A Sightseeing Navigation System without Route Information

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***Abstract*—A novel sightseeing navigation system that does not show route information is proposed. Most existing navigation systems support efficient sightseeing by giving users the detailed route information such as the shortest route. However, casual sightseeing by foot in which tourists can freely choose time and place is a major trend in Japanese tourism in recent years. Therefore, a sightseeing navigation system that does not show a map was designed, based on the "Benefit of Inconvenience," which is the novel concept that inconvenient things can have a positive effect on people. This approach is expected to prompt users to interact with their surrounding environment. Two evaluation experiments were conducted in Kyoto, and it was proved that the proposed method can increase opportunities for new discoveries and chance encounters during sightseeing.**

Keywords-Navigation System; Benefit of Inconvenience; Landmark; Preferences.component.

I. INTRODUCTION

In the current information society, a wealth of information makes our lives comfortable and convenient. It has become natural to cut out wasted time from our lives and to demand efficiency. Moreover, various types of information device which increase efficiency have been developed or researched. In today's capitalism society, a cognizance that time is limited and it is essential for us to use it effectively is expanding widely. On the other hand, there are benefits which have been overlooked in the pursuit of efficiency. These benefits have been regarded as a minor factor in trends of recent years, but are now beginning to gain attention as the "Benefit of Inconvenience" [1]. Using a somehow inconvenient system enables the user to obtain benefits which are easily hidden, more than an existing convenient system which demands efficiency.

While the systems which are considered to have the "Benefit of Inconvenience" are gaining attention in this way, the sightseeing style of recent years is also changing. Traditionally, the package tour has been the most popular sightseeing style in Japan. The package tour is a travel product wherein the entire process, from departure to destination, is managed by a tour company. Common practice is for the tour company to determine the route and time schedule for sightseeing and then let the participants enjoy their sightseeing following the instruction of a tour guide. However, another sightseeing style has come into use significantly in recent years. This is a style wherein tourists determine the process of their sightseeing themselves and enjoy their trip without using a package tour. Ishimori [2] describes this as "autonomous tourism." In addition, "Travelers Trends 2010", published by the Japan Travel Bureau Foundation [3], calculated that the number of people who were interested in gourmet food, history, urban tourism, and strolling had increased by 10% in 2009 compared to 2007. All these factors indicate that tourists expand their interest to various things and want experiences of various types. Therefore, just as Ishimori points out, the sightseeing style in Japan is changing from moving efficiently along a predetermined route to freely visiting places of interest anywhere, anytime. Tourists are looking for new discoveries and chance encounters.

However, most sightseeing navigation systems used by tourists during sightseeing are adapting the algorithms used in car navigation systems. These navigation systems recommend the shortest route and methods of transport from a departure place to a destination, and attach a high value to the efficiency of user movement. For example, NAVITIME [4] is a famous application. This enables users to go to their destination in the shortest time without getting lost the way. In fact, an efficient sightseeing route scheduled by a navigation system is an effective way for people who do not have much time. However, considering the recent sightseeing trends in Japanese, such methods are not effective for increasing number of tourists who demand fun and memorable sightseeing, even if they need to spend a little more time. Emphasis on efficiency will restrict the user's area of activity and opportunities for new discoveries and chance encounters that may happen during sightseeing. A new approach is required to support tourists for enjoying their sightseeing opportunistically and fortuitously.

This paper proposes a novel approach to sightseeing support which targets tourists who are carrying out casual sightseeing on foot. More concretely, adapting the idea of "Benefit of Inconvenience", the proposed system does not provide the detailed route information in a sightseeing area but only landmarks on the way to a destination. As a result, it promotes interaction with the environment surrounding the users which was previously unnoticed, and fosters new discoveries and chance encounters. In this research, two evaluation experiments were conducted with two types of prototype system.

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In the next section, the proposed method is described. In Section 3, we present the evaluation experiment, then the problem of the proposed method. Then this paper moves to another proposed method, and its evaluation experiment. Finally, a discussion and a conclusion are described.

