Computer-Aided Internet of Things System Structure for Urban Tourist Attractions

Qingqing Liu[1,*] and Qing Wei[2,3]

[1]School of Tourism & Exhibition, Henan University of Economics and Law, Zhengzhou 450002, China, qingqing_liu@huel.edu.cn
[2]School of Management Engineering, Capital University of Economics and Business, Beijing 100070, China, weiqing@cueb.edu.cn
[3]School of Computer and Information Engineering, Henan University of Economics and Law，Zhengzhou 450002, China, weiqing@cueb.edu.cn

Corresponding author: Qingqing Liu, qingqing_liu@huel.edu.cn

Abstract. Since the reform and opening up, the social and economic level has been continuously developed. The living standards of the masses have been steadily improved. Tourism activities have become an indispensable part of people's daily life. Therefore, my country's tourism industry has also achieved great development. The number of tourists is increasing year by year, and the scale of the tourism market is also expanding. At present, while my country's tourism industry is developing steadily, some new situations have also emerged. On the one hand, under the general trend of industrial integration, the tourism industry is more closely integrated with other industries. Under the current environment, many new forms of tourism have emerged in society. On the other hand, the level of information construction has been continuously improved, and the level of tourism development has also been affected to a certain extent. Information technology has become an important support for the development and transformation of the tourism industry. Based on the existing research results, this paper takes the tourist attractions as the research object, and analyzes the main ideas and key contents of the construction of smart scenic spots under the Internet of Things technology. This paper firstly clarifies the purpose, background and significance of the research systematically. In addition, this paper reviews the research situation at home and abroad, and expounds the ideas, contents, methods and innovations of this research. This paper further introduces the key technologies of the Internet of Things, and summarizes the construction of smart scenic spots from the perspective of construction background, connotation characteristics and construction specifications. Based on this, this paper further analyzes the goals of the construction of smart scenic spots. This paper comprehensively studies the

outstanding problems existing in the construction of smart scenic spots. Finally, this paper puts forward relevant suggestions from the perspective of the Internet of Things technology to promote the construction of smart scenic spots in scenic spots. The research results of this paper include four aspects: service upgrade of smart scenic spots, improvement of smart management level of scenic spots, innovation of marketing model of smart scenic spots, and improvement of security system of smart scenic spots.

1   INTRODUCTION

Smart tourism is a new form of tourism supported by information technology and Internet of Things technology. Smart scenic spots are the main body of smart tourism. Compared with traditional scenic spots, smart scenic spots are the important channel for tourists to obtain more information. Smart scenic spots provide a lot of convenience for tourists to travel. In addition, Chang [1] believed that smart tourism has also strengthened the service capabilities of the scenic spots themselves, greatly improving the service quality of China's tourist scenic spots. Based on this, Danbatta and Varol [2] believed that more and more scenic spots regard the construction of smart scenic spots as the focus of their own development. At present, Lei et al. [3] believed that the construction of tourist attractions is faced with many problems; these problems mainly include the following points. The specific contents include that smart services cannot meet the needs of the tourism market, the smart management system and mechanism are relatively lagging behind, the tourism e-commerce system is not perfect, and there is a shortage of tourism information professionals. This paper further discusses the problems existing in the smart construction of tourist attractions, including the lack of comprehensive service capabilities, the lack of modern management awareness, the lack of innovation and development awareness, and the weak talent training system.

At present, human beings have entered the information age, and information technology is widely and profoundly reshaping the production and life forms of human society. Recupero et al. [4] believed that the Internet of Things technology is an important development direction of information technology. According to the "Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries" issued by the State Council in 2009, the new generation of information technology belongs to the strategic emerging industries. The Internet of Things is an important part of the new generation of information technology. At the same time, the Internet of Things technology is also an important development direction of the information industry. Zha et al. [5] believed that the IoT technology pushes the boundaries of the Internet. The Internet of Things is deeply integrated with the Internet through various information sensing devices such as infrared sensors, laser scanners, radio frequency identification, and global positioning systems. The construction of the Internet of Things is further integrated to form a huge network including personnel, machines and materials. From this perspective, the Internet of Things can be seen as the Internet that connects all things. Nder et al. [6] believed that the development of the network has gradually shifted from the interaction between people and people to the interaction between people and things, as well as the interaction between things. The Internet of Things continues to deepen in human production and life, and the Internet of Things also plays an important role in an intelligent society. The development potential of the Internet of Things is huge. Therefore, Johnson [7] believed that the various countries take the Internet of Things technology as the focus of current research and development and application.

