Sightseeing Assistance via Information Inheritance with Journey Note System in Sightseeing Spots

Shuichi Takagi, Tomoko Izumi, and Yoshio Nakatani

***Abstract*— This research proposes a sightseeing assistance system in which tourists inherit information from previous tourists at particular spots in a sightseeing area. The proposed system provides users with a sightseeing service in order to promote new discoveries, actions, and interest through information inheritance. This has the same concept as "journey notes", which are available at facilities such as hotels. People can browse and post information by visiting these places. In addition, the posted information has a "life span" according to each genre. The "life span" is extended depending on evaluation by tourists. As a result, valuable information remains for longer, and non-valuable information dies out. In this way, by each tourist inheriting information which they obtained in the sightseeing area, this system provides instant and novel sightseeing.**

***Index Terms*—Sightseeing assistance system, information inheritance, journey note, life span**

I. Introduction

A. Background

The tourism industry has grown on a mass global scale in recent years, and has a significant role to play in the industrial activities of modern society. In Japan, the Tourism-based Country Promotion Basic Act was formulated in 2007, and the Japan Tourism Agency was established within the Ministry of Land, Infrastructure, Transport and Tourism in 2008. In ways such as these, various measures have been implemented for the realization of a tourism-oriented country [1]. In response to this movement, institutions such as regional autonomous communities, as well as the general population, have developed an interest in the tourism industry. In this way, there is a trend for tourism demands in Japan to be increasing [2].

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On the other hand, sharing of information has become popular among the general population due to the spread of web services. For instance, social networks such as Facebook and Twitter are widely used in Japan: the utilization rate is over 55% for both [3]. These services are gaining popularity because of their features whereby users can easily post or view comments, photos and location information anytime, anywhere.

In the field of tourism, sightseers are easily able to obtain information about tourist destinations in advance, posted by others on web services like these. As a result, the sightseeing style of recent years is 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. 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 with information collected in advance [4].

It is certainly convenient for sightseers to obtain a variety of information before sightseeing. However, the best part of sightseeing is to discover something unique to the destination and to experience it [5]. In addition, attractive tourist destinations tend to vary depending on the circumstances of the moment, such as changes in seasonal scenery and weather. Even looking at information that can only be found in certain places may not feel interesting if the viewer is in a different place. People are likely to feel a stronger sense of interest when seeing the real place for themselves. That is to say, we can indicate the possibility of missing out on interesting tourist attractions in the locality due to the tourism plan being restricted by the information collected in advance.

B. Importance of Regional Tourism

As previously mentioned, sightseeing has a significant role to play in industrial activities. Therefore, various efforts have been made to attract visitors to each region. Revitalization of tourist destinations via mobile computing has also seen a definite effect along with the rapid growth of recent years.

For example, "Potential-of-Interest Maps" is a service that visualizes the degree of attraction of tourist destinations at each spot from the vast amounts of information that have been posted on photo-sharing sites [6]. Using this map, the movements of sightseers, hidden attractions in tourist destinations, and their popularity can be seen clearly. As a result, sightseers felt a sense of value not found in conventional guide maps. Lucchese et al. [7] and Xin et al. [8] have also devised algorithms for route recommendation in tourist destinations utilizing photos posted on photo-sharing

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sites, for example Flickr [9] and Panoramio [10]. Moreover, considerable research has been conducted on sightseeing systems using AR (Augmented Reality). For example, Choubassi et al. [11] proposed a sightseeing guide with AR for mobile devices. Their system generates augmented information from the relationship between the current location of the user and geotagged photos in a database. In addition, it combines motion estimation algorithms and orientation sensors, and then provides users with tourist information of interest to them. Schinke et al. [12] have researched visualization technology of POI (Points of Interest) in the real world. Their system guides sightseers using arrows embedded in an augmented reality layer that point directly to POI.

In ways such as these, revitalization of tourist destinations using information systems is actively taking place due to the development of Web services and mobile devices.

C. *Structure of this Paper*

This study proposes a novel sightseeing system to promote new discoveries, actions and interest from tourists who inherit information from each other. Information to be inherited is placed in certain spots in tourist destinations, and sightseers can obtain information by visiting the place. This is the same concept as "journey notes" (called *tabi nooto*), which are made available at travel facilities such as hotels in Japan. Via inheritance of information that each sightseer possesses, this system aims to provide users with highly novel and immediate sightseeing.

In the next section, related work is introduced. In Section 3, we present the proposed method, and in Section 4 an investigative experiment using a prototype system is described. Finally, we present our conclusions.

