

Development of Sightseeing Support System with Emphasis on Scenery and Detours in Strolls

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Abstract. This paper proposes a sightseeing support system that uses pictures and location information to guide tourists to of interest when they take a stroll during the free time available in sightseeing tours. This system allows the selection of a place that the user wants to visit by displaying various pictures of nearby interesting places on a map. This enables the user to choose a course freely, and enjoy detours at one's own leisure. The system thus helps tourists in visiting multiple places of interest other than their predetermined destination within the limited time available for sightseeing. The results of experiments on 30 min strolls using the proposed system suggest that in choosing the places of interest, the pictures displayed on the map were found to be very useful, and comparing the actual scenery with the pictures helped the subjects reach their destination easily. They were also able to change their destination to a different one easily during the strolls.

Keywords: Sightseeing support system · Stroll · Photograph · Location information · Vacant time

1 Introduction

In this article, we propose a sightseeing support system that helps tourists use the free time available in sightseeing tours effectively.

Combining GPS with SNS has become useful in collecting information and providing navigation to sightseeing spots as a tourist moves from one place to another during a tour. However, existing sightseeing support systems are tailored to famous sightseeing spots only, and many of them do not provide any information on other sightseeing spots nearby [1–4]. There is a lack of information regarding places of interest worth visiting and the type of experience that one may enjoy in such places. This is especially so for tourists who want to visit other places of interest near their destination, or want to explore the area around the destination within a certain time without selecting a specific spot. Furthermore, it is difficult for tourists to obtain information to plan how to spend unscheduled vacant time around their destination.

Therefore, we focus on effective utilization of unexpected vacant time at unfamiliar travel destinations and many scenic photographs around sightseeing spots. The purpose of this study is to develop a smartphone service to support about 20–30 min of strolls around sightseeing spots using pictures of nearby places of interest and location information.

Our system displays pictures taken around the current location on a map in a smartphone, enabling the user to set a tentative destination based on the impressions derived from the pictures and remaining time. A user freely takes a stroll through multiple places of interest around a sightseeing spot within a limited period of time.

This paper is organized as follows: in Sect. 2, we describe the related service for sharing sightseeing information. In Sect. 3, we explain our proposed system, which supports strolls in a travel destination using photographs. A validation test for our system will be given in Sect. 4. Finally, we discuss conclusions and future work in Sect. 5.

2 Related Works

2.1 Optimal Route Recommendation

A common trend among existing sightseeing support services is to determine the most efficient way to travel by providing an optimal route to the destination. This results in a lack of information about other places around the sightseeing spots, for a user who may want to enjoy some free time or explore the surrounding area. Google Places is one of information-sharing service that uses a map [1]. Users share information such as addresses, photographs, and comments about popular locations. Most of the information relates to shops, and especially to restaurants, and users can evaluate the shops on five levels. In some cases, a lot of information may overlap so users cannot easily locate the information they are trying to seeking.

2.2 Recommendation Based on Information on the Web

Approaches using geotagged photo data posted to a photo-sharing service are proposed [2, 3]. They analyzed large quantities of photograph and extracted travel information such as activities or typical patterns of sightseeing. These systems provide users visual analysis result about attractive areas or example itineraries. In these systems, the emphasis is on famous places of interest within an area, or providing an efficient route to move around. Therefore, there is a lack of information along the routes connecting one place of interest to another, and the walking routes provided are also limited. Accordingly, with respect to the inability to change a tentative destination or the route in the middle of a stroll, these services are not much different from existing navigation systems.

Tiwari et al. proposed a tourist spot recommender system using enrichment information including weather conditions and traffic conditions [4]. They assemble a database that contains location data and contextual information registered

by users. Users could obtain detailed graphical information about a tourist area using these systems. Fujii et al. propose a method to analyze tourists' behaviors automatically from travel blog entries [5]. By using this method, tourist information on souvenirs and sightseeing spots was extracted with high accuracy. This result can also be applied to automatic construction of tourist information link collections. In these systems, recommended sightseeing routes are provided to the user based on relevant information collected on route preferences from other users. However, these systems find it difficult to provide route recommendations for the not-so-famous sightseeing spots because of the lack of data, as sharing of such data depends on user preference.