In 2010, China clearly pointed out in the government work report that the Internet of Things technology is a powerful tool to promote the transformation of economic development. The

characteristics of the Internet of Things make it have a wide range of application values in various industries. The Internet of Things is also a pillar force to promote the transformation, upgrading and transformation of the industry. However, the tourism industry is a key industry for the application of IoT technology. After 40 years of reform and opening up, China's social economy has achieved tremendous development, and people's living standards have continued to improve. Specifically, Li et al. [8] believed that the continuous deepening of the consumption field is a basic feature of the people's daily life. The proportion of people's basic living expenses has continued to decline. The share of mass tourism consumption expenditure continued to increase. In 2019, China's total tourism revenue was 6.63 trillion Yuan, an increase of 11% year-on-year. This growth rate is higher than that of GDP. The comprehensive contribution of tourism to GDP is close to 11 trillion Yuan, accounting for 11.05% of GDP. Abou and Soliman [9] believed that smart tourism is the overall trend of tourism development. The Internet of Things technology provides a crucial role in the development of smart tourism, and the Internet of Things technology is an important supporting technology for the development of smart tourism. The Internet of Things technology is also an important starting point to promote tourism activities and tourism management processes. In addition, the Internet of Things technology is also the core technology to realize the digitalization and intelligence of the entire tourism industry chain. Therefore, Lin et al. [10] believed that the tourist attractions in various places are based on the Internet of Things technology to further promote the construction of smart scenic spots. This work has become an urgent task for each scenic spot. Judging from the current status of the construction of smart scenic spots, there are a series of achievements and deficiencies in the development of scenic spots. Although some smart scenic spots are aware of the role of IoT technology in promoting the transformation and development of scenic spots. However, the scenic spots still have serious deficiencies in the fields of smart management system and smart services.

1.1 The Current Status of International Research on Urban Tourist Attractions

The current international related research mainly focuses on the two levels of smart tourism and tourism intelligent system. Chinese society put forward the concept of smart tourism in 2000. At that time, Phillips, president of the Canadian Tourism Industry Association, defined smart tourism in a speech. Experts believe that smart tourism is a tourism industry that adopts a comprehensive, long-term and sustainable approach to planning and marketing. Smart tourism is also a tourism service model. The proposal of this definition preliminarily clarifies the connotation and requirements of smart tourism. In 2009, some scholars called on the tourism departments of member states to actively practice the concept of smart tourism at the World Tourism Organization Tourism Committee. Scholars have discussed the connotation of smart tourism from four aspects: clean, green, moral and quality. Scholars agree that smart tourism is the key to ensuring the carrying capacity of tourist attractions. Smart tourism system is the key content to improve the quality of tourism service. Judging from the search results of Google search system and international literature databases such as SCI, relevant international research mainly focuses on two levels of smart tourism and tourism intelligent system. Some scholars believe that digital ecosystem and smart business network are the foundation of smart tourism, and the study further proposes the concept of smart tourism ecosystem. The system further draws on the concepts of smart technology, smart city and smart tourism, and systematically plans the overall architecture of the smart tourism system. The Organizational framework of recommendation system for urban tourist attractions based on Internet of Things is shown in Figure 1.

As the central content of smart tourism, smart scenic spots occupy an important position in the development of China's tourism industry and even the construction of smart China. On the basis of literature collection, reading and analysis, this paper briefly sorts out the relationship between the Internet of Things technology and the construction of smart scenic spots. This paper further sorts out the development and management modes of well-known scenic spots at home and abroad.
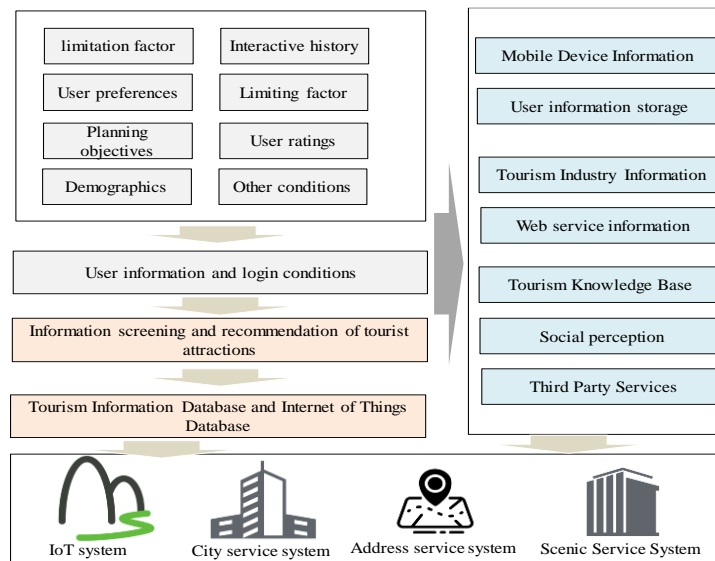
Figure 1: The Organizational framework of recommendation system for urban tourist attractions based on Internet of Things.

