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A STUDY ON TOURIST NAVIGATION WITH THE USE OF APPLICATION SERVICE PROVIDER OF LOCATION POSITIONING SYSTEM - A CASE STUDY IN KAMAKURA -

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Abstract: This study aims to develop a travel information service system by using application service provider (ASP) of location positioning system in order to assist sightseeing scheduling. The proposed system has the following features; (1) tourists with GPS handy phones can communicate with the operators who send requested information, (2) locations of the tourists are detected arbitrary by the operator on the internet GIS server so that the operator can answer the request according to tourists' positions and (3) the operator and the tourists can share sightseeing spots that the tourists send to the server. As a result of demonstration experiment, it is shown that the proposed system is useful for rescheduling and for the situations when congestion level of footway and sightseeing spots are provided for the tourists. It is also indicated that tourists could make sightseeing trips smoothly when they send their schedule to the operator before sightseeing.

Key Words: Tourism ITS, Tourist navigation, Application service provider (ASP), GPS handy phone with camera, Travel guidance

1. INTRODUCTION

Recently in Japan, it is one of the crucial issues to encourage attractiveness of urban tourism. In order to make tourists' scheduling more convenient and more smooth, various information services on sightseeing spots or travel assist has been provided. Several social experiments of travel information services for tourists have also been demonstrated by using GPS, internet GIS, PDA, RFID (or ubiquitous communicators) and so on. Some of them are indicated to relieve tourists' stresses while traveling and to assist decision makings. Many of these demonstrations, however, have been finished over a short amount of term, for example one year or so. It is assumed that the reason why tourism ITS is not matured is partly because usability of travel information service devices is not appropriate for tourists, and because contents that are provided for tourists are not always matched for users' demand. Actually, when requesting the current positions or travel information by using commercially available services of handy phone with GPS, users tend to be annoyed by complication of device manipulation.

Regarding tourism ITS study, various demonstrations have been conducted. Furuya, H. *et al.* (1996) indicated that providing travel time costs could execute tourists' scheduling. In some demonstrations, route information and weather information are provided (Uemura, T. *et al.*, 2003, Omori, Y. *et al.*, 2001). Misawa, T. *et al.* (2003) proposes an information service system for drivers to provide several contents by personal handy phones. In several sightseeing spots, P&R/P&BR information are also provided in order to relieve congestion around parking (Sakamoto, K. *et al.*, 1997, Takayama, J. *et al.*, 1997). Many of them are applied to tourists

who drive cars, but Harayama, T. *et al.* (2003) developed ITS device for bicycle. Travel information service demonstration in Asuka area is also demonstrated for tourists traveling by bicycle (KRDV, 2001). Improvement of GPS accuracy has made travel guidance for pedestrian possible. Travel guidance systems are demonstrated in a relatively small commercial district to indicate frequency and contents demand of information services (Aoki, A. *et al.*, 2002, Daito, T. *et al.*, 2003). However, it is necessary to show demand for information and appropriate way to provide information in wider sightseeing areas. In many demonstration of tourism ITS, such kinds of information as routes, sightseeing spots, maps, event, restaurants and so on, and travel information of them is basically provided according to the existing travel information sources. It is not clarified how to provide requested information by tourists when they need travel information yet.

Therefore, this study aims; (1) to develop travel information service system for tourists who visit sightseeing spots by using personal handy phone with GPS and digital camera, (2) to develop a system with which tourists can share pictures that are taken by the handy phones in order to show how tourists behavior change by sharing information gathered by tourists and (3) to validate usability and problems of the proposed system. The originality of the proposed information system is that (1) tourists with GPS handy phone can request to and communicate with operators about travel information according to the current location and/or previously reported schedules through the application service provider system (ASP) of location positioning, (2) tourists can exchange information including pictures and text regarding the study area by personal handy phones, if necessary.

Kamakura city is selected as a study area where is one of the popular sightseeing spots around Tokyo. In the next chapter, features of the study area are described. Additionally, what kinds of information tourists gather in the study are is shown. In chapter 3, outline of the proposed travel information system by applying the application service provider system of location positioning system is shown. In chapter 4, the mounted system is introduced. In chapter 5, results of demonstration experiment are indicated. Finally in chapter 6, conclusions and future research directions are remarked.

2. OUTLINE OF TOURISM INFORMATION DEMANDS IN THE STUDY AREA

As tourists can visit Kamakura from about 1.5 hours from the center of Tokyo, the study area is one of the most popular sightseeing areas to make one day round trip in Tokyo (Figure 1). About 18 million Japanese tourists and about 600 thousand foreign tourists are estimated to visit Kamakura city in 2004 (Furutani and Fujita, 2005). In the study area, not only historic spots, temples and shrines, but also natural pathways, parks and seashore are popular among tourists.

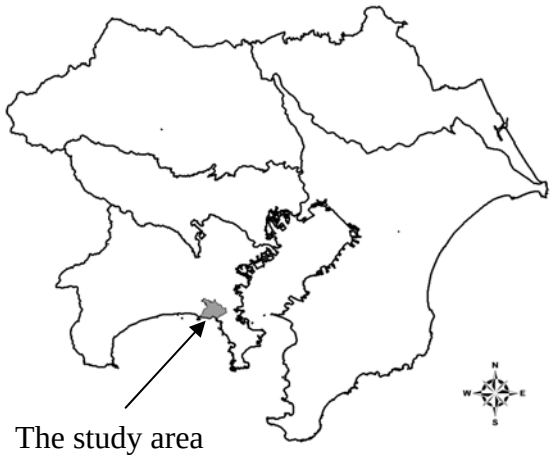

Figure 1. Location of the Study Area

Although many guidebooks, brochures and internet sites regarding sightseeing spots in the study area are published, it is not certain what kind of information and resources tourists refer. Therefore, a

questionnaire survey is conducted in order to clarify this point. The survey is conducted in weekend from April to May, 2004 at Hase station in Kamakura. Figure 2 shows information sources that Japanese tourists used before and during sightseeing. It is indicated that about 72% of tourists refer guidebooks or brochures and about 44% of tourists refer internet before tourists visit the study area. On the other hand, about 57% of tourists refer guidebooks or brochures and about 10% of tourists refer on-line information through internet by handy phone or PDA, instead that about 64% of tourists refer signs in the town. As shown in Figure 3 and 4, we can understand that tourists refer various kinds of information about the study area, but almost all contents of them seems depend on the existing guidebooks or brochures. In many demonstration of tourism ITS, such kinds of information as routes, sightseeing spots, maps, event, restaurants and so on, but basically these contents are serviced according to the existing travel information sources. It is considered that the reason why commercial based service to provide tourism information by handy phones is not popular is partly because there is few difference of contents between existing guidebooks and ITS services.

