Design and Research of Intelligent All-area-advancing Tourism Cloud Platform in the Era of Big Data

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Abstract. In the era of big data, it is one of the important ways to make intelligent all-area-advancing tourism by informatization. This paper, through big data, cloud computing, mobile, Internet and other information technologies, combined with the practical application of tourism information in Shandong Province, puts forward the construction content of intelligent all-area-advancing tourism cloud platform, and designs the overall framework, system structure and database system of the platform, which is of great significance to integrate the tourism resources of the whole province to build an information resource sharing system of intelligent all-area-advancing tourism that integrating intelligent tourism management, intelligent tourist service and intelligent tourism marketing.

1. Introduction
With the development of big data, cloud computing, Internet of things, mobile Internet and other new information technologies, the tourism industry has entered an era of intelligence and digitalization. In the era of big data, drove by "Internet + intelligent tourism", the deep integration of Internet information technology and tourism industry has been actively promoted, and the world's cloud computing leading enterprise, Amazon AWS, has been introduced to establish a new generation of Omni-natural air-cooled data center, making it a tourist’s must-see cloud area, which provides a broader stage for the construction of intelligent all-area-advancing tourism cloud platform. It is one of the important ways to make all-area-advancing tourism by means of informatization to improve the level of tourism intelligence. The problems that need to be solved urgently in the informatization construction of intelligent all-area-advancing tourism in Shandong Province are as follows: The present information system can not meet the increasing demand of tourists. For example, in major holidays as well as golden week, there is a sea of people in the scenic spots and attractions, which causes serious congestion around the scenic spots at the same time. For this reason, it is urgent to using informatization as a means to transform and upgrade the informatization system of scenic spots and attractions so as to further improve the level of tourism intelligence and promote the transformation and upgrading of tourism industry to adapt to the new normal. There needs a further enhancement in tourism service, management and marketing. It is also necessary to make innovations from aspects of tourism service, management and marketing modes by means of informatization to improve the level of tourism intelligence in the whole field. The intelligent tourism information sharing service is still in the primary stage, and the big data has not played its due role in intelligent all-area-advancing tourism. Hence the intelligent tourism big data system needs to be established as soon as possible.

2. The Contents of Construction
According to the requirements pilot the construction of the all-area-advancing tourism, as well as the
service concept of "taking tourists as the center", make the best of big data, new generation telecommunication network and other information technology, combined with the actual situation of tourism informatization application, to establish intelligent all-area-advancing tourism cloud platform combined with the intelligent tourism big data system, intelligent tourist service application system and intelligent tourism marketing application system, which is also integrated with the previous tourism information system to construct a perfect application services of the intelligent all-area-advancing tourism cloud platform.

2.1. Intelligent Tourism Big Data System
This paper is mainly the studies of the establishment of big data analysis system and big data acquisition system. Based on the scenic spot data resources, the tourism big data analysis system can support the visual decision of tourism data analysis, provide the scenic spot management analysis, industry analysis, city portrait, user portrait, etc. which provides sufficient decision-making reference for the tourism industry management department to formulate the tourism development strategy. The tourism big data collection system is used by the tourism operators to integrate the weather, transportation, operators, GIS geographic information and other tourism data resources under the control of respective management departments, with which it automatically transfer the tourism business data to the intelligent tourism big data platform by sharing and exchanging the information resources of the tourism data, and achieves accurate in-depth data mining and analysis by the big data analysis technology.

2.2. Intelligent Tourist Service Application System
This paper is mainly the studies of the construction of electronic ticketing system and car parking management system. The E-ticketing system means the establishment of a unified ticketing service system covering all the tourist attractions above 3A level. In another words, it is to integrate the ticket resources of all scenic spots in Shandong Province to concentrate online sales so as to facilitate tourists’ ticket purchase, and effectively guide tourists to assure the rational population in different scenic spots through internet technology. The car parking management system is applied to manage the parking resources of scenic spots and around scenic spots in Shandong Province, by which the convenient and fast parking service for tourists is provided, and at the same time, it also realized the overall guidance and regulation of the parking of tourists at the peak time of scenic spots.

