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On-Foot Content Tourism Support System in Urban Tourist Destinations of Japan

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Abstract

It has also become possible for people to easily acquire tourism information that matches their own particular tastes using the internet, so tourism has taken a more diverse range of forms. One of these is "content tourism" that became popular in recent Japan. Sgains such a backdrop, the present study aimed to design, develop, operate and evaluate a system that integrated three subsidiary systems including Web-geographic information systems (GIS), a tourism information system and social networking service (SNS) in order to support walking-based content tourism. This made it possible to create sightseeing routes and to submit, store, and view tourist attraction information. Additionally, the system was operated for one month in Chofu City, Tokyo Metropolis, and the total number of users was 42. During the operation period, 12 new sightseeing routes were created and 30 new tourist attractions were submitted. Based on the results of the web questionnaire survey, users highly evaluated the key functions of the system and the overall system. However, of those key functions, evaluations were somewhat low for the ease of operation of the creation function of sightseeing route, so the improvements must be made. From the results of the access log analysis of users' log data, the total number of sessions in this system was 134, 64% used PCs, 36% used mobile devices, Therefore, the approach of designing the system such that the same functions could be used regardless of the type of device one is using was an effective design approach.

Keywords

Ccontent Tourism Support System, Web-Geographic Information Systems (Web-GIS), Tourism Information System, Social Networking Service (SNS), On-Foot

1. Introduction

The rapid advances in advanced telecommunications networks in recent years

have made it possible for people to gather diverse information via the internet. In recent years, the widespread use of social media has made it possible for everyone to not only acquire information, but also to share their own information. The same is also true for tourism information. People aren't limited to traditional means of acquiring tourism information, such as using guidebooks or travel magazines, but are increasingly using the internet. It has also become possible for people to easily acquire tourism information that matches their own particular tastes, so tourism has taken a more diverse range of forms.

One of these is "content tourism". In Japan, a report announced by the Ministry of Land, Infrastructure, Transport and Tourism [1] defined content tourism as "tourism that stimulates tourism and related industries by using content (films, TV shows, novels, comics, games, etc.) related to actual locations". So-called "pilgrimages", in which people visit areas associated with elements of subcultures, such as anime, are one type of content tourism, and have drawn a great deal of attention in recent years. A survey conducted by the Ministry of Land, Infrastructure, Transport and Tourism [2] indicated that not only Japanese but also foreigners have frequently visited the places related to Japanese contents. Academy of Contents Tourism (ACT) was established in 2011. Seaton *et al.* [3], Seaton [4], Yamamura *et al.* [5] [6] discussed and introduced the relationship between content tourism and popular culture in Japan. Additionally, the studies on the relationship between content tourism, urban development and regional revitalization have increased since 2000's. In such an area, Yamamura [7], Utsumi *et al.* [8], Shibata [9], Sato *et al.* [10], Miwa *et al.* [11], Song *et al.* [12], and Murakami [13] can be taken up as representative studies in recent years.

Locations related to anime or the like which are called "holy lands" are often known only to fans, and are seen as ordinary locations by people who are not fans. That means that in order to promote content tourism, it is vital that members of the community understand the content and the locations associated with it. This creates the need for a system that can simultaneously provide information related to conventional tourist attractions and "holy lands" in content tourism. Engaging in content tourism on foot has the potential not only to give local residents a greater understanding of their area, but also to promote their health.

Present study aims to develop a system that supports on-foot content tourism by not only tourists but also local residents, based on the social and academic background described above. The system integrates Web-Geographic Information Systems (Web-GIS), a tourism information system, and social networking services (SNS). Web-GIS is used to visually indicate tourist attractions on a digital map. SNS is used for the submission, storage, and viewing of user comments related to sightseeing routes and new tourist attraction information. The tourism information system makes it possible for information related to tourist attractions and sightseeing routes to be shared between users in advance, before they go sightseeing. During operation, various people use the system and answer a

web questionnaire survey. Based on the results of the questionnaire survey, together with access log analysis, they evaluate the system in order to identify issues, and propose improvement measures.

2. Related Work

The system is designed and developed integrating Web-GIS, a tourism information system and SNS. Therefore, the present study relates to two areas: 1) studies related to tourism support systems, and 2) studies related to content tourism support systems. Below, representative preceding studies related to these two areas in recent years are introduced, and then the originality of the system developed in the present study is demonstrated.