Starting from the construction goals of smart scenic spots, this paper analyzes the problems existing in the construction of smart scenic spots. This paper focuses on the in-depth application of the Internet of Things technology for a systematic analysis. Specifically, this paper puts forward corresponding countermeasures and suggestions from the aspects of upgrading scenic spot services, improving management level, innovating marketing mode, and improving security system. The research results of this paper, on the one hand, provide support for improving the construction effect of smart scenic spots, and on the other hand, provide reference for the construction of other smart scenic spots. At present, the tourism industry has become a pillar industry of China's national economy. From a long-term perspective, the role of the tourism industry in social and economic development will be more significant. Smart tourism is an important trend in the development of the tourism industry. This article takes the concept of smart earth as the starting point, and gradually interprets the concepts of smart China, smart tourism, and smart scenic spots. This paper studies the construction of smart scenic spots as the key content of tourism industry development. The research results of this paper have certain significance for the development of tourism industry theory.

1.2 Overview of Related Research on the Construction of Smart Scenic Spots

From the perspective of tourists' practice, the construction of smart scenic spots provides tourists with a convenient public information service platform. On the one hand, tourists can preview various information and order products and services before traveling; on the other hand, they can communicate with scenic spots during the traveling process and after the tourist activities. Tourists can interact with tourist attractions, send out consultation information and make travel suggestions. From the perspective of scenic enterprises, smart scenic spots have greatly improved the management capabilities of enterprises. With the help of the Internet of Things, enterprises can comprehensively and timely grasp the development of various resources in the scenic area.

Enterprises can dynamically monitor the situation of scenic spots and carry out precise management of the operation content of scenic spots. From the perspective of management departments, the construction of intelligent scenic spots provides business support for tourism departments, cultural departments, and market supervision and management departments. Various departments provide corresponding policy decisions through in-depth understanding of the scenic spot and tourists' demands. The operation of the smart tourism system has positive significance for promoting the standardization of scenic spot management and the overall development of China's tourism industry.

2 THE MAIN GOAL OF THE CONSTRUCTION OF SMART SCENIC SPOTS BASED ON THE INTERNET OF THINGS

2.1 The Improvement the Intelligence of Infrastructure Construction

At present, with the rapid development of information technology, smart phones with large screens are increasingly popular. The Internet has become a very important part of people's daily life. The construction of smart scenic spots fits the lifestyle of contemporary people, and intelligent hardware is an important starting point for tourist scenic spots to enhance their own soft power. Smart devices are an important means to stand out in the fierce competition in the tourism market. Therefore, this paper proposes that intelligent infrastructure is the main goal of the construction of smart scenic spots. The infrastructure construction of smart scenic spots is a systematic project. The construction of smart scenic spots involves multiple links. The Internet of Things is an important part of smart scenic equipment. Servers and computers are also important components of scenic equipment. Optical fiber networks, sensors, routers and other equipment are also an important part of network infrastructure construction. In order to make it easier for tourists to surf the Internet, the scenic spot uses the latest broadband network equipment to provide a network environment and supports all mobile device terminals to access the network. On the other hand, scenic spots focus on improving network speed, and these subtle services can improve tourists' travel satisfaction. In addition, electronic ticket purchase has become a common ticket purchase method in current tourist attractions. Through the analysis of existing data, the study found that more than 70% of young tourists in China choose electronic ticketing. With the high popularity of mobile smartphones in today's society, the use of electronic ticketing channels by tourists is also increasing. Compared with the traditional queuing to buy tickets, e-ticketing can be simply operated on the mobile phone. The overall architecture and node context relationship of the recommendation system for tourist attractions is shown in Figure 2.

