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Group Tour Management System using LBS-Based Path Deviation Detection

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ABSTRACT:_Recently, citizens traveling overseas have been exponentially increased thanks to the increased interest in foreign countries from globalization and the raised income level. Individual traveling is the case but there are many cases to choose group tours due to convenience and saving cost. However, it is hard for group leaders to control the members in the group tours, causing the tourists to lose the way or exposing many accidents and crimes such as negligent accidents, disappearances, and so on. In this paper, the system is suggested to control the tourist groups easily using LBS(Location Based Service) and Bluetooth.The route deviation detection method presented in this paper was able to detect very high accuracy with a relatively simple algorithm with a small number of reference points. In addition, since the number of reference points used for path deviation detection is small, management and change of reference points are relatively easy. Using this system, the group leaders can know the number of members and their locations real time basis. As a result, this system will secure the easiness of control to be able to prevent the negligent accidents. Also, it will minimize time consuming by quickly calling the roll with the system using the characteristics of Bluetooth._

KEYWORDS:_LBS, Attendance check system, Global Positioning System, Tour application, Bluetooth._

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I.　INTRODUCTION

Recently, citizens traveling overseas have been exponentially increased thanks to the increased interest in foreign countries from globalization and the raised income level. Individual traveling is the case but there are many cases to choose group tours due to convenience and saving cost. Recent trend showed the preference of package tours that travel oversea as a group collected by the tour agencies. Package tours have the advantages to be less costly and travel more places within the limited time period than individual tours. Also, it is convenient because tour agencies provide all the itineraries including accommodations, transportation, and so on. Especially, tourists from East Asian countries including Korea, China, and Japan, prefer group tours and the size of groups varies from 20 to 40.As the size of group is higher, it is more likely to lose the way and to be exposed to the crimes and accidents such as negligent accidents, disappearances, and so on due to difficulty in controlling the members of the tour groups.

In this paper, the system is suggested to control the tourist groups easily using LBS(Location Based Service) and Bluetooth. The route deviation detection method presented in this paper was able to detect very high accuracy with a relatively simple algorithm with a small number of reference points.Using this system, the group leaders can know the tourists' locations real time basis. The leaders can quickly acknowledge the cases that members get out of the certain boundary so as to control them more easily and to prevent negligent accidents. In addition, it could minimize the time to check the members because it uses Bluetooth.

The organization of this paper is as follows. In chapter 2, previous studies related to this are described. In chapter 3, design and implementation process of this system are explained and in chapter 4, conclusion and further studies are discussed.

II.　RELATED WORKS

2.1 GPS and Bluetooth

Global Positioning System(GPS) is a system to find the positions of planes, ships, cars, as well as individuals using the satellites wherever in the world. GPS is used mainly for the navigation systems in the planes, ships, cars together with Geographic Information System(GIS). It is also used to find the position of

individual, cars, and so on upon embedding GPS receiver in the smartphones. The advantages of GPS are strong resistance against interference and jamming signals and using the common coordinate system globally. However, it has the disadvantage not to be used where the satellite signals are not detected, or signal attenuations are significant[1].

Bluetooth, one of the short-range wireless networking technologies and short-range mobile communication standards co-developed by Bluetooth Special Interest Group that was organized in 1998 by 5 parties including Ericson, Nokia, IBM, Intel and Toshiba, is the technology standard to connect and control multiple electronic and telecommunication devices within 10 to 100 meter diameter[2].

2.2 Automated Attendance Check System

Recently, due to the development of auto recognition technology such as RFID[3], NFC card, etc., and the biometric technology such as fingerprint recognition, face recognition an automated attendance management system that automatically manages the attendance and absence of students utilizing such technologies are widely studied and developed.

