

A Study on the integrated management system for tourism complexes based on IoT technology

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IoT 기술을 기반으로 한 관광단지 통합관리시스템에 관한 연구

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요약 본 연구는 관광단지의 실태를 분석하고, 관광단지의 활용 및 관리를 개선하기 위해 IoT 기반 통합관리시스템을 관광단지에 적용하는 것을 목적으로 한다. 관광수요자들은 관광활동에서 관광지를 선택하기 위해서 다양한 필요하며 이러한 필요한 모든 정보는 인터넷이나 여행사, 신문, 주위의 경험자들의 정보 등 여러 경로로 통해 수집하게 된다. 최근 정보기술의 발달로 인터넷을 통한 정보 제공이 큰 비중을 차지하고 있으며, IoT 기술을 접목한 시스템들이 구축되고 있다. IoT 기술의 대중화로 인해 정보의 다양성과 접근성, 편리성이 향상되고 사용도 편리해지고 있기 때문이다. IoT 기반 시스템을 활용한 관광정보 서비스의 중요성과 향후 연구방향에 대해 제시하고자 한다. IoT 기술의 효율성을 고려하여 IoT 기반 시스템 구축에 대한 선행연구도 검토되었다. 관광단지의 문제점을 해결하기 위해 본 연구에서는 IoT 기반 관광단지 운영체계를 개선하여 운영관리를 수행하였다. IoT 기반 경영시스템은 관광단지 플랫폼으로서 운영에 있어 개선될 것으로 기대되며, 전반적인 경영 사례와 경험으로 개선될 것으로 기대된다.

키워드 : 산업관광단지, 시설, 이용, 관리, IoT, 통합관리시스템, 시설개선

Abstract The purpose of this study is to analyze the actual condition of tourism complex and to apply IoT-based integrated management system to tourism complex to improve the utilization and management of tourism complex. Tourists need various information to take the lead in tourism activities, and all of these necessary information is collected through various routes such as information of the Internet, travel agencies, newspapers, and surrounding experiences. Recently, information provision through the Internet has taken a large part due to the development of information technology, and systems that combine IoT technology are being constructed. This is because the popularization of IoT technology improves the diversity, accessibility and convenience of information and makes it convenient to use. The purpose of this study is to suggest the importance of tourism information service using IoT-based system and future research directions. The previous studies on IoT-based system construction were also reviewed considering the efficiency of IoT technology. In order to solve the problems of tourism complex, this study improved the IoT-based tourism complex operation system and conducted operation management. IoT-based management system is expected to be improved as a tourism complex platform and is expected to be improved by overall management cases and experiences.

Key Words : Tourism Complexes, Facilities, Utilization, Management, IoT, Integrated Management system, Facility improvement

have positive effects such as economic revitalization and job creation as local tourism bases, but it is necessary to introduce various types of facilities to actively respond to changes in the demand environment. Especially, the tourism complexes that are developed or developed in the region due to the change of the tourism demand pattern are gradually diversified into urban type, settlement type, and complex type, but the facilities and facilities that can be installed in the current tourist complex are very limited[1,2]. Although the Tourism Promotion Act clearly defines the purpose and role of the designation of tourist complexes, it defines the tourist complex as a tourist base area that comprehensively develops various tourist facilities for various tourism and recreation of tourists in the definition of Article 2 of the Tourism Promotion act[3,4]. In order to support tourism activities in order to expand the leisure time of the people and to change the life pattern, it is the purpose of designating the tourist base area by reflecting the artificial facilities based on the natural environment in order to support the national emotion. Since there is a problem that various tourism and recreation facilities introduced and constructed in the tourist complex can not cope with these changes, it is necessary to introduce and review new types of facilities, so we have studied ways to actively respond to new changes without damaging the original purpose and purpose of the tourism complex [5-8]. First, this study will analyze the difficulties of management and operation of tourist complex facilities and important factors in management and operation of tourist complex facilities through the management and operation of tourist complex facilities, and

analyze the problems and improvement factors of facilities felt by users of tourist complex facilities [9,10]. Second, in order to cope with the problems derived from the management and operation of tourist complex facilities, we will present a strategy to utilize integrated management system of tourist complex facilities based on the Internet of things that can contribute to efficient and stable management of tourist complex facilities and promotion of user use [11-14]. To this end, we will first identify the status of the construction of an integrated reservation and operation system for the tourist complex facilities of the local governments, and present an example of the construction of an integrated management and operation system that can contribute to the low-cost, efficient and safe management operation in terms of the user side and the convenience of the user side.