This convenient form of ticket purchase greatly saves the time of ticket purchase. Not only that, traditional paper tickets cannot be reused. After tourists enter the scenic spot, most of the paper tickets are thrown away as waste paper, which also causes a great waste of resources. The smart scenic spot takes the development of the electronic ticketing system as the key content of the scenic spot construction. At present, there are three main ways to purchase electronic tickets for smart scenic spots. One is to scan the QR code to buy tickets on the spot. Every ticket window in the scenic spot has undergone years of development. While the number of tourists in my country is increasing, the demand for tourists is also increasing. The most typical situation is that the demand for cultural tourism is constantly increasing. Traditional natural landscape tours have been unable to meet the needs of tourists. Therefore, smart tourism can enhance the cultural connotation and cultural atmosphere of tourists. The construction of smart tourism has become the current focus of each scenic spot. The Internet of Things technology has provided many conveniences for tourists in tourist attractions. The combination of IoT and other technologies also supports the rapid development of scenic spots.
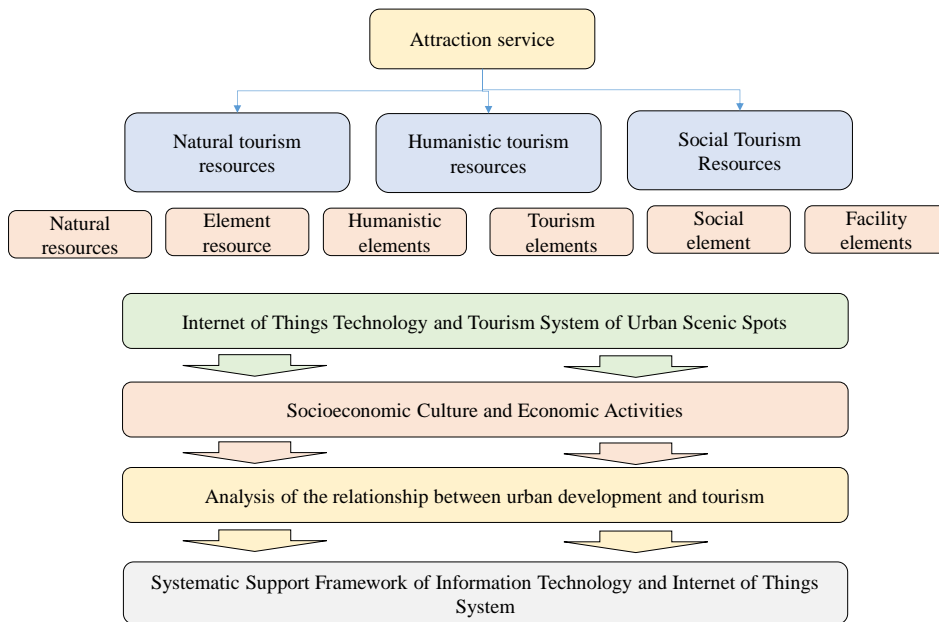
Figure 2: The overall architecture and node context relationship of the recommendation system for tourist attractions.

2.2 The High-quality Intelligent Scenic Spot Services

Tourists can obtain important information about the scenic spot by scanning the code to follow. At the same time, tourists can obtain the introduction information of various scenic spots in the scenic spot through voice introduction. In addition, major scenic spots have also launched voice explanation services. Tourists only need to enter the digital code on the sign of each scenic spot in the public account, and then they can get the audio explanation. This form provides convenience for tourists to have a deep understanding of the scenic spot information. With the continuous improvement of the degree of opening to the outside world, the number of foreign tourists visiting China is increasing every year. From the data analysis, it can be seen that foreign tourists in the scenic spot mainly come from South Korea, Japan, the United States and other countries. Therefore, the scenic spots have added Chinese, Japanese, English and other versions to the audio explanation. These tourists have the following characteristics, including low education level and poor understanding of Mandarin. The system can add local voice services according to the situation of tourists. In addition, the construction of tourism public information platform is also a basic requirement for the intelligent operation and management of scenic spots. There are three main points in the construction of the platform. The first is system openness. From a long-term perspective, the construction needs of smart scenic spots are in a stage of dynamic development. With the increase in the business volume of scenic spots, the Internet of Things equipment can be continuously updated. New technologies are also being continuously applied in various tourism links. The requirements for information management systems are also increasing. Therefore, the information management system needs to have good openness and scalability. The system must comply with various specifications and standards of software engineering in the subsequent development process. Scenic spots need to open more interfaces on the premise of ensuring

system security. The model fitting effect of Internet of things technology and tourism scenic spot management is shown in Figure 3.