With regard to (1) studies related to tourism support systems, Maruyama *et al.* [14] developed a system that creates sightseeing routes tailored to user's preferences and that provides navigation functions. Kurata *et al.* [15] developed the CT-planner system, a dialog-based system which recommends sightseeing spots and sightseeing routes tailored to user's preferences and then creates detailed plans based on them. Ueda *et al.* [16] developed a tourism support system that generated information a posteriori based on the movement of tourists while sightseeing and that provided this information to other users in advance of their own sightseeing. Sasaki *et al.* [17] developed a mobile application to support sightseeing adopting psychological approach. Ikizawa-Naitou *et al.* [18] developed a system which integrated a route recommendation system that uses information related to public transportation timetables, Web-GIS, and an AR (Augmented Reality) application. Sonobe *et al.* [19] proposed a tourism support system for tourists' migratory behaviors using AR. Sasaki *et al.* [20] [21] and Abe *et al.* [22] developed sightseeing support systems using AR and pictograms. Hidaka *et al.* [23] developed an on-site trip planning support system adopting dynamic information concerning sightseeing spots in addition to tourist' preferences and profiles. Koga *et al.* [24] developed a sightseeing planning support system that incorporates gamification to increase motivation.

In (2) studies related to content tourism support systems, few studies have been conducted until now. However, in Japan, as contents tourism is actively promoted and a unique form, some studies in this area was conducted with a very few exceptions. Because, as mentioned in section 1, both Japanese and foreigners have frequently visited the places related to Japanese contents within Japan. For examples, Yamazaki *et al.* [25] developed a system for recording detailed activity histories using a function for checking into tourist attractions on anime pilgrimages and by analyzing global positioning system (GPS) logs. Akiyoshi *et al.* [26] developed a system with a function for effectively recommending nearby tourist attractions and a function for having fun creating sightseeing plans for use in pilgrimages to anime "holy lands". Echigo *et al.* [27] developed conectAR, a system that uses AR to create opportunities to talk to local residents while on anime pilgrimages. Kitabayashi *et al.* [28] developed a recommendation

system that introduces novels related to anime pilgrimages using location information.

In (1) studies related tto ourism support systems, the routes created by the system of Ikizawa-Naitou *et al.* [18] could only be seen by their respective creators. There were no functions for the viewing of routes created by other users. Furthermore, only tourist attractions that were registered in the database in advance were displayed. Users were not able to submit new tourist attraction information or create their own routes. The systems of Ueda *et al.* [16] required a posteriori information related to the tourism activities of other tourists as a priori information. If the number of system users were low, it would make it difficult to acquire sufficient effective a priori information. In (2) studies related to content tourism support systems, only content fans are envisioned as using the system, so systems which would also be used by others have not been proposed. In the system of Akiyoshi *et al.* [26], only information for the "holy lands" of a single anime was registered.

Compared to the above preceding studies, the first element of originality in present study is that it integrates Web-GIS, a tourism information system and SNS, enabling even people who do not know about the content to view sightseeing routes and comments created by other users and enjoy content tourism. The second element of originality is that it strives to promote a greater understanding in the community and promote health by enabling both tourists and local residents to take part in content tourism on foot.

3. System Design

3.1. System Features

This system is composed of Web-GIS, a tourism information system and SNS. Figure 1 shows the features of each part of the system. The first time someone uses the system, they select an ID and password, and register their user information in the database of the system. When users are logged into the system, they can submit new tourist attraction information on the digital map of Web-GIS.

They can select the tourist attractions they wish to visit and create a sightseeing route to visit them. They can also view and evaluate sightseeing routes that other users have created. The system uses the information for the sightseeing route selected by the user to calculate the total distance that would be covered, the number of steps, and the total number of calories that would be consumed by walking the route. The system displays the top five users in terms of total distance covered and the top five most-used sightseeing routes. The information related to the new tourist attractions submitted by users and the sightseeing routes created by them are stored in the database.

3.2. System Effectiveness

This system offers the following three benefits.