RFID based automated attendance check system [4] is a system that automatically aggregates the attendance and absence status when smart card attached with RFID tag is recognized by the reader.According to the recent development of auto recognition technology such as RFID, label, card and the biometic technology such as fingerprint recognition, facial recognition the automated attendance and absence system that automatically manages the attendance and absence of students utilizing such technologies have advantages such as unmanned verification of attendance and absence, reduced verification time for attendance and the internet verification of attendance and absence. However, in order to structure the automation system, it has problems in terms of costs because it requires additional equipments such as RFID reader, fingerprint reader and clicker and has problems of management due to dishonest attendance by loaning the card and photos.

Fingerprint recognition-based automatic attendance check system[5] is a system that counts attendances by recognizing fingerprints. This is not a problem such as loss, rental and theft, but there is a disadvantage that takes a lot of cost to build the system.

In the attendance and absence management system using the self-organized type of facial recognition, a client-server system that automatically manages the attendance status of the corresponding course by recognizing the person's facial information using the self-organization neural network was developed [6, 7].

The clicker[8] is a two-way wireless lecturing system consisting of portable responder and receiver attached to the computer. It is a useful lecturing support system that enables effective questions and answers between teachers and students as well as automatically checking the attendance and absence[9].

Such automated attendance check system reduces the time of checking the attendance and absence due to unmanned operation. However, in order to construct the system, additional equipment such as an RFID reader and a fingerprint reader is required, which is not suitable for a group travel personnel check system.In addition, there could be problems such as not being recognized of attendance when the smart card is lost or not in possession, difficult situation of checking the attendance and absence due to equipment failure such as damaged cards.

III. DESIGN AND IMPLEMENTATION OF GROUP TOUR MANAGEMENT SYSTEM

The system structure in this paper is designed as Fig. 1. First, five core functions can be used upon membership joining and login by users.
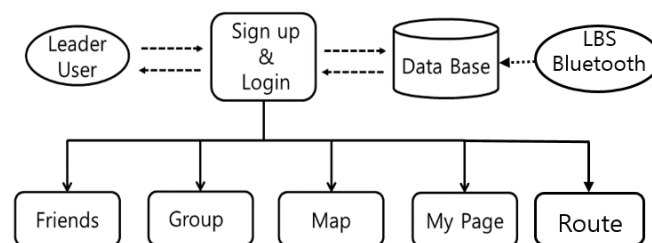

Fig. 1.Structure of group tour management system

3.1 Friends

Upon synchronization of contact list stored in the smartphone, other users who use this system can be registered as friends. Registered friends are listed in the list of friends to be searched whenever needed, and they can be deleted and blocked later.

3.2 Group

Invite the users registered as friends to the group. The user who invites group becomes a host automatically and invited users become members. Host becomes a leader to control the tour members. The leader has the authorities to receive the information on the positions of members and to check, manage and control them. Also, it can share or delegate the authority of host with other members. Leader can perform the call roll for the members as being a subject of call roll in Bluetooth which is one of the important functions in this system.

The call roll function is operated as follows. First, if host who is a group leader pushes the button for call roll in the smartphone application, alarm of call roll is delivered to each member. Once the members receive the alarm of call roll, push the reply button, immediately. Then, the position information of the members who do not reply is demonstrated in the smartphone of the leader. In case of abnormality or in danger of the members, urgent alarming function can be performed. This is performed upon pushing the button to be shared with the members on the position information immediately as well as to be delivered with emergency alarming. To prepare the environment where emergency alarming function cannot be used, emergency alarming function is operated automatically by the smartphone dropped down or impacted.

Leader informs the members that they watch the cultural heritages freely and come back when and where. Then, leader needs to check whether all his or her group members are gathered. In this case, automatic checking is possible using the Bluetooth function.

3.3 Map

Map function includes GPS navigating system which is a core function of this system. Once it is performed, the map is appeared based on the position information of the users. If the user is a group leader, the position information of group members is displayed as the Fig. 2. Also, leader can set the restricted territory as a circle in the map and alarming is alerted if the position of any members is out of the restricted territory.

Fig. 2.Screen shot of map menu

Table 1 is the result of applying to a group tour in Dubrovnik city, Croatia. The group that participated in the experiment consisted of 14 people, and the experiment was conducted at five tourist destinations in Dubrovnik.As a result of the experiment, all the people of traveler group within the data range of Bluetooth were checked in real time. Those who weren't checked could use GPS to find their current location.