2. Related Work

2.1 study result

The tourism complex facilities to be studied were limited to tourist complex facilities that can collect evaluation data such as the status of use and the operation balance among major tourist complex facilities such as complex exhibition hall and tourist special product souvenir hall[15]. The tourist complex facilities include an exhibition hall, a sales hall, and a souvenir shop for special products. The survey was conducted on 1,003 facilities (as of the end of 2016) for the management and management of the tourist complex facilities (including the local government tourism facility officials, the consignment

management operators, and the private entrusted persons). Since the public facility manager manages various tourist complex facilities in the area, it is analyzed by management subject rather than facility analysis. The questionnaire survey was conducted for tourists aged 20 to 65 years old nationwide. The survey items on the use and management of tourist complex facilities were based on the research purpose and established data on the operating balance (income, expenditure), usage status (the number of people used annually, and the number of days of opening). In cooperation with the Ministry of Culture, Sports and Tourism, the survey method was conducted using a structured questionnaire through e-mail to the person in charge of the facilities of the basic autonomous tourism complex. The user questionnaire surveyed the problems of the use of tourist complex facilities and the physical and non-physical improvement requirements[16]. The management operator questionnaire conducted a survey on the difficulties of management and the importance of physical and non-physical elements of tourist complex facilities. The survey was conducted using structured questionnaires during the same period. A sample was collected by proportional allocation method considering the type of facilities and the area. A total of 500 copies were collected by 165 exhibition halls, 175 special products halls, and 160 tourist and recreational facilities by facility type. The survey on the status of online integrated reservation system was divided into 17 types of metropolitan municipalities and 264 municipalities using the Internet.

The most difficult ranking of the facility management and operation of the tourist complex was the difficulty of “lack of facilities equipment and aging (34.8%), followed by “lack of financial resources (28.7%) such as over-management and operation costs” and “imperfect capacity of management and management personnel such as manpower shortage (25.1 percent). It was analyzed that the price was high. Facilities managers at management agencies responded that 'lack of facility equipment and aging' was the most difficult priority. The management of independent departments (A) and independent departments (B) of local governments recognized the “lack of financial resources such as excessive management and operation costs” and “imperfect capacity of management, management personnel such as lack of manpower, expertise” as important issues, while other consignment management organizations (C, D, and F) were in the condition of the facilities. In other words, in the case of tourist complex facilities managed by the public, the human resources and financial difficulties of management and operation are important issues, We need to take precedence[17].

3. Method

If you look at the actual use and management of tourist complex facilities, There are a total of 185 exhibition halls. As of 2016, the average number of people who can accommodate is 11,664, which is open at an average annual rate of 332 days. Considering that the average accommodating population is 11,664, the

average of the total number of users is only 94,684, which is open, but only about 8 days a year is actually used. As described in Table 1, there are 289 specialties, and the average number of people available by 2016 is 1,878, which is open at an average annual rate of 327 days. The average number of users in the three-year special product hall was 62,520, and the average number of users was 1,878, which means that only 33 days were used. There are a total of 376 tourist and recreational facilities. As of 2016, the average number of people who can accommodate is 2,941, which is open at an average annual rate of 325 days. Comparing the utilization rate by facility type based on the average number of users in three years, the exhibition hall built as a tourist complex facility was the highest at 18.3%, and the utilization rate of special product facilities was low at 2.4% and 10.2%, respectively(<Table 1>).

<Table 1> Average annual users by sports facilities in 2016

Category	exhibition hall	special product hall	tourist and recreation center
No. of facilities	185	289	376
person	11,664	1,878	2,941
Average annual users(B)*	94,684	62,520	175,199
Period of opening(C)(days)	332	327	325
Rate of utilization(B/A*C)(%)	2.4	10.2	18.3

*: The average annual total number of users from 2014 ~ 2016

The average operation scale of tourist complex facilities such as Table 2 is estimated to be deficit in all types of tourist facilities between the last three years (2014 and 2016). By facility, the deficit level of the exhibition hall was the highest at 416 million won, and the special

product hall was smaller than the other facilities, while the income and expenditure were larger.

