v) &= \frac{1}{mn} \sum_{i=1}^{m} \sum_{j=1}^{n} (S(i + u, j + v) - T(i, j))^2, \\ \mathrm{MA}(u, v) &= \frac{1}{mn} \sum_{i=1}^{m} \sum_{j=1}^{n} |S(i + u, j + v) - T(i, j)|, \\ \mathrm{PD}(u, v) &= \sum_{i=1}^{m} \sum_{j=1}^{n} S(u, v). \end{aligned} \quad (2)$$

The advantage of the absolute balance search algorithm is that the idea is simple and easy to implement. However, it is extremely sensitive to the change of image grayscale, and the image to be tested and the template will have different grayscale values and search subimages. This makes it impossible to find a suitable threshold, so the algorithm has a high false match rate.

The normalized product correlation grayscale matching algorithm is a classic algorithm based on image grayscale correlation. The algorithm uses the normalized product correlation method to eliminate the incorrect matching of product correlations. The matching algorithm formula is as follows:

$$p(u, v) = \frac{\sum_{i=1}^{m} \sum_{j=1}^{n} S(i + u, j + v) T(i, j)}{\sqrt{\sum_{i=1}^{m} \sum_{j=1}^{n} S(i + u, j + v)^2} \sqrt{\sum_{i=1}^{m} \sum_{j=1}^{n} T(i, j)^2}}, \quad (3)$$

where p (u, v) is the matching metric value of the metric function at the reference point (u, v). When p (u, v) takes the maximum value, the point (u, v) is identified as the best matching point.

Sequential similarity detection method is a fast matching algorithm based on image grayscale. The algorithm is an improvement based on the traditional template matching method. The steps are as follows:

It defines the absolute error value:

$$E(u, v, m_k, n_k) = \left| S_{uv}(m_k, n_k) - \widehat{S}(u, v) - T(m, n) + \widehat{T} \right|, \quad (4)$$

where $\widehat{S}(u, v)$ is the pixel average of the search subgraph and $\widehat{T}$ is the pixel average of the template. It sets a suitable, constant threshold T_k. It arbitrarily selects a pixel point on the subimage S_{uv}, calculates the absolute error value E between the pixel point in the template image T and the corresponding pixel point, and then accumulates the difference with any other point pair [10]. When the error exceeds the set value and reaches the threshold value T_k, the accumulation is stopped and the accumulation time R is recorded. The detection surface formula of the sequential detection method is shown in the following formula:

$$I(u, v) = \left\{ R \middle| \min_{1 \le R \le mn} \left[\sum_{k=1}^{r} E(u, v, m_k, n_k) \ge T_k \right] \right\}. \quad (5)$$

3.2. VR Technology in Digital Tourism. Combining virtual reality technology with Java technology and Web database technology can realize virtual tourism on the Internet. Virtual tourism is divided into two parts: the construction of tourism virtual scene and the roaming of tourism virtual scene, as shown in Figure 1.

In image-based virtual reality technology, panoramic images are the basic way to store image information. The generation of panoramic images is an important task in constructing virtual panoramic space, and the quality of this task is very important. If the quality of the generated panoramic image is not high, it is impossible to obtain the effect of realistic virtual browsing. Therefore, this chapter focuses on the panorama generation algorithm and realizes the panorama generation [11]. The panorama generation steps include original image acquisition, cylindrical projection, image matching, and image stitching.

To ensure matching accuracy, large grayscale changes will complicate texture details. Therefore, in areas with obvious features of the source image, such as areas with large grayscale changes, a template must be selected to reduce the occurrence of differences. This is because, in adjacent photos with different brightness, the same scene may have slightly different degrees of drastic changes in pixel values. However, the position where the pixel value changes drastically is the same, and the similarities and differences of the scene can be judged according to this feature [12]. First, the calculation is performed for each pixel (i, j) in the source image I_1. It computes the sum of squares of (i, j) and the difference between the grayscale values of two adjacent pixels horizontally, vertically, and diagonally. It records the minimum eigenvalue of the grayscale change of point (i, j), denoted as P (i, j), and the grayscale value of each pixel is denoted as g (i, j).

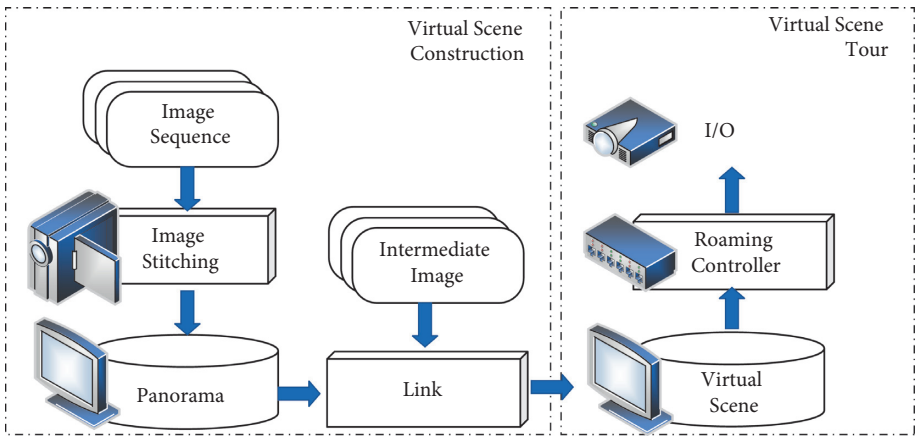

Figure 1: System model of virtual tourism.