II. PROPOSED METHOD 1

A. *Skil-tronics*

The concept of skil-tronics exists in the field of "Benefit of Inconvenience". This is a system design model proposed by Nishino [5] that requires some skills from its users in order to use the designed equipment. The proposal of skil-tronics does not compensate for high-technology by skill or extend skill by high-technology, but prompts creation by the combination of high-technology and skill. Therefore, users are able to gain benefit by manipulating on their own skill instead of relying on a machine to do everything.

Our proposed sightseeing navigation system is innovated by utilizing the concepts of skil-tronics and "Benefit of Inconvenience."

B. *Proposed Method*

1. Without Route Information

The proposed sightseeing navigation system does not provide users with the detailed route information but with a point of departure, a destination and landmarks on the way. Therefore, users are not able to see the route or the city district. In this way, their attention is naturally drawn to their surrounding environment.

Cases in which users get lost may happen, because the system does not show a map. However, they look around themselves more than usual when they get lost. As a result, they are able to experience a special kind of sightseeing which is different from existing navigation systems which suggest the shortest route. In response to this system, they are prompted to pay attention to their surrounding environment, and it can be expected that opportunities for new discovery and chance encounters will increase during their casual walking sightseeing.

2. Guidance to Landmarks Using Photos

This system shows landmarks of some points on the way to a destination. Each landmark is given a landmark number (1-6), a landmark name and a photo. The landmarks involve alleyways, historic buildings, distinguishing objects and so on. The users stroll around looking for them in numerical order and reach the destination. Moreover, some landmarks are located in hard-to-find places, and some pictures were taken from the opposite side of the traveling direction. These are contrivances designed to entertain the users.

C. *System Fuctions*

The proposed system is an application for Apple Inc.'s iPhone, written in a programming language Objective-C. It is equipped with the Global Positioning System (GPS) and users are able to use it anytime, anywhere. Fig. 1 shows the main screen of the system. Users embark on casual walking sightseeing while relying on this screen. The pins on the screen indicate the landmarks predetermined by this system.

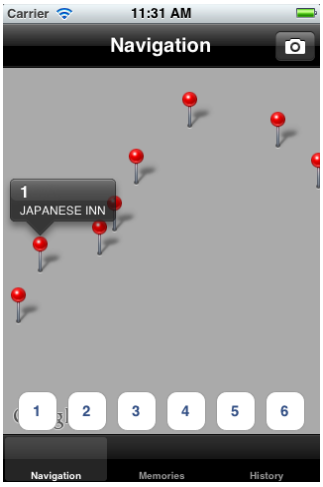

Figure 1. System Main Screen

Figure 2. History Screen

The numbered buttons on the bottom part of the screen are linked with the landmark number. When the users tap the numbered button, the landmark designated with that number is shown on the main screen.

In addition, this system has the functions of taking and recording photos, using the camera mounted on the iPhone. Users can use these functions by tapping the camera button on the upper right of the screen. By doing so, users are able to take photos of surroundings that they like during sightseeing, and then to save them with the location information which is obtained from GPS (Global Positioning System). They are called "Memories of Sightseeing." Moreover, this system has the function of recording the user's traveling history. This is called "History of Sightseeing." (Fig. 2).

By using these two functions, users are able to review their data after casual walking sightseeing, and reflect on their sightseeing easily.

III. EVALUATION EXPERIMENT 1

A. *Experiment Method*

An evaluation experiment with 8 human evaluators was conducted in order to verify the effectiveness of this navigation system. The experiment was conducted with Kyoto as the experiment area, and subjects strolled from Kyoto station to Kiyomizu-dera temple. The reasons why Kyoto was chosen as the evaluation experiment area are given below. The experiment was carried out in January 2011.

1. The area is suitable for casual sightseeing by foot, because there are various famous spots including historical places, cultural places and so on.
2. Tourists are able to enjoy the streetscape of Kyoto, which has many Japanese old-style houses along with narrow and winding alleyways.

The evaluators in the experiment were 4 men and 4 women in their twenties who live in the Kansai area. They were assigned randomly to three groups without considering

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their gender, age, previous experience of sightseeing in Kyoto, and so on.

The evaluators were asked to answer two types of questionnaire in order to gather evaluation data on the usefulness of the system.

