An Opportunistic Tourism Navigation System using Photography Location Recommendation

Hiroya Sakaguchi
Graduate School of Information Science and Engineering
Ritsumeikan University
Shiga, JAPAN
is0017re@ed.ritsumei.ac.jp

Tomoko Izumi
College of Information Science and Engineering
Ritsumeikan University
Shiga, JAPAN
izumi-t@fc.ritsumei.ac.jp

Yoshio Nakatani
College of Information Science and Engineering
Ritsumeikan University
Shiga, JAPAN
nakatani@is.ritsumei.ac.jp

***Abstract*— In recent years, a style of sightseeing, which is planned by individuals and focuses on strolling has become widespread, while sightseeing navigation systems have attracted attention. However, most existing navigation systems support efficient sightseeing by giving users information such as the shortest route to their destination. Accordingly in this research, we propose an opportunistic sightseeing navigation system, which navigates users to a destination while recommending some photography locations that exist on the way to the destination, and adapts to the users' moods. An evaluation experiment conducted in Kyoto, Japan, demonstrated that conducting casual sightseeing on foot using this system enabled opportunistic sightseeing suited to the users' moods, which led to user enjoyment.**

Keywords-Tourism Navigation System; Opportunistic Planning; Benefit of Inconvenient; Photography Location

I. INTRODUCTION

A. Background

In previous tourism trends, many tourists participated in tourism where the destination, route, and time were all pre-determined by a travel agency. However, in recent years, many tourists decide on their destination and route by themselves and enjoy their trip freely. Tourism conducted in this way is called "autonomous tourism", whereby tourists design their own itineraries to their preference [1].

In other words, the present trend is for tourists to visit their preferred places at their preferred times. However, many navigation systems for sightseeing that have been developed in recent years place a high value on efficiency, thus are not suitable for tourists who prefer to stroll casually.

In this study, we focus on "Opportunistic Planning" [2], which is a plan based on the principle of flexibly adapting to opportunities at the place, situation, and time. We consider that these principles will be effective in supporting casual sightseeing on foot. We propose an opportunistic sightseeing navigation system for casual sightseeing on foot. The system recommends sightseeing spots according to the tourist's situation (i.e., their available time for sightseeing or the distance to a destination) and interests. This system changes the photography locations opportunistically when the user's interest changes or when the user happens to encounter another attractive photography location. Users can enjoy casual sightseeing on foot freely because sightseeing spots are recommended to them during sightseeing. We expect that adapting to the user's situation and changes in interest will lead to discoveries of new attractions in sightseeing areas.

B. Relationship between of Photography and Sightseeing

In recent years, people who take photos in sightseeing areas have increased dramatically in comparison to the age when only analogue cameras were available. This is because camera functions in current mobile devices have increased in resolution and multi-functionality. Moreover, due to widespread Internet use, photography is now not only enjoyed by the photographers themselves. Especially, use of social media such as Twitter and Facebook has spread rapidly in recent years. Such sites include functions to contribute photos, by which users can enjoy sharing the pictures they have taken. Taking photos at sightseeing areas can be considered an effective means to record one's memories of sightseeing. Moreover, by showing pictures taken at sightseeing areas to others, it is possible to recommend sightseeing areas to others.

Panoramio is a service, which connects photographs to maps. Panoramio is one of several photo-sharing services with location information, by which the user is able to view photos shown on a map. Users can share their photos with other users and can view photos contributed by other users on a map. In this way, using photos can stimulate the users' desire to go to the location. In this research, we focus on photography that is frequently carried out during sightseeing, and propose a system that navigates to sightseeing spots by recommending attractive photography locations.

A brief outline of this paper follows. In Section 2, we introduce studies related to this study. Section 3 and 4 describe system proposal and system function. Section 5 describes evaluation of the system and consideration. Finally, Section 6 describes conclusion of this paper.

II. RELATED WORKS

A. Trends in Sightseeing Navigation

With the advancement of mobile environments in recent years, many sightseeing navigation systems have been

 ISBN: 978-1-61208-306-3

developed for mobile devices. For example, NAVITIME [3] has functions such as searching for the shortest route by mixing train, bus and walking, and transport transfer guide information. As such, it is very convenient for sightseeing that places a high value on efficiency, but is not suitable for casual sightseeing on foot.