$$P(i, j) = \min(h, v, l, r). \tag{6}$$

The calculation method of various elements in formula (6):

$$\begin{aligned} h &= [g(i, j) - g(i, j-1)]^2 + [g(i, j) - g(i, j+1)]^2, \\ v &= [g(i, j) - g(i-1, j)]^2 + [g(i, j) - g(i+1, j)]^2, \\ l &= [g(i, j) - g(i-1, j-1)]^2 + [g(i, j) - g(i+1, j+1)]^2, \\ h &= [g(i, j) - g(i-1, j+1)]^2 + [g(i, j) - g(i+1, j-1)]^2. \end{aligned} \tag{7}$$

The algorithm proposed in this paper adopts the matching method of rough first and then fine. But it does not need to preprocess the image like the hierarchical search method, but searches directly from the original image. And because the setting of the threshold value in the traditional SSDA directly affects the execution speed and matching effect of the algorithm, it is difficult to select an appropriate threshold value. Therefore, this algorithm adopts an adaptive threshold, which is called the cumulative error minimum method here. After these steps, the collected images can be processed to construct an ecotourism VR scene.

3.3. Sustainability Assessment of Ecotourism and Economic Culture. Input-output method can measure the degree of integration of tourism industry and cultural industry. However, in order to highlight the difference between the integration of the cultural industry led by the tourism industry and the integration of the tourism industry led by the cultural industry, the calculation method of the integration degree has also been improved accordingly. This paper adopts the proportion of cultural industry investment in the total output value of tourism industry as a comprehensive indicator of the active integration of cultural industry and tourism industry and measures the degree of integration of active integration of cultural industry. Tourism industry integration degree i actively integrates cultural industry j:

$$B_i A_j = B_i / A_j. \tag{8}$$

Among them, B_i represents the intermediate input of industry i in the tourism industry to industry j in the cultural industry and B_j represents the total output of industry j in the cultural industry. The degree of integration of the industry i initiative in the tourism industry to the integration of cultural industries:

$$B_i A = \sum_{j=1}^{n} B_i A_j, \tag{9}$$

where n is the total number of industries in the cultural industry. The degree of integration of cultural industry i industry and tourism industry j industry:

$$A_i B_j = A_i / B_j. \tag{10}$$

Among them, A_i represents the intermediate input of industry i in the cultural industry to industry j of the tourism industry, and B_j represents the total output of industry j in the tourism industry. In the cultural industry, the degree of integration of the industry i initiative to the integration of the tourism industry is as follows:

$$A_i B = \sum_{j=1}^{m} A_i B_j, \tag{11}$$

where m is the total number of industries in the tourism industry. When $B_i A_j > A_i B_j$, it means that the tourism industry i industry takes the initiative to drive the cultural industry j industry to integrate.

As a new stage of China's tourism development, global tourism has expanded the scope of scenic spots. It takes the tourist destination as a large scenic spot to build and plan [13]. Taking the tourism life cycle theory as the theoretical basis, it will link the new stage of tourism and the tourism life cycle. The mutual confirmation and mutual explanation of the two can enrich the research content of the tourism destination life cycle theory. Moreover, it helps to deepen the sublimation of the connotation of global tourism from practice to theory and to recognize the life cycle characteristics and development requirements of the development stage of global tourism. This promotes the promotion and application of the global tourism

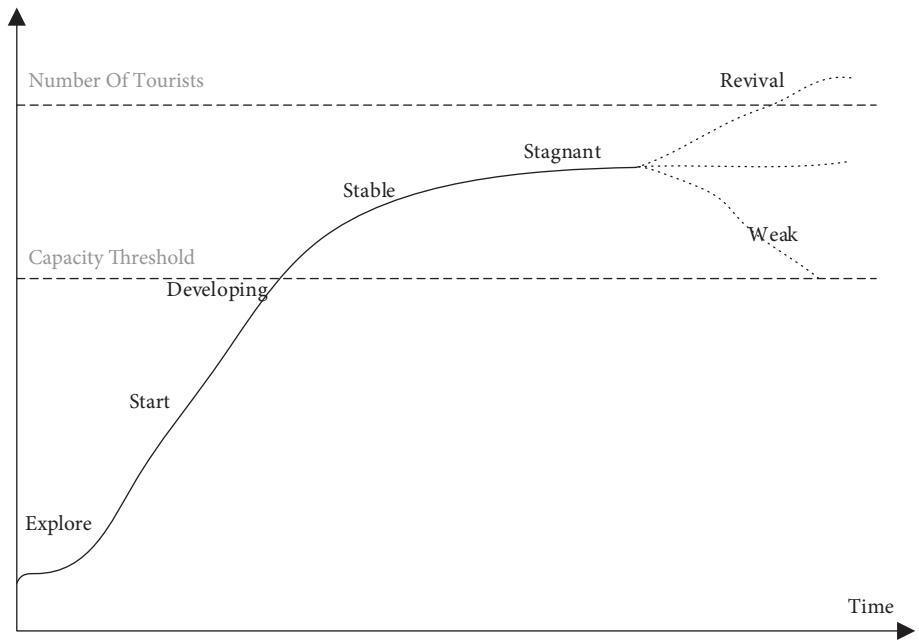

Figure 2: Tourism destination life cycle model.

development model. The research on the tourism life cycle mainly focuses on revealing the evolution process of the tourism destination. The life cycle model is shown in Figure 2.