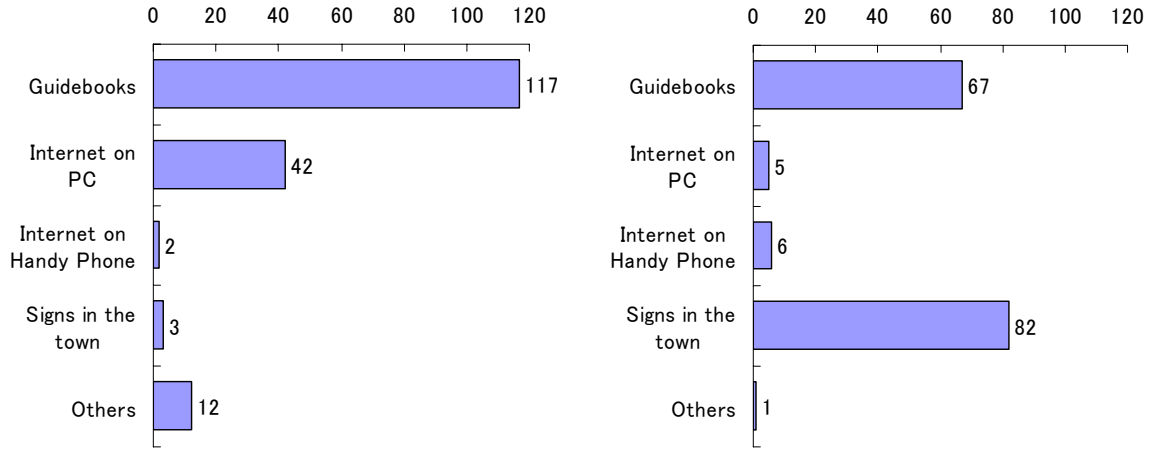

Figure 2. Information Sources before and during Sightseeing (multiple choice, n = 135)
(source: Tourist survey conducted from April to March in 2004 by the authors)

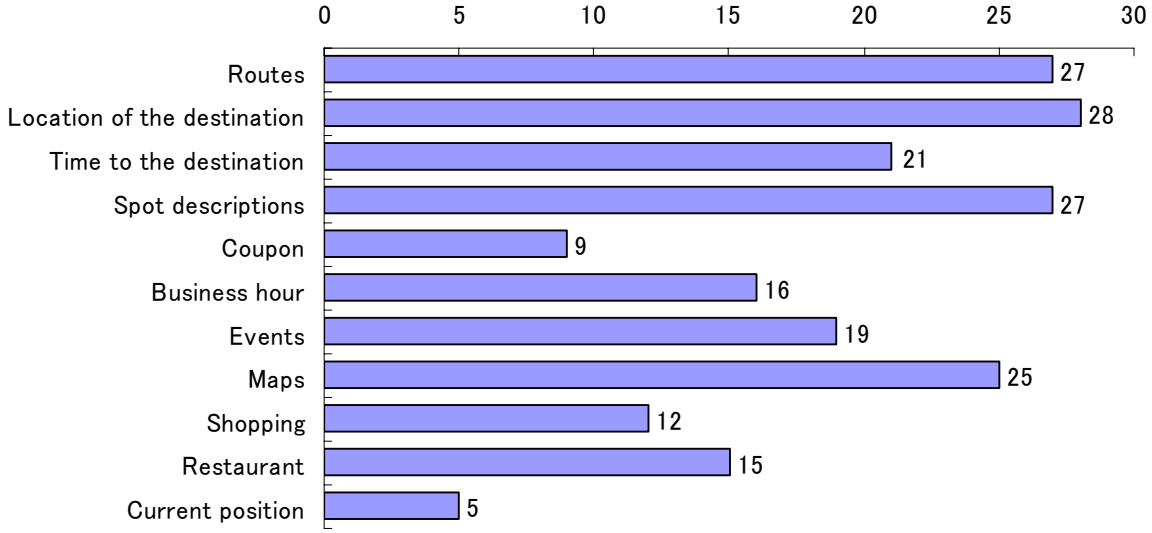

Figure 3. Contents of Information Gathered by the Tourists before Sightseeing
(multiple choice, n = 135)
(source: Tourist survey conducted from April to March in 2004 by the authors)

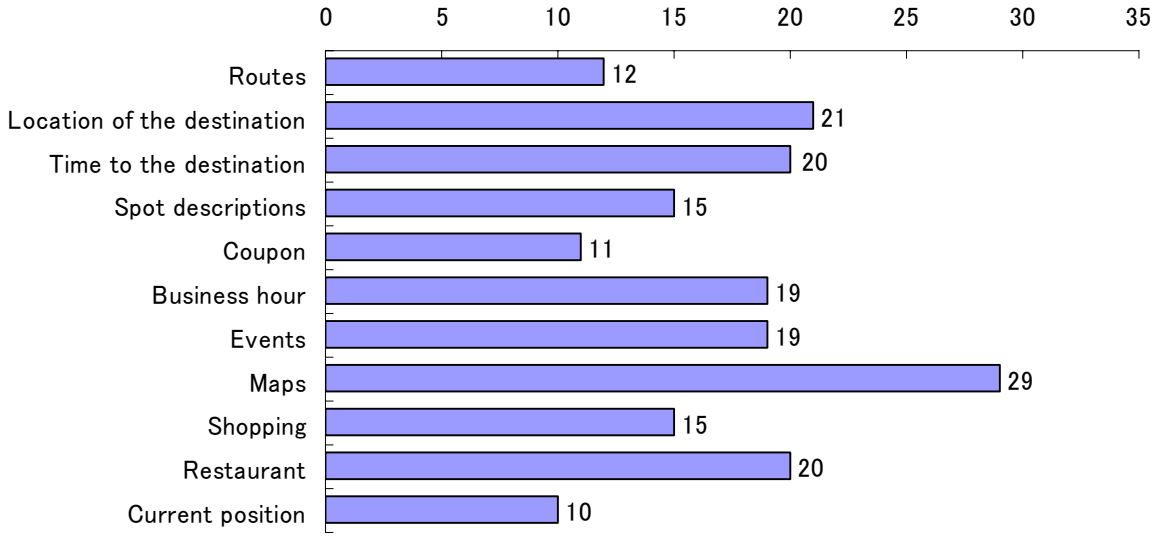

Figure 4. Contents of Information Gathered by the Tourists during Sightseeing
(multiple choice, n = 135)
(source: Tourist survey conducted from April to March in 2004 by the authors)