Model fitting effect of Internet of things technology and tourism scenic spot management
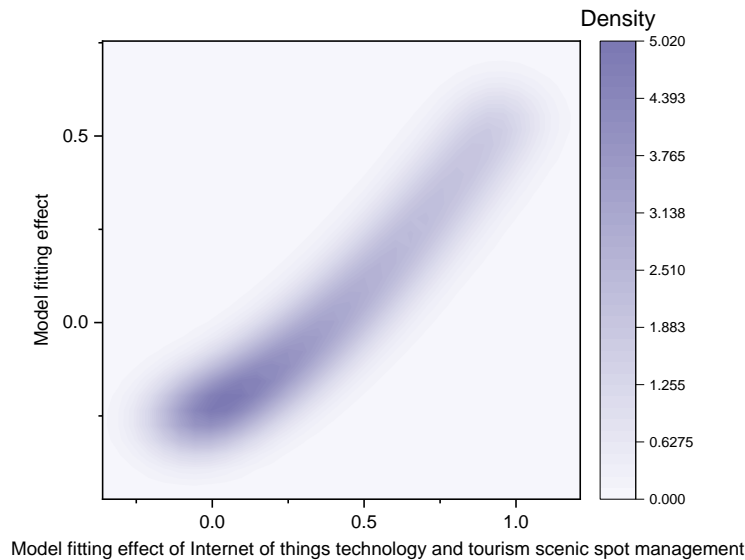
Figure 3: The model fitting effect of Internet of things technology and tourism scenic spot management.

2.3   The Level of Intelligence in the Operation of Tourist Attractions

The specification of the system structure facilitates the access of other systems. Secondly, the construction of the scenic information system needs to reflect the ease of use. There is a large number of staff in the scenic area, and the information technology operation ability of different staff members is very different. Some older staff have a low level of IT operations. The operability of the system can ensure the efficient use of the management system by the staff. In addition, the management system will inevitably have problems during operation, and professional management personnel are required for maintenance. The easy maintenance of the system can reduce the operating cost in the later stage of the system and improve the economic benefits of the system operation. Finally, the system construction needs to meet the characteristics of security and stability. The system platform should have the function of troubleshooting and automatic repair. In the case of non-major failures, the system needs to be able to automatically repair the failure to ensure the continuity of system operation. At the same time, the platform also has high requirements for security. There is a large amount of tourist information data in the tourism public information platform. These data are the basis for the operation management and marketing of tourist attractions. The platform needs to have data backup. The relationship between tourism system users and service providers is shown in Figure 4.

In addition, 3D digital technology plays a unique and important role in the construction of smart scenic spots. Scenic spots should pay attention to the application of three-dimensional digital technology. For example, the management department needs to use 3D digital technology to restore some damaged cultural relics in the scenic spot. In addition, the scenic spot also needs to use three-dimensional digital technology to present the folk stories in the scenic spot. The application of Internet of Things technology can enhance the cultural connotation of scenic spots and enhance the tourist experience of tourists.
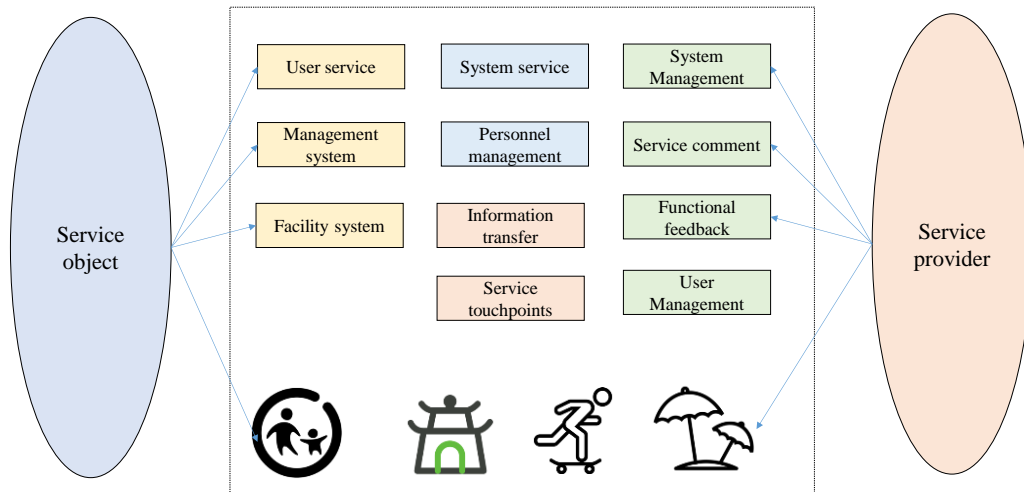
Figure 4: The relationship between tourism system users and service providers.