CT-Planner introduces routes starting from a specific point and moving within a certain area without a predetermined destination [6]. Users can design their tour interactively. The systems allows users to register new tourism resources with recommendation reasons, so attractive tourism information can be provided sufficiently. However, it is not clear whether the place that the traveler actually wants to visit is included in the recommended route.

2.3 Utilization of a Vacant Time

Service that utilizes a vacant time have also been proposed. Layover with a Local is an application that gives opportunities to interact with local residents during the layover time [7]. The target user is passengers arriving in the Amsterdam Schiphol airport, who stay for more than six hours until the next transfer. Travelers are matched with an Amsterdam local based on languages and social interests. The application provides travelers with clear instructions to lead Amsterdam's city centre, where they hook up with the local. Although tourists can use their vacant time efficiently for sightseeing, this service is only helping to directly lead people's interpersonal exchanges. Therefore, it may be assumed that travelers fail in matching or direct negotiation.

2.4 Approach of this Study to the Problems

In response to these problems, we propose a sightseeing support system that pictures taken around the current location are displayed on a map in a smart-phone, enabling the user to set a tentative destination by themselves based on the impressions derived from the pictures. Users can grasp the required time from displayed information on the map while they set a place that they are interested in as a temporary destination. It also allows the tentative destination to be changed at any arbitrary time, allowing for easily changing the route. This way the system allows a user to freely take a stroll through multiple places of interest around a sightseeing spot within a limited period of time. In Sect. 3, we describe the system's details.

3 System Framework

3.1 Goal

Our goal is to realize a system that uses pictures and location information to guide tourists to places of interest when they take a stroll during the free time available in sightseeing tours. Our target user is not familiar with the sightseeing area or not collecting tourist information in advance.

In contrast to conventional navigation systems that display the shortest route to the sightseeing destination, our system provides scenery pictures to guide tourists to places of interest when a user take a stroll and information to plan how to spend unscheduled vacant time around a user's travel destination. The user can choose a course freely, and enjoy detours at one's own leisure. In our system, it is assumed that the vacant time is about thirty minutes to about two hours.

3.2 Design Method

The system is implemented as a web service that can be accessed from a smart-phone. Google Maps API is used to display maps on the web, and the pictures are placed as markers on the map. The following section describes the system design method.

1. Setting the destination based on pictures

The user sets the destination of interest based on the impressions derived from the pictures of nearby places displayed on the map of the current location. The time, date, and location information of each picture are also displayed in the application. Pictures of scenery other than those at the sightseeing spots are also displayed at times. This lets the user to select a destination that appears to be intuitively attractive, since no explanatory text is displayed.

2. Displaying a list of pictures taken around the current location

As the destination is set, the shortest route is not displayed; instead, a list of pictures of nearby places is displayed, along with the date, time, and place the picture was taken at. This is also accompanied by a rough estimate of the time required to reach the place on the picture from the current location. This enables visual selection of a route as the user looks for places of interest other than the destination.

3. Setting and changing the candidate destination

As the user selects a picture of a place of interest, the selected location is recorded as a candidate destination on the map. The selection of a stroll route or a destination is made easier as the user can visually confirm the candidate spot displayed on the map.

4. Displaying pictures at a branching point on a route

The route selection at a branching point is assisted by displaying a list of pictures along each possible route beyond the branching point.

3.3 System Overview

The system is implemented as a web service that can be accessed from a smart-phone so that users can easily access our service even if they suddenly have unexpected free time outdoors. The clients in the system are smartphones running on iOS or Android, with GPS and PHP-enabled web browsers installed. Google Maps API¹ is used to display maps on the web, and the pictures are placed as markers on the map. All map data in this article is based on Google Maps.

