The Construction and Application of a Smart Tourist Public Service System from the Perspective of C-RAN

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Abstract. At present, mobile services are developing at exponential speed and the competition is becoming increasingly fierce. Confronted with the numerous challenges, which mainly consist of the rising construction and operation costs, shrinking frequency spectra, enormous energy consumption, soaring network traffic, mobile operators have to bear the growing costs. Therefore, a sustainable, long-term development program is direly needed to address the problems. Based on current technological and Internet conditions, the paper puts forward C-RAN, a green type of wireless access infrastructure. The smart tourist public services can help the government promote the healthy and sustainable development of the tourist industry, and meanwhile serve as a way to increase tourist satisfaction. Great importance is attached to smart tourist public services and legal and conventional support is offered in developed tourist countries and regions. By referring to many a domestic and foreign theory and practice of smart urban tourist public services, the paper looks into the construction of such a system, which consists of five sub-systems: the dispatching command sub-system, information management sub-system, complaint sub-system, training sub-system and emergency sub-system. The application of the smart tourist public services is investigated in terms of the five systems and policies and recommendations are proposed accordingly.

Introduction

C-Ran is a wireless access infrastructure based on centralized, cooperative radio and real-time cloud infrastructure. The application of centralized basebands enables a smaller number of base stations for the same area; wireless terminal modules and antennas can considerably increase the efficiency of frequency spectrum. Virtualized cloud infrastructure and base stations may effectively cut costs, reduce energy consumption, and increase infrastructure efficiency. The advantages above offer solutions to the problems that mobile operators are confronted with and meet the needs of future development.

Substantial progress has been made in China’s tourist industry in the new millennium. DIY travel has carved out a large niche in tourist market (over 70% of tourists in China in 2012 are DIY travelers, a leading force of China’s tourist market). Compared with group tourists, DIY travelers have access to a larger range of options and expect more of tourist information, emergency and complaint services alike, which demand the establishment of a sound smart system of tourist public services to cater to the tourist trend and to meet personalized customer needs. China International Travel Service Limited, Head Office (hereinafter referred to as CITs) works closely with Cisco Systems, Inc. (China) to extend and update the booking with the aid of the latest versions of IP call center (IPCC) and computerized voice program (CVP), offering 24-hour all-weather consultation services to clients.

Our society is being increasingly digitalized. Likewise, tourism is becoming increasingly digital, smart, and personalized. The key to a smart tourism is to take full advantage of modern information technology, optimize the development of tourist resources, achieve the maximal and sustainable development of tourist values, thus ushering in an era of custom-made and smart public services.
Many free services as tourist information, books, brochures, consultation, and route designs are available in developed tourist countries (regions), along with emergency rescue services run by the government or privately.

Currently in the construction of tourist public service system in many parts of China, hardware infrastructure has far outweighed “intelligence”, a core element of personalized services, and due attention has not been paid to the actual demands of the tourists. Meanwhile, some tourist destinations attempt to develop smart tourism by building tourist centers and public information service networks alike; however, the services available are merely confined to ticketing and administrative information posting alike. Therefore, smart tourist public services, as a form of public product, shall be wide in range and non-profit, actualized via a mechanism of competition among governmental agencies, private sectors, independent agencies, and social autonomous or semi-autonomous organizations alike. Based on an analysis of domestic and foreign theories and practices on urban smart tourist public services, the paper suggests that a sound system of smart tourist public services shall include the dispatching command system, information management system, complaint system, training system and emergency system.

Outline

In recent years, some theoretical and practical progress has been made by relevant experts, scholars, and government employees in the field of tourist public services in the international community. However, China’s research in this field has just started, most of which is empirical from the perspectives of the government, tourist businesses, and/or tourists, focusing on such factors as tourist service experience, satisfaction and individual needs alike, and/or on how the government and tourist businesses meet the needs of tourists and increase their satisfaction.