The action guide for the optimization and specification of the global tourism sustainable development evaluation system is the "Global Tourism Sustainable Development Goals". It is the basic plan for the sustainable transformation of global tourism [14]. Coordination and development are the ultimate goals of the global tourism sustainable development system. Development is a fundamental task of the global tourism sustainable development system. Coordination is an important tool to ensure the common development of the whole system and part of the system. According to the above analysis, the subsystems of global tourism sustainable development are in the process of dynamic connection with each other. Through the interaction of various cohesive forces, the system presents a state of regional coordinated development. The coordination of the global tourism sustainable development system is mainly the coordination of the social subsystem, the tourism economic subsystem, and the ecological environment subsystem. In order to facilitate understanding and enhance the operability of coordination goal setting, a coordination degree model combining static and dynamic is used to reveal its evolution process. Its expression formula is as follows:

$$L_s(i) = \prod_{j}^{n} W_{i,j} A_i, 0 \le H_s(i) \le 1,$$
$$L_d(t) = \frac{1}{T} \prod_{j=0}^{T-1} W_{i,j} A_i, 0 \le H_d(i) \le 1. \quad (12)$$

In the formula, $L_s(i)$ represents the static coordination value of the global tourism sustainable development system at a certain time, and the larger the $L_s(i)$, the better the coordination. A_i is the standardized value of each subsystem, $W_{i,j}$ is the measure of the satisfaction of each subsystem at time i, and $W_{i,j} \in [0, 1]$. $L_d(t)$ refers to the dynamic coordination degree value of the global tourism sustainable development system, and 2 refers to the change of the static coordination degree value at the time (T − t)~t [15]. The ecotourism sustainability assessment system is a complex system composed of many elements. In this paper, the linear equilibrium method is used to quantitatively reflect the overall status and evolution process of the system. The formula is as follows:

$$u_i = \sum_{i=1}^{n} w_{i,j} \times u_{i,j}. \quad (13)$$

Among them, u_i represents the comprehensive evaluation value of the ecotourism industry of a certain place in the ith year, $u_{i,j}$ is the contribution of index j to the tourism industry, and $w_{i,j}$ is the weight of the index. In order to avoid the influence of subjective factors, the entropy method is used to determine the weights of indicators.

In this study, the coupling degree and coupling coordination degree models are used to quantitatively evaluate the mutual influence and role degree of each subsystem in the global tourism sustainable development system in Shandong Province. According to the coupling coordination principle between multiple systems, the coupling coordination degree model of tourism economic subsystem, social subsystem, and ecological environment subsystem is constructed. The formula is as follows:

$$C = \left\{ \frac{(Z(l) \cdot Z(s) \cdot Z(h))}{\left[(Z(l) + Z(s) + Z(h)/3)^2 \right]} \right\}^{1/3},$$
$$\begin{cases} D = (C \times T)^{1/3}, \\ T = aZ(l) + bZ(s) + cZ(h). \end{cases} \tag{14}$$

In the formula, Z (l), Z (s), Z (h) are the tourism economic subsystem, social subsystem, and ecological environment subsystem, respectively. D is the value of the coupling adjustment degree, C is the coupling degree between the three subsystems, and the comprehensive level values a, b, and c are the undetermined weights. Considering that tourism economy, society, and ecological environment are equally important, $a = b = c = 1/3$. C∈[0, 1], D∈[0, 1], and the coupling degree is divided by the uniform distribution interval method. According to the above formula, the degree of coupling and coordination among the tourism economic subsystem, social subsystem, and ecological environment subsystem of China's ecotourism sustainable development system is calculated. The results are shown in Figure 3.

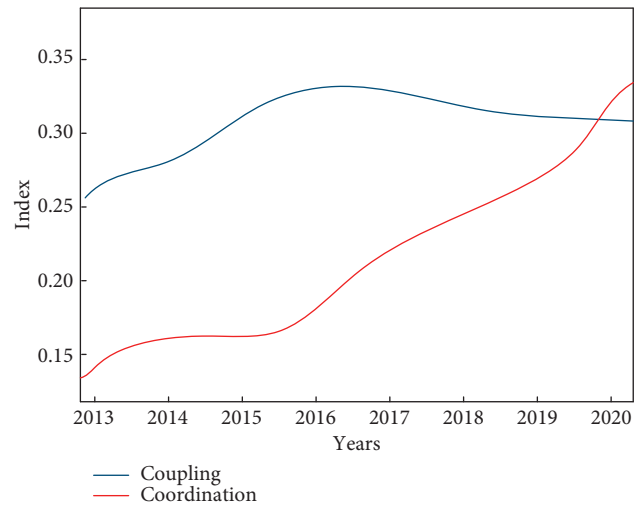

Figure 3: The coupling degree and coupling coordination degree of the three subsystems of China's tourism sustainable development system.

4. Experiment on the Influencing Factors of Virtual Reality Technology on Economy and Culture

4.1. Application of Virtual Reality Technology in Ecotourism. Virtual reality technology (VR for short) is based on computer technology. It combines related science and technology disciplines to create a digital environment that is very similar to a specific range of real-world environments in terms of vision, hearing, touch, etc. In the real virtual environment established by virtual reality technology, people's vision, hearing, and even touch feel as if they are in the real environment. In other words, people feel like they are there. People can immerse themselves in this environment and have real-time conversations. This is called "intimacy", "interaction," and "conceptualization" [16].