3. DEVELOPMENT OF TRAVEL INFORMATION SERVICE SYSTEM BY USING THE APPLICATION SERVICE PROVIDER (ASP) OF LOATION POSITIONING SERIVCE

3.1 Outline of the System

In this study, a travel information system with which the application service provider (ASP) system of location positioning service is used to trace positions of tourists with GPS handy phones or GPS device is proposed. When tourists travel with GPS handy phones, their locations can be sent to the internet GIS server and displayed GIS maps. This service is called as ASP of location positioning service. Recently, this kind of service is applied for detection of children or roaming elderly people, for example. In the proposed system, location of tourists can be detected at fixed interval. Additionally, the operators who manipulate server PC can request to confirm the latest position of GPS holders. Additionally, tourists are assumed to do the following basic operations; (1) to request travel information to and communicate with the operators who are tracing the latest position of them in real-time and (2) to provide spot information that tourists gather by the GPS handy phones with camera and to share them with the members who join the service. On the other hand, according to the tourists' requests, sightseeing-related information is sent to the tourists by e-mails or personal communication on the handy phones. Not only one-way information provision, but also communication between tourists and the operators are characteristics in the system. As of this moment, it is assumed that the service is available for the limited members (Figure 5).

Here, a tourist is required to hold either an NTT Docomo's GPS handy phone (F505iGPS) or a GPS device (Posiseek R). When tourists hold the former GPS handy phone, they can take photos to the server in order to share them with other persons who are taking part in the system. In case that a tourist holds only the GPS device, he/she needs to carry his/her own handy phone in order to communicate with the operator. In order to secure the examinees' privacy, they are asked to choose each of the devices.

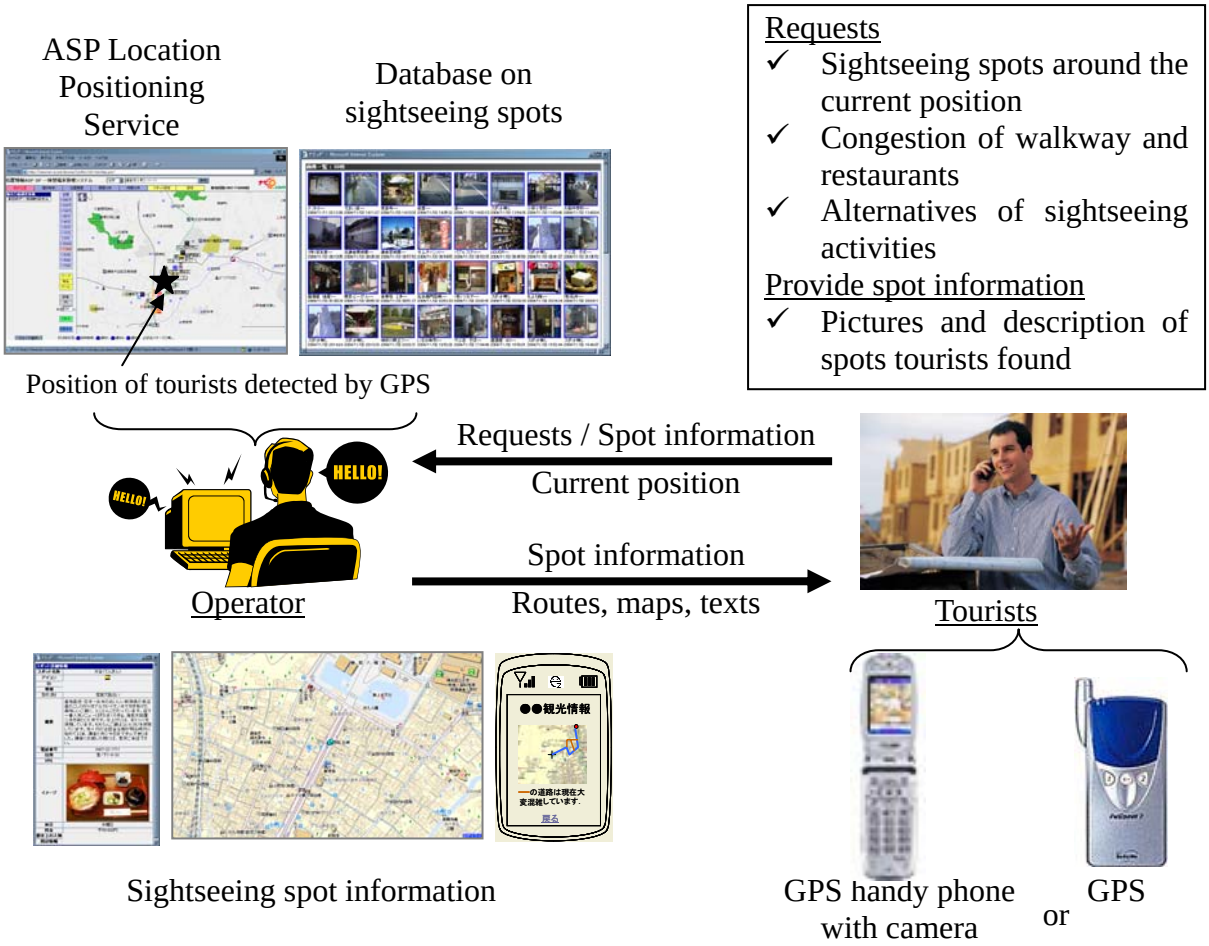

Figure 5. Outline of the Proposed Tourist Navigation System

3.2 ASP Location Positioning Service and Travel Information Service

As is mentioned before, the proposed system emphasizes not only information provision from the operator to the tourists through the APS location positioning service, but also communication between the operators and the tourists.