In addition, a sightseeing navigation system for casual sightseeing on foot was proposed in a study by Takagi et al. [4]. The system recommends landmarks to the user based on individual preferences of food, history and landscape by presenting photos of landmarks.

The user then chooses a landmark and heads for their destination. However, as recommendation of landmarks is only based on the user's pre-input preferences, this system cannot adapt to changes in the user's interest or situation during sightseeing. On the other hand, Takagi et al.'s study indicates that photos of landmarks have an impact on the user's choices and interests. Figure 1 shows the main screen of this system and a photo of a landmark.

(a)Main Screen (b)Photo of a Landmark

Figure 1. Previous System, Screen

B. Benefit of Inconvenience

In sightseeing, a person can feel a sense of uneasiness due to not knowing detailed routes and buildings, etc. of the places they are visiting for the first time. However, this uneasiness can be transformed into excited anticipation of what lies ahead. This kind of navigation is based on the theory of the "Benefit of Inconvenience" [5], which suggests that inconvenient things bring benefits. A navigation system that uses the "Benefit of Inconvenience" has the effect of providing opportunities to look around and discover new aspects of the sightseeing area without keeping the user glued to the system screen by not providing detailed route indications. In the study by Takagi et al. [4], the effect of the "Benefit of Inconvenience" was actually demonstrated.

In the current study, we propose a system based on the theory of the "Benefit of Inconvenience" that shows map information via aerial photographs, whereby it is more difficult to understand route details than using a normal map. Moreover, the system can convey the ambience and scenery of the sightseeing area to the user using aerial photographs, and enables the user to discover photography locations and other spots suitable to their interests. Also, the navigation to these locations consists of showing the direction from the user's position to the destination, without showing a detailed route.

III. Outline of Proposal

A. Basic Policy of System

In this study, we propose a tourism navigation system that supports users searching for sightseeing spots using photography locations that are adapted to the users' interests. First, users input their destination and available time for sightseeing in the tourism area. The system recommends photography locations using photos from the information on the location, distance to destination and the user's available time for sightseeing. The photography locations recommended by this system include rare sights, food, landscapes and other things associated with the tourism area. Moreover, the system recommends not only famous sightseeing spots introduced in guidebooks, but lesser-known sightseeing spots. Therefore, the users are encouraged to go to the location by viewing attractive pictures. Users select a spot from a list of recommended spots, according to how they feel at that moment, and head for the spot based on the system's navigation.

As users of the system increase, we assume that in future, the data of photography locations can be collected from photos taken by general tourists. That is to say, users will upload picture data with location information as in Panoramio. However, in this system, data of photography location is registered in the system ahead of time. Based on the theory of "Benefit of Inconvenience", the system limits the amount of information that is displayed when navigating to the photography locations. Specifically, the system navigates with only a map screen using aerial photographs, whereby it is difficult to understand route information and the direction to the photography location. Users head for the photography location and use the ambience near the photography location that they can perceive from the aerial photographs, and direction, as hints. The system aims to attract the users' eyes to the surrounding landscapes, by comparing the aerial photographs and real landscapes and searching for the photography locations.

In this study, we propose a sightseeing navigation system that changes photography locations opportunistically in response to users' changeable feelings and supports more free casual sightseeing on foot. In sightseeing, there are many varieties of places that users want to visit and these depend on the user's feelings at that time. This system

 ISBN: 978-1-61208-306-3

recommends destinations while repeating navigation in accordance with the user's moods, for example when their feelings change and the user wants to visit other places. Specific to the situation, users choose photography locations that are recommended by the system and repeat the action of heading for the location as a way to move to destination. However, if while casually walking, the user's interests change to other things - for example, they take a photo at another place and are satisfied - the system provides a new recommendation of other photography locations. Accordingly, users can change the next photography location, in consideration of their mood or the situation at any time.

B. *System Flow*

1) First, the user decides their destination and the target time for the destination. The system uses these to calculate which walking routes are possible, and recommends some photography locations.

2) From the list of recommendations, the user chooses a photography location in accordance with their feelings at that time.

3) The system shows a map screen with aerial photographs and directions to the destination calculated from the location information of the photography location and the user's current location.

