Smart Tourism Based on Internet of Things

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Abstract
In the era of big data, with the development of computer technology, the application of Internet of Things in tourism industry is the inevitable of the development, transformation and upgrading of tourism industry. In view of the relatively lower tourist resources deployment and traditional tourism service facilities in Yan’an, the paper introduces Internet of things and smart tourism, and their architecture as well, analyses smart tourism embodiment based on Internet of Things, moreover, puts forward the existing problems and development strategies in the application of Internet of Things in Yan’an smart tourism industry to improve tourism information service function.

Key words: Internet of Things, Smart tourism, Existing problems, Development strategies

1. INTRODUCTION
Smart tourism is based on Internet of Things, cloud computing, mobile communication terminal and Artificial Intelligence, and the core is Internet of Things. In the era of big data, the application of Internet of Things in tourism industry is the inevitable of the development, transformation and upgrading of tourism industry. (Zhang linyun. Li Nao and Liu Min, 2012)

Yan’an rich in tourism resource, is the State Council’s first named China’s historical and cultural city and the sacred place of Chinese revolution, also education base of the national patriotism and revolutionary tradition and Yan’an spirit. Yan’an is the preferred destination of red tourism in China, which has the reputation for “the Chinese Revolution Museum City”. Its special historical position (the Central Party in Yan’an for 13 years), makes Yan’an red tourism resource unique. An increasing number of domestic and foreign tourists pay a visit to historical sites in Yan’an to understand its history and culture.

In view of the relatively lower tourist resources deployment and traditional tourism service facilities in Yan’an, tourism information with finite supply ways, dispersed incomplete as well as limited, lack of depth and slow updating. Tourism industry is lacking technological innovation. Only brief scenic spot introduction, several pictures, some news are on government tourism website, which lack of profound cultural connotations. There’s few application of Internet of Things, cloud computing and mobile communications in Yan’an tourism industry, so the digitization and intelligence of tourism industry chain make information transmission and real-time exchange difficult to achieve. On the basis of abundant tourism resources in Yan’an especially red tourism resources, it is essential to reintege the Chinese and English materials in Yan’an scenic area to tap its cultural connotation for the protection and development of red cultural heritage and to establish a database of tourism information resources for further improvement of tourism elements and tourism information service function, with Internet of Things as a platform. The realization of smart tourism is also one of important contents of the construction of smart city. The application of IoT to Yan’an tourism industry becomes an inevitable choice for the further development and expansion of tourism market, which is of great significance to the propaganda of Yan’an.

2. INTERNET OF THINGS AND SMART TOURISM
Smart tourism is a new form of tourism through the application of Internet of Things, cloud computing and other modern technologies in tourism experience, industrial development and administrative supervision. Internet of Things is the core network of smart tourism, and it is the basic guarantee condition to realize smart tourism.

2.1 Internet of Things and Its Architecture
Internet of Things (IoT) is generally defined as: All things are connected to the Internet via Radio Frequency Identification (RFID), infrared sensor, Global Positioning system, laser scanner and other information sensing equipment to carry out information exchange and communication, in order to realize the intelligent identification, positioning, tracking, monitoring and management of a network.

Internet of things dates back to 1998 when Massachusetts Institute of Technology of the United States came up with electronic product code (EPC) system on the basis of radio frequency identification (RFID). ITU issued a report ITU Internet reports 2005-the Internet of things that we are heading towards a “ubiquitous
network society”, one in which networks and networked devices are omnipresent, in which The concept of Internet of Things formally put forward. The core and foundation of Internet of things is still the Internet, which is an extension and expansion network on the basis of Internet; its user side extends and extends to any object, exchanging and communicating of information. Information cross infiltration and interoperability can be achieved among tourists, tourism enterprises, and tourism-related departments.

The architecture of Internet of Things consists of four layers: object sensing layer, data exchange layer, information integration layer, and application service layer. The four-layer architecture is shown in Fig.1.

**Figure1. Four-layer architecture of Internet of Things**

The object sensing layer tackle sensing the physical objects and obtaining data; the data exchange layer cope with transparent transmission of data; the information integration layer deal with recombination, cleaning and fusion of uncertain information obtained from the networks, and integrates the uncertain information into usable knowledge; the application service layer provides content services for various users(Ma, 2011).

2.2 Smart Tourism and Its Architecture

“Smart tourism” comes from “Smart earth” and “Smart city” based on the new information technology such as Internet of Things. As a product of the high integration of tourism and modern information technology, intelligent tourism is a new form of the high development of tourism informatization on the basis of smart city, with important content of intelligent scenic spots, intelligent hotels, intelligent transportation, intelligent services and intelligent management etc. Smart tourism is not an isolated system, but a complete system covering the entire tourism industry. The core of intelligent tourism is the seamless link of information in the tourism industry chain. The overall architecture of smart tourism includes technology layer, data layer, application layer and user layer, which is shown in Fig.2.