First of all, outline of the communication service on travel information is described. Basic ideas are as followings. Tourists who would like to use the service are asked to resister the system so that the operator could identify their handy phone numbers. Here, the tourists can choose whether they borrow the handy phones that are prepared by the operator, or they use their own handy phones. This is mainly because the tourists could protect their privacies by giving their phone numbers to the operator. In case that the tourists carry their own handy phones, they can borrow the GPS devices. While the tourists are sightseeing with the GPS handy phones or the GPS devices, their locations are detected and they do not need to detect or send their current positions to the server or the operators in order to request, for example, routes to their destinations. The tourists can request anything about their sightseeing activities to the operator arbitrary. Here, the authors expect that the operators can response the following kinds of requests; (1) routes to the destinations and landmarks around the requested facilities, (2) details of sightseeing spots and restaurants (entrance fees, historic outlines, prices of foods, major menus, business hours, fixed holidays, pictures, address, telephone numbers and homepage addresses), (3) alternative routs, back roads and road conditions when roads are congested or have problems (e.g. under construction), (4) recommended routes

according to the tourists' favor, (5) advice to modify schedules and (6) public transit schedules. In order to make the communication smooth between the tourists and the operator, these items are stocked in the database.

On the other hand, the operators are assumed to send the requested information to the tourists by e-mails and by personal communication on the phones. When we conducted several preparatory demonstrations, it is indicated that not a few tourists felt stressed when responses from the operators are delayed more than about three minutes, but they felt less stressed if they can obtain some information immediately though it is not a complete answer to them. It is also shown that many tourists would like to know tourism resources around the place where they are located and the alternative routes or facilities when they are congested. Therefore, the tourists' requests are expected to be replied in the following manner; (1) if the tourists request only details of sightseeing spots and restaurants or what can be answered immediately, these requests are guided just by dialogue between the operator and the tourists, (2) texts and pictures prepared in the database are sent immediately by e-mail to the registered handy phone addresses after dialogues between the operator and the tourists terminate (expected response time is less than one minute), (3) maps in which routes to destinations and land marks on the routes are described are sent by e-mail (expected response time is less than three minutes), (4) the alternative plans are also provided according to the tourists request until the expected time they do the next activities and (5) if part of the schedule is informed, the operators send information of the next activities by e-mails when the tourists start previous activities. Basically, these situations are assumed that the tourists send their request en-route. As the preliminary demonstrations indicated that there are the following two different patterns to determine sightseeing schedules; (1) the tourists who determine their schedules before they start their sightseeing and (2) the tourists who do not always determine their schedules before they start their sightseeing. Therefore, these two patterns of scheduling are compared in the demonstration.

In many cases, tourists are expected to carry guidebooks or maps of the study area, and it is indicated that directing routes on the map through communication by telephone is more convenient for the tourists. Therefore, direction of routes is done not only by GIS map of the server but also by the maps the tourists are carrying. In this study, the operator and the tourists use a common map that is provided at the tourist information center in Kamakura station.

3.3 Tourism Spots Information Registration/Sharing Service

Secondary, the tourism resource database is mounted so that the tourists can send information they gathered by themselves and can share it with other members of the system. In this system, tourists can send pictures and texts about spots where they notice in the study area to the server by the GPS handy phones with camera. In this case, the tourists are required to carry the prepared GPS handy phones. These pictures and texts are stocked in the database server so that both the operator and the tourists can refer on the internet GIS. Stocked information by the tourists can be sent again to the other tourists by e-mail.

Major purpose of this system is to gather spot information by the tourists. It is considered that weakness of the paper guidebooks is that modification intervals are relatively longer than those of web news or internet sites. It is possible for the tourists and the operator to update the contents of the database as their changes. The other effect of the system is that the operator can gather information not only on congestion of footway, sightseeing spots and restaurants, but also on bargain sales of shops, barrier free level of facilities and so on.

4. THE PROPOSED SYSTEM MOUNTING

In this chapter, the mounted system of the proposed ASP location positioning and tourism spot information sharing are introduced.

4.1 ASP of Location Positioning Service System

Examples of displays to detect locations of the tourists are shown in Figure 6 and 7. The levels of GPS positioning errors are indicated in order for the operator to direct the tourists as accurate as possible. While the demonstration, however, it is not reported that both the operators and the examinees felt inconvenience by inaccuracy of location positioning by GPS. Default interval to detect the tourists' locations is fixed to one minute, but individual positions can be detected arbitrary when the operator request. Each location of the tourists can be identified by IDs and by giving individual symbols. This is because privacies of the tourists are to be secured. Current positions of the tourists on the map can be sent by e-mail to the tourists. Considering visibility of the maps on the display of the handy phones, original maps are prepared on the database to send them to the tourists.

Figure 6. An Example of Location of Tourists Displayed on a Personal Handy Phone (© Navi-p.com)