4) The user strolls freely while searching for the photography location or other spots where they want to take photos.

5) The user requests the system to recommend the next photography location when the user reaches the photography location, finds a favorite place or has a change in interest.

6) The system calculates the remaining time and recommends new photography locations.

7) The user heads for their destination, repeating Steps 2~6.

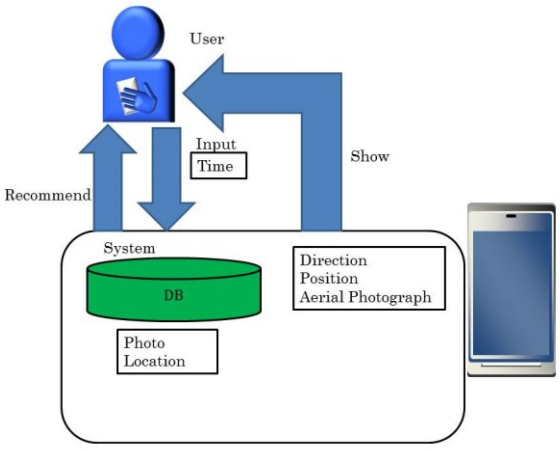

Figure 2. System Structure

Figure 2 shows this systems' structure.

IV. OUTLINE OF SYSTEM

A. *Development Environment)*

The proposed system was developed as an application for mobile devices using the Android OS, for the following reasons.

- Android mobile devices can be carried and used at sightseeing areas.
- Android mobile devices can use GPS function to obtain location information.
- Android mobile devices can use Google Maps to obtain map information.

The development environment was Eclipse, and the system was implemented in the Java programming language.

B. *System Functions*

In this system, we prepared photography locations between the vicinity of Yasaka Shrine and the vicinity of Kiyomizu Temple in Kyoto, Japan. The reasons for this choice are that there are many sightseeing spots such as historic buildings, appealing alleyways, souvenir shops and cafés, and Kyoto is suitable to casual sightseeing on foot.

1) Initial screen

First, the user inputs their destination and available time for sightseeing in minutes. The time is managed by the system and a navigation screen is shown with a countdown timer, which then starts. The system places a pin at the destination obtained from the previously inputted information. The user can confirm whether the location is correct or not by tapping the pin.

2) Photography location recommendation screen

The system shows photography location candidates by calculating possible routes from the inputted time and location information of the user's position and destination. Figure 3 shows the recommendation screen. Photography locations are retained in a database, which stores location information and a photograph as data for each photography location.

Next, the selection method of the photography locations will be explained. The system calculates the walking time from the user's position to the photography location, and from the photography location to the destination. When the total time is shorter than the remaining time for sightseeing, the photography location is recommended. In this system, all spots that meet this condition are recommended to the user. The system places a pin at the photography locations, and the user can view a photo of the location by tapping the pin. The user selects their preferred place and decides on visiting a photography location.

 ISBN: 978-1-61208-306-3

Figure 3. Photography Location Recommendation Screen

3) Navigation screen

After the user decides on the photography location, the system changes to the navigation screen, obtains the user's location information, calculates the direction to the photography location and displays a compass. The system shows the map as an aerial photograph. The system starts measuring elapsed time as soon as the screen changes to the navigation screen.

The user searches for the photography location using the aerial photograph map and compass as clues. Figure 4 shows the system's navigation screen.

Figure 4. Navigation Screen

When the user touches the "Refresh" button, the map's central position is refreshed to the user's current location, and the new direction is calculated. There are two reasons for not renewing the user's location at all times: 1) In order to make it easy to comprehend the ambience of the environment from the aerial photograph showing a stationary landscape; 2) So that the user can search for things that interest them and stroll freely without clinging to the map information.

When the user touches the "Camera" button, the mobile device's camera initiates and the user can take a photo when they have found a favorite spot.

When the user touches the "Next" button, the system recommends new photography locations. This button is used when the user has found the recommended photography location or the user wants to go to another location. The system recommends locations that are further from the destination than the user's current location. Thus, the user can take a roundabout way and conduct casual sightseeing on foot freely. This enables opportunistic sightseeing in accordance with the user's mood without being bound to the user's location or the photography location. Furthermore, when there is little time remaining and no photography locations satisfy the conditions, the system starts to navigate to the destination. In this way, the user can go to their destination while changing the visited locations according to their feelings.