Considerable research suggests that effective competition between private and public sectors will lead to increased efficiency of public services, thus rendering them more cost-effective and high-quality. Schofield Thompson and Murray Howat have conducted research on the quality of tourist public services respectively in Manchester of UK and Australia; the former focused on the quality of traffic services, pointing out that tourist satisfaction and willingness to come back are affected to a great extent by the quality of traffic services available, while the latter tested the quality of public services in fifty local recreational centers from the perspective of tourists. With his own assessment model of tourist reception, Chon comprehensively tested tourist satisfaction and analyzed the major factors involved. Western tourist public services have been laying emphasis on tourist public services. John and Valeria propose that facilities construction is the very foundation of tourist public services and therefore the government should pay due attention in this respect; Jameel explores the relationship between traffic services and tourism; White Youngs analyzes the feasibility of combining tourist cultures and traffic services for improving customer satisfaction by conducting a field research in Yosemite National Park. Apart from such infrastructure as traffic, tourist information has been an important part of Western research. Ritchie emphasizes the importance of information in marketing tourist destinations and carries out his field study in Alberta of Canada in the content and the way information is communicated. Molina Rayman analyzes major American tourist websites and compares and contrasts them with conventional media, emphasizing the role of the Internet in tourist information communication. Chen has made favorable attempts to build a tourist information database and empirical research into the tourist destinations of islands. Other aspects, such as security, education and training of tourist practitioners, and infrastructure alike, also arouse the concern of many scholars. Heggie stresses the necessity of safety monitoring and exemplify it by several tourist accidents that happened in recent years in American national parks; Jones Haven-Tang is of the opinion that practitioners’ service skills and awareness are crucial factors in improving tourist services and in boosting the images and competitiveness of tourist destinations.

Scholars like Fucai Huang, Shuang Li, and Jianzhong Li stress that public products should be based on public needs, whose very first feature is communal consumption by all members of a society, rather than by a particular person or group. Normally, 80% of mobile operator CAPEX’s cost
is used for the construction of wireless access network, a major portion of which goes to wireless cell shops. From 2007 to 2015, global expenses on 3G network CAPEX were increasing on an annual basis. The higher frequency of 3G/B3G over GSM network requires the same coverage of the original 2G network and thus more cell stations.

With the increasing demand of data applications, joint macro relay network has become an emerging, promising heterogeneous subordination for extended coverage and enhanced capacity. However, present cell networks are often designed as performance-oriented, failing to take flow changes into sufficient consideration and causing a tremendous waste of energy. One set of BSS in C-RAN converges in the same location and the number of information stations may be reduced by several times, thus considerably decreasing the energy consumption of supporting equipment of mobile information stations. In addition, a denser BRH is technically feasible because of the application of cooperative anti-interruptive technology.

Given that an isolated scenic spot cannot stand alone as a tourist destination and that most cities are functioning as both tourist destinations and travel hubs, cities naturally assume the major responsibility of supplying tourist public services. For example, roads, airports, railways, scenic spots, and tourist authorities, information websites, service hotlines and rescue agencies mainly center on cities.

Basic Concepts

**Tourist Public Services**

Tourist public services refer to communal public products that are supplied by the government or any third party and that tourists, travel businesses and relevant practitioners are entitled to. Tourist public services range from such infrastructure as traffic and communications systems, tourist resources, image promotion of tourist destinations, regional tourist planning, and industrial codes of practice. Meanwhile, they also consist of the maintenance of tourist rights and interests and personal safety alike. It may be safely concluded that tourism is a driving force as a service industry involving many facets. The basic tourist resources are public to a certain extent and so are the service targets of the tourist industry. Tourist public services are an integration and escalation of the present public services for meeting the needs of tourists, which is a dynamic interaction between tourists and service delivery systems, the latter consisting of the interaction between tourists and tourist service personnel, between tourists and all the tangible service factors as tourist facilities, environment, and other tourists alike.

Therefore, it is a fundamental requirement to install service facilities, man them accordingly, and perfect relevant service codes of practice according to related rule and regulations.

**Smart Tourism**

Smart tourism is based on a new generation of technology (information and communications technology, ICT); it renders personalized services to tourists and meet their individual needs, thus sharing tourist and social resources. As a systematic and intensified change of tourist management, smart tourism mainly resorts to smart communications technology. ICT-based smart tourism may help effectively improve the quality of tourist services, enrich tourist experiences, boost the innovation of management models, and optimize the distribution of tourist resources, thus increase the competitiveness of tourist businesses.

In June 2006, the government of Singapore proposed a plan of Smart State 2015, which is a decade-long blueprint initiated by the Infocomm Development Authority of Singapore (IDA) and participated in by other government departments and whose aim is to envision a smart and global Singapore transformed for the better by inforcomm media by 2015, involving telecommunications, infrastructure, business and human resources, among many others.
**Smart Tourist Public Service System**

Closely connected with smart tourism, smart tourist public service system performs via information technology the functions of dynamic surveillance of tourist information, real-time dispatching command, tourist information and complaint solution, booking, and other services involving tourist destinations and sources of tourists, such as transport, marketing, internal traffic within a given tourist destination, accommodation and sightseeing alike. A tourist service system is to be built in tourist cities to render high-quality services, increase customer satisfaction, and boost the image of tourist destinations. The establishment of such a system can enrich tourist destination information of travelers’ choice, meet the transport needs of travelers and so on. Due to their lower transmission power, mobile devices of smaller sizes may be deployed for higher frequency reuse and capacity, while their coverage stays the same. Transmitting dispatched information reduces the power for signal transmission, thus helping lengthen the life span of users’ batteries.