1) Users do not require prior information before sightseeing

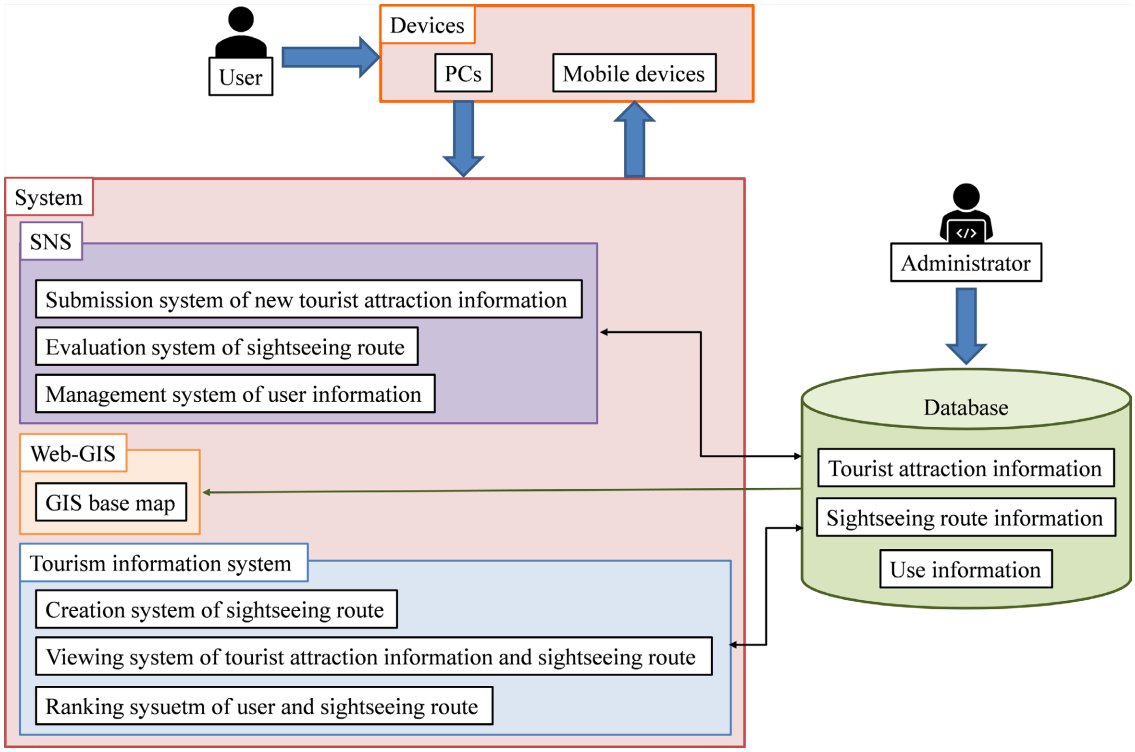


Figure 1. System design.

Even users who are not knowledgeable about the content can learn about related content from the tourist attraction information. Users can also see sightseeing routes created by other users, which can assist them when creating their own sightseeing plans. Sightseeing routes used by a large number of people are displayed in rankings, making it possible for users to obtain information related popular sightseeing routes.

2) Users can learn about the sightseeing routes of other users

Users can see the sightseeing routes created by other users, which are stored in the database. This enables users to learn new information related to tourist attractions and sightseeing routes at any time.

3) Users can improve their health as they sightsee

Users can obtain information on the total distance they have covered, the total number of steps they have taken, and the total number of calories they have consumed. The system makes it easy for users to determine how much they have exercised, so they improve their health without even thinking about it.

3.3. Target Devices

Though this system is expected to be accessed using PCs and mobile devices, same functions can be used from any device as there is no difference in functions depending on the device used. The use from PCs, which are mainly indoors, is assumed to be the content tourism planning assistance, by creating sightseeing route, viewing tourist attraction information and sightseeing route, and evaluating sightseeing routes created by other users. On the other hand, the main use

from mobile devices both indoors and outdoors is assumed to be the assistance of content tourism activities by means of submitting new tourist attraction information, and viewing tourist attraction information and sightseeing route.

3.4. System Operation Environment

The system uses a web server, a database server, and a GIS server. Figure 2 shows the system operating environment. Heroku that is a PaaS provided by the Salesforce is used for both the web server and the database server. ArcGIS Online that is provided by the Environmental Systems Research Institute, Inc. (ESRI) is used for the GIS server. The web application used by the system was implemented using PHP, JavaScript, and HTML.

3.5. Design of Each System

3.5.1. Web-GIS

There are various types of Web-GIS. In present study, ArcGIS API for JavaScript provided by the ESRI was used to develop the Web-GIS. ArcGIS API for JavaScript does not require software installation, and can be accessed by using a website. The detailed design is indicated below.

1) Display of tourist attraction information

The tourist attraction information saved in the database of the system is displayed on a digital map of Web-GIS. This makes it easy for users to determine the locations of tourist attractions. Tourist attractions are shown on the digital map using color-coded icons that indicate their categories.