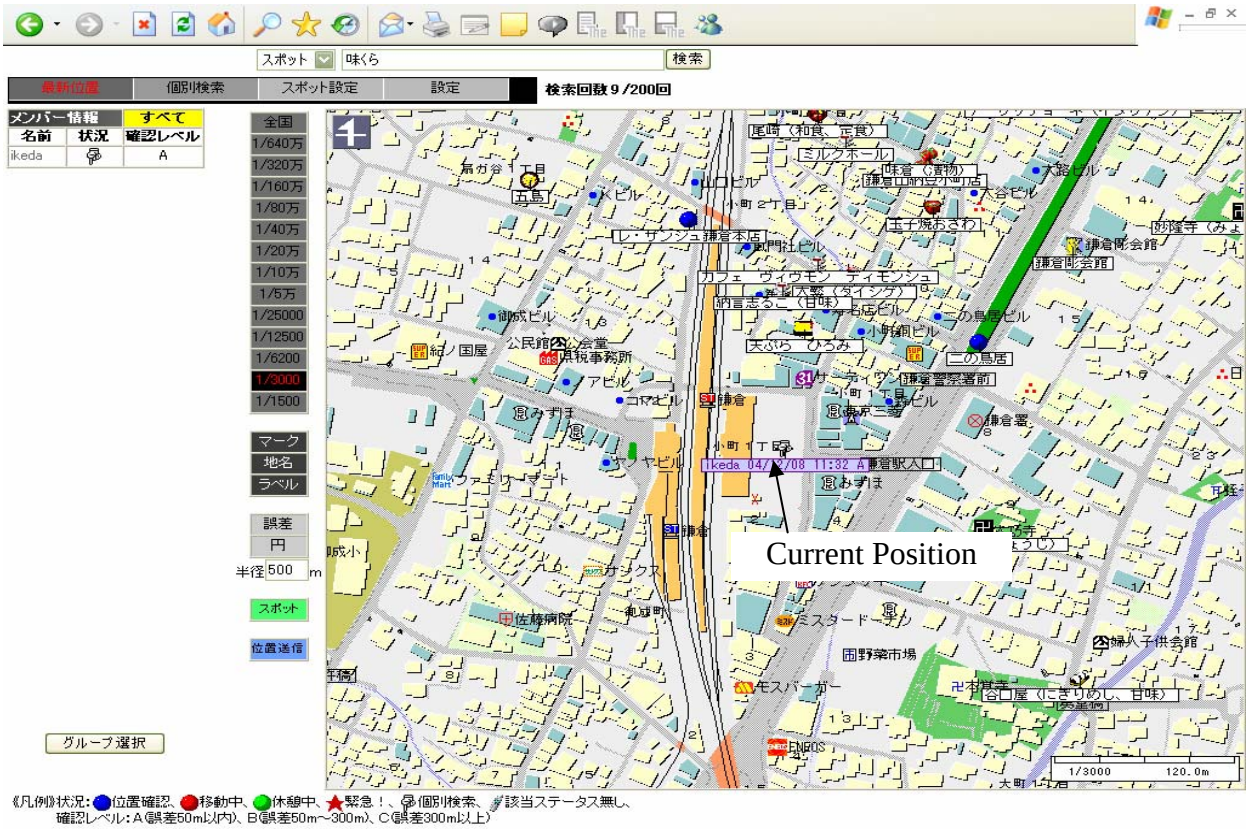

Figure 7. An Example of Displaying Location of a Tourist on the Internet GIS Server (© Navi-p.com)

4.2 Sightseeing Spot Database

An example of sightseeing spot database is shown in Figure 8. These sightseeing spots can be registered on the internet GIS server by the operator. When the operator clicks an interesting spots' icon on the internet GIS shown in Figure 9, the descriptions and the pictures are displayed (Figure 10). It is known that roads around popular sightseeing spots are congested especially in the afternoon and some of them are reported as roads with high volume of tracks, buses and passenger vehicle even in the weekend. Therefore, estimated congestion situations and high risk points of conflict between vehicles and walker are also prepared in the database.

On the other hand, in order to send spot information stocked in the server smoothly, spot information on 94 sites are prepared in the database.

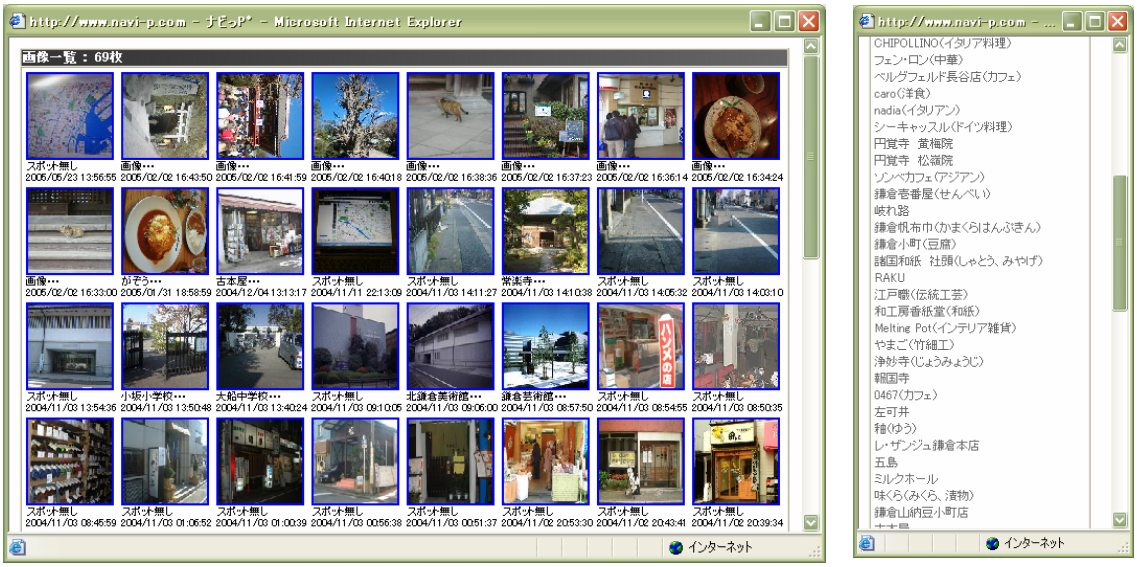

Figure 8. Sightseeing Spot Database in the Server (left: picture database, right: list of spots) (© Navi-p.com)

Figure 9. Interface of Registering Spot Information (© Navi-p.com)

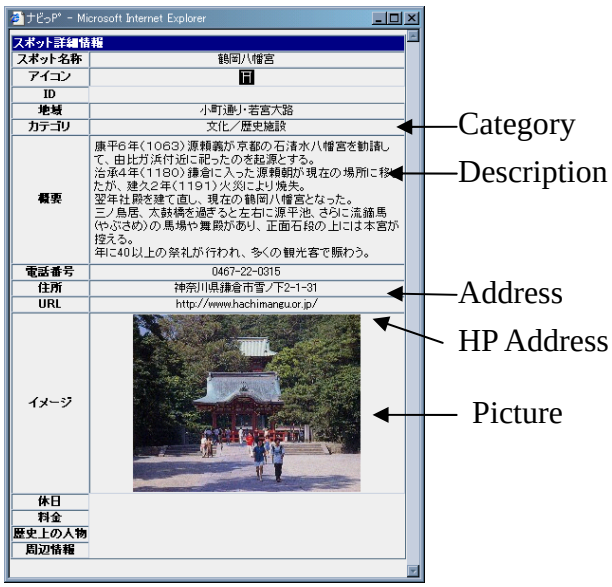

Figure 10. An Example of a Sightseeing Spot (© Navi-p.com)

4.3 Tourism Spots Information Registration/Sharing Service

Spot information registered by the tourist is stocked to the database together with spot information registered by the operator as shown in Figure 8. In this system, three pictures could be attached to one spot.