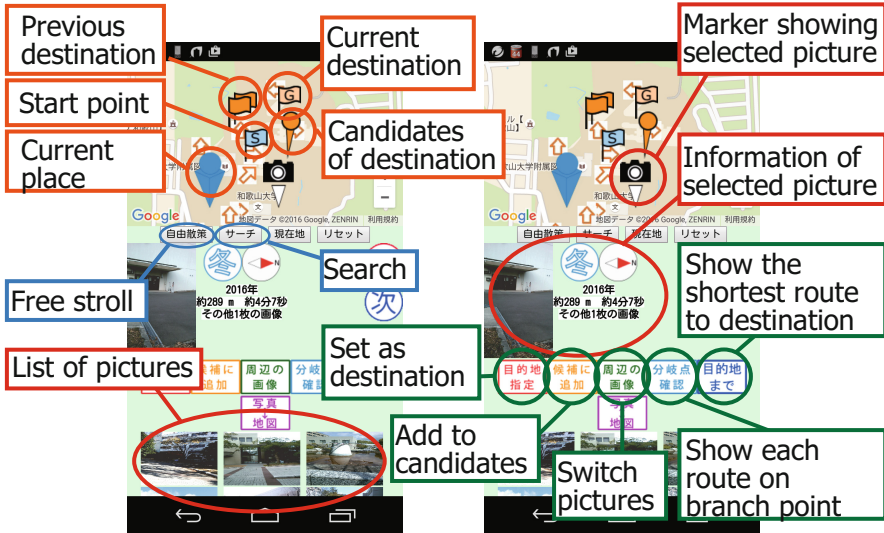


Fig. 1. Screenshot of the proposed system in operation.

Figure 1 shows the screenshot of the proposed system in operation. The map with markers for the current location and the destination is displayed in the upper part of the screen. Just below that, the “free stroll”, “search”, “display current location”, and “reset” buttons are displayed. In the middle of the screen, the selected picture along with the information on time, season, and direction the image was captured from, is displayed. Moreover, the operations available on the selected picture are also concurrently displayed. The pictures of nearby places are listed at the bottom of the screen.

The usage patterns are shown in Fig. 2. The system displays the pictures along the path from the current location to the final destination as thumbnails or markers on the map, or in the form of a list. The user can decide on the next destination (or transit point) after browsing the pictures. The user can also have a good view of the scenery at different places through the pictures displayed by the system.

¹ Google Maps API: <https://developers.google.com/maps/>.

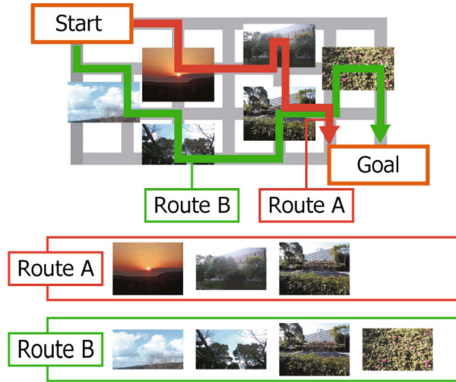


Fig. 2. Usage patterns in deciding the stroll route.

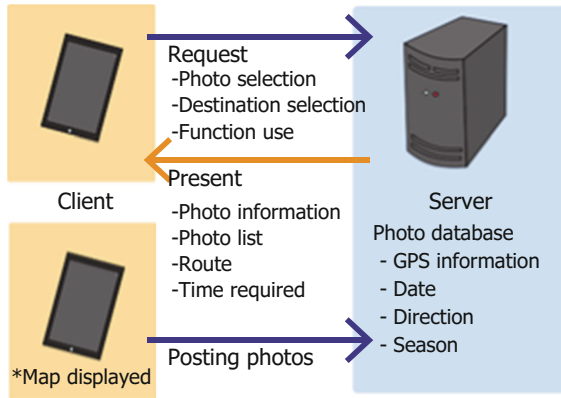


Fig. 3. Server and clients.