2) Display of sightseeing route

The minimum distance between tourist attractions on sightseeing routes is displayed on the digital map of Web-GIS. This enables users to visually learn about sightseeing routes and see the locations of tourist attractions in relation to each other.

3) Measurement of sightseeing route distances

When multiple tourist attractions displayed on the digital map of Web-GIS are selected, the system measures the minimum distance between them. Users can use this total sightseeing route distance information to easily ascertain how

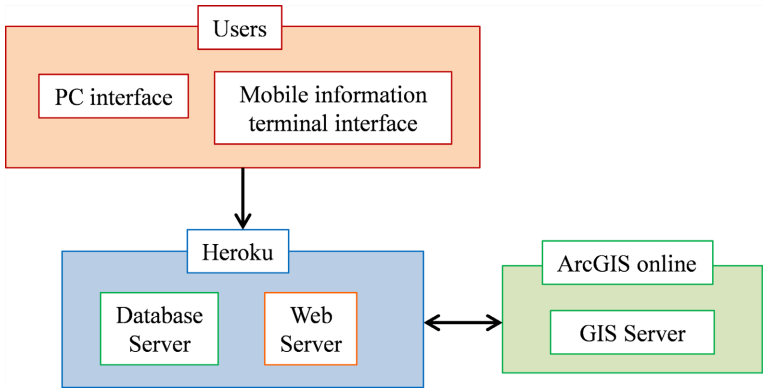


Figure 2. System operating environment.

much time it would take to walk the route and how much of a burden it would present.

3.5.2. Tourism Information System

The tourism information system makes it possible for users to view information related to tourist attractions and sightseeing routes before they go sightseeing. Sightseeing routes used by a large number of people are displayed in rankings, so users can obtain information related to popular sightseeing routes. The detailed design of these three subsystems is indicated below.

1) Creation system of sightseeing route

Users can create sightseeing routes on the system. Users who have already walked the routes can register them as records of their trips, while they who have yet to go sightseeing can register them as sightseeing plans. Users can also select tourist attractions shown on the digital map to include them in their sightseeing route, and they can enter a title, description, and required walking time for their route. The registered information is stored in the database.

2) Viewing system of tourist attraction information and sightseeing route

Users can view tourist attraction information registered in the database and sightseeing routes created by other users. Tourist attraction information can be viewed in either list form or on a digital map. When viewing information on the digital map, users can select to show only tourist attractions related to content such as movies or anime. The following sightseeing route information is displayed: the date and time the route was created, the title, a description, the amount of time required to walk the route, and the number of times the route has been selected. The sightseeing route is also shown on the digital map, and information related to tourist attractions on the route can be viewed.

3) Ranking system of user and sightseeing route

The system displays the top five users in terms of total distance covered and the top five most-used sightseeing routes. For the most-often used sightseeing route ranking, the title and the number of times each route was selected are displayed. For the users in the total distance ranking, the user ID and total distance walked are displayed. The sightseeing route is also shown on the digital map, and information related to tourist attractions on the route can be viewed.

3.5.3. SNS

This system is composed of an evaluation system of sightseeing route, a submission system of tourist attraction information, and a management system of user information. The only profile information that is disclosed to other users is the user ID, and the disclosed information cannot be used to identify individuals. The detailed design of these three subsystems is indicated below.

1) Submission system of tourist attraction information

Users can submit new tourist attraction information. When registering tourist attraction information, users enter the name of the tourist attraction, its category, and if there is any content that relates to the tourist attraction. If there is any

related content, the user can register the website that corresponds to the content. The registered information is stored in the database.

2) Evaluation system of sightseeing route

Users can submit comments on sightseeing routes that other users have created. The comment, the commenter's user ID, and the comment date/time are displayed. Comments are stored in the database.

3) Management system of user information

The system manages user information and uses the information for the sightseeing route selected by the user to calculate the total distance covered, number of steps, and total number of calories consumed. Equation (1) used to determine the number of steps was based on information on the website of the OMRON corporation [29]. Equation (2) used to calculate calories consumed was based on the "Physical Activity Standards for Health Promotion 2013" proposed by Ministry of Health, Labour and Welfare [30]. The distance covered by users is calculated each time a sightseeing route is selected, using values measured by the Web-GIS.

The number of steps taken by users is calculated using Equation (1). The value measured by the Web-GIS is used as movement distance l. The average height for the user's gender and age are used as height h. Table 1 shows the average heights and weights by gender and age. The stride length is calculated by multiplying height $h \times 0.45$.

$$s = \frac{l \times 1000}{h \times 0.45} \tag{1}$$

s: Number of steps;

l: Distance covered (km);

h: Height (cm).