1. Questionnaire before the experiment

The purpose of this questionnaire was to investigate the evaluators' attributes. The specific contents were their gender, number of previous sightseeing trips in Kyoto, whether they had previously experienced walking to Kiyomizu-dera from Kyoto Station, and the purpose of their usual sightseeing.

2. Questionnaire after the experiment

The purpose of this questionnaire was to inquire into the evaluators' opinions and reflect on this experiment. During the questionnaire, they used the "Memories of Sightseeing" and "History of Sightseeing" functions for reference.

B. Results by Group

Group A: This group got lost frequently. Therefore, they were not able to find one of the landmarks. A key factor for this was assumed that the system does not show detailed route information. Indeed, the evaluators in Group A explained in the questionnaire after the experiment that "it was difficult for us because we did not know our current position." On the other hand, they described that "the opportunity to take small roads rather than taking the main street increased. As a result, we were able to enjoy a townscape of Kyoto that we usually do not experience." Therefore, Group A was able to make a new discovery and chance encounter.

Group B: This group's evaluators commented that "we had a conversation different from the usual kind during sightseeing." A factor in this was that since this system did not show the map, they frequently consulted each other about how to reach the destination.

Group C: This group paid close attention to their surrounding environment by looking at the landmark photos. As a result, they answered that they "felt like detectives." In addition, they happened to visit a temple that they had never known about before.

Fig. 3 shows the required time for each group. Google Maps calculates a walking time of 40 minutes from Kyoto Station to Kiyomizu-dera. So they took double to three times longer.

C. Validity of Not Displaing Route Information

From the questionnaire after the experiment, the gaze of the evaluators was raised and they paid more attention to their surroundings by not showing route information. In addition, they answered that they were able to find some spots which they had never known about, and they took rarely-used routes. From these results, it was verified that not showing the detailed route information induced opportunities for new discoveries and chance encounters. This is also an effect of the "Benefit of Inconvenience."

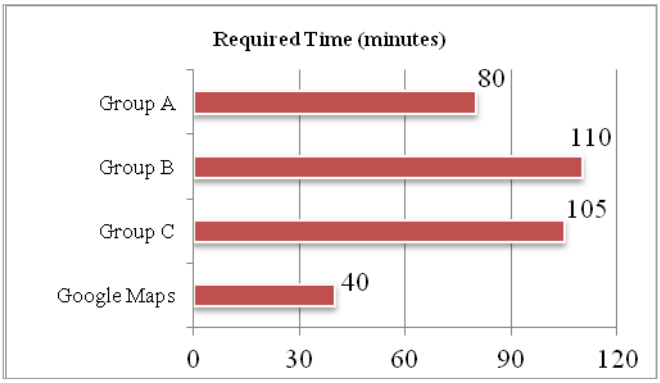

Figure 3. Required Time of Experiment 1 by Group

D. Differences from Existing Navigation System

In answer to the question "How did you enjoy this sightseeing trip compare to the usual?" all evaluators replied that they had enjoyed it. One of the evaluators told us: "I usually consider getting to the destination in the shortest time when I do ordinary sightseeing. But, this system made me enjoy the spots on the way, and they stood out in my memory strongly." Thus, the effectiveness of our proposal for a new sightseeing navigation system was verified.

IV. PROBLEMS

From the results of the evaluation experiment, opportunities for new discoveries and chance encounters were increased by not showing the detailed route information. This trip, however, was not a completely free trip. The landmarks had been predetermined by the system and evaluators were not able to select the landmarks which they wanted to visit. Therefore, the three evaluator groups followed almost the same route. This suggests a major problem that users are not able to visit spots of interest freely anywhere, anytime, which is the main concept of casual walking sightseeing. In fact, some evaluators remarked that "the landmarks which we visited were not attractive for me" in the questionnaire after the experiment.

On the other hand, evaluators answered that they enjoyed looking for the landmarks, as if they were doing "orienteering." Key factors accounting for this are that the system's navigating method is completely different from that of existing systems, and that they felt a game element in which they cooperate to look for the landmarks. However, one group lost their way because the clue to find the landmark exists only in photos. Therefore, they were not able to find one of the landmarks, and that caused a point of dissatisfaction with the system.