3.4 Presentation of Photograph Information

Figure 3 provides an illustration of the server and the clients. A client selects a picture on the map, then a request is sent to the server.

Photographs are placed on the map as a marker or a thumbnail. Figure 4 shows screenshots that a picture on the map is selected. The left side of Fig. 4 uses arrow markers and the photo information is displayed in the balloon with thumbnail. The photo information includes the direction in which the picture was taken, the date and the season. The direction of the arrow means that the picture were taken in which direction from the current location. The right side of Fig. 4 uses thumbnails of each photo. The photographs with characters that means the direction are placed in groups on the map. Users can switch the representation.

Users check each picture and set a marker indicating a picture of interest as a tentative destination based on the photograph information. From the photo



Fig. 4. Photograph data on the map.

and the photo information displayed by the system, it is possible for users to easily grasp what kind of scenery the users can see where to go.

3.5 Picture Search Function

When the user presses the “search” button in Fig. 1, the system displays a list of thumbnails of the pictures captured around the current location. The thumbnails are grouped into eight categories based on their direction of capture. This feature enables the application to display all the pictures of other sceneries in the same direction as that of the image selected by the user from the thumbnails displayed.

The “search” button can also be used to determine the route while checking the detailed information on the pictures by selecting the arrow marks displayed on Google Maps. The arrow itself points to the direction of the camera in which the image was captured, and by tapping on it, the date, season, and time of the day when the image was captured, and its thumbnail gets displayed.

3.6 Listing Stroll Spots Function

When the user presses the “set as destination” button in Fig. 1 during marker selection, a flag marker with the letter G is displayed on the location of the picture. The picture is set as the tentative destination.

Once the destination is set, the pictures of different spots between the current location and the destination are displayed as a list at the bottom of the screen. The screenshot of the photograph list is shown in Fig. 5. In Fig. 5, the photograph at the second row and the third column is selected. The distance from the user’s current location to this photo location and required time are displayed next to the photo.

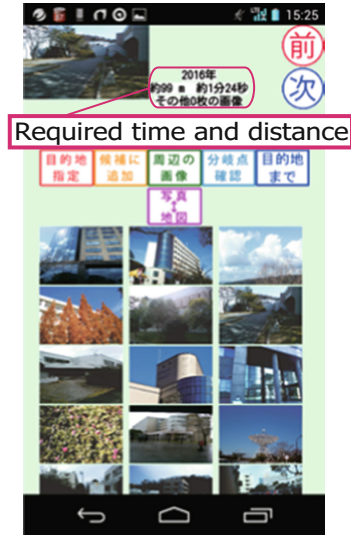


Fig. 5. List of photographs between the current location and the destination.

This function enables the user to select detour spots while keeping track of the remaining stroll time, the distance to the destination, and contents of the images. If more than one place of interest is found, the application allows them to be stored as candidate destinations for subsequent visits.

3.7 Reviewing Branch Point Function

When the route being followed reaches a branching point, the user can check the pictures along the different routes beyond the branching point. The direction of different routes at the branching point can be displayed as markers on the map by pressing the “show each route on the branching point” button. As shown in Fig. 2, if the user chooses the marker that points to the right, then route A is selected, and if the marker pointing down is chosen, then route B is selected, and the pictures along the selected route are listed starting from the one nearest to the current location. Since the list of pictures for each route is different, the user can select a preferred route, either by selecting the shortest route to the destination or by selecting a route that include detours to the places of interest to the user, before reaching the destination.

Figure 6 shows the screen of a result of using this function. The photographs are placed in order of distance. The user can review in advance the scenery pictures seen by going in the selected direction.