The number of calories consumed by users is calculated using Equation (2). The METs value m indicates how many times greater the energy used by exercising is than the amount of energy used by resting. Walking at a speed of 67

Table 1. Average height and average by each age group.

Age groups	Male		Female	
	Average height (cm)	Average weight (kg)	Average height (cm)	Average height (cm)
10 - 19	161.8	52.1	153.0	45.7
20 - 29	171.5	64.8	158.5	52.6
30 - 39	172.1	71.0	158.3	53.4
40 - 49	171.3	71.1	158.7	55.8
50 - 59	170.8	70.4	157.0	55.2
60 - 69	167.2	67.1	153.9	54.2
70-	162.7	62.7	149.0	51.3

meters per minute (4.0 kilometers per hour) has a METs of 3. The average weight for the user's gender and age are used as weight w. Exercise time t is calculated by dividing the distance measured using the Web-GIS by a walking speed of 67 meters per minute.

$$cal = m \times w \times t \times 1.05 \quad (2)$$

cal: Calories consume (kcal);
m: METs value;
w: Weight (kg);
t: Exercise time (m).

4. System Development

4.1. The Frontend of the System

This system implements 5 unique functions for users, which will be mentioned below, in response to the purpose of the present study as mention in section 1. In order to implement these functions, the system was developed by integrating plural systems into a single system.

4.1.1. Function of New User Registration and Login

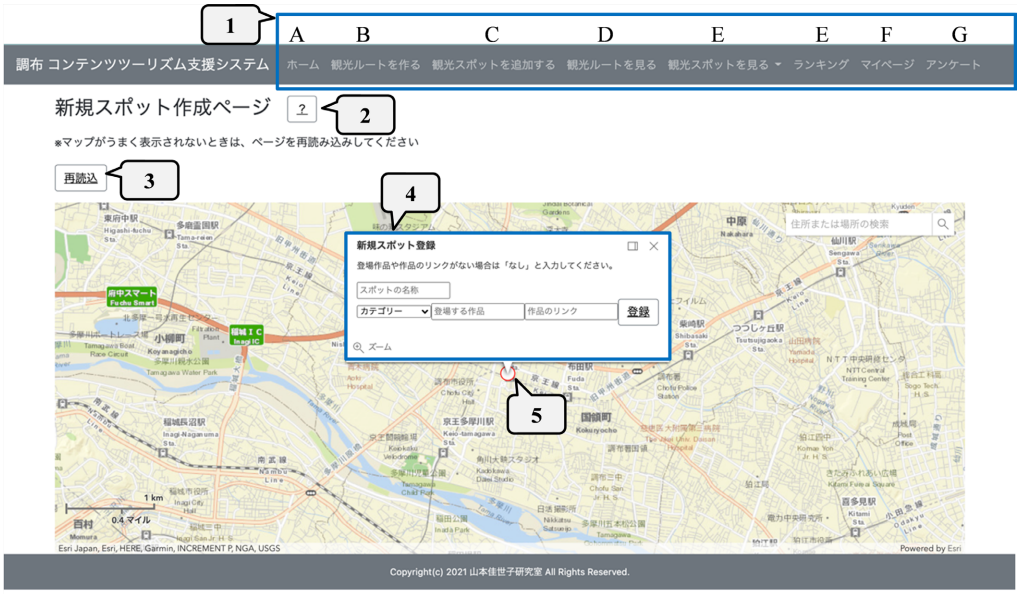
When first using this system, users register an account. On the page of the function of new user registration, they enter their ID, password, gender and age. Once they are registered, they can access the system by entering their ID and password.

4.1.2. Submission Function of New Tourist Attraction Information

Figure 3 shows the page for the submission function of new tourist attraction information. Users can submit new tourist attraction information by selecting "Add attraction" on the menu bar at the top of main page of the system. When submitting new tourist attraction information, users enter the name of the new tourist attraction, its category, associated content, and a link for the associated content. The user can select one of 11 categories: famous places and historical sites, parks and gardens, public facilities, eateries, temples and shrines, museums, hot springs, cherry blossom viewing, festivals and events, theme parks and others. These categories are displayed as specific icons that are created referring to the map icon [31] on the digital map of Web-GIS. If there is no associated content or link for the associated content, users can enter "None".