2.3. Construction of Intelligent Tourism Marketing Application System
This paper focuses on the construction of OTA distribution system. The OTA distribution system is a distribution channel that integrates local tourism service resources and provides the OTA platform whose aim is to help scenic spots and tourism service enterprises to establish, manage and operate the network of sales channels, and also help all kinds of tourism distributors at all levels to obtain local tourism product resources as well as promote the its rapid sales.

3. The Design of Cloud Platform’s Framework

3.1. The General Framework
The intelligent all-area-advancing tourism cloud platform adopts B/S mode, and the general framework is divided into base layer, data information layer, service layer, application layer, presentation layer and user layer.

3.1.1. Base layer
The base layer is the basic engineering of the cloud platform, it undertakes the supporting of network environment, the security of information system, and the construction of host, storage, disaster recovery backup and other infrastructure. The base layer of intelligent all-area-advancing tourism cloud platform receives the services provided by the cloud computing data center of e-government built by Shandong Province.
3.1.2. Data information layer
Data information layer includes information of scenic spots, tourists, geographic location, commodity, as well as thematic database supported by each application system, data resource sharing database and other data resources including structured data resources and unstructured data resources to support the operation of platform. The data information layer provides support for its upper service layer and application layer, while all kinds of resources collected are the basis for the construction of tourism big data.

3.1.3. Service layer
The service layer provides directory management service, workflow, E-form, BI report, search engine and other tools and component services to support technical tools and services for upper application and development.

3.1.4. Application layer
The application layer includes e-ticketing system, scenic spots parking area system, OTA distribution platform, tourism big data system and other cloud based application systems of intelligent all-area-advancing tourism, providing information services for tourist services, tourism industry development and government supervision.

3.1.5. Presentation layer
The presentation layer is the entrance for users to use intelligent tourism applications. In addition to the traditional web door, it also interfaces with mobile clients to meet the needs of the rapid popularization of mobile internet.

3.1.6. User layer
The user layer includes merchants and tourism regulators related to the tourists, scenic spots, tourism industry, and other types of users.

3.2. System Structure

3.2.1. Tourism big data system
Tourism big data system can be divided into data collection layer, data storage layer, data engine layer, API service layer and data presentation layer from bottom to top.

(1) The pattern of data collection layer can be divided into active capture and passive collection. That is so say, tourism related data can be collected from scenic spots parking system, e-ticketing system, video monitor system, OTA marketing system and internet industry data, it also can capture them through API or HTTP provided by other systems to realize data collection services, while other systems can be accessed through interfaces or manually transfer data to intelligent tourism big data system.

(2) The data storage layer can achieve the storage of relational database and distributed big data. The distributed big data storage uses the original data collected by HDFS, Hive and other storage collection layers, and after the analysis and processing of the data engine, the results are stored in the distributed big data storage or lost database. Due to the requirement of access delay, the relevant data used in the data presentation layer is mainly stored in the relational database.

(3) Data engine includes data cleaning, data analysis and data mining. Data cleaning is to de-noise and normalize the original data, and the cleaning results are stored in the data storage. While data analysis concerns business characteristics to correlate and analyzes different data sources so as to obtains statistical analysis results from different dimensions. As to data mining, it uses various mining algorithms to conduct in-depth mining analysis on tourism related data.

(4) The API service layer is mainly to realize API services of data exchange. The pattern of HTTP / HTTPS is used to query data and store data of different dimensions in XML or json and other standard data formats.

(5) The data presentation layer includes large screen display system, analysis and decision-making
system, and other tourism application systems. Based on the API service layer, the analysis results of tourism big data are presented in different ways.

### 3.2.2. Electronic ticketing system

The electronic ticketing system consists of five parts: lost link system and interface, public service, function module, big data interaction and ticket booking channel. The lost link system interacts with the business data of OTA distribution system, big screen of information and park catering retail system. And the tourism big data platform is mainly used for the collection of e-ticket related data to make a basic database for big data analysis. The public service is mainly a basic module irrelevant with business logic processing, including login, cash register, transaction, security, etc. And the function module is for the core business logic processing of the system, which mainly includes (1) Order Management: sales of various orders and ticket collection; (2) Basic Information: basic information management consisted of tickets, users, groups, security, etc.; (3) Membership Management: member-related logic processing, including information management, data storage and so on; (4) Gate Access: two modes to enter: ticket as the admission and member access.