In addition, some subjects answered that they had wanted to visit famous spots in Kyoto. Therefore, it is important for the system to recommend not only spots on the way to the destination, but also some famous sights. This relates to the fact that they were not able to select their preferred landmarks.

In the next section, a second sightseeing navigation system is proposed in order to resolve these problems.

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V. PROPOSED METHOD 2

A. Approach

The second sightseeing system has a function to recommend the landmarks which are considered preferences of users (tourists who are carrying out casual sightseeing by foot) in order to resolve the problems of the previous system, in which the users were not able to select the landmarks they like and sometimes got lost. This new system will allow the users to experience a different, personalized route. As before, it does not provide detailed route information, since not showing the map was proven to be effective by the experiment on the first system. However, this system has added improvements. The detail of two new functions is described below.

B. Landmark Recommendation Based on Personal Preferences

The degree of enjoyment of sightseeing depends on how much the tour experience differs from everyday life, and how much it coincides with the interests of the tourist [6]. Therefore, the purposes of sightseeing vary greatly from person to person. The first system, however, predetermined the landmarks which are recommended to users. Therefore, the users were not able to select the landmarks that they wanted to visit. To solve these problems, the new system recommends plural landmarks to the users during the casual walking sightseeing based on personal preferences. To consider personal preferences is megatrend in a recommendation system. For example, Amazon [7] is known to collaborative filtering and it has proved effective [8, 9]. Personal preferences in the second system are grouped into three kinds: "Landscape," "History" and "Gourmet Food and Shopping." Users select the preference that coincides with their preference on the welcome screen of this system.

C. Navigation Using Direction Information

When people are casually sightseeing by foot in an unfamiliar city, they generally feel anxious or excited because they cannot know what lies ahead on the road. This factor is the "difficulty of prediction" [6]. If this acts on people's psychological state, a feeling of anxiousness of not knowing what will happen next induces a feeling of expectation. Ultimately, it remains strong in the memory even after the issue is solved.

The second proposed navigation system uses information relating to current position, direction, distance, and photos of landmarks based on the preferences of users, which are recommended automatically by the system. It does not provide users with the detailed routes to destinations, in common with the first system. This concept is also based on the "Benefit of Inconvenience." By hiding information in this way, users feel anxious or excited, which results in being even more satisfied with the sightseeing experience. Furthermore, afterwards the experience becomes a good memory.

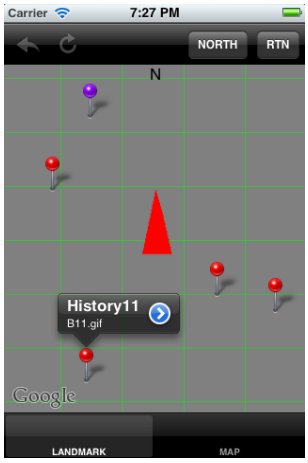

Figure 4. New System Main Screen Figure 5. New System Photo Screen

D. Function of Second System

The improved system also uses Apple Inc.'s iPhone and the development language is Objective-C. The iPhone is used for the same reasons as stated for the first system.

First, the user is asked to input a destination and the purpose of the tour, with choices selectable from among "Landscape," "History" and "Gourmet Food and Shopping" on the welcome screen of the system. The purpose is to consider the preference of the user. Then the system recommends to the user four or five landmarks that match their preferences, near to their current position (within 300 meters). These landmarks include at least one landmark that does not match the user's purpose, for the sake of variety of landmarks. The user selects one of the proposed landmarks based on their photos and other information, and walks around the city to find it.

Fig. 4 shows the main screen of the second system. This improved system recommends four or five landmarks in addition to not showing route information, so that the user can select the landmark which they want to visit. Those landmarks are based on the user's personal preferences.

The arrow in the center of Fig. 4 is an electronic compass that constantly points to the north. It appears when the user taps the "NORTH" button shown in Fig. 4. The user checks the direction to the landmarks in a method that is similar to using a magnetic compass, and recognizes the approximate direction to get there.

Fig. 5 shows landmark photo information. These photos were taken in advance using the iPhone camera. In addition, they were chosen as being attractive landscapes or historic buildings on the basis of our subjective viewpoint. Finally, the information is saved in the landmark database as one set comprised of the photographic information, location, and genre of preferences.