3.8 Free Stroll Function

The “free stroll function” has been designed to enable the user to stroll freely with the user’s current location set as the final destination. The target is the



Fig. 6. List of photographs to the destination in order of distance.

users who want to walk around without setting the final destination, or who want to stroll around the current location while they want to search for new experiences. This function can also be used when the user plans to return to the original location after a stroll around any particular area.

4 Evaluation Experiments

4.1 Experimental Overview

An experiment was conducted with 7 university students to test the proposed system for strolling within a limited period of time. The site for the experiment was the university campus where the participants studied. The participants used their own Android phone or iOS phone equipped with a GPS function in the experiment. The participants confirmed beforehand that the system will operate on the web browser of their own smartphone.

We explained the functions and usage of the system in advance to the participants. Although all the participants started the stroll from the same point, they were allowed to freely stroll without setting any particular destination or route. The participants were subsequently asked to fill out a questionnaire after completing the experiment.

It is to be noted that pictures within the campus were recorded in the system prior to the experiment. The students used several sets of pictures along roads mostly frequented by the students, places along less trodden alleys, as well as places around research buildings other than their own. This was done to enable the participants to discover new sceneries that they may have never seen in their day-to-day campus life.

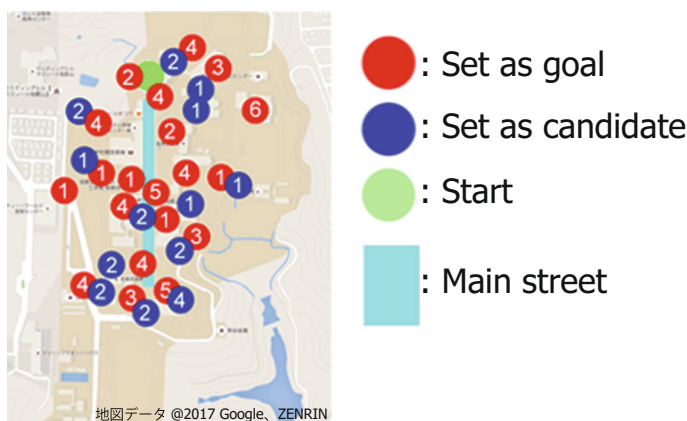


Fig. 7. Distribution of the number of times the destinations were set.

4.2 Experimental Results

Figure 7 shows the distribution of places that were selected as destinations or candidate destinations. The figures within the circles denote the number of times a particular place was selected. The values in Table 1 are the number of times that each function was used. The experimental results are presented in Table 2.

The average number of places marked by the participants as destination and candidate destination was 9.7 and 3.4 per person, respectively. It was observed that many of the participants used the markers for places near the current location as destinations and not as candidate destinations. In contrast, the number of markers for candidate destinations increased for places that were farther from the current location. The results suggest that this is likely due to the fact that the participants tended to move gradually from the marker closest to the current location to the ones further away as they adjusted the time to stroll around.

The results of questions (i), (iv), and (vi) in Table 2 suggest that although there was no written information available such as pamphlets describing sightseeing spots, the participants were able to select their destinations based solely on the information provided by the pictures. Moreover, the results of questions (ii), (v), and (vi) suggest that it is likely that regarding guidance in selecting a destination for strolling, introducing routes solely using pictures was adequate for most of the participants.

The existing tourism support service can guide users with less operation since the voice guidance are played back and the instruction are displayed on the screen only by setting the destination. On the other hand, in this system, many operations such as setting of destinations and candidate places are required. Therefore, there were some comments in the free description fields on the questionnaires regarding the improvement of the interface. One of them is screen design tailored to small screens like smartphones; “I want to freely change the size of the photos in the list”, or, “It will be hard to see each photo if the markers are overlapped”.

Table 1. Number of times that each function was used.