### 3.2.3. Parking system of scenic spots

The intelligent parking system of scenic spots is composed of external interface, system function and the docking part of tourism big data platform. The external interface as an important part of tourism big data is mainly used for data transmission with external system, and the data related to parking lot will also be transmitted to big data platform as its data source; The system function is the core business processing part of the system, mainly including (1) Exit-inlet control system is mainly the the entrance and exit related system of the parking lot, including detection, identification, control and other systems; (2) Management center system: mainly used through control terminal to manage all kinds of systems of the parking lot, and check the existing records as well as get statistics; (3) Video acquisition system: mainly used for the collection, transmission and storage of the picture and video data at the entrance and exit as well as inside parking lot.

### 3.2.4. OTA distribution system

The OTA distribution system is composed of correlation system and interface, public service, basic business of OTA platform, and sales channel, and the correlation system is mainly connected with OTA System and electronic ticketing; The public service mainly provides functions of user login, distributor sales, orders distribution and docking external interface; The management platform provides OTA management, scenic area management, distributor management, user management and purview management; And the sales channels are divided into OTA and distributor. The basic business of OTA platform is the core business logic of the system, which mainly includes (1) Order management consisted of order query, order cancellation after verification and distributor refund; (2) Business management consisted of OTA management, distributor management and scenic spot management; (3) Product management, including tourism product management; (4) Product package management, including product package management, package price management and package refund rules; (5) Agreement management: agreement management of each and every product.

### 3.3. Database system

The database system includes the database of each business subsystem and integrates with the tourism data warehouse constructed by each system. The database of business subsystem adopts relational database such as Oracle, MySQL, etc. And the tourism data warehouse needs to store fine-grained data from multiple data sources to conduct multidimensional analysis. While to build by Hive, the big data tool such as Hadoop, Spark, Storm in Hadoop ecosystem and others can be used to perform offline or real-time big data analysis on tourism big data, and the analysis results can be stored in the relational system in MySQL database synchronously to dock various data applications and perform data display or query.

1. Business system: Each business subsystem of the intelligent all-area-advancing tourism cloud platform, which includes parking system, ticketing system, gate control system, monitor system, OTA
marketing system and internet industry data. And the database of the business system is the tourism cloud big data system database, which is the data source of the tourism data warehouse, collects data into the data warehouse through the data collection platform.

2. ODS layer: Operation Data Store. The ODS layer is the synchronous storage of business system data sources and its data granularity is consistent with the source system. It is also the buffer layer of data warehouse and business system whose data structure is the same as that of each business system.

3. DW layer: Data Warehouse. The data of ODS layer are integrated into DW layer after standardization, analysis, integration and screening.

4. DM layer: Data Mart. The DM layer is the data mart for specific analysis needs, and the DW layer data generation is calculated by data engine.

5. APP layer: Application. The application layer organizes data according to specific business requirements, and still can obtain data from DW layer or DM layer without complex calculation. In order to ensure the query performance, it is generally stored in relational database. Data flow among all layers of data warehouse is mainly realized by ETL. It uses SQL association query to take advantage of data source or by Map Reduce, spark, and other tools to implement algorithm processing. Data in DW, DM and APP layers can be divided into S-dimension table and fact table. Dimension table is the description information of analysis object attributes, such as scenic spot information table, city table, parking lot table, etc; while fact table is the measurement information of each business scope, such as parking record table, etc.

4. Conclusion
In the age of big data, the intelligent all-era-advancing tourism cloud platform has established an all-era-advancing tourism data resource sharing system integrating intelligent tourism management, intelligent tourist service and intelligent tourism marketing for the tourism industry of Shandong Province, to further improve the capacity of tourism public service. The tourism big data system accumulates tourism data information to form tourism data analysis system, helping tourism industry management departments to grasp the operation of tourism related enterprises so as to effectively improves the efficiency and level of management. The e-ticketing and intelligent parking system has enriched the public service capacity of tourism resources and realize the intelligent tourism service. The OTA distribution system is an important part of promoting the internet-based ticket sales. Combined with the analysis of tourism big data, it achieves accurate tourism marketing. The reserved video monitor, connection interfaces of intelligent sensing equipment and to-built system of this platform need further research and discussion, which leaves perfect situation for the next step of the overall software and hardware upgrading and other subsystem construction of all-era-advancing tourism, and of the comprehensive realization of intelligent development of tourism.

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