Smart tourism is non-profit, which is to effect dynamic command of tourist information on the part of related parties, and real-time dispatching of tourist resources with the aid of modern information and communications technology, performing multiple functions like booking, emergency treatment, consultation and complaint solution. Smart tourism is generally supplied by governmental departments or social organizations.

Smart tourism offers an integrated package of digital solutions to enhancing the overall urban tourist services and management. Smart urban tourist public services are distinctly public, which can effectively meet the personal needs of tourists.

**The Establishment and Application of the System**

Smart tourist public service system refers to a public service system under which personalized tourist services are offered with the aid of information and communications technology in accordance with certain supply models and relevant governmental policies. Such a system plays an important role in constructing tourist public service facilities, perfecting the functions of tourist public services, improving tourist services and governmental management in this regard.

The system offers on the dimensions of the entire industrial management and services an integrated package of digital solutions to dynamically commanding tourist information and boosting tourist services and management. It consists of five sub-systems: the dispatching command sub-system, information management sub-system, complaint sub-system, training sub-system and emergency sub-system.

**The Dispatching Command Sub-system**

As the core of the entire system, the sub-system aims to command in a timely manner the information in scenic spots, traffic flow, places of tourist distribution (railways stations and airports), and vehicle flow in hotels with the aid of videos and cameras, and to reinforce the fast-reaction mechanism by combining with the geographical information system and through an integrated system of real-time surveillance, dynamic prevention, and public accidents, thus ensuring the smooth operation in tourist destinations and/or scenic spots.

Important facilities of software and hardware involved are the tourist dispatching command center and the video surveillance terminals. The tourist dispatching command center gives directions and dispatching commands to subordinates via the terminals. The center may monitor any given node on a real-time basis via the cameras and conduct an audio-visual interaction with any tourist spot. The surveillance terminals consist of high-definition cameras, pan tilts, encoders, and shields. At every tourist node, the video cameras collect information and transmit it to the video surveillance system, which in turn delivers the processed signals and directions to persons and departments concerned.

As an international sub-system of maintaining tourist routines and an important mechanism of coordinating tourists, traffic vehicles, and information, the sub-system performs the functions of collecting field information, integrating information within the entire system, delivering commands and coordinating multiple the sub-systems. In practice both in China and abroad, the sub-system is
The sub-system is capable of pragmatic application and extensibility with its reliable hardware performance, humanized UI design and communications path options of multiple circuits. Moreover, the sub-system is of the salient property of starting up on standby with the platform of smart tourism and the redundancy design at some key nodes.

The sub-system is supportive of communications protocols, establishing fast and effective connection with other sub-systems, and allows multiple user registration, achieving one-to-one correspondence between each node. While upgrading the dispatching scale, the sub-system also enables the dispatching center to give direct commands to field operators. The sub-system may rely on the infrastructure and related facilities of tourist cities and/or destinations to enable governmental departments to have a dynamic control of tourist information and a real-time surveillance of the changes in customer flow and tourist resources, supplying information for tourist dispatching command, sharing and coordinating tourist information, improving considerably the ability to cope with tourist accidents in tourist destinations, thus laying solid foundation for the emergency system.

**The Information Management Sub-system**

The sub-system consists of collection, release, operation and maintenance of tourist information, tourist marketing and e-commerce. It is designed to integrate all the tourist information available, and with the aid of ICT, to advertise and promote tourist resources online, to update the reputation and satisfaction of tourist brands, and to enhance the appeal of tourist destinations. To that end, effective tourist information management system or sub-system is to be created in tourist cities, along with a mechanism of the share and classified management of tourist public service data resources, so as to unify the sources of the information concerned and regulate and rationalize the structure of the system or sub-system, thus paving the way for more effective exploitation and application of the tourist information system or sub-system.