4.1.3. Creation Function of Sightseeing Route

Figure 4 shows the page of the creation function of sightseeing route. Users can create sightseeing routes by selecting "Create route" on the menu bar at the top of the main page of the system. When the user selects an icon on the digital map of Web-GIS, a pop-up appears in which they can enter information for tourist attractions on the sightseeing route. Figure 5 shows the flow of the sightseeing route registration. When the user selects multiple tourist attractions and presses the "Selection completed" button, the system switches to the page for sightseeing



No.	Description
1	Menu bar (A: Top page, B: Create route, C: Add attraction, D: View sightseeing route, E: View tourist attractions, E: Ranking, F: My page)
2	Page for the submission function of new tourist attraction information
3	Reload
4	Register the name of the new tourist attraction, its category, associated content, and a link for the associated content
5	Location of new tourist attraction

Figure 3. Page for the function of setting start and end point stations.

No.	Description
1	Menu bar (A: Top page, B: Create route, C: Add attraction, D: View sightseeing route, E: View tourist attractions, E: Ranking, F: My page)
2	Page for the creation function of sightseeing route
3	Select tourist attraction and enter the information
4	Reset the selection of sightseeing spot
5	Selection completed

Figure 4. Page for the creation function of sightseeing route.

route registration. Here, the user enters the title, category, description, total distance and required time of the sightseeing route, and then presses the "Finalize route" button to create the sightseeing route.

4.1.4. Viewing Function of Tourist Attraction Information and Sightseeing Route

Figure 6 shows the viewing function of tourist attraction information (list view), and Figure 7 shows the viewing function of tourist attraction information (digital

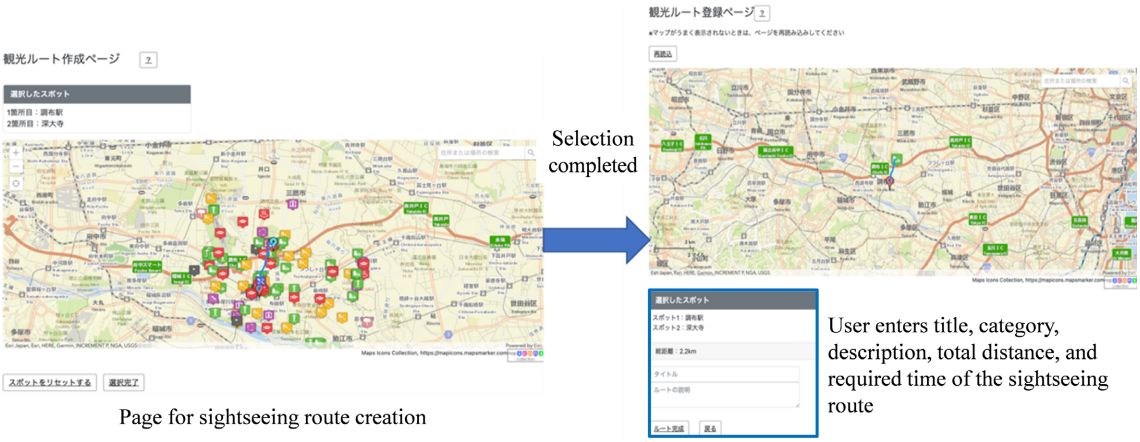
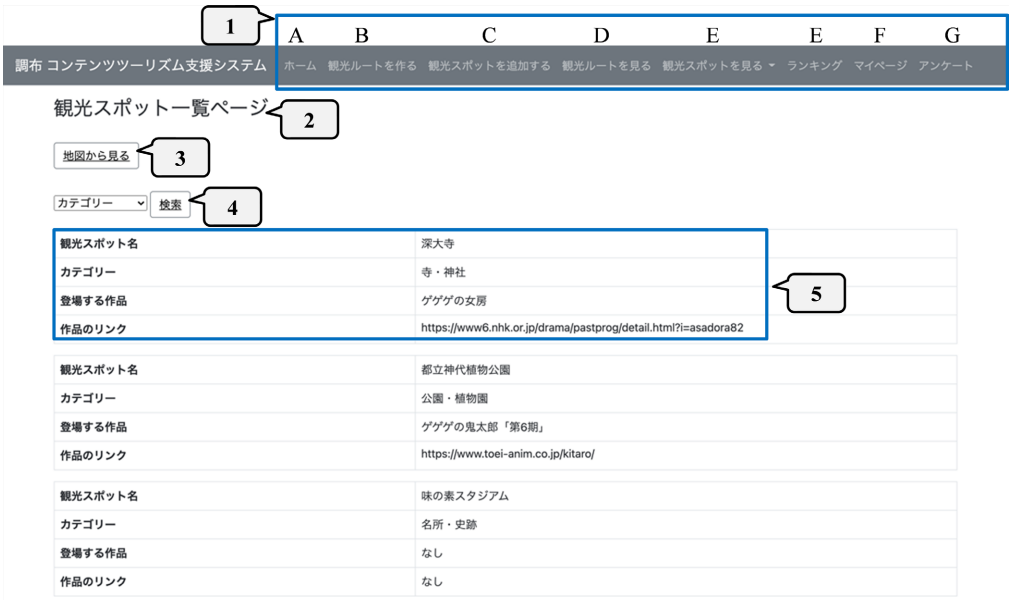
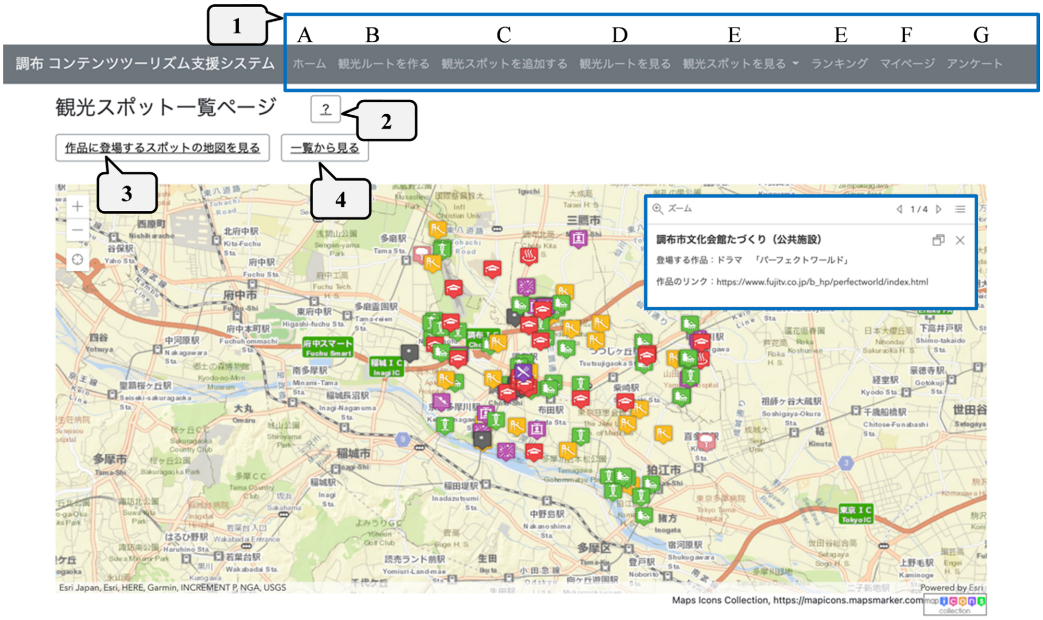