Panoramic image stitching refers to a scene rendering method that uses partially overlapping image samples obtained by camera translation or rotation to generate larger or 360-degree omnidirectional images. It first looks for control points representing the same feature in different images. The feature descriptors of different images are then compared with each other to find features that match each other in different images [17]. It determines inliers in all found matches, removing mismatches due to limitations in feature similarity. Then image registration is performed, and the model parameters of each frame of the image are calculated. Finally, the panorama is drawn and generated. It includes horizontal position adjustment, illumination compensation adjustment, multichannel image mixing, and black border removal.

The panorama browser reads the scene script and transmits the panorama as needed. It changes the camera orientation and focal length according to user input, converts the spherical panorama into a flat projection in real time, and displays it on the screen. Figure 4 shows the roaming tool workflow and main modules.

After obtaining the spatial transformation relationship between the images to be registered, this paper needs to choose an appropriate image synthesis strategy. It completes the image stitching to obtain a composite image. The so-called image synthesis is to combine the information of two or more images. It obtains a more accurate, comprehensive, and reliable image description for the same scene, so as to realize the final image stitching. Image synthesis is widely used in military, remote sensing, machine vision, and medical imaging.

Considering the practicality of the system, this paper proposes a virtual tourism system that can be applied to outdoor. The system relies entirely on computers to achieve the effect of augmented reality. Figure 5 shows the implementation of the system.

The real-world images captured by the camera are input to the computer, seamlessly combined with the computer-generated virtual scene, and finally, output to the screen. As a new means of communication, virtual tourism can present more comprehensive and complete site information to the world without changing and affecting the status quo of Chinese cultural heritage and cultural relics [18]. At present, the technologies involved in virtual tourism include virtual reality technology and augmented reality technology. The current mainstream technology is virtual reality technology, and the application of augmented reality technology is still relatively small.

As of today, the presentation of original ecological art by virtual reality technology is still a blank. But there is a very clear example in the field of cultural heritage that this article can learn from, that is, the "Digital Dunhuang" network museum. It realizes the preservation and digital processing of Dunhuang cultural relics with the help of VR technology, innovates the preservation methods on the basis of retaining the intangible cultural heritage, and better restores the glorious history of Dunhuang.

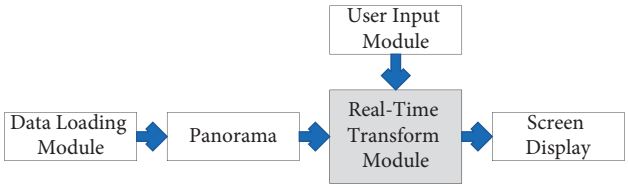

Figure 4: Panorama browsing workflow.

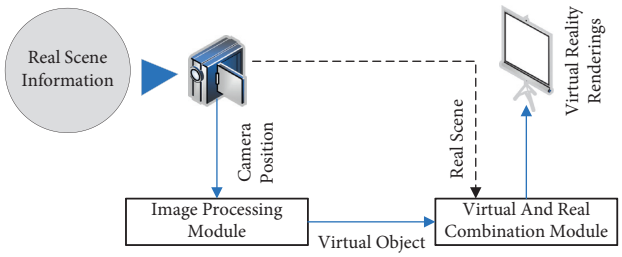

Figure 5: Implementation plan of the outdoor virtual tourism system.

The "Digital Dunhuang" online museum has made a panoramic tour for each cave, and the experiencer can choose two browsing methods. One of them is to click the arrows on the screen to move the screen left and right up and down. There is no stereoscopic effect in this way, but every orientation map of the cave can be seen [19]. The other is to switch to VR mode, where it can watch by wearing VR glasses. At this time, the experiencer enters the virtual situation of the cave, and the situation inside will also change with the movement of the experiencer's head. In this mode, the experiencer seems to have entered the cave and can watch from any angle. The project team of "Digital Dunhuang" uses VR technology to truly restore the panoramic shape of the cave to the experiencer. Experiencers can come here to browse from all over the world as long as they wear VR glasses. The only fly in the ointment is that the current VR mode experience requires moving the center cursor to change direction. This operation greatly hinders the smoothness of browsing. It hopes that in future designs, the experiencer will not be restricted by the cursor after wearing VR glasses. The scene can be changed according to the footsteps of the experiencer, and the experiencer can browse at will. The VR display effect of "Digital Dunhuang" is shown in Figure 6.

It can be said that "Digital Dunhuang" provides a very good idea for this article, and people can also reproduce the original ecological art in VR. This allows the experiencer to truly enter the scene where the art takes place, face-to-face with the people who perform the art. The experiencer can perceive the place where the art takes place and feel the unique charm of the original ecological art [20].

4.2. The Impact of Tourism Digitalization on Ecotourism. Virtual reality technology can break through environmental constraints and save research funds. It has also been initially applied in aerospace, architecture, medical care, education, art, sports, and other fields, such as virtual city exhibitions, virtual exhibitions of tourist scenery, virtual museums, virtual real estate exhibitions, and virtual exhibitions of architectural planning [21]. With the advancement of technology, tourist destinations use information systems such as VR and AR to provide tourists with a more realistic and immersive virtual environment, enhancing social presence. In the context of the virtual environment, design existence has become a research hotspot.

Based on this, this study proposes the following hypotheses: H1: The quality of the cultural heritage digital system positively affects the tourism experience. H2: The quality of cultural heritage digital content has a positive impact on the tourism experience. H3: The quality of digital interaction of cultural heritage has a positive impact on the tourism experience.