Table 1.The result of applying to a group tour

place	Number of people	Checked by Bluetooth	Checked by GPS	Checked rate
A	14	12	2	100%
B	14	13	1	100%
C	14	14	0	100%
D	14	13	1	100%
E	14	14	0	100%

3.4 Route

In this paper, a traveler's route deviation is detected using LBS. Location-based service is a wireless content service that provides specific information to wireless Internet users according to the user's location.

The experiment was conducted a total of 30 times, and the GPS function of the smartphone was used.Latitude and longitude coordinate values according to the traveler's location were detected every second. The route deviation was detected using the latitude and longitude coordinate values according to the traveler's location.The application used in the experiment was implemented in the Android operating system. The map used in this paper is a google map.The reference route set in this paper was used by designating a walking route in Dubrovnik city as shown in Fig. 3. Since the total distance of this reference route is about 200m and the width of the walking route is about 2m, the effective width of the reference route was set to 32m.As the reference points used in this experiment, a total of five points, including the start point, end point and curve point were used.In Fig. 3, the black point is the reference point and the dotted line is the reference path.
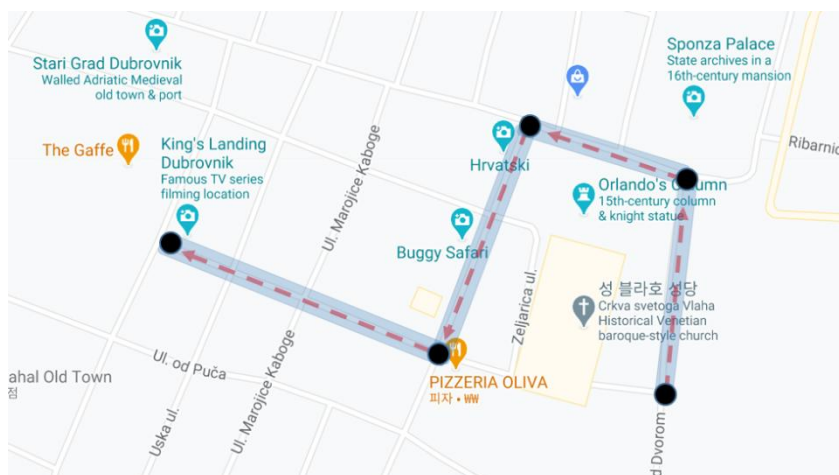
Fig. 3.Reference point and path

Fig. 4 shows the detection of the travel route.This experiment was conducted in two cases.In the first case, as shown in Fig. 4 (left), it is the case of walking without deviating from the reference route.In the second case, intentionally deviated from points 1, 2, 3, 4, and 5 in Fig. 4 (right).Among the GPS positioning methods, the experiment was conducted using S-GPS and A-GPS.