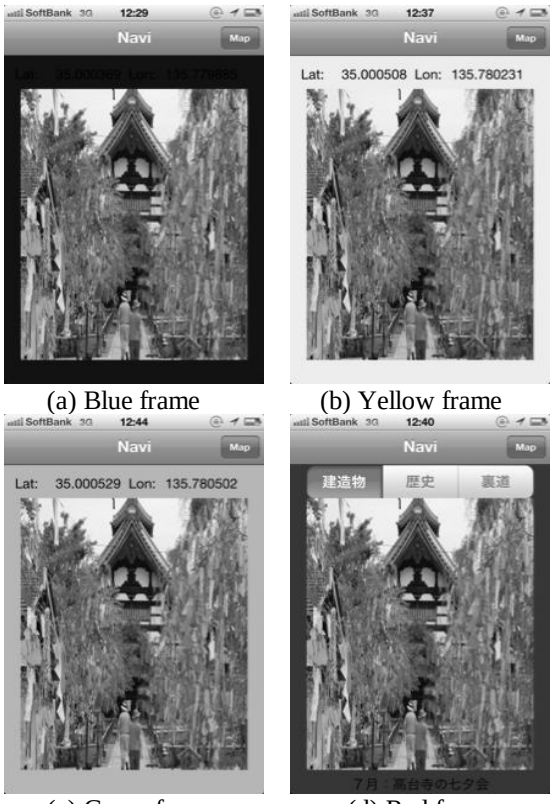
II. RELATED WORK

A. *Sightseeing Support Systems*

With the growing popularity of high-performance mobile devices such as smartphones and tablets, various studies about systems used during sightseeing have been researched. Some examples of sightseeing systems are introduced below.

Dinh et al. [13] developed a system to support the introduction of tourist destinations using a smartphone application. In this system, users add graffiti and comments to photos which are taken at the tourist destination, and the annotated photos are then shared on an online map. Thus each user conveys the attractiveness of sightseeing spots, which stimulates other users to feel like visiting there. It was confirmed by experiments that sharing annotated photos with other users was a factor in attracting interest.

Masuda et al. [14] researched a system that stimulates tourists to return to the same destination by allowing them to feel regret. This system uses the "Zeigarnik effect" [15], which states that people remember "unfinished or interrupted" tasks better than those they have completed. Masuda et al. applied this effect to something a person wished to view or visit but could not. Their method intentionally produces a situation where the tourist feels "I missed out, even though I was interested", and induces a revisit by creating such unfinished tasks. Firstly, the user selects a field of interest on the start screen. Next, the user strolls around the tourist destination with the system, and if the user approaches within 100m of a suggested spot, the system shows a photo of that spot (Fig.1). Then, the user moves to the spot while relying on the online map. At that time the system shows the distance from the user's position to the spot using colors. For example, if the user is within 100m from the spot, the system's screen color changes to blue (Fig.1 (a)). It subsequently changes from blue to yellow, to green, then to red as the user approaches the spot. Moreover, the photo shown by the system is intentionally different from the current season. This means that if the user visits the spot, they cannot see it at its best. Therefore, the user feels frustrated by the incomplete experience. As a result, Masuda et al. found the Zeigarnik effect stimulates people to wish to visit the place again in another season.



(a) Blue frame (b) Yellow frame

(c) Green frame (d) Red frame

Fig. 1 Example of photo display screen

B. *Game for the Purpose of Regional Development*

A treasure hunting game called Geocaching [16], which uses GPS and Internet message boards, is popular all over the world with over five million participants. The game's method is simple. First of all, a player hides a "cache", a container holding treasure (distinctive accessories, toys, coins and so on) in a location of their choice and registers the coordinates of the hiding place on the official Geocaching site. Then, other players search the area using a GPS receiver and a hint about the hiding place. Until a few years ago, players needed to carry a GPS receiver. However, the number of players has increased rapidly along with the evolution of high-performance mobile devices equipped with GPS. Accordingly, the number of valid caches has increased from about 500 thousand in 2007 to over 2 million worldwide in 2013.

Various studies have been conducted on Geocaching because of its large number of players and global scale. Hooper [17] analyzed the pleasure of Geocaching via an interview survey of players. As a result of analysis, it was demonstrated that people feel pleasure from the "hidden

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communities" based on the world of invisible coordinates, and in the "competitive aspect" for achieving higher ranking. O'Hara [18] investigated motivations for Geocaching. According to his survey result, it was found that enjoyment of walking, searching, collecting, communities and competing are the major factors.