**Tourist Information Collection**

Tourist information is at the center of the factors in the tourist industry. Sufficient information is the very foundation of a digitalized tourist industry, a prerequisite of effectively marketing tourist destinations and offering online services, and a key criterion of the services supplied by tourist destinations and businesses. Tourist information collection is a primary link in the operation of tourist information management sub-system and a foundation and core of establishing tourist information database. The enormous amount of tourist information and the demand for timeliness necessitate a long-term mechanism of tourist information collection. The completion and timely collection of tourist information need a network of information collecting, filtering, processing, communicating and feedback.

Tourist information should be collected on a complete, real-time, and factual basis in the following ways: field investigation, information platforms (portal websites, Wechat, microblogs, QQ, etc.), open publications, relevant files and regulations, cooperative organizations, meetings, conferences, advertisements, and business contacts.

**Tourist Information Release**

Tourist information may be released via such channels as text messaging, digital television, and touch terminals. With a shared GIS (Geographical Information System) in tourist cities, a smart tourist guide is possible. A set of new tourist terminals may be developed with the aid of the Internet and the multi-media technology, which, by resorting to the service platforms available on smart phones and tablet computers, make it possible to interact real-time with official tourist websites and microblogs (Wechat) and to release such real-time tourist information as the number of tourists and their accommodations in scenic spots, thus providing timely and comprehensive information services, and establishing a tourist public service system which covers tourist information, booking, complaints, and rescue services alike, for a more prosperous tourist industry.
Tourist Marketing

Against the background of information technology, tourist marketing, by referring to a continuous and interactive mechanism of humans, machines, and programs, consists of collecting, analyzing, selecting, storing, and transmitting in an accurate and timely manner tourist information for the reference of tourist marketing decision-makers to improve, execute, and control market plans. Tourist marketing information refers to the files, data, and materials that reflect on a global basis the actual situations, properties, and relevance of the internal and external environments and marketing operations of tourist businesses. In practice, tourist public information services (based on geographical locations) may be readily available on the apps of smart phones, enhancing the experiences of tourists and hence give impetus to tourist consumption. With the development of mobile Internet, tourist marketing serves as a foundation of the opportunities of tourist businesses, a prerequisite of right promotion strategies, and also an important reference for business operations.

Tourist E-commerce

It is designed to, by means of computer networks and modern communications technology, adequately integrate the internal and external resources of tourist businesses, expand the transmission channels and coverage of tourist information, release and market tourist products online, create an interactive platform for businesses and tourists, and thus achieve online operation of tourist business. E in the current tourist e-commerce model of B2E (Business to Enterprise) refers to all types of companies, institutions and agencies associated with tourist businesses. Large companies conduct frequent activities, including business travels, exhibitions of all kinds, and bonus tours, which often require close cooperation with professional travel agencies for their advice, action plans and budgets. Upon deliberation and approval of the company concerned, the activities are entrusted to the professional travel agency in its behalf, thus saving time and expenses, which is indicated in Figure 1.

![Figure 1. The operation model of tourist e-commerce platform.](image)

Tourist Information Operation Maintenance

The tourist information management center is an important organ of maintaining the routine operation of the tourist information sub-system. Meanwhile, as a node of IT services, the sub-system is also capable of handling information associated with tourists, tourist businesses, and competent authorities. With intelligent analysis in the tourist information management center, data concerning tourist businesses, practitioners, and services may be matched both dynamically and statically, finally arriving at the data that administrators need and increasing their efficiency accordingly. The center also provides a platform for inter-departmental interactions to deal with service requests within the information management sub-system and is a functional division responsible for comprehensive management of tourist information services. The center is directly linked to tourist incident management and service levels and plays a decisive role in tourist information allocation, release and alteration.
Tourist Complaint Sub-system

Classifying scenic spots and areas can help identify subordination and effectively performs the functions of operation, management, and protection, thus favorable to foregrounding the tourist themes. Picturesque description with illustrations are necessary for the promotion of scenic spots; so are the cultural connotations involved.

The tourist public service system is a platform of tourist information release, which integrates all the necessary tourist information and releases it via different media. The model has evolved into the mainstream of tourist market with the growing number of Foreign Individual Tourists (FIT). However, the effective operation of such a model requires the support of mature, powerful information technology. FITs are intrinsically rather flexible, random, and diversified in demands, requiring corresponding services as supplied by tourist public service departments, such as information concerning food, traffic, accommodation, and shopping alike on the part of the tourist information center.

Visible tourist signs and tips, along with such information as exact positions and tourist hotlines alike, are to be available in the densely populated locations like major scenic spots/areas, traffic hubs, public transport stations, hotels, and restaurants. Upon dialing the suggested hotlines near the signs, tourists have access to the surrounding tourist service information concerning scenic spots, accommodations, food, traffic, entertainment and shopping alike as supplied by back office personnel of the call center who position the tourist with the aid of GIS system. Thus, tourist services are offered via the call center.