5. DEMONSTRATION OF THE TOURISM ASP SERVICE EXPERIMENT

The tourism ASP location positioning service system is then demonstrated in the study area. In this chapter, first of all, methodology of the experiment is illustrated. Especially in this study, the purpose of the experiment is to show how the tourists' scheduling would be affected by information services. Secondary, results of the demonstration is indicated. The demonstration experiment is conducted in the weekends from October to November in 2004. The examinees of this demonstration examination are 24 students of Keio University. Every examinee is asked to start and finish sightseeing at Kamakura station and required to travel alone.

5.1 Methodology of the Demonstration Experiment

In order to clarify effectiveness and limitations of the proposed system, examinees are categorized into two groups; (1) tourists who make schedule before trips and send their schedule to the operator before sightseeing (C1), (2) tourists who do not send their schedule to the operator before sightseeing regardless that they make schedule before their trips(C2). Here, all examinees are allowed to carry a popular guidebook ("Rurubu Kamakura") or maps provided by Kamakura Tourist Information Center. According to these categories, 48 examinees are asked to make three kinds of sightseeing from these two categories. When they make trips in different categories, each sightseeing schedule is assigned to visit different spots from the other category trip patterns.

Every events and locations are recorded during and after the experiment. Activity survey is conducted to reconfirm the examinees' actual schedules after their trips. As mentioned before, locations of the examinees are detected at one minute intervals and all examinees are asked to start their sightseeing activities in front of Kamakura Station. In the sightseeing spot database, 94 spots are prepared for the demonstration around the study area.

In this study, "spot" means the facility that the examinees visit for sightseeing, shopping and meals. Besides, "sightseeing time" is from time that the examinees leave Kamakura station for sightseeing, shopping and meals to the time they go back to the station again. And "interval of announcement" is intervals from the time that the tourists request some information to the operator to the time that the messages arrive to the tourists' handy phone by e-mails.

5.2 Results of the Experiment

(1) An example of tourists that belong to category 1

First of all, results of the cases of tourists' schedules are given to the operator are shown. Table 1 and 2 is an example of schedule plan and actual sightseeing activities an examinee that belong to category 1, and Figure 11 shows the examinees' trajectory traced by GPS. In this case, the examinee (male) planned to arrive at Kamakura station by train to start

Table 1. An Example of Schedule Informed by an Examinee of Category 1

Order	Activity
1	Arrive Kamakura station at 12:00 and start sightseeing
2	Visit Daigyo-ji temple
3	Shopping at Ajikura
4	Lunch at Café Vivmon
5	Visit Myosyoji-temple
6	Leave Kamakura for home at least until 14:30

sightseeing. He would have liked to visit two temples before and after lunch and to go shopping before lunch. Before he arrived at Kamakura station, a message in which route and spot information on the first destination had already been sent to him.

According to the schedule that was sent to the operator before sightseeing, the operator sends sightseeing spot and route information to the examinee three times by e-mail and two times by telephone. Timing to send information by e-mail is decided by detecting locations of the examinees by GPS. Generally speaking, GPS positioning errors did not matter in order to judge the timing in the demonstration.

Table 2. Actual Sightseeing Activities of the Sample Whose Schedule is in Table 2

Time	Activity
11:30	*Send route information on Daigyo-ji temple*
11:38	Arrive at Kamakura station and start sightseeing
12:01	Arrive at Daigyo-ji temple
11:30	*Send route information on Ajikura*
12:10	Shopping at Ajikura
12:14	*Send route information on the scheduled lunch spot (e-mail)*
12:18	Request to change the restaurant
12:20	*Send spot and route information on the recommended restaurant (e-mail)*
12:29	Lunch at the recommended lunch restaurant
12:36	*Send route information on Myosyo-ji temple (e-mail)*
13:36	Arrive at Myosyoji-temple
13:44	Request to rest at a café around Myosyo-ji temple
	Answer on the phone
13:45	Rest at the recommended café
13:51	Request of routes to Kamakura station
14:16	Leave Kamakura station for home

Note) *Italic* is a message sent by the operator. ▭ means requests by the examinees.

In this case, the examinee did not need to request spot information until he changed a restaurant for lunch. The reason why the examinee changed the schedule was that the scheduled restaurant was congested and expensive. Regarding spot information of the recommended restaurant, it is input by another examinee, which is not described in the guidebooks or the guide maps. Regarding the scheduled restaurants, the operator sends spot information that indicates the restaurant is usually congested in lunch time.

This examinee requested a fine café around the last destination. As the operator could find an appropriate café that is located within about 300m, the operator answered the location of café immediately. This is a fine example of travel information service by using the proposed system.

(2) Analysis of Requested and Provided Information

Average sightseeing time, average number of spots and average interval of announcement are shown in Table 3. Average sightseeing time is about two hours and average number of spots for C1 and C2 is about 4.7 and 4.1, respectively. Average announcement interval of C2 is more than that and C1 by about 1.4 times.

