IJACT 22-3-38

Smart Tourism Information System and IoT Data Collection Devices for Location-based Tourism and Tourist Safety Services

¹Tae-Seung Ko, ²Byeong-Joo Kim, ³Jeong-Woo Jwa

 ^{1,2}Undergraduate course, Department of Telecommunication Eng., Jeju National University, Jeju, Korea
³Professor, Department of Telecommunication Eng., Jeju National University, Jeju, Korea {tsko7777, newb37, lcr02}@jejunu.ac.kr

Abstract

The smart tourism service provides services such as travel planning and tour guides to tourists using key technologies of the 4th industrial revolution, such as the Internet of Things, communication infrastructure, big data, artificial intelligence, AR/VR, and drones. We are developing smart tourism services such as recommended travel products, my travel itinerary, tourism information, and chatbots for tourists through the smart tourism app. In this paper, we develop a smart tourism service system that provides real-time location-based tourism information and weather information to tourists. The smart tourism service system consists of a smart tourism app, a smart tourism information from the IoT data collection device. The smart tourism information. The location-based smart tourism service is provided as a smart tourism app in the smart tourism information system according to the Beacon's UUID in the IoT data collection device. The smart tourism information system stores the Beacon's UUIDs received from tourists and provides a safe hiking service for tourists.

Keywords: Smart Tourism, IoT service, Location-based Service, Real-time Video Service, Mobile App

1. INTRODUCTION

Smart tourism uses the Internet of Things (IoT), communication systems, big data, artificial intelligence (AI), VR/AR technologies to provide context-aware personalized travel products and tour guide services to tourists [1]-[3]. We are developing a smart tourism system consisting of a smart tourism app and a smart tourism information system to provide smart tourism services to tourists. The smart tourism app provides recommended travel products and tourist information so that tourists can create their own itinerary [4]-[6]. Before travel, tourists can create a personalized travel itinerary using the tourism information and recommended travel products provided by the smart tourism information system. The smart tourism information and tourism information system provides tourists with a smart tour guide service that provides weather information and tourism information of tourist destinations according to a personalized travel itinerary. Tourists can create a travel itinerary based on the tourism information provided by the smart tourism information system and use the smart tour guide service according to the itinerary during the trip. We developed a server-based multilingual

Manuscript received: March 1, 2022 / revised: March 3, 2022 / accepted: March 9, 2022

Corresponding Author: <u>lcr02@jejunu.ac.kr</u>

Tel: +81-64-754-3638, Fax: +81-64-754-3610

Professor, Department of Telecommunication Eng., Jeju National University, Korea

Copyright©2022 by The International Promotion Agency of Culture Technology. This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0)

text-to-speech (TTS) tourism information system that provides location-based voice tour guide services using Beacons and GPS [7].

The smart tour guide service for hiking and walking tourists traveling to tourist spots such as Hallasan Mountain and Olle Trails in Jeju, South Korea requires real-time weather information such as temperature and humidity, wind speed, and fine dust at major points of the tourist destination. We developed the IoT monitoring device that collects real-time weather information while counting the number of visitors to tourist attractions such as *Hallasan Mountain* and Oreum that require environmental preservation [8]. The smart tourism information system provides tourists with big data analysis of weather data collected from IoT devices. As the number of tourists on Hallasan *Mountain* and Olle Trails increases, safety accidents are occurring continuously in proportion. In this paper, we develop a smart tourism system that can safely hike while providing location-based tourism information and weather information at major waypoints in tourist destinations. We install IoT data collection devices with Bluetooth Beacons at major points of tourist destinations, provide location-based tourism information services to tourists with a smart tourism app, and analyze travel route data for tourist safety in a smart tourism information system.

2. REAL-TIME WEATHER INFORMATION AND IMAGE INFORMATION SERVICE USING THE TOURISM INFORMATION SYSTEM AND IOT DATA COLLECTION DEVICES

The smart tourism service system should be able to provide real-time weather information while analyzing the travel route at the tourist destination in consideration of the safety of hiking and walking tourists. In this paper, we develop a smart tourism service system to provide real-time tourism information services to tourists during their trip based on their location. Figure 1 shows the functional block diagram of the smart tourism service system proposed in this paper.



Figure 1. Smart tourism service system that provides tourism information and weather information while considering the safety of tourists based on the tourist location

In Fig. 1, the Android and React native smart tourism apps provide smart tourism services such as recommended travel products, my travel products, tourism information, and chatbot, and others. The smart tourism information system consists of the Spring framework and MySQL database, and manages tourism

information and travel product information provided by the smart tourism app. The IoT data collection device collects real-time weather information and image information of tourist destinations.



(a) IoT monitoring device



(b) IoT data collection device





(a) Meteorological data collection of tourist destinations using IoT data collection device



(b) Collection of tourist destination image data using IoT data collection device

Figure 3. Tourism information collection of weather data and image data from IoT data collection devices using a NBIoT communication module or a LTE modem

313

Figure 2 shows the IoT monitoring device developed previously and the IoT data collection device developed in this paper. The new device is developed with a miniaturization so that it can be easily installed in tourist destinations that are difficult to install. IoT devices installed in tourist destinations are powered by solar modules and rechargeable batteries. The battery capacity used in the device is 25,000mAh, and considering the power consumption of the sensors, it can operate for about 178 hours when fully charged. Since the device's battery can be charged with a solar module, the device can be installed in outdoor tourist destinations and used semi-permanently. The smart tourism information system collects weather data such as temperature, humidity, wind speed, and fine dust from IoT devices in real time using the NBIoT (Narrowband Internet of things) communication module as shown in Fig. 3(a). As shown in Fig. 3(b), the smart tourism information system can collect real-time image information from cameras installed in tourist destinations using a LTE modem.