V. EVALUATION EXPERIMENT

A. Experiment Site

In our evaluation experiment, we set the start point as Yasaka Shrine and the destination as Kiyomizu Temple in Kyoto, Japan. There are four reasons for conducting the experiment in Kyoto.

- Most streets between the two locations have few cars and are easy to walk in.
- Many streets or buildings are historic and appealing.
- There are many souvenir shops and restaurants.
- There are many narrow streets suitable for casual sightseeing on foot.

B. Evaluators

We conducted this experiment with the cooperation of seven students who live in the Kansai area, which includes Kyoto. The evaluators were separated into three groups based on a preliminary survey that asked how many times they had visited Kiyomizu Temple or Yasaka Shrine and what they want to see during sightseeing. The purpose of this group division was to investigate how the results of limiting the route information is affected by the number of visits. Moreover, the aim of separating three groups by their tourism preferences was to investigate how this affects users' choices of photography locations or the type of photos they take. Table 1 shows the evaluator group composition.

 ISBN: 978-1-61208-306-3

TABLE I. EVALUATOR GROUP COMPOSITION

	Group 1	Group 2	Group 3
Number of People(Male : Female)	2(1 : 1)	3(3 : 0)	2(0 : 2)
Number of Previous Visits	0	Over 3	1~2
Want to See	Streets	History	Food

C. Experimental Procedure

The experiment was conducted for each group with the start point of Yasaka Shrine and destination of Kiyomizu Temple. Each group set their available time for sightseeing freely and headed for Kiyomizu Temple using the system. The first author accompanied the evaluators and observed the circumstances of the experiment. After the experiment, the evaluators were asked to complete a questionnaire, via which we expected to examine the results and problems of this study.

D. Purpose of Experiment

In this experiment, we conducted evaluation by paying attention to the following points, in order to confirm this study's outcome.

1) Realization of opportunistic sightseeing, and its difference to regular sightseeing

In this system, the users do not decide on the details of the route. They can stroll freely according to their mood and can choose photography locations that they want to visit, in contrast to conventional navigation systems that show the shortest route. We aimed to investigate how free situations like this affect the users' actions and whether that effect gives users satisfaction in comparison to conventional navigation systems.

2) Influence on sightseeing of photography location recommendation, and of addition of camera function

We aimed to investigate whether the user's eyes are attracted to the surrounding environment, not to the system screen, by "searching" for recommended photography locations.

In addition to this, we aimed to evaluate whether the system prompts users to discover new attractions in the tourism area with the function of taking photos.

3) Balance of anticipation and uneasiness with navigation using only aerial photograph maps and direction information

In this system, users are navigated using only aerial photograph maps and direction information. This is more difficult and inconvenient than conventional navigation systems. The uneasiness that this navigation style, based on the "Benefit of Inconvenience", inflicts on users is moderate. We aim to inspect whether the system can change this uneasiness into anticipation during sightseeing.

E. Experiment Results

1) Group 1

For both of Group 1's members, this was their first visit to Kyoto. Accordingly, they conducted sightseeing carefully by refreshing their location information frequently, and often got lost. From these points, we can consider that navigation using only aerial photograph maps and direction information inflicts uneasiness on people for whom it is their first visit. However, on the other hand, the Group 1 members looked around well in order to search for the recommended photography location carefully. They initiated the camera function of the system and took photos five times.

2) Group 2

The photos chosen by Group 2's members were inconsistent, and were a mixture of rare sights and streets. Since all three members had visited Kyoto several times, they were familiar with the surroundings, rarely updated their location information, and did not lose their way.

Moreover, the photography locations chosen by Group 2 did not approach Kiyomizu Temple; instead, they went around and sometimes left the Kiyomizu Temple area. The members conducted sightseeing opportunistically and freely, interrupting or diverting their route to go to photography locations. However, because they diverted so much there was no time, so they stopped in order to walk to Kiyomizu Temple. For this reason, they regretted their preset time. From this result, we determined that the system can support users in conducting sightseeing that matches their moods at that time by recommending photography locations regardless of the user's position and the genre of sightseeing. On the other hand, we also discovered issues in the system, including that users could not change the destination or time.