In addition, the scenic spot should also pay attention to the role of somatosensory technology, integrating 3D digital technology and somatosensory technology. Scenic spots need to further enhance the tourist experience of tourists. Somatosensory technology refers to human-computer interaction technology centered on somatosensory information processing. It interacts with the computer in established ways, such as gestures, speech, and body movements. This form of interaction completely gets rid of other additional equipment required for human-machine interaction in the past. This kind of interaction also enables users to focus on the task itself, which greatly improves the efficiency of information processing. Judging from the physical properties of somatosensory technology and the current application status, somatosensory technology presents strong virtual and interactive characteristics. This technology has a wide range of applications and good application prospects. Visitors only need to stand in front of the somatosensory device, and the device will capture the consumer's somatosensory information and automatically display a three-dimensional image of the tourist at the tourist attraction.

3 THE SUGGESTIONS ON THE CONSTRUCTION OF SMART SCENIC SPOTS BASED ON INTERNET OF THINGS TECHNOLOGY

3.1 Strengthen the use of Information Management Systems

In today's increasingly fierce competition in the tourism industry, the construction of brand image is the focus of improving the comprehensive competitiveness of scenic tourism. The construction of smart scenic spots has created conditions for the all-round brand image of the scenic spots. Building a brand image in an all-round way has also become an important goal of the construction of smart scenic spots. First of all, the scenic spot carries out related work with quality as the guide. Brand building and quality building are inextricably linked. From a short-term perspective, brand building depends on publicity. From a long-term perspective, brand building must be based on quality. The development of scenic spots is the focus of the construction of smart scenic spots to improve tourism quality. The development of scenic spots needs to focus on improving the

satisfaction of tourists. From the perspective of information feedback and other work, the scenic spot management department needs to be able to respond to the questions raised by tourists in the first time. For example, when a tourist enquires about a tourism product, the staff should convey the information of the product to the customer in clear and accurate language. When introducing, the staff need to attach electronic documents to help customers fully understand the business. For problems that cannot be reported on the spot in actual operation, the staff must clearly inform the customer of the feedback time. Generally, within 3 working days, customers need to get feedback from the staff. The comprehensive management methods of tourist attractions with different information modes are shown in Figure 5.
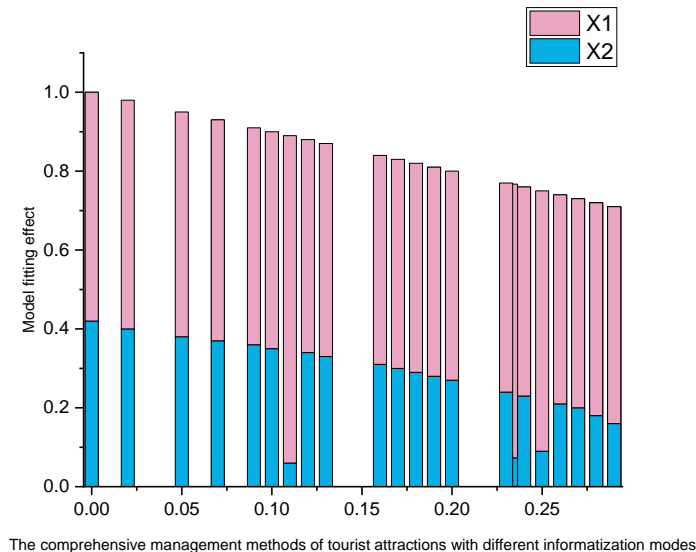
The comprehensive management methods of tourist attractions with different informatization modes

Figure 5: The comprehensive management methods of tourist attractions with different information modes.