In addition, the second system has the function of updating landmarks. When the system detects that a user has entered within a 30 meter radius of a recommended landmark, the user can update the landmarks. When the user updates the landmarks, a new set of four or five landmarks in that area are recommended to the user. At that time, the current position is set as the updated landmark.

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VI. EVALUATION EXPERIMENT 2

A. Experiment Method

A second evaluation experiment was carried out in Higashiyama, Kyoto. The point of departure was Kyoto City Hall and the destination was Yasaka Shrine. The reasons why this area was chosen as the evaluation experiment area are that it is easy for tourists to understand the direction because Kyoto streets area laid out in a grid pattern, in addition to the reasons given for the first evaluation experiment. The experiment was carried out in January 2012.

The evaluators in the experiment were 9 people in their twenties who live in the Kansai area. They were divided into three groups on the basis of the objects of their personal preferences, and how frequently they had visited Kyoto.

In addition, they were divided in consideration of whether or not they were able to go to Yasaka Shrine from Kyoto City Hall without consulting a map. Options for the preferences were "Landscape", "History" and "Gourmet Food and Shopping." Table 1 shows the group composition of the evaluators.

The evaluators were asked to walk freely to the destination of Yasaka shrine from the departure point of Kyoto City Hall using the second navigation system. After the explanation of how to use the system and the experimental procedure, each group was provided with one iPhone equipped with the system. The experimental procedure is described below.

First, the evaluators selected one landmark from the landmarks that are recommended by this system. Then, they walked freely using the system. Finally, they arrived at the destination by repeating this procedure several times. Moreover, they were asked to answer three types of questionnaires in order to gather evaluation data on the usefulness of the system.

1. Questionnaire before the experiment
   The purpose of this questionnaire was to inquire into the evaluators' personal preferences and to divide the groups.
2. Questionnaire during the experiment
   This questionnaire was conducted each time the evaluators reached a landmark. The purpose of this questionnaire was to inquire into their opinion on the selected landmark, and reflect on the route to the landmark.
3. Questionnaire after the experiment
   The purpose of this questionnaire was to obtain feedback from the evaluators about the experiment.

TABLE I. EVALUATOR GROUP COMPOSITION

	Group A	Group B	Group C
Preference	Landscape	Gourmet food	Gourmet food
Kyoto sightseeing experience	1-2 times	More than 3 times	More than 3 times
Go without consulting map	Can	Cannot	Cannot

B. Results by Group

Group A: This group selected "Landscape" as their personal preference. It took the group an hour and a half to walk to the destination from the point of departure. The landmarks that they visited during the experiment were three in total. It is notable that they were all interested in "Landscape" at first. However, they selected different genres for landmarks.

Group B: This group selected "Gourmet Food and Shopping." It took the group an hour and forty minutes to walk to the destination. The landmarks that they visited were five in total. The notable point of Group B is that they selected the gourmet food landmarks that coincide with their preferences five times. The reason why they selected these was in a large part due to the time when the experiment was conducted (from 12:00 to 14:00).

Group C: This group used a method consisting of receiving recommendations for landmarks in all of the genres without considering their personal preferences. This was done in order to observe the effect of the personal preferences on selection of landmarks. It took the group an hour and fifty minutes to stroll to the destination, and they visited four landmarks in total. The standout point of this group is that they lost their way several times because they were not familiar with the experiment location, and because they were confused about how to use the system. On the other hand, they were able to travel via traditional Kyoto-style alleyways that are generally not passed through on the way to the landmark.

Moreover, they were able to see the famous *maiko* of Kyoto. At the end, they answered that they had a fun time.

Fig. 6 shows the required time for each group in the second experiment. Google Maps calculates a walking time of 20 minutes from Kyoto City Hall to Yasaka Shrine.