It selects tourists who visit ecological parks as research objects. It distributes the questionnaires through field distribution, one-to-one electronic questionnaires, and entrusting the assistance of tourism practitioners. In the experiment, 500 questionnaires were actually collected, and 22 invalid questionnaires were deleted through the analysis and arrangement of the original data. Finally, 478 valid questionnaires were obtained, with an effective rate of 95.6%. Table 1 reflects the demographic characteristics of the survey sample of this study.

Table 2 shows the descriptive statistical analysis of the mean, standard deviation, variance, skewness, and kurtosis of each scale variable measurement index.

The standard deviation of the indicators in the table is between 0.5 and 0.8, indicating that the data has a certain stability. In a structural equation model, the data must follow a normal distribution with absolute skewness within 2. The absolute value of kurtosis is within 7, indicating that the data is normally distributed. The absolute values of kurtosis and skewness of each measure in the table are reasonable, indicating that a structural formula model can be established.

Structural formula models were built and tested by AMOS. The results are shown in Table 3.

Figure 6: Panoramic tour of the cave.

Table 1: Sample demographic characteristics.

Demographic variables	Sample structure		Demographic variables	Sample structure	
	Category	Effective percentage		Category	Effective percentage
Gender	Male	0.636	Age	Below 18	0.034
	Female	0.364		18–25	0.127
Profession	Self-employed persons	0.365		26–30	0.304
	Corporate staff	0.143		31–40	0.329
	Education staff	0.114		41–50	0.142
	Professional worker	0.102		51–60	0.052
	Freelancer	0.078		Over 60	0.012
	Government officer	0.071	Education	Junior high school	0.026
	Student	0.056		High school	0.057
	Retirees	0.014		Specialist	0.071
	Soldier	0.008		Undergraduate	0.739
	Other	0.049		Master degree	0.107

Table 2: Descriptive statistical analysis of measurement indicators.

Facet	Item	Average value	Standard deviation	Variance
Content quality	CQ1	4.307	0.588	0.444
	CQ2	4.439	0.553	0.423
System quality	SQ1	4.018	0.781	0.498
	SQ2	3.996	0.694	0.455
Quality of interaction	IQ1	4.175	0.776	0.332
	IQ2	4.404	0.519	0.327
Presence	P1	4.490	0.532	0.500
	P2	4.087	0.521	0.408
Travel experience	TE1	4.473	0.619	0.373
	TE2	4.051	0.556	0.389

Table 3: Direct path correlation coefficients.

		P
Presence	Content quality	***
	System quality	***
	Quality of interaction	0.371
Travel experience	Content quality	***
	System quality	***
	Quality of interaction	0.292
	Presence	0.393
Willingness to Act	Travel experience	***
	Presence	***
	Content quality	***
	System quality	0.341
	Quality of interaction	***

Note. * means $P < 0.05$, ** means $P < 0.01$, *** means $P < 0.001$.

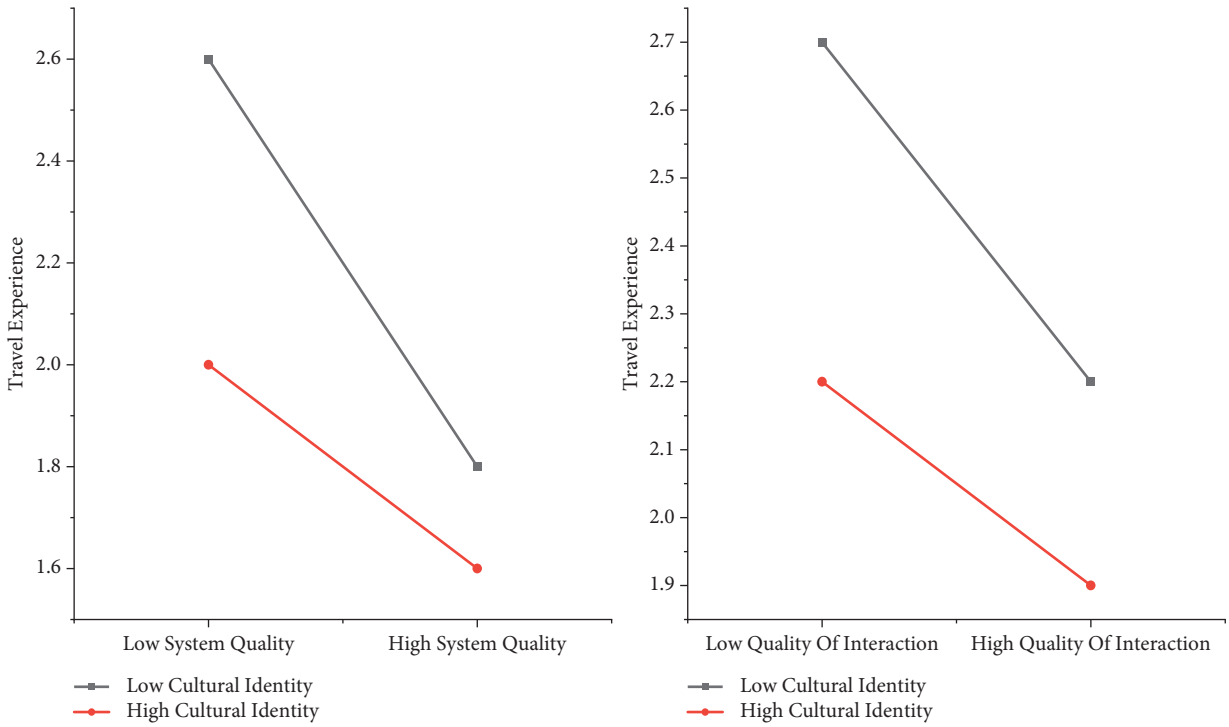

Figure 7: The mitigation effects of system quality, interaction quality, and cultural identity on tourism experience.