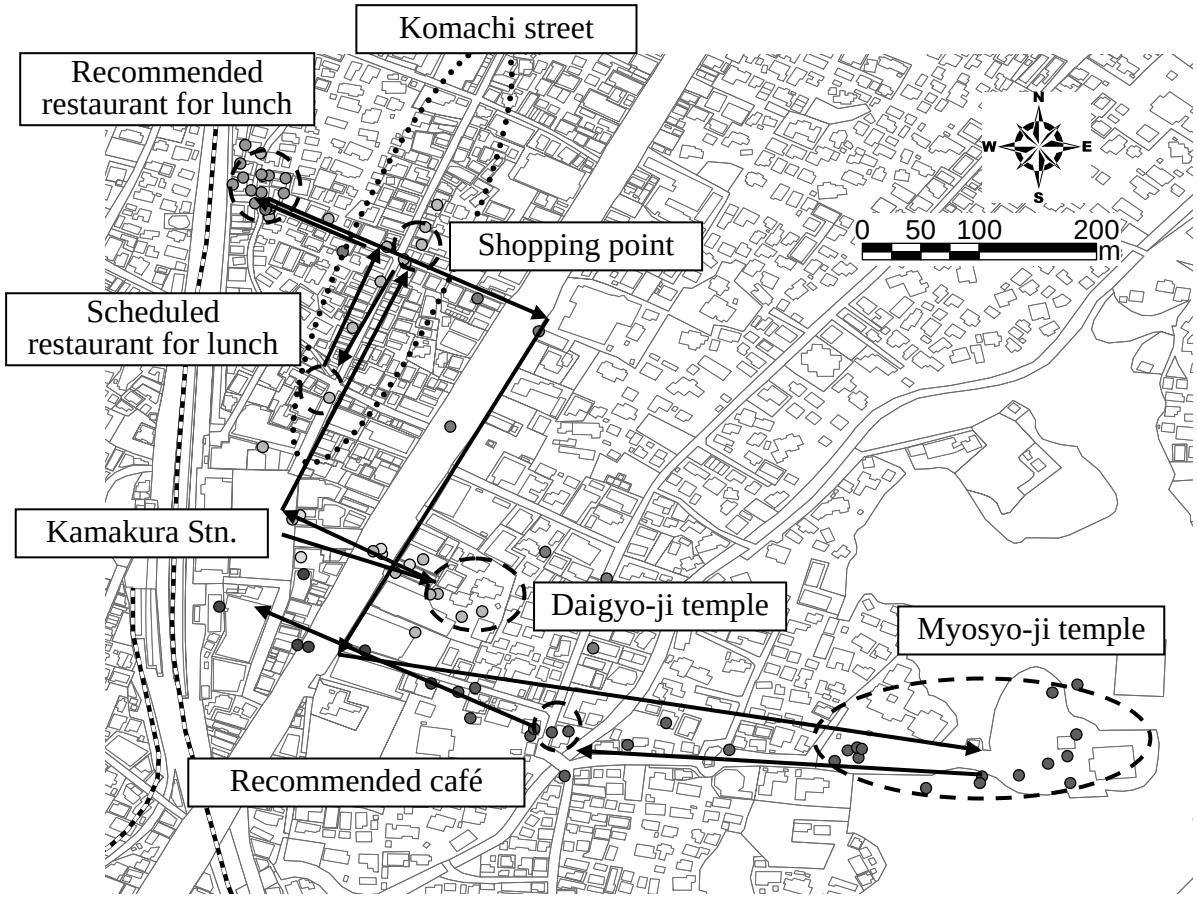

Figure 11. An Example of GPS Trajectory of the Examinee that Belong to Category 1

Table 3. Brief Summary of Examinees' Activities

	C1 (n = 24)	C2 (n = 24)
Average sightseeing time (unit: hours)	2.3	2.2
Average number of spots (units: spots)	4.7	4.1
Average interval of announcement (unit: min.)	2.3	3.2

Table 4. The Number of Requests by Types the examinees to the operators

Types of spots	C1 (n = 24)	C2 (n = 24)
Tourism spots	18	20
Restaurants	16	20
Souvenir shops	10	6
Transportation facilities	0	2
Rest places	2	0
Others	2	0

Table 5. The Number of Requests by Contents the examinees to the operators

Contents of requests	C1 (n = 24)	C2 (n = 24)
Whether the destinations locate near the place they are	18	16
Recommended spots	16	6
Get lost	6	2
Routs for the destinations	20	22
Details of the destinations	2	2
Others	0	0

This is mainly because the examinees asked such requests that the operator needed to find "appropriate" spots and routes, as they had no plan for sightseeing. In many cases for informants categorized into C1 and C2, the operators could find appropriate spots and routes easier and quicker.

Table 4 and 5 indicate variation of requests by types and by contents, respectively. It is shown that requests on tourism spots and restaurants are dominant (about 75%) both for C1 and C2 (Table 4). Regarding contents of requests, questions on routes for the destinations and questions whether the destinations locate near their places are dominant (about 70%) both for C1 and C2. It is interesting that tourists categorized into C1 tend to requests spot information recommended by the operators (Table 5). Some tourists asked questions with several combinations of requests. Other examinees required the operators to make their schedules themselves, only telling them key spots and event (time) of their activities.

(3) Satisfactions for Information Provision

Average satisfactions for information provision are shown in table 6. Here, tourists' satisfaction for media, contents and waiting time by media are evaluated by five degrees (from 1 = very dissatisfied to 5 = very satisfied). It is interesting that average satisfaction of maps and pictures on spots are the lowest both for C1 and C2. Especially, not a few examinees answered that maps around spots are not needed because information by the operators is enough for them to be guided. This seems a crucial implication for exploring navigation system for pedestrians because major navigation services tend to use maps via handy phones. The reason why satisfaction for e-mail of C1 is the highest is considered that information regarding tourists' schedules is sent before they start their trips. Some tourists answered that they do not need pictures, maps and information on internet homepages because it takes a few minutes to get necessary information by mail. In stead of that, they indicated that communication with the operators by phone is enough to know what they want.

On the other hand, average satisfaction of waiting time by e-mail is relatively lower for C1. This is mainly caused because tourists felt that waiting time is longer than expected when rescheduling, though scheduled travel information is sent immediately.

Regarding route and direction guidance, not a few tourists requested less-congested path when their routs are congested. In the next step of the study, it is necessary to stock congestion information of roads and shops. In this experiment, some operators informed congested situations of sites which they knew by other tourists' request.

Table 6. Average Satisfaction for the Experiment by Categories

Categories	C1 (n = 24)	C2 (n = 24)
Communication by Phone	3.8	4.0
Communication by E-mail	4.5	3.5
Spot information	3.2	3.8
Spot pictures	3.0	2.9
Route guidance	3.6	3.6
Guided directions	3.5	3.9
Maps around spots	3.0	2.9
Waiting time by phone	3.9	3.4
Waiting time by e-mail	3.3	3.5

(4) Evaluation by Visit Frequency

According to Furutani and Fujita (2005), Japanese tourists who visit the study area frequently tend not to refer tourism information on Kamakura at all before or while they are traveling. Therefore, it seems important to analyze satisfactions for the information provision by frequency that the examinees visit the study area.