The left side of Fig. 5 is a case of normal detection when intentionally deviated. Points 1 and 2 on the right of Fig. 5 are the points where detection errors occur.
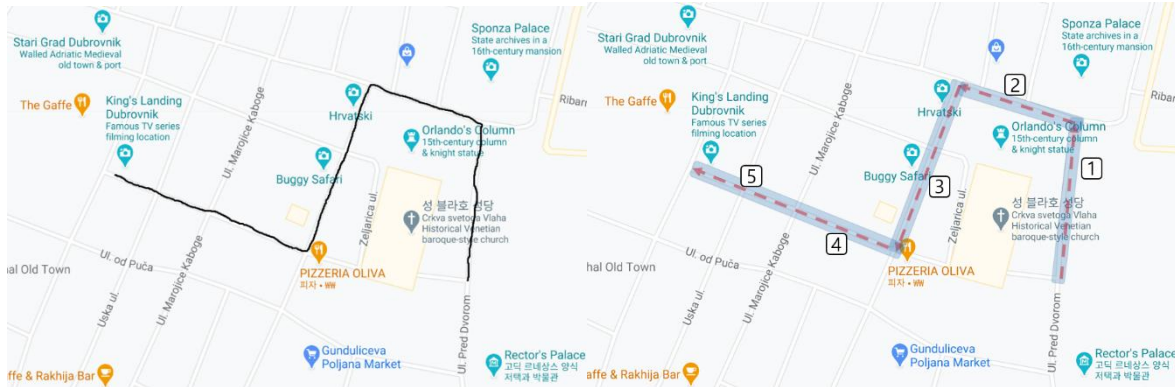
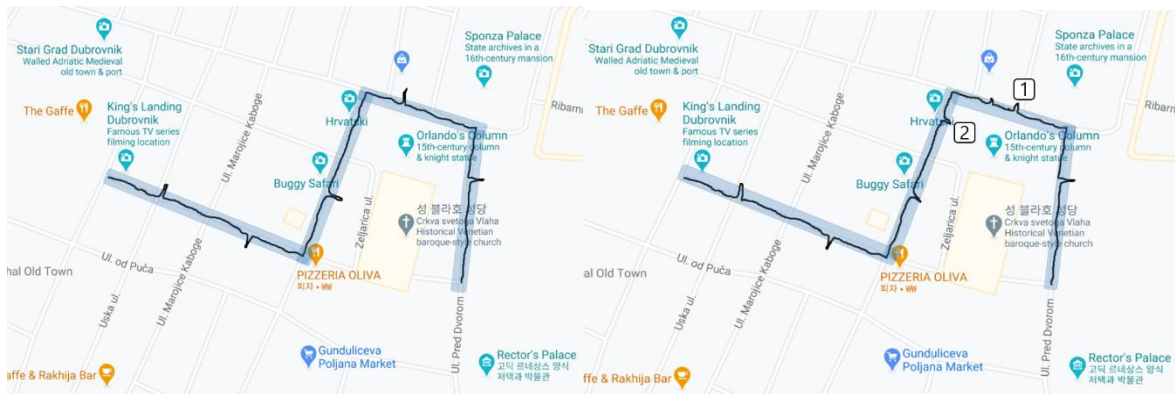**Fig. 4.Actual route(left) and intentional deviation point(right)**

Fig. 5.Result of normal detection(left) and error point(right)

Table 2 shows the error rate when moving on foot. When measured based on a radius of 16m, the error rate is 0.11% to 0.17%.

Table 2.Result of detection and error rate

	Radius(16m)	Radius(16m)
Total point	5,670	7112
Error point	10	8
Error rate	0.17%	0.11%

Table 3, which is a method using A-GPS, shows the error rate at 0%.In the case of S-GPS, the location is calculated by communicating with the satellite alone without going through a separate server.On the other hand, since A-GPS accesses a mobile communication network and undergoes a correction procedure using XTRA data, its error rate is lowered.

Table 3. Experimental results by A-GPS

	Radius(16m)	Radius(16m)
Total point	5,670	7112
Error point	0	0
Error rate	0.0%	0.0%

IV. CONCLUSION

In this paper, convenient and practical management system of group tours was designed and realized.The route deviation detection method presented in this paper was able to detect very high accuracy with a relatively simple algorithm with a small number of reference points. In addition, since the number of reference points used for path deviation detection is small, management and change of reference points are relatively easy. The outcomes from the proposed system using GPS navigation and Bluetooth call the roll for the management

of group tours are as follows. By quick call the roll with convenient operation of smartphone application, the time and effort could be saved to provide the tourists with more convenience. LBS was used to find and control the positions of members. Setting the restricted areas by host, alarm is delivered to host in case that members get out of the area so as to be well controlled. Also, emergency alarm function can respond to the crimes and call the roll by Bluetooth makes the efficient tours. However, further studies are required to solve the problems like difficulty in finding the position of members in the locations where the data transmission is difficult such as indoor areas.

ACKNOWLEDGEMENTS

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