3) Group 3

All of Group 3's members had previously visited Kyoto, but they cautiously confirmed their position at the start of the experiment.

However, they gradually decreased the frequency of refreshing their position while walking and searching for photography locations. In addition, although this group said that they wanted to visit locations focused on food, they did not choose a photography location related to food. They gave the reason that they wanted to visit photography locations recommended for other genres. However, as they stopped by a sweetshop and a café, they took actions that matched their feelings. This group used the camera function positively, taking over ten pictures.

VI. CONSIDERATION

1) Realization of opportunistic sightseeing, and its difference to regular sightseeing

In this system, users do not only choose a photography location according to personal preference, and follow a route while looking for the place; they can also freely change the photography location according to their moods while they head for the photography location. In the evaluation experiment, users freely changed the photography location according to their feelings at that time,

 ISBN: 978-1-61208-306-3

decided on a course spontaneously, took very roundabout routes, and sometimes stopped or went away from the destination. Thus, they were able to conduct sightseeing freely. Moreover, they answered that they were able to enjoy sightseeing using this system more than sightseeing using a normal sightseeing navigation system, by always acting in accordance with their feelings.

2) Influence on sightseeing of photography location recommendation, and of addition of camera function

This system was able to prompt users to turn their attention to their surroundings by letting users look for the scenery in the photograph by recommending the photograph. From the fact that all groups used the camera function of the system and took pictures over five times, we can consider that the system allowed users to consciously discover new appeal of the sightseeing area.

3) Balance of anticipation and uneasiness with navigation using only aerial photograph maps and direction information

This system allows flexibility in the user's route, by not assigning the route during navigation. Instead, the navigation uses only aerial photograph maps and direction information, which inflicts uneasiness to many users but also provides a further sense of anticipation. In addition to this, users were able to enjoy sightseeing by taking their favorite routes more than in regular sightseeing. However, problems arose, including that this style of navigation can inflict such uneasiness that it was easy for users visiting Kyoto for the first time to lose their way.

VII. CONCLUSION

A. Problems

In this study, we proposed a sightseeing navigation method that adapts to users' feelings opportunistically, and its efficacy was demonstrated. However, the system requires a function to change or extend the sightseeing time, because in the evaluation experiment there was a group that did not have enough time. Moreover, the navigation system needs to be developed in order to add a function that supports when users want to change their destination depending on their moods. In future, we will examine an even more opportunistic sightseeing navigation system. In addition to this, we will develop a sightseeing navigation system that can recommend photography locations that to some extent consider the weather or the user's feelings, guessed according to the user's selection of photography locations, not only using the available time for sightseeing.

B. Conclusion

In this research, we focused on photography that is frequently conducted in sightseeing and proposed an opportunistic sightseeing navigation system that navigates to the destination by recommending photography locations one by one. The method of navigation uses aerial maps and direction to photography locations based on the "Benefit of Inconvenience", without showing or appointing a detailed route. It was demonstrated that the freeness of sightseeing using navigation that always follows the moods of the user, the recommendation method of photography locations and the display method of the navigation led to enjoyment of the sightseeing. Moreover, the system allows users to pay attention consciously to their surroundings by promoting searching for the photography locations and taking photos, and enables new discoveries in the sightseeing area.

REFERENCES

[1] S. Ishimori, "The Potentialities of Autonomous Tourism in the Twenty-first Century," Senri Ethnological Reports, 2001, Vol.23, pp.5-14 (in Japanese).

[2] E. Horvitz, P. Koch, and M. Subramani, "Mobile Opportunistic Planning: Methods and Models," User Modeling 2007, 2007, pp.228-237.

[3] NAVITIME JAPAN, NAVITIME, http://www.navitime.co.jp, [retrieved: 8, 2013].

[4] S. Takagi, M. Masuda, T. Izumi, and Y. Nakatani, "Tour Navigation System Using Landmarks that Are Customized by Personal Preference", Human Interface Symposium 2012, 2012, pp.393-398 (in Japanese).

[5] K. Kawakami, "Toward System Design based on the Benefit of Inconvenience," Human Interface. Transaction of Human Interface Society, 2009, Vol.11, No.1, pp.123-134 (in Japanese).

 ISBN: 978-1-61208-306-3