In terms of the impact of ecotourism digitization on tourism experience, the nonstandardized coefficients of each dimension are positive. And there is a significant correlation at the 0.05 level, so it is assumed that H1, H2, and H3 are established.

Previous analysis has shown that consumer innovation has no moderate impact on interaction quality, system quality, and travel experience. Therefore, further analysis is needed on the quality of interactions, the quality of systems, and trends to mitigate the impact of cultural identity on the travel experience. It divides cultural identity into high and low groups according to plus or minus one standard deviation and uses a simple slope method to explore its moderating effect on tourism experience [22]. It plots the trend of the moderating effect of different levels of cultural identity on tourism experience, as shown in Figure 7.

The fitting curve of cultural identity to system quality and tourism experience is relatively flat. With the enhancement of cultural identity, the negative predictive effect of system quality on tourism experience increases [23]. That is, when cultural identity is low, the negative effect of system quality on tourism experience is weaker. When cultural identity is high, the negative predictive effect of system quality on tourism experience is significantly enhanced.

It then explores the trend of moderating effects of cultural identity and consumer innovation on interaction quality. The results are shown in Figure 8.

When cultural identity is low, the positive effect of system quality on behavioral intention is weaker. The moderating effect of cultural identity on interaction quality and behavior intention is consistent with that of system quality.

It explores the moderating effect trend of consumer innovation, system quality, and behavioral willingness, and the results are shown in Figure 9.

When consumers are less innovative, the negative effect of system quality on behavioral intention is weaker. The moderating effect of consumer innovation on interaction quality and behavioral willingness is consistent with that of system quality.

There are multilevel mechanisms between the content quality, system quality, interaction quality, and tourist behavior willingness of ecotourism digitization. The higher the cultural identity of tourists, the greater the negative impact of interaction quality and system quality on tourism experience. This shows that the application of digital technologies such as VR in ecotourism can effectively attract tourists, thereby promoting the development of the industrial chain and improving the regional economic level. At the same time, more tourists can feel the charm of ecotourism, which is conducive to promoting the cultural concept of sustainable development and promoting regional cultural development [24].

4.3. The Impact of Ecotourism on Economy and Culture. It is necessary to promote tourism with culture, promote culture with culture, and seek comprehensive development. Culture is the soul of tourism, and tourism is the carrier of culture. Culture improves the quality of tourism, and tourism promotes cultural dissemination. This paper attempts to introduce virtual reality technology into the study of dynamic changes in ecological landscape patterns. This can not only reproduce the wetland landscape in the past and more intuitively see the dynamic changes of the

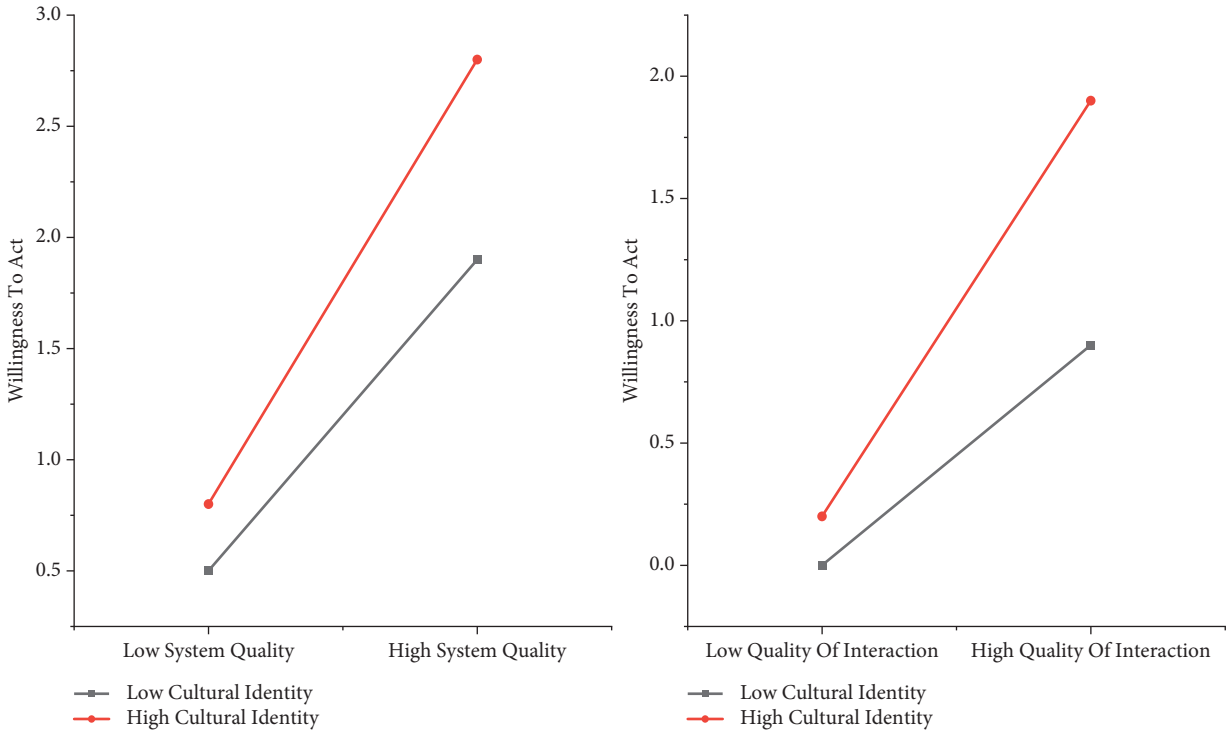

Figure 8: Moderating effects of system quality, interaction quality, and cultural identity on behavioral intent.