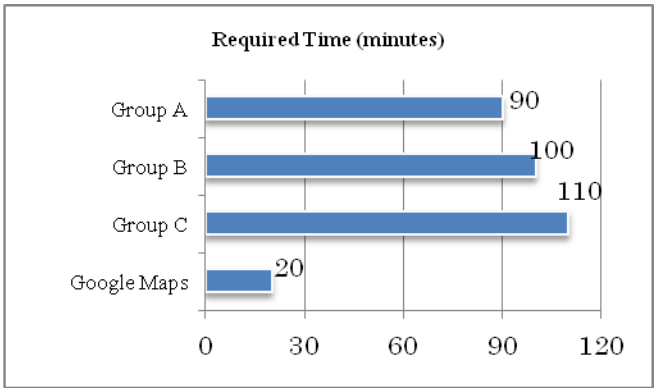

Figure 6. Required Time of Experiment 2 by Group

TABLE II. DISTANCE TO THE DESTINATION

	Group A	Group B	Group C	Sum
Near	5	6	4	15
Suitable	4	9	5	18
Far	0	0	3	3

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C. Validity of the Landmark Recommendation Based on Personal Preferences

The improved system is designed so that users are able to choose landmarks freely in order to resolve the problems of the first system. As a result, some evaluators recounted in the questionnaire after the experiment that they enjoyed the process of selecting the landmarks in consultation with each other. Moreover, although the second system recommends landmarks based on the personal preferences of the users, the evaluators mainly selected the landmarks from the perspective of whether or not the photo was attractive. Therefore, it was established that they do not select landmarks that coincide with their personal preferences, but they select the landmark with the most attractive photo. As a result, it is highly important to show "attractive photos" in order for users to select the landmark.

D. New Discovery

Evaluators were asked, "Did you feel that the distance to the landmark was 'far'?" in the questionnaire conducted during the experiment. Almost all evaluators answered "Near" or "Suitable" to this question. Table 2 shows the detailed results for that question (Subjects were asked to answer each time they visit a landmark). Regarding this, it is thought that the evaluators purposely avoided selecting landmarks that were located far away from their current position, and that they already knew the route to the landmarks because some subjects were familiar with the evaluation experiment location. This system has a function that recommends landmarks within approximately 300 meters from the current position when landmarks are updated. Therefore, the efficacy of the function that limits the range of the recommended landmarks was verified.

Next, the case in which the evaluators felt the distance to the landmark was "Far" is explained. Group C was the only group to answer "Far" in the entire experiment. The reason given by all who answered "Far" was, "because we lost our way." Reasons for Group C getting lost are suggested below.

1. They were not familiar with the experiment area.
2. They did not know how to use the system appropriately.
3. They did not pay enough attention to the landscape around them.

In other words, the landmark that they selected was not so far away, but they felt exhausted due to the extra walking time from losing their way. In addition, they felt anxiety because they did not know where the recommended landmark was. these negative effects made them feel that the distance was "Far."

VII. FUTURE WORKS

The required time to walk to Kiyomizu-dera from Kyoto Station is about 40 minutes according to the calculation of Google Maps. However, it took an average of about 90 minutes using the old system in the first experiment. Likewise, the required time to walk to Yasaka Shrine from Kyoto City Hall is about 20 minutes. However, it took over 90 minutes for all groups in the second experiment. Both systems target casual walking sightseeing, in which tourists visit anywhere, anytime. Therefore, neither of our systems take account of the sightseeing time. However, spending too much time makes users exhausted, and they might not go to the places they wanted to. Therefore, we need to consider the sightseeing time in this system.

The second system set the genre of the recommended landmarks based on users' preferences. However, it could also be said that it is important for users to receive recommendation for many attractive landmarks without considering their preferences. Therefore, other methods of recommendation need to be incorporated in order to recommend a wider array of landmarks.

The second system attached photo information only. However, some evaluators stated that, "we wanted other information about the landmark," in the questionnaire given after the experiment. For example, they requested information on topics including shop business hours and history.

VIII. CONCLUSION

In this paper, the focus is on casual walking sightseeing in which tourists can visit anywhere at anytime freely, without being pressed for time. Moreover, our proposal of a novel sightseeing navigation system aims to increase opportunities for new discoveries and chance encounters. Therefore, neither of our systems show detailed route information, with the purpose of the "Benefit of Inconvenience." As a result, it was established that such an approach can make users pay more attention to their surrounding environment. In addition, from our evaluation experiments on two types of prototype system, the effectiveness of not showing the map, and how to recommend the landmarks to attract users, were verified.

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