<Table 2> Costs and Benefits of Tourism Complex Facilities

Category	Stadium	hall for ballgame	Gymnasium	
No. of facilities	179	277	375	
Average operating balance*	gross income	248	109	702
	gross expenditure	665	289	879
	operating balance	-416	-180	-177
Average income	renta	234	24	70
	rental fee	65	52	100
	the rest	336	175	944
	sum	634	250	1,113
Average expenditure	managementexpense	227	113	346
	payrollcost	239	129	403
	renovation expense	225	79	73
	the rest	263	122	336
	sum	950	444	1,157

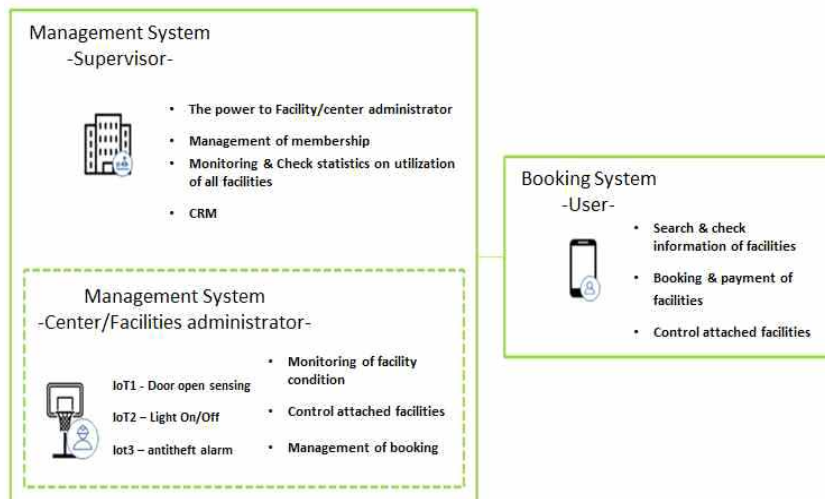
It is required to establish an integrated management and operation system that integrates the reservation and management of tourist complex facilities in order to improve accessibility to public services by the development of information and communication technology and the spread of smart phones, and to improve the utilization rate of tourist complex facilities and smooth management operation. However, it is not possible to grasp whether these systems are built or not and the status of the Internet facility system of local governments. In this study, we surveyed the Internet to see whether the integrated management and operation system of the metropolitan and municipal governments including the online reservation site was established. The survey was divided into four types according to the type of system operation, and 17 metropolitan municipalities and 264 basic municipalities were surveyed on the Internet to determine whether the system

was built. As confirmed in the data on the construction of the integrated reservation system, the online reservation system construction rate of the national public sports facilities is 18%. In addition, the management and operation system that can remotely control the facilities of the tourist complex of the manager has not yet been introduced to IoT technology, so there is no place to operate the system. In this study, we would like to propose an efficient integrated management and operation system for tourism complex facilities using IoT technology so that users and managers of tourism complex facilities can conveniently use and manage sports facilities. The composition of the integrated management system for tourist complex facilities is divided into reservation system for users, control system for administrators, and IoT H/W (hardware) attached to individual facilities. The system-specific features are the same as Table 3.

<Table 3> A Structure of Integrated Reservation Management System for Tourism Complex Facilities

Structure	Contents	System user
Online reservation system	<ul style="list-style-type: none"> - Provide online system to Facility user - Offer user facility information and function of reservation & payment 	Facility user
Online control system	<ul style="list-style-type: none"> - Provide control system to manager & supervisor - Modification of facility & center information / reservation information - Offer manager and supervisor utilization statistics function 	Facility/Center manager Supervisor
IoT Hardware	<ul style="list-style-type: none"> - Attach IoT to facilities and belongings - Check condition of Facilities and belongings - Monitoring and accumulation of facility usage data 	-