Therefore, the numbers of major requests by types and by contents are shown in table 7 and 8, respectively. As shown in table 7, the number of requests to the operators would not decrease just because frequency of visit increases. Regarding tourism information contents, more than 75% of tourists who have visited more than four times required whether the destinations locate near the place they are. On the other hand, frequent visitors do not tend to require recommended spots by the operators.

Average satisfaction for the experiment by visit frequency is indicated in table 9. There is no statistically significant difference among visit frequency groups, but satisfaction for spot pictures and maps around spots for the examinees who have visited the study area more than 10 times are especially lower than the other groups.

It can be said that information provision by types and contents by considering visit frequency seems crucial to increase satisfaction for tourism information demands.

Table 7. The Number of Major Requests by Types and Frequency

Types of spots	0 - 3 times (n = 12)	4 - 10 times (n = 16)	10 times + (n = 12)
Tourism spots	12	6	11
Restaurants	4	12	11
Souvenir shops	2	8	4

Table 8. The Number of Major Requests by Contents and Frequency

Contents of requests	0 - 3 times (n = 12)	4 - 10 times (n = 16)	10 times + (n = 12)
Whether the destinations locate near the place they are	6	12	9
Recommended spots	10	6	3
Routs for the destinations	10	12	12

Table 9. Average Satisfaction for the Experiment by Visit Frequency

Categories	0 - 3 times (n = 12)	4 - 10 times (n = 16)	10 times + (n = 12)
Communication by Phone	3.8	3.8	4.0
Communication by E-mail	3.5	4.6	3.9
Spot information	3.7	3.3	3.4
Spot pictures	3.0	3.3	2.3
Route guidance	3.6	3.8	3.4
Guided directions	3.8	4.0	3.0
Maps around spots	2.7	3.3	2.7
Waiting time by phone	3.2	4.2	3.6
Waiting time by e-mail	3.7	2.9	3.4

(5) Needs for Information Provision: Analysis of Free Answers for the System

As mentioned above, the most frequently requested matter is to tell places and routes of restaurants. In the guidebook that the examinees carried, various restaurants are described. Because roads around major commercial areas are congested in the lunch time, however, it is inevitable for tourists to wait for in front of restaurants. Therefore, in many cases that places and routes of restaurants are requested, expected levels of congestion of the sites are pleased by the examinees. In the same reason, when route information between the current positions of the examinee and the destinations are requested, the operator added congestion information of the routes. Besides, some examinees requested restaurants where is affordable for them, or asked temples/shrines where the entrance fees are free.

It is indicated that almost all of the tourists prefer paper guide maps together with paper maps rather than maps sent by e-mails. Some of the reason of this is because tourists sometimes feel dangerous when they watch displays of their handy phones. As the widths of the roads in the study area are narrow, the tourists tend to feel danger when light and middle duty trucks and buses are passing by pedestrians. Besides, route directions by the operator seem to be appropriate, many examinees reported that they could arrive at the destination without the maps that are provided by the operator. Especially in the demonstration, the operators are asked to inform landmarks and major sceneries of roads without mentioning distance and compass direction, when they indicate route information.

Among three categories, many examinees of category 1 reported that they could make sightseeing activities smoothly comparing with category 2 and 3. This result indicates that the tourists could make travel smoothly if they informed their schedule before they arrive at the study area. On the other hand, it is still a remained problem how to quantify effectiveness for the tourists' scheduling by using the proposed system. This way of directing route information is modeled after the method of the tourism guide at Kamakura Tourist Information Center. This is mainly because not a few examinees reported that it is difficult to understand routes according to distance and direction. It is considered that announcement method of the professional tour guides should be used for training the operator of the proposed system.

(6) Spot Information Registered by the Examinees

69 spots are registered to the data by the examinees (Table 8). The number of shops and restaurants is registered more than the other contents. What is interesting is that 9 pictures of transportation facilities are about road conditions. As mentioned above, roads around major sightseeing spots or restaurants around Komachi streets (Figure 11) are congested in the weekend. Some of those pictures include congested situations of roads and shops so that the other tourists can understand when and where the facilities are congested. 4 of 7 other pictures are spot information of landmarks.

Table 8. Spot Information Registered by the Examinees

Contents	Number
Shops & restaurants	22
Sightseeing spots	18
Transportation facilities	11
Scenery	11
Others	7
Total	69

6. CONCLUDING REMARKS

In this study, a travel information service system is developed by using application service provider (ASP) of location positioning system in order to assist sightseeing scheduling. Besides, a demonstration experiment is conducted in order to show effectiveness and limitations of the proposed system.

Results of the demonstration experiment show that the travel information system seems to be effective when tourists require route information to confirm their schedule or sightseeing activities. Dislike the guidebooks, one of the advantages of this kind of information service is that contents could be replaced with up to date information.

It is interesting that not a few tourists pointed out that the maps on the handy phone display were not always necessary when walking or congested. As mentioned in chapter 5, several examinees requested their schedules after they decided a part of their itineraries. This result may indicate that traditional methods of information provision on sightseeing spots does not match needs of certain target of tourists. For example, some tourists of C1 asked to the operator that “We decided to go to spot A and spot B. And we would like to leave Kamakura 5:00 PM.” In this kind of case, the operator is asked to arrange total schedule of the tourist. It might necessary for the operators to inform order-made schedules to tourists’, like as hotel concierges. At least, it seems important not only to study explicit demands but also to know latent demands about what kind of information tourists need and what could be triggers to make their latent demand to become explicit.

In the experiment conducted in this study, the examinees are limited into university students. These youngsters are used to using personal handy phones. However, it is necessary to show the proposed system might be useful for what kind of age bracket. In order to show effectiveness of the system further more, it is necessary to conduct a demonstration experiment that the examinees make sightseeing activities in wider area so that multimodal activities could be evaluated.

Detailed congestion levels of paths and public transit information should be stocked in the database in order to inform comfort routes to the destinations. When tourists’ location data by GPS is collected, approximate congestion level of paths could be calculated. Besides, operators’ knowledge for requests could be applied to the next information provision as their experiences. In the next step, data mining on these experiences seems also to be a crucial issue.

Additionally, quality of information provided by the operators has to be uniform. This is because it could be happen that difference of information quality might effect tourists’ satisfaction for scheduling/rescheduling. In this study, it is reported that the operators got used to tourism information operation after four or five times experiences. Training of the operators is also an important issue.

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