Figure 5. Flow of sightseeing route registration.



No.	Description
1	Menu bar (A: Top page, B: Create route, C: Add attraction, D: View sightseeing route, E: View tourist attractions, E: Ranking, F: My page)
2	Page for the viewing function of tourist attraction information (in list form)
3	Switch to the page for the viewing function of tourist attraction information (on digital map)
4	Search for category
5	Tourist attraction information (Tourist attraction name, category, associated content, and link for associated content)

Figure 6. Page for the viewing function of tourist attraction information (in list form).



No.	Description
1	Menu bar (A: Top page, B: Create route, C: Add attraction, D: View sightseeing route, E: View tourist attractions, E: Ranking, F: My page)
2	Page for the viewing function of tourist attraction information (on digital map)
3	Switch to the page for the viewing function of tourist attraction information (in list form)
4	Search for category
5	Tourist attraction information (Tourist attraction name, category, associated content, and link for associated content)

Figure 7. Page for the viewing function of tourist attraction information (on digital map).

map view). Users can switch to the viewing function of tourist attraction information by selecting "View tourist attractions" on the menu bar at the top of the main page of the system and then, on the following page, selecting either "View in list" or "View on map". If users select "View in list", as shown in **Figure 7**, the tourist attraction information (tourist attraction name, category, associated content, and link for associated content) will be displayed in list form. Users can select a category based on their own preferences to search for tourist attractions in that category. If users select "View on map", as shown in **Figure 8**, the tourist attractions will be shown on a digital map of Web-GIS. When the user selects an icon on the digital map, a pop-up will appear. This pop-up will contain the name of the tourist attraction, its category, its associated content, and a link for the associated content. Selecting "View map of tourist attractions associated with the content" will cause the digital map to show only tourist attractions associated with the content.