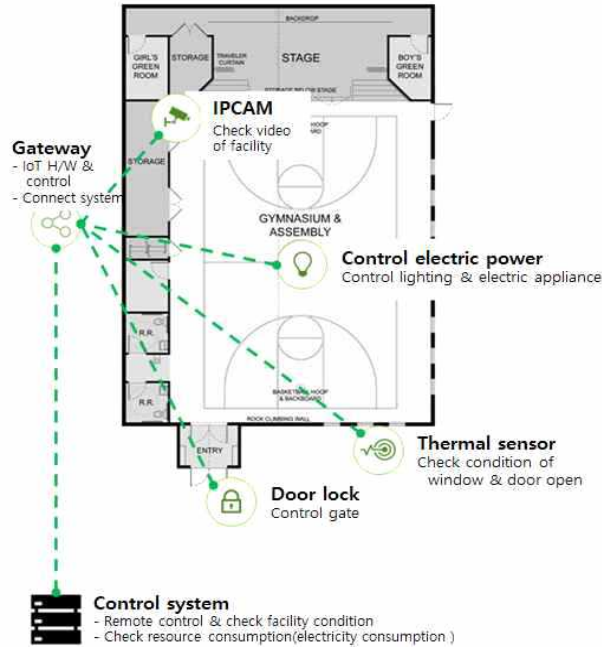
The S/W is structured as in Fig. 1. The facility management corporation, which serves as the integrated manager of the control system, has the authority to appoint facilities and center managers and manages the members in an integrated manner. In addition, as in Fig. 2, we collect various data through facility operation and check statistics to find ways to manage and operate facilities efficiently in the future.



[Fig. 1] Exemplification of S/W composition

As described in Fig. 2, IoT hardware and software can be selected and attached only according to the condition and environment of the facility and expanded the need. In addition to the basic H/W infrastructure (such as servers), IoT hardware and software are attached to the facility to ensure

management efficiency. IoT hardware and software attached to facilities or attached facilities enable remotely checking and controlling the condition of the facility, which requires that each IoT hardware and software be connected to the wired and wireless Internet network.



[Fig. 2] IoT hardware and software of 3 can be selected and attached only according to the condition or environment of the facility

4. Result

In the case of exhibition halls where various programs and available tourist products are operated among the tourist complex facilities, the utilization rate and the utilization balance are relatively good. In addition, considering the ease of management of tourist complex facilities and the ease of user use, it is necessary to introduce an IoT-based integrated management and operation system that enables mutual communication of

information on physical and non-physical information of tourist complex facilities and user behavior.

The online reservation system, which has already been built, is also problematic. First, all the focus is focused on PCs, which is a lot of inconvenience to use mobile. Considering the rapidly increasing number of smartphone users, it is urgent to switch to a mobile-oriented system. Although it is not impossible to access the reservation system by mobile, it is a big inconvenience for users to repeatedly

expand the screen because it provides a web page of the PC version.

The configuration of the integrated management and operating system is divided into a reservation system for users, a control system for administrators, and IoT H/W (hardware) attached to individual facilities, and can be divided into online reservation system, online control system, and IoT hardware. The IoT S/W configuration is available on a variety of platforms, both in the mobile version and in the web version of the booking system and control system. The control system can be linked to the reservation system used by the existing management agency.

Currently, this environment prevents users from checking and accessing information about their facilities. Another problem is that when the facility manager is absent, the user is often restricted from using the facility. There are many cases where the facilities are not available due to managerial leave or absence for some reason at the available time of the tourist complex facilities. As a temporary measure, facility managers often leave keys to club officials or local residents, which is not a fundamental solution to increasing the utilization of tourist complex facilities. Still, many users are pointed out as a problem because they are restricted from using facilities.

5. Conclusion

The integrated management and operation system of the tourist complex facilities can be an alternative to the problems mentioned above because both the manager and the user can provide convenience to the facility management and use by applying advanced

technology than the online reservation system currently in operation. The user can use mobile devices to identify facility information (location, available time, etc.) and expect three effects: a system for managing the facilities, allowing the user to make reservations and payments, and a system for managing the facilities to control access and access through remote control and reduce unnecessary energy consumption. First, it is an improvement in the efficiency of facility operations. Once the integrated management and operation system is established, data collection of users' usage behavior is very easy. Second, it is an improvement in the ease of facility management, and because it is possible to control facilities remotely under this system, it is possible to manage facilities without a manager. Third, it is a user's convenience improvement, and the user can do everything from checking the facility information to making reservations and paying with only the mobile device at once. Therefore, it is necessary to build a system considering the characteristics of individual facilities in order to build an integrated management and operation system because the type and size of the facilities are different. In order for the system to be policyized and applied to tourist complex facilities, the verification process through the pilot project of the integrated management and operation system of tourism complex facilities should follow.

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