**Figure 2. Four-layer architecture of Smart Tourism**

Technology layer of smart tourism includes Internet of Things, perceptual and identification technology, network and communication technology, cloud computing technology and virtual reality technology and these are the key supporting technologies to constitute smart tourism(Gao Tianming, 2012). Technology layer is the foundation of smart tourism architecture, but also the source of smart tourism. Data layer refers to the integration of technology layer with the tourism elements. through data fusion and information sharing, collect and integrate the tourism resource information, service enterprise information, service object information, including GPS, which were dispersed in tourism enterprise, tourism management department and related organization to form the accurate and high value comprehensive tourism information database. The database includes database and business database, data sharing Exchange platform, data security system, data management and maintenance system. The application layer refers to make emerging technologies into tourism
elements, to form intelligent tourism resources analysis, intelligent tourism services, intelligent tourism marketing, and intelligent tourism management and so on. The user layer refers to the user group of Intelligent Tourism information platform, including tourists, tourism enterprises and tourism management departments.

2.3 Intelligent Embodiment Based on Internet of Things

The role of Internet of Things is to install sensing devices to things, and make things have ‘intelligence’, thus, carrying on the communication between people and things, things and things, for facilitating man’ management and control of various objects. The application of Internet of Things to tourism industry timely has accurate access to its dynamic information by install sensing devices to physical resource in tourism market.

With the help of Information processing platform of Internet of Things, the entire tourism system achieve 3A (any time, any place, anything) connection, to achieve high degree of integration of traditional separation of the physical world with information time, which is shown in Fig.3.

![Figure 3. 3A (any time, anything, any place,)](image)

In the three-dimensional coordinates of Figure 1, Z represents the object field axis, and Y represents the time domain axis, and X represents the space axis. In the object domain, the emphasis on all objects (people, computer, thing) can be fully interconnected; In time domain and space domain, the emphasis on all things are accessible at any time or place.

![Figure 4. Intelligent embodiment based on Internet of Things](image)

Intelligent service-tourists oriented: In smart tourism system, tourists, as the center, can experience brand-new intelligent service on food, accommodation, tour, shopping, entertainment and other related information. During traveling, thus enhancement of tourism quality through electronic wallet, WeChat Pay, Alipay and other online payments have Online booking, itinerary planning, and other services. Tourists have access to adequate and convenient travel information and choice to arrange tourism planning and form tourism decision-making. In traveling process, modern technology such as Internet of Things can achieve effectively the immediate information transmission and provide tourists with intelligent guided tour by means of accurate positioning technology, text, pictures, audio and video and other forms to vividly show the natural scenery, humanistic landscape, perfect tourism infrastructure, projects and so on to tourists to bring a wealth of tourism experience, enhance the comfort and satisfaction of tourism, and better tourism security and tourism quality assurance as well.

Intelligent business-travel enterprise oriented: Intelligent business refers to travel enterprise use the powerful network channels, such as Internet of Things, and so on to organize the corresponding online tourism marketing activities by the characteristics of different customers in order to improve the radiating power and influence of the marketing content and reduce the operating cost of the enterprise. Travel enterprise Tourism enterprises can tap tourism hotspots and tourist interest. Travel agencies can design and plan tourist routes;
Tourism products distributors (for example, Ctrip etc.) to establish and improve the digital marketing monitoring and evaluation system, expand online marketing channels, etc. While providing tourist resources information and related services, tourism enterprises also accept Tourism Management department supervision and management. Corporate intelligence business is mainly aimed at all tourism enterprises (tourist attractions, travel agencies, hotels, transportation, tourism products distributors, etc.), including tourism routes, hotels, lines, catering, product recommendations, marketing promotion, business analysis, business statistics.

Intelligent administration-tourism management department oriented: Through the information integrated platform and intelligent management mode, the tourism management department can better master the whole tourist activity process and operating management of tourist enterprise to realize the effective supervision and service to the tourist market and maintain the lawful rights and interests of tourists, tourism enterprises, tourism practitioners. Intelligent administration can realize the transformation of traditional tourism management mode to modern, better maintain the tourism order, strengthen the operation and monitoring of tourism market, to enhance the service ability and management ability, and realize the monitoring and protection of tourism resources and intelligent management. It can improve the effectiveness and scientificity of tourism macro-decision making.

3. PROBLEMS AND SOLUTIONS TO THE POPULARIZATION OF SMART TOURISM

The application of Internet of Things in Yan’an tourism industry can enhance its attraction and economic benefit, perfect the tourism industry chain, promote the sustainable development of the Yan’an tourism, improve the tourism environment and competitiveness, and increase visitors’ satisfaction index. Achieving smart tourism matches the theme of creation of Smart city.