Twelve seats are currently available in the call center and the number is not sufficient to meet public demands with the growing business.

The technology concerned has taken into full consideration the question of integrating 12345 open telephones, and the current equipment is adequately compatible for future use. Due to the pressure of time, the present integrated mechanism is not functional yet and mostly restricted to tourist inquiry services before travel. Therefore, in response to the project requirements, the number of seats available will be expanded from the original six to eighteen. With the improvement of the 12301 tourist hotline system, better services are available to effectively handle tourist complaints and emergencies with enhanced command and coordination.

Tourist Training Sub-system

At present, the software and hardware necessary for creating tourist websites have mature. But the operation and management of a tourist website require also a great number of talented technical staff in e-commerce, tourism, the Internet, marketing, and management alike. The dearth of such personnel with a comprehensive command of such expertise is a crucial factor in the struggling e-commerce of tourist businesses.

In C-RAN, a cluster of VBSS converge at the same BBU and large computing resources are actually available. Therefore, VBS pools consist of all the required processing systems BSS. Virtualization may dynamically allocate resources. Upon use request, computing resources are allocated to corresponding services, which will lead reinforced capability of utilizing and adjusting processing resources to cater to the tidal effects in different areas. To speed up the process of modern Internet, China Mobile Corporation expects more in the construction of GSM, applying much up-to-date technology like 3G and 4G to GSM network. It is a rewarding exploration how to apply C-RAN, a future-oriented concept, to the construction of GSM network, to solve the problems that emerge in the construction. Given the enormous scale of GSM network, the introduction of the C-RAN concept will bring many benefits to tourist e-commerce.

Tourist Emergency Sub-system

Based on GIS, a tourist emergency sub-system is to be created to offer solutions to all sorts of emergencies. In the sub-system, the tourist hotline 12301 should be brought into full play for timely treatment and follow-up in the professional and efficient call center. In case of any emergency,
treatment procedures are to be initiated for comprehensive command and management and competent authorities are to coordinate to cope efficiently, accurately, and comprehensively.

Figure 2. Tourist Emergency Treatment Sub-system.

With the aid of Internet-based distributed control system (DCS), the sub-system is compatible with cascading for ease of system capacity expansion, the digital or simulated video monitoring system of all kinds to be shared with the established video monitors of the tourist city emergency command system, and such applications as video dispatching command for future steady upgrade.

Tourist emergencies often go out of control; it is rather difficult to have access to the de facto situation due to chaos on the scene. The tourist emergency sub-system offers a solution, through which the detailed field information is available. In case of need, the government, based on emergency dataset and in combination with GIS, may consult the emergency directories in the public service system, correspond with relevant departments by means of fixed telephone, tablet computer, and facsimile alike, and convene video conferences in a timely manner to deliver efficient commands, thus minimizing potential losses. The tourist public service system integrate the emergency video network of urban public security, the major urban scenic spots, surveillance cameras of traffic hub, and the surveillance center of the Administration of Tourism, and monitor real-time such densely visited areas as the scenic spots and traffic hubs through large screens. Thus, the density and direction of persons and vehicles may be known; regional saturation can be concluded by quantitative analysis and early warnings can be released. Real-time surveillance may indicate dynamic tourist information, provide support for decision-making processes, and thus coordinate dispatching command. In the event of a tourist emergency, surveillance information may be transmitted to the surveillance center immediately, which may, in accordance with received information, give commands to the information platform, accept and handle it, supervise and follow up the entire process, with the aid of GIS and modern call system.

Conclusion

With the support of IT and the application of C-RAN, the construction of a smart tourist public service system has become an important part in reforming China’s tourist administration. By means of a sound tourist public service model and necessary government supervision, tourist public services may be effectively and efficiently distributed; warm, safe, and satisfactory tourist public services may be available to tourists with the aid of C-RAN. The smart tourist public service system is constructed entirely on the basis of big tourist data. Such a sound system should conclude five sub-systems, namely, the dispatching command sub-system, information management sub-system, complaint sub-system, training sub-system and emergency sub-system, in all of which C-RAN is indispensable. With the application of such a system and/or sub-systems, an increasing amount of tourist public information service will be automatically pooled into the database in preparation for updating public services. Therefore, creating a sound tourist public service system is not simply a response to public
demands, but a trend that conforms to tourist administration reforms and the creation of a service-oriented government in an era of information technology.

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