Next, we introduce the example of Shikine Island, which has used Geocaching for regional development [19]. Shikine Island is a remote island of 600 inhabitants and an area of 3.9km^2. Approximately 21,000 tourists visit the island each year. However, since the majority of sightseers are concentrated in summer, attracting sightseers in other seasons has been an issue. Therefore, since 2009 the island authorities have held an event for the children of the island and Geocaching enthusiasts who participate from outside the island, which combines treasure hunting with picking up trash. This effort has been taken up in the media, making Shikine Island famous. The advantages from the introduction of Geocaching are that 1) Geocaching has become a tourist guide of unattended locations, and 2) the adventure of treasure hunting has led to extended length of stay and improvement of visit value. In this way, Geocaching leads to attraction of sightseers to Shikine Island by making it into a "treasure hunt island".

As observed above, treasure hunting games using the spatial restrictions give special stimulus to people, which then changes into pleasure. Our research also adopts this method for provision of novel sightseeing via an unseen community.

C. Effectiveness of Information Restriction

With advances in information technology, the notion of "anytime, anywhere" is taken for granted in modern society. In such a convenient society, there are benefits which are overlooked because of too much emphasis on efficiency. Some try to find these benefits by creating inconvenience intentionally, which is called the "benefit of inconvenience" [20]. Systems that are designed utilizing the "benefit of inconvenience" have been attracting attention.

We conducted previous research on a sightseeing navigation system with information restriction for leveraging the utility of the "benefit of inconvenience" [21]. Most conventional navigation systems show a detailed map, route and required time to a destination from the point of departure, and guide the users to their destination in the shortest period of time. These systems are self-evidently convenient. However, the users are not able to visit spots that they like due to such detailed information, because people tend to think that they must obey it. Therefore, we developed a system that navigates users only using information on direction and spots that are scattered throughout the tourist destination, without any detailed map information (Fig. 2). As a result of an experiment conducted in Kyoto, which is a famous sightseeing city in Japan, the system was shown to provide users with new discoveries and accidental encounters. Moreover, users were able to reach their destination without major problems. From this result, we can consider that restriction of map information directs people's attention to their surrounding environment and creates new awareness.

Fig. 2 Example of System Screen

III. Outline of Proposal

A. Approach

This research aims to promote novel sightseeing that adapts to the fluctuating attractiveness of tourist destinations via inheritance of information that can only be obtained at particular spots and times, targeted at sightseers. Thus, the proposed system is based on the same concept as "journey notes", which are made available at facilities in tourist destinations such as hotels. Anybody can write and read "journey notes" freely, but neither of these actions can be realized if a person does not visit the place. When a sightseer gains surprising information that cannot be obtained from a guidebook or the Internet etc., by viewing a "journey note", this can trigger new interest and actions. Users of social networks such as Twitter, which are gaining popularity in recent years, can obtain various kinds of information easily, anywhere at any time. However, it is hard to know the value of such information, because it has no restrictions, and various different kinds of information are mixed in the same place. Therefore, we focused on information inheritance within the local region like "journey notes", rather than information on a global scale, and developed a system to create value for information by applying restrictions. As a result, we can anticipate stimulation of actions for obtaining the information, and actions afterward. In order to limit the information that is inherited using this system, we applied two restrictions: spatial and temporal.

B. Information Inheritance and Restriction

Spatial Restriction

As previously noted, "journey notes", cannot be written or viewed without visiting the place. Based on such spatial restrictions, this system allows users to inherit information only within a particular spot. Spots where information can be inherited are assumed to be places such as crossroads, street map signs at the tourist destination, storefronts and so on. The system uses GPS (Global Positioning System) equipped in mobile devices to detect the spots where information can be inherited. Therefore, although users are only able to use the system outside, preparation of special equipment is not necessary. When users approach a spot within 10-15m from their current position, they are allowed to view and contribute information. The effectiveness of the exact location, number

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and range of spots where information can be inherited will be verified and concretely established in a future experiment.

As described above, this system restricts the area of information that users can view or contribute. We anticipate that spatial restriction will stimulate sightseers to visit the spot to obtain information.