Operation contents	No.	Avg.	SD
Set as a destination	68	9.7	8.4
Set as a candidate destination	24	3.4	2.6
Route search at branch point	30	4.3	3.0
Free stroll	22	3.1	2.1

Table 2. Average values from the posting questionnaire.

Questionnaire item	Median	Mode
(i) Selecting the next destination based on the pictures was easy	4.0	4
(ii) There were no concerns about getting lost despite the absence of any voice guidance	5.0	5
(iii) The number of pictures displayed in the list was appropriate	3.0	3
(iv) The pictures in the list were effective in advancing the stroll	4.0	4
(v) The scenery at different places could be confirmed using the pictures displayed	4.0	4
(vi) The scenery of interest was easy to find	4.0	4
(vii) An enjoyable stroll was realized within the limited time available	4.0	4

Additionally, there were opinions on the functions that they wanted to add such as “I want a warning for the narrow street that it is hard to pass.”

The screen of the smartphone is very small, so complicated operation forces users to bear the burden. However, we think that it is important to adopt a format that displays maps and photo information at the same time. Therefore, in the future, it is necessary to improve the interface that can comfortably provide photograph information on the map and select a destination while minimizing operation.

5 Conclusion

This study proposed a system that supports strolls to a destination using maps and pictures. Unlike the existing sightseeing support systems where voice assistance and current location information are used, the proposed system enables the user to freely select the destination or the route to the destination from pictures and location information displayed on maps and complete the stroll within a limited time.

An experiment was conducted to verify whether an enjoyable stroll can be undertaken within a limited time, guided by pictures and sceneries using the

proposed system. The results suggest that the users, despite not being presented with any text-based route guidance or introduction to the sightseeing spots, were able to select the stroll route and destination based solely on information provided through pictures. It must be noted that the participants, through their daily activities, were already very familiar with the area where the experiment was conducted. This may have likely affected their evaluation. It is believed that implementing improvements in the user interface by adjusting the number of pictures displayed and conducting verification experiments in an area that the participants are unfamiliar with are necessary in the future.

References

1. Google Developers: Google Places API. <https://developers.google.com/places/>. Accessed 28 Feb 2017
2. Kisilevich, S., Krstajic, M., Keim, D., Andrienko, N., Andrienko, G.: Event-based analysis of people's activities and behavior using Flickr and Panoramio geotagged photo collections. In: 2010, 14th International Conference on Information Visualization (IV), pp. 289–296 (2010)
3. Popescu, A., Grefenstette, G., Moellic, P.: Mining tourist information from user-supplied collections. In: Proceedings of the 18th ACM conference on Information and knowledge management (CIKM), pp. 1713–1716 (2009)
4. Tiwari, S., Kaushik, S.: Information enrichment for tourist spot recommender system using location aware crowdsourcing. In: IEEE 15th International Conference on Mobile Data Management (MDM), vol. 2, pp. 11–14 (2014)
5. Fujii, K., Nanba, H., Takezawa, T., Ishino, A., Okumura, M., Kurata, Y.: Travellers' behaviour analysis based on automatically identified attributes from travel blog entries. In: Workshop on Artificial Intelligence for Tourism (AI4Tourism), PRICAI 2016 (2016)
6. Kurata, Y.: Collecting tour plans from potential visitors: a web-based interactive tour-planner and a strategic use of its log data. In: Egger, R., Gula, I., Walcher, D. (eds.) Open Tourism, Open Innovation, Crowdsourcing and Co-Creation Challenging the Tourism Industry. TV, pp. 291–297. Springer, Heidelberg (2016). doi:[10.1007/978-3-642-54089-9_20](https://doi.org/10.1007/978-3-642-54089-9_20)
7. KLM Royal Dutch Airlines: Social airline KLM connects travellers and Amsterdam locals. Amstelveen, 18 February 2016, Newsroom. <http://news.klm.com/social-airline-klm-connects-travellers-and-amsterdam-locals>. Accessed 28 Feb 2017