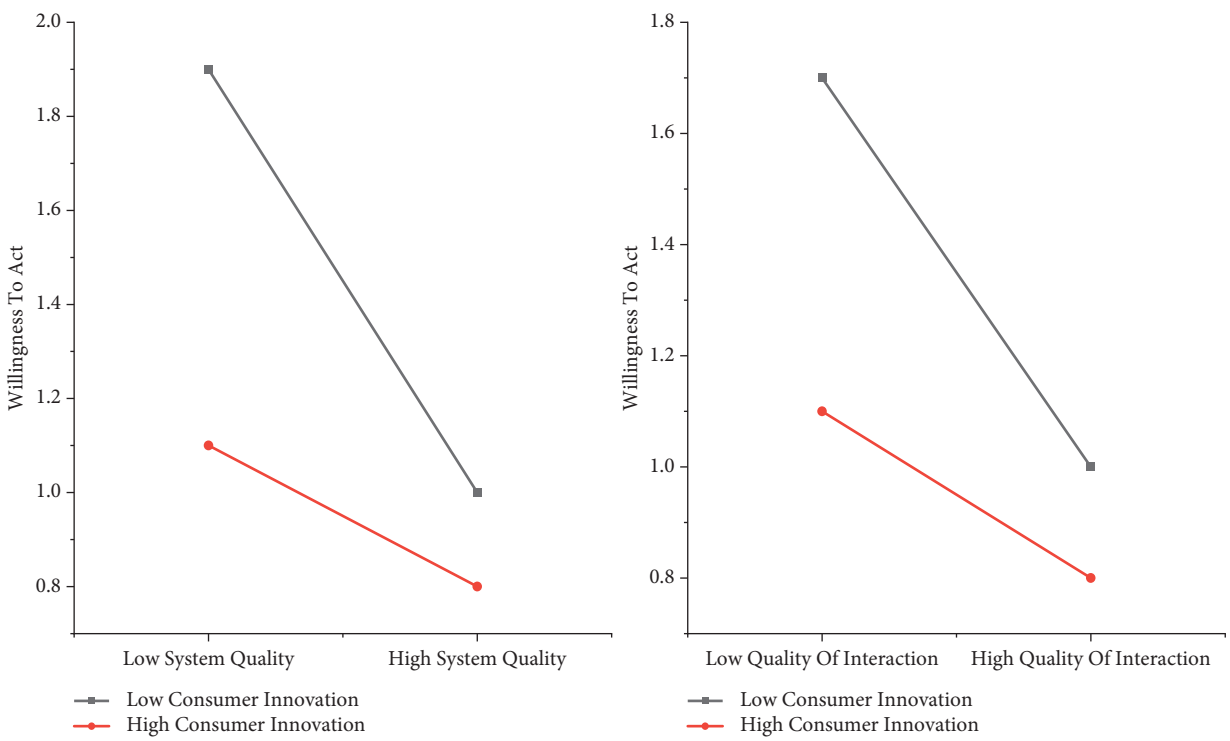

Figure 9: Innovations that mitigate consumers' perceptions of system quality, interaction quality, and willingness to act.

ecological landscape pattern, but also help to optimize the landscape planning and design scheme and guide the planning practice. This makes the management of ecological landscapes more scientific and systematic and improves the comprehensive utilization of ecotourism resources.

Tourism industry, regional economy, and cultural industry were originally three relatively independent systems.