Temporal Restriction

This system also has temporal restriction. This is a function in which posted information is deleted automatically after a specific amount of time has passed from the time the information was posted. We named this function "Information Life Span"; it applies a restriction by which users are only able to obtain information within a certain time period. However, the contents of the posted information are not always similar. Thus, we specified the life span of information for each genre of posted information. Table 1 shows the respective life spans for each genre. For example, information in the genre of "Event" has a life span of one day. Because most events take place on a pre-determined date and time, a specific period of time is required to obtain that information. However, this information loses its value after the event is over. Thus, we set this genre's life span to be one day. The life span of "Interesting scenery" is set to half a day, because of significant changes due to the season. The life span of "Shops/Places" is set to three days, because these rarely change in the long-term. In addition, this system has a genre of information called "It seems that…" which is information based on rumors. For example, "It seems that someone is doing a street performance in the park" corresponds to this genre. Such information conveys the circumstances of a tourist destination to users in real time. Therefore, the life span is set to be short in order to have a strong restriction, which enables the system to adapt to the fluctuating attractiveness of tourist destinations.

TABLE I
LIFE SPAN FOR EACH GENRE

GENRE	LIFE SPAN
Event	1 day
Interesting Scenery	Half day
Shops/Places	3 days
It seems that…	60 min

This function of temporal restriction allows information to be restricted. On the other hand, sightseers always want to obtain attractive information, and it is not desirable for attractive information to be removed immediately due to "information life span". Therefore, each item of posted information on this system has a respective "Evaluation." If the user taps the "Evaluation" button when they feel that the information is attractive, the life span of the information is extended. For example, when the "Evaluation" button for certain "Event" information is tapped by three sightseers, the life span of the "Event" information is extended to three days. In this way, information with higher appeal remains for a longer period, and users are able to know its importance and popularity. As a result, quality of information is ensured. Moreover, it is possible to eliminate information that is meaningless or false, and also to restrict the amount of information that is stored on the server.

As described above, we aim to provide attractive information for sightseers by setting information life span according to genre and by extending life span according to user evaluation.

C. System Structure in Detail

This system was developed as an application for Apple Inc.'s mobile operating system, iOS. The system is assumed to be used during sightseeing. Therefore, the devices for implementation of the system are Apple Inc.'s iPhone and iPad mini, as both of these are easy to carry and to view the screen. The development language for the application is Objective-C. Fig.3 shows the structure of the system, and the system flow is described below.

i. Query location information using GPS
ii. Verify whether the user is in a spot where information can be inherited
iii. It is possible to view/contribute information if the user is within the area
iv. Posted information is registered to a Post Information Database (MySQL) via a PHP file
v. When the user views the information, he/she repeats Steps 1 and 2. Then, the system queries the database, and sends the corresponding information to the device.

Table 2 shows the structure of the Post Information Database. The user is able to post photos and location information in addition to comments. Posted information is automatically assigned an ID, and the date and hour of posting is registered. Each spot where information can be inherited is assigned a unique ID. It is then possible to retrieve appropriate information from the database according to the relationship between the user's location information and this ID. Moreover, we intend that users will be able to post the genre, photos, location information, and evaluation to the database. The importance of the genre and evaluation information is as described in Section 3.B, and it is used to restrict the information. The importance of the photo and location information is described in the following section, based on a survey questionnaire.

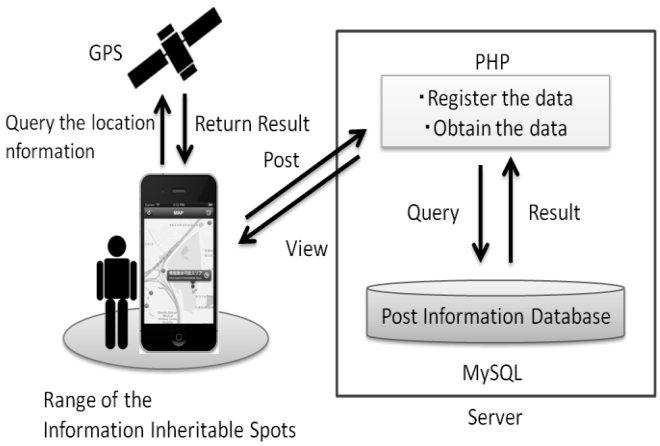

Fig. 3 System Structure

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TABLE 2
DATABASE OF CONTRIBUTED INFORMATION

ITEM	FIELD	DATA TYPE
Posted Information ID	ID	INT (Primary Key)
Date and Hour	Date	TIMESTAMP
Comment	Text	TEXT
Genre	Gen	INT
Photo	Photo	CHAR
Latitude	Lat	DECIMAL(7,4)
Longitude	Lon	DECIMAL(7,4)
Evaluation	Eval	INT
Spot ID	SpotID	INT

IV. SURVEY EXPERIMENT

A. Survey Experiment

We developed a prototype system and conducted a survey experiment. The prototype system has functions of detecting the distance from the user's current position to spots where information can be inherited, and of permitting viewing and posting of information. Fig. 4 shows the prototype system's map screen. The pins on the map indicate spots where information inheritance is possible. Posted information consists of only comments, date and hour. The targets of the survey are: 1) system usability, 2) appropriateness of the range of spots where information can be inherited, 3) appropriateness of the distance between each of these spots, and 4) user needs assessment.