The tourism information platform is the main carrier of the service of smart scenic spots. The defects of the platform itself affect the effectiveness of the smart service. In response to this situation, the scenic spot needs to carry out related work from the following three points. First of all, the scenic spot needs to develop an integrated scenic spot tourism app. At present, the tourism information platform of scenic spots has the characteristics of decentralization. This decentralized information platform makes it difficult to concentrate information resources. This situation increases the time cost for tourists to obtain information. The scenic spot should start from the background of the current change in the way of tourist information acquisition, and take the integrated app of traveling, playing, eating, living and shopping as the focus of the construction of the tourism information platform.

3.2 The Improvement of the Smart Scenic Spots' Systematic Services

Scenic spots need to improve the concentration of information resources and provide more convenient services for tourists. Secondly, scenic spots need to release information content closely according to the needs of tourists. At present, there are different degrees of disconnection between the information released by the scenic tourist information platform and the information needs of tourists. This information release mode simply cannot meet the needs of tourists. Tourist attractions should pay attention to the research of tourists' needs. Scenic spots need to use

questionnaires and big data analysis technology to fully understand the demands of tourists. On this basis, scenic spots need to adjust the content of information released so that the information resources released can meet the needs of tourists. Finally, scenic spots need to improve the update speed of information. Scenic spots should pay attention to the effectiveness of the information in the information release, and update the important information of the scenic spots as soon as possible. The management methods and technical effects of different tourist attractions management systems are shown in Figure 6.
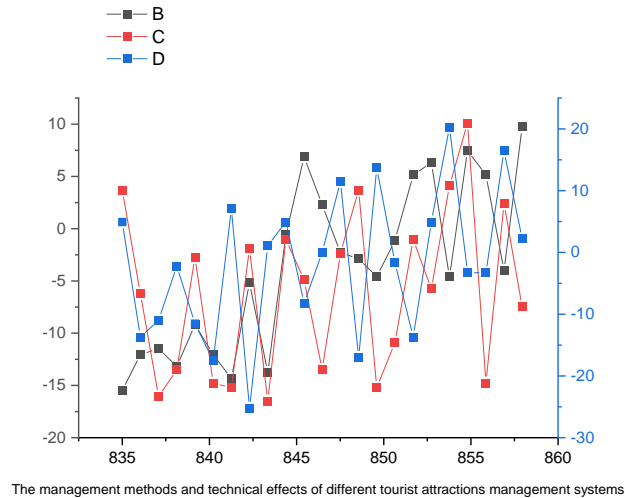

The management methods and technical effects of different tourist attractions management systems

Figure 6: The management methods and technical effects of different tourist attractions management systems.

3.3   The Improvement of the Scenic Spots' Intelligent Management Level

The construction of smart scenic spots is not only related to the tourist experience of tourists, but also affects the management level of scenic spots. The development of smart scenic spots is also related to the development of regional tourism. Tourism has become a pillar industry of the national economy. Local governments attach great importance to the development of tourism, and are actively promoting new models such as rural tourism and global tourism. In the construction of the security system of smart scenic spots, the guiding role of the government in the construction of smart scenic spots must be brought into play. The first is to strengthen the top-level design. Although the construction of smart scenic spots is aimed at specific scenic spots, it is not an internal matter of specific scenic spots. The Combination Relationship between Internet of Things Technology and Scenic Spot Management is shown in Figure 7.

4   CONCLUSION

In fact, IoT technology is an important part of smart tourism and even smart cities. The construction of smart scenic spots is closely related to the smart construction in other fields. As the main body of smart city construction, the government should carry out corresponding guidance based on the development needs of the tourism industry within its jurisdiction. The government needs to start from the requirements of the construction of smart scenic spots and strengthen the top-level design work.

The Combination Relationship between Internet of Things Technology and Scenic Spot Management
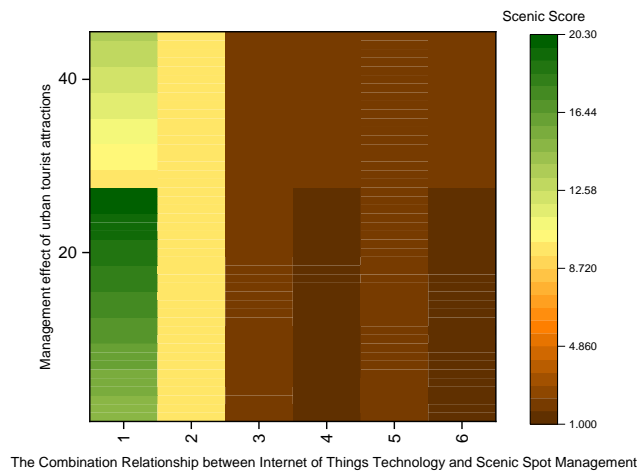
Figure 7: The Combination Relationship between Internet of Things Technology and Scenic Spot Management.