3.1 Existing Problems

The application of Internet of Things in Yan’an smart tourism industry still has some problems: traditional tourism service mode, the pressure of technological innovation and tourism technology upgrading and lack of interdisciplinary talents.

Scenic areas in Yan’an follow the traditional tourism services pattern. While traveling, tourists simply have visual sightseeing for single tourism product. A wide variety of distinctive product seldom appears in scenic areas. In the information age, the traditional tourism model has not been able to provide a comprehensive, personalized service; it is difficult to meet the increasing diversity of tourists personalized tourism needs. Tourists’ self-service tour in scenic areas cannot come true. Taking Nanjing city as an example, Jin Weidong probes into the construction of smart tourism and tourism public service system, and puts forward that smart tourism system is the inevitable choice to solve and satisfy the mass personalized tourism demand. Smart tourism is the main channel to provide public goods and services for the masses of people and important measures of transformation and upgrading of tourism industry(Jin Weidong, 2012). Huang yinong and Wu Wingqing studied the development of self-service tour in the context of smart tourism (Huang yinong and Wu Wingqing, 2012).

Unfortunately, compared with the developed cities, there’s few application of modern technologies to Yan’an tourism such as Internet of Things, cloud computing and tourist resources deployment are relatively lower. Information transmission and real-time exchange is hard to realize. Chinese information is not very comprehensive and all-sided, not to mention the English materials. Tourism information service is not good enough. Tourism information lag and asymmetric information cause some loopholes in the area of traffic management, safety management, environmental management and tourist management. Yan’an tourism industry is difficult to move towards digitization, science, intelligence and internationalization.

The application of Internet of things needs the professional talents to effectively turn research achievements of Internet of Things into social and economic benefits. However, there are quite few interdisciplinary talents proficient in both computer operation and tourism expertise in Yan’an.

3.2 Development Strategies

The establishment of Yan’an Tourism information resources database and smart technology system provides a comprehensive and powerful support service for smart Tourism. The core database includes tourism resources (both Chinese and English) database, tourism product design and service database, and dynamic statistical information database. With the help of Internet of Things, the display contents of the museum’s collections will be enriched by taking Chinese and English as a medium and deep excavation of the cultural connotation.

Tourist resource database, static data, is a comprehensive collection of tourism-related resources data, including tourism resources of Yan’an city, scenic spots around Yan’an (Hukou Waterfall, Huangdi Mausoleum, etc.), scenic hotel, travel agencies, and others related to tourism; also including geographic information, locating information, image information, video and audio information, etc. The original monotonous tour becomes colorful through the text, audio and video digitization to improve visitors’ travel perception, thus
enhance the attraction of Yan’an tourism. Currently there’s no English tourism website in Yan’an, thus it is necessary to build an English foreign propaganda website for tourists at home and abroad. Tourism product design and service database is the data collection of tourism product design through professional tourism management department and tourism planning organization (including tourism route, consumption standards and ancillary services, etc.) to provide the public with data collection of specific tourism products services and suppliers. Dynamic statistical information database has a strong timeliness. Statistical information in variety in Yan’an can be objectively and timely reflected on the basis of dynamic tourism information data, such as operating conditions, competitive advantage and industry position and so on. Formation of a complete data collection comprehensively reflects the state of Yan’an tourism, so as to adjust the marketing strategy, improve intelligence degree and service quality.

To strengthen the construction of standardized information system security and training of interdisciplinary talents provide consumers and service providers with protection. If the management is not in place and some loopholes appear in security measures, individual, enterprises and tourism management department suffer from a certain amount of trouble and infringement. For professionals, make sure to strengthen the comprehensive ability and professional technical accomplishment, meanwhile, bring in technological talents vigorously to effectively promote smart tourism in Yan’an.

4. CONCLUSIONS

With the development of modern information technology such as Internet of Things, cloud computing and mobile communication, smart tourism has technical support and impetus to meet individualized and diversified demand of tourism information service. Smart tourism is the product of the deep integration of information technology and tourism industry by taking advantage of information technology such as Internet of Things etc. to integrate tourism-related elements. The introduction of modern information technology such as I Internet of things realizes the technological innovation of Yan’an tourism system, enhance the attraction of Yan’an tourism, perfect the tourism industry chain, promote the upgrading of tourism industry, promote the sustainable development of Yan’an tourism (especially red tourism), improve tourism information service function, and accelerate traditional to modern tourism in Yan’an. Meanwhile, it is of great significance to spread the propaganda of tourism and image of Yan’an and also for the need of the construction of smart city.

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