This experiment was conducted to evaluate mainly our proposal of "spatial restriction". The experiment was carried out at Ritsumeikan University, Japan, in June 2013. The evaluators in the experiment were 11 university students in their twenties. The experimental procedure was as follows. First, evaluators were instructed on how to use the prototype system. Then, the evaluators visited the spots where information can be inherited, which were displayed on the map of the system. Finally, the evaluators posted comments when they visited each spot. After the evaluators repeated this procedure three to four times, we asked them to answer a questionnaire. The contents of this questionnaire were as follows.

i. Was the system usage method easy to understand?
ii. Was the posted information list easy to view?
iii. Did you want to post information other than comments?
iv. About the distance before detecting the information inheritance spots
v. About the distance between each information inheritance spot

Answers were given on a 3-point scale or a 5-point scale. The highest level, "Excellent" is "1" for Questions 1 and 2, and the lowest level "Poor" is "5". In Question 3, we asked the evaluators whether they had any other information that they wanted to post. If so, the questionnaire asked them to write what this information was. In Questions 4 and 5, the evaluators answered on a 3-point scale, "Near", "Average" and "Far".

B. Results of Survey Experiment Questionnaire

When the experiment was conducted, all evaluators immediately understood how to use the system after the explanation, and then moved to the next phase, visiting the spots where information can be inherited. In the questionnaire results, evaluation of Question 1 produced an average of 1.36 points, and evaluation of Question 2 produced an average of 1.64 points, both of which were considerably high. Therefore, it was demonstrated that the usability of this prototype system sufficiently satisfies the users. Next, all 11 evaluators answered "Yes" to Question 3.

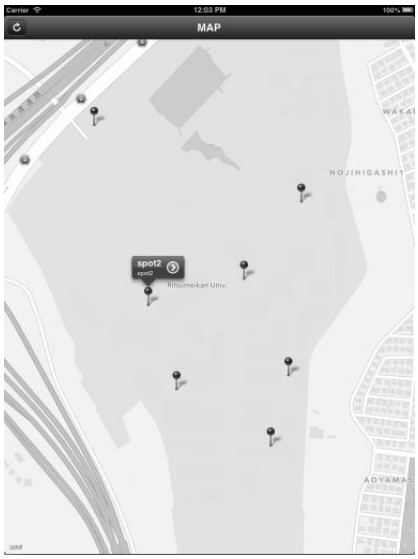

Fig. 4 Map Screen of Prototype System

The most common opinion was that they wanted to post photos in addition to comments. We found that actions to convey location information visually to others are desired by sightseers, as in conventional social networks. Other opinions included information about the spots that they visited and the weather of the day. In regard to Question 4, four evaluators described the distance to the spots where information can be inherited as "Near", and seven evaluators answered "Average". Nobody answered "Far". In consideration of this result and also of GPS errors, the appropriate range of the area was found to be around 15-20m. Finally, in regard to Question 5, two evaluators described the distance between each spot as "Near", and nine evaluators answered "Average". From this result, we determined the appropriate distance between each spot where information can be inherited. Therefore, we intend to use the results of this experiment at a real tourist destination.

On the other hand, all evaluators were familiar with the experiment site, as the experiment was conducted within their university. Therefore, no evaluators became lost. However, we received criticism that this system needs to navigate to the spots because it is possible for users to become lost in a real tourist destination. In future work, we plan to add functions to navigate, to post other types of information, to extend the life span of information, and others, in order to develop a system that meets the needs of users on the basis of experiments conducted at a real tourist destination.

V. CONCLUSION

In this paper, we proposed a sightseeing assistance system to provide users with highly novel and immediate sightseeing via inheritance of information, and both spatial and temporal restrictions. As a result of a survey experiment, we determine

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the appropriate range of spots where information can be inherited. At present, we are further developing the system for an evaluation experiment scheduled for the fall tourist season. In the future, we plan to verify the appropriateness of information life span and locations of the spots by multiple survey experiments.

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