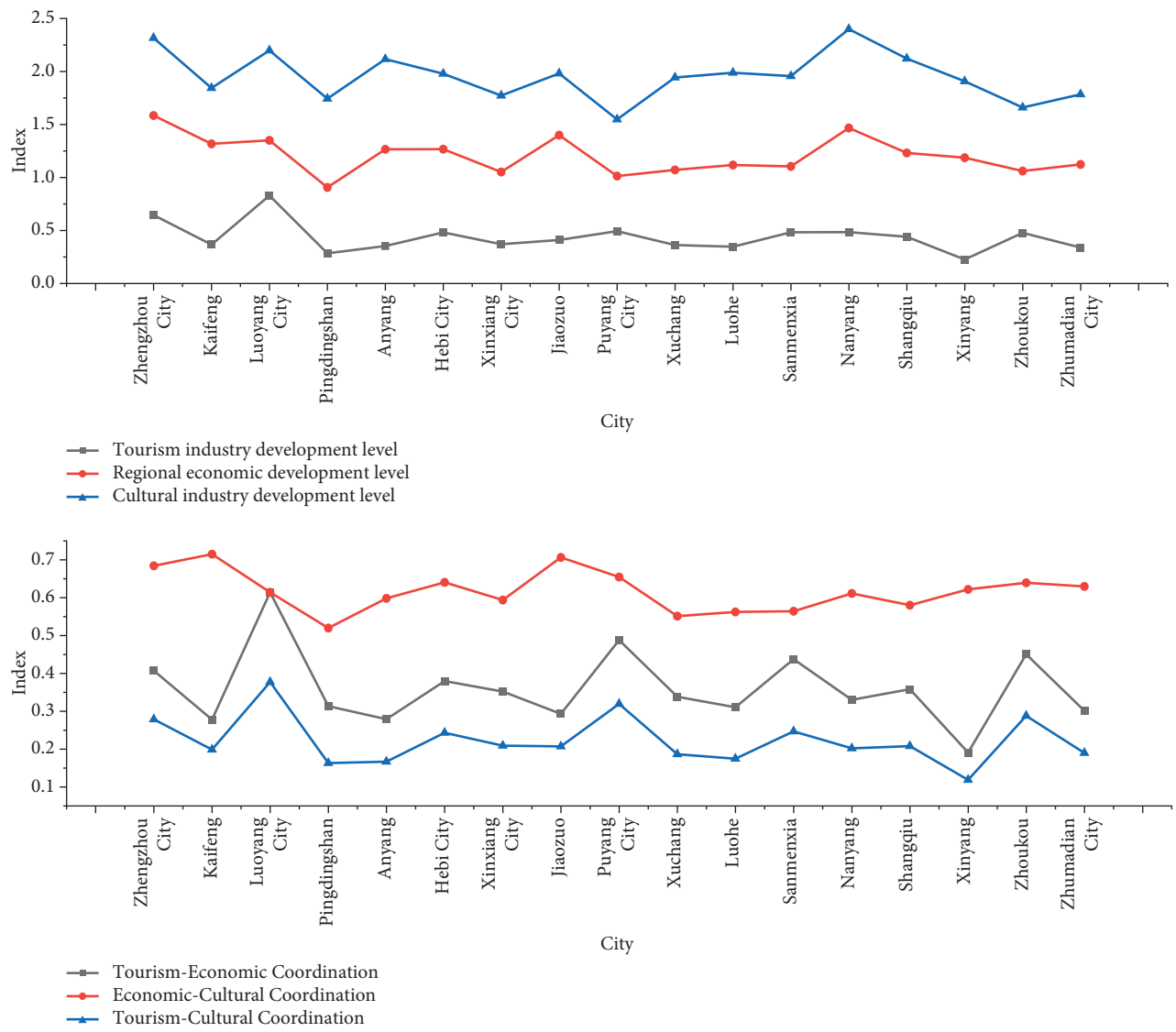

Figure 10: Tourism-economic-cultural comprehensive development level and coordination degree in various cities in Henan Province.

The coupling between the three means that the three independent systems and the independent elements in each system finally form a relationship of mutual influence and correlation through a series of connections. The elements of each system are interdependent and mutually influencing. They can develop symbiotically at the system level and finally realize the coordinated development of the tourism industry, regional economy, and cultural industry. One-sided pursuit of the benefit maximization of the development of any one system will affect the harmonious symbiosis among the three systems. Of course, the lagging development of any one system will also hinder the comprehensive development benefits of the three systems. The coupling between the three systems is based on breaking the original independent operation mode of the respective systems, breaking through the barriers between the original systems, and effectively combining their respective structures and functions. But this coupling does not mean a simple superposition between the elements of each subsystem but through continuous penetration and fusion. This ultimately optimizes the structures and functions of the three systems, which is conducive to the mutual promotion and coordinated development of the three systems.

Taking Henan Province in China as an example, according to the statistics obtained from the public documents of the Henan Provincial Government, this paper has produced the tourism-economy-cultural level of Henan Province, as shown in Figure 10.

The overall level of tourism-economic coordination in Henan Province is relatively low, and a spatial pattern centered on Zhengzhou has initially formed. The regional differences in coordination level are relatively obvious, and the overall level of economic-cultural coordination is relatively high. There is little difference in the level of regional coordination, and the overall level of tourism-cultural coordination is low. It has initially formed a development pattern centered on Zhengzhou and Luoyang, with little difference in the level of regional coordination. Its

tourism-economy-cultural coupling coordination level is generally low and regional differences are large. The average coordination levels of tourism-economy-culture are 0.359, 0.616, and 0.222, respectively, and the overall average is 0.339.

In recent years, the ecotourism industry has played an irreplaceable role in promoting the development of related industries, stimulating employment, and promoting economic development. The ecotourism industry is a "rich people" industry and a strategic pillar industry. The development of ecotourism has promoted the development of new product formats such as the integration of culture and tourism, the integration of agriculture and tourism, and the integration of cultural and agricultural tourism.

5. Discussion

Due to limited time, the thesis has achieved the above preliminary results. But there are still some issues that need further research: The "personalized service" provided by the virtual tourism system needs to be further studied. The research on tourism data integration of building smart tourism information systems starts from the data and functional requirements of smart tourism information systems. On this basis, it strives to form a tourism data integration strategy suitable for building a smart tourism information system. The coupling and coordination research of the three subsystems of tourism, economy, and culture involves multiple industrial sectors, and the influencing factors are relatively complex. In the process of selecting the indicator system, this paper tries to find some representative indicators. There is still room for optimization in the selection of indicators, which is also the direction that should be optimized in the future.

6. Conclusion

Based on the basic theory of smart tourism and data integration, this paper uses the object-oriented method to construct a tourism data integration strategy that conforms to the characteristics of the smart tourism information system. It uses a variety of methods and technical means in the construction of the data integration model and finally completes the integration of tourism data. This paper adopts the coupling coordination degree model to analyze the coupling coordination relationship between the three subsystems of the ecotourism industry, regional economy, and cultural industry. It also analyzes the impact of virtual reality technology in ecotourism on the regional economy and culture.

Data Availability

The data used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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