3. LOCATION-BASED REAL-TIME TOURISM INFORMATION SERVICE AND TOURIST SAFETY SERVICE

The smart tourism information system provides tourists with weather information and image information collected from IoT data collection devices at major points of tourist destinations. The IoT data collection device transmits the weather data collected from the sensor to the smart tourism information system through the NB-IoT mobile communication network. Real-time image data of tourist destinations captured with Raspberry Pi and camera module is transmitted to the smart tourism information system using LTE modem that provides high-speed transmission speed. As shown in Fig. 1, the smart tourism information system has tourism information, meteorological information, and image information databases of major tourist spots and a database that manages the Beacon's UUID (universally unique identifier) installed in IoT data collection. During a hiking or walking tour, tourists can receive real-time tourism information and weather information of major tourist spots where IoT data collection devices are installed.



Figure 4. Real-time tourism information provision process using Beacon's UUID

The smart tourism app transmits the Beacon's UUID information received from the beacon of the IoT data collection device to the smart tourism information system, and the system provides tourism information and weather information corresponding to the Beacon's UUID. In the Beacon's UUID database of the smart

tourism information system, the names of major points of tourist destinations are matched and managed with the Beacon's UUIDs in the IOT data collection device. In the smart tourism information system, we use the tourist location information collected when the smart tourism app requests tourism information with the Beacon's UUID information of the beacon to analyze the tourist's movement route in the tourist destination. We can promote the safety of tourists by analyzing the travel route data of tourists and quickly rescue them when a safety accident occurs at a tourist destination.



Figure 5. Location-based tourism information service on the Eorimok Trail in Mt. Halla



Figure 6. A safe hiking system based on the location of tourists

315

Figure 4 shows the process of providing real-time tourism information and weather information to tourists using the Beacon's UUID in the IoT data collection device. When a tourist comes within the receiving radius of the IoT data collection device Beacon, the smart tourism app receives the Beacon's UUID as shown in the Fig. 4. The smart tourism app transmits the Beacon's UUID to the smart tourism information system to request tourism information and weather information. The smart tourism information system provides tourism information and weather information corresponding to the Beacon's UUID in the IoT data collection device as a smart tourism app. The smart tourism information system stores tourists' Beacon's UUID information to provide tourists' safe hiking services. Figure 5 shows an example of providing location-based tourism information and weather information center and consists of a course to Sazebi-dongsan, Mansedongsan, Witse Oreum, and Nambyeok Junction as shown in Fig. 5. Figure 6 shows a safe hiking system using the tourist beacon data stored in the smart tourism information system. When an accident occurs to tourists, it is possible to identify the location of the accident and respond quickly by using Beacon's UUID in the IoT data collection device stored in the process of providing tourist information.

4. CONCLUSIONS

It is necessary to develop a smart tour service for the safety of tourists as well as real-time tourism weather information in the smart tour guide service used by tourists during travel. In this paper, we develop the location-based smart tourism service system to provide real-time location-based tourism information services in hiking and walking tours. Tourists can obtain tourist information and weather information services from the smart tourism information system through the smart tourism app by grasping location information from the Bluetooth beacon of the IoT data collection device during walking tours. During the trip, tourists can take a safe walking tour by being able to grasp the weather information of the tourist stopover in advance. In addition, we can safely rescue tourists by analyzing the travel route data of tourists in the tourist information system in the case of a mountain accident.

ACKNOWLEDGEMENT

This research was also supported by the 2021 scientific promotion program funded by Jeju National University.

REFERENCES

- Gretzel, U., Sigala, M., Xiang, Z. and Koo, C, "Smart Tourism: Foundations and Developments", *Electronic Market*, pp.179-188, 2015. DOI:10.1007/s12525-015-0196-8
- [2] Sameera A Abdul-Kader and JC Woods. "Survey on chatbot design techniques in speech conversation systems", *International Journal of Advanced Computer Science and Applications*, 6(7), pp.72-80, 2015. DOI: 10.14569/IJACSA.2015.060712
- [3] F.Clarizia, F. Colace, M. Lombardi, F. Pascale, "A Context Aware Recommender System for Digital Storytelling", *IEEE 32nd International Conference on Advanced Information Networking and Applications*, pp.542-549, 2018. DOI: 10.1109/AINA.2018.00085
- [4] JeongWoo Jwa, "Development of Personalized Travel Products for Smart Tour Guidance Services", International Journal of Engineering & Technology, 7 (3.33) 58-61, 2018. DOI: 10.14419/ijet.v7i3.33.185 24
- [5] Jeong-Woo Jwa, "Pedestrian Network Models for Mobile Smart Tour Guide Services," International

Journal of Internet, Broadcasting and Communication, vol.8, no.1, pp.73-78. 2016. DOI: 10.7236/IJIBC.2 016.8.1.27

- [6] JeongWoo Jwa, "Service Platform and Mobile Application for Smart Tour Guide," The Journal of The Institute of Internet, Broadcasting and Communication, vol.16, no.6, pp.203-209. 2016. DOI: 10.7236/JII BC.2016.16.6.203
- [7] KiBeom Kang, JeongWoo Jwa, SangDon Earl Park, "Smart Audio Tour Guide System using TTS", International Journal of Applied Engineering Research, pp.9846-9852, 2017. https://www.ripublication.c om/ijaer17/ijaerv12n20_81.pdf
- [8] Jin Sung Kim, Hyeon Jun Kang, Jeong Woo Jwa, "Smart Tourism Monitoring Device Based on IoT Technologies", International Journal of Recent Technology and Engineering (IJRTE), pp. 2277-3878, 2019. https://www.ijrte.org/wp-content/uploads/papers/v7i6s5/F12210476S519.pdf