The government's work needs to be carried out from the following aspects. On the one hand, it is necessary to avoid the phenomenon of information islands in the construction of smart scenic spots, and on the other hand, it is necessary to highlight the synergy of various government departments in the construction of smart scenic spots. Through the coordination of departments, the government promotes the development of the entire smart tourism industry, thereby enhancing the overall intelligence level of the tourism industry. Secondly, the government also needs to do a good job of financial support. The construction of smart scenic spots is a systematic project. Especially for scenic spots, due to the large area of scenic spots and many tourism projects, the financial guarantee for the construction of smart scenic spots is an important content.

The government should strengthen the financial support for the construction of smart scenic spots. On the one hand, the government adopts the form of financial subsidies and tax rebates to further address the problem of insufficient funds in the construction of smart scenic spots. On the other hand, the government needs to do a good job in the docking work between the scenic spot and financial institutions to create a good financing environment for the scenic spot. The active promotion of the government can eliminate the worries about the construction of smart scenic spots. Finally, scenic spots also need to focus on tourist participation. The tourist experience and satisfaction of tourists are the starting point and foothold of the construction of smart scenic spots. Similarly, the construction of smart scenic spots is inseparable from the participation and feedback of tourists. The government should act as a bridge between scenic spots and tourists, focus on mobilizing tourists' enthusiasm in the construction of smart scenic spots, and improve tourists' participation.

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Qingqing Liu, https://orcid.org/0000-0002-3637-523X
Qing Wei, https://orcid.org/0000-0003-4042-1072

REFERENCES

[1]   Chang, J.: Broadband technology opportunities program public computer center grants and residential broadband adoption, Telecommunications Policy, 4(12), 2021, 45-52. https://doi.org/10.1016/j.telpol.2021.102147

[2]   Danbatta, S.-J.; Varol, A.: ANN-Polynomial-Fourier series Modeling and Monte Carlo Forecasting of Tourism Data, Journal of Forecasting, 1(12), 2021, 21-27. https://doi.org/10.1002/for.2845

[3]   Lei, S.-I.; Ye, S.; Wang, D.: Engaging Customers in Value Co-Creation Through Mobile Instant Messaging in the Tourism and Hospitality Industry, Journal of Hospitality & Tourism Research, 44(2), 2020, 229-251. https://doi.org/10.1177/1096348019893066

[4]   Recupero, A.; Talamo, A.; Triberti, S.: Bridging Museum Mission to Visitors' Experience: Activity, Meanings, Interactions, Technology, Frontiers in Psychology, 18(20), 2019, 108-111. https://doi.org/10.3389/fpsyg.2019.02092

[5]   Zha, J.; He, D.; Zhu, Y.: Evaluation and Decomposition of Tourism Inefficiency Considering Heterogeneous Technology: An Empirical Study from China, Journal of Hospitality & Tourism Research, 46(2), 2022, 370-399. https://doi.org/10.1177/1096348020988323

[6]   Nder, I.; Gunter, U.: Blockchain: Is it the future for the tourism and hospitality industry?, Tourism Economics, 28(2), 2022, 291-299. https://doi.org/10.1177/1354816620961707

[7]   Johnson, A.: Discrimination and technologies in tourism: Applying critical race theory to future studies, International Journal of Tourism Research, 24(2), 2022, 308-310. https://doi.org/10.1002/jtr.2502

[8]   Li, M.; Yin, D.; Qiu, H.: A systematic review of AI technology-based service encounters: Implications for hospitality and tourism operations, International Journal of Hospitality Management, 95(1), 2021, 102-110. https://doi.org/10.1016/j.ijhm.2021.102930

[9]   Abou, M.; Soliman, M.: The impact of gamification adoption intention on brand awareness and loyalty in tourism: The mediating effect of customer engagement, Journal of Destination Marketing and Management, 20(2), 2021, 101-119. https://doi.org/10.1016/j.jdmm.2021.100559

[10] Lin, H.-C.; Han, X.; Tu, L.: Task-technology fit analysis of social media use for marketing in the tourism and hospitality industry: a systematic literature review, International Journal of Contemporary Hospitality Management, 8(7), 2020, 19-24. https://doi.org/10.1108/IJCHM-12-2019-1031