Figure 8 shows the page for the viewing function of sightseeing route, and **Figure 9** shows the page for the details of sightseeing route. As shown in **Figure 9**, users can switch to the page for the viewing function of sightseeing route by selecting "View sightseeing route" on the menu bar at the top of the main page of the system. On this page, the following information is displayed: the date and time the route was created, the title, a description, the amount of time required

No.	Description
1	Menu bar (A: Top page, B: Create route, C: Add attraction, D: View sightseeing route, E: View tourist attractions, E: Ranking, F: My page)
2	Page for the viewing function of sightseeing route(in list form)
3	Sightseeing route information (The date and time the route was created, the title, a description, the amount of time required to walk the route, and the number of times the route has been selected)
4	"Details" button

Figure 8. Page for the viewing function of sightseeing route.

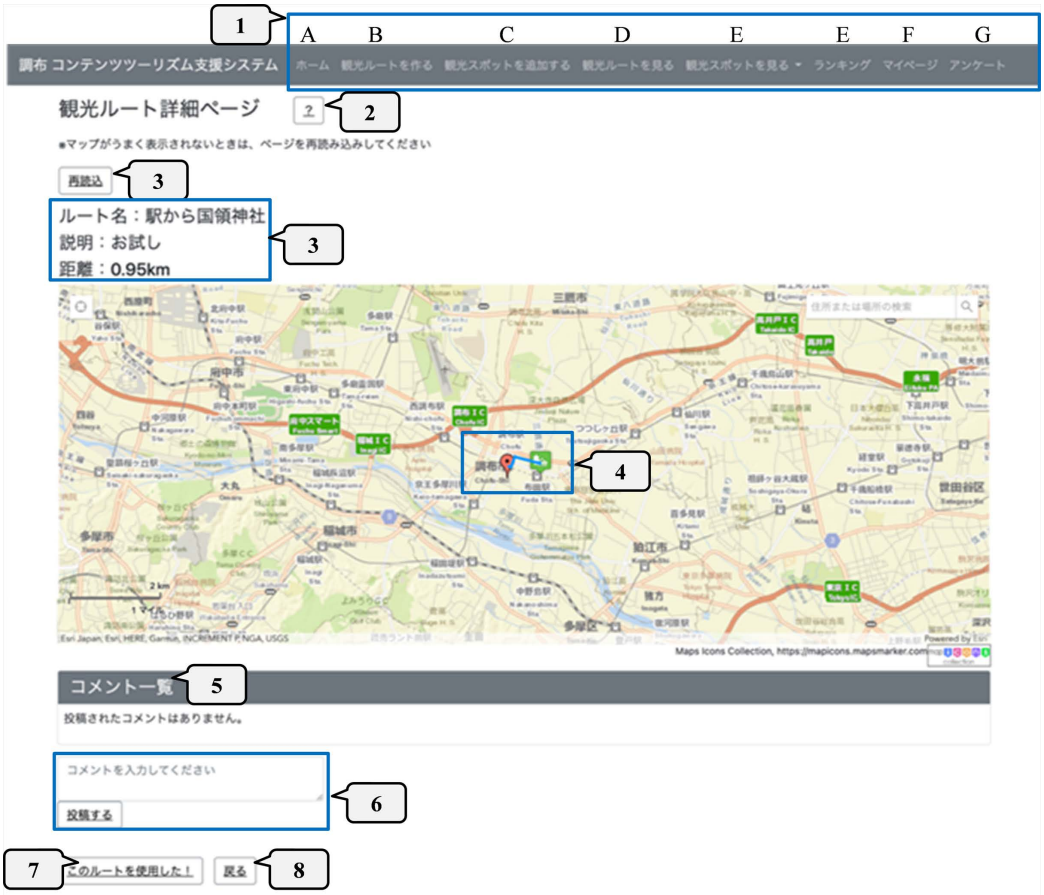
to walk the route, and the number of times the route has been selected. Pressing the "Details" button (Figure 8) causes the system to switch to the page for the details of sightseeing route (Figure 9). Pressing the "I used this route!" button on this page will update the total distance covered, the number of steps, and the total number of calories consumed. The user can confirm which sightseeing routes were used on the page for the management function of user information introduced later.

4.1.5. Evaluation Function of Sightseeing Route

Figure 9 shows the page of the evaluation function of sightseeing route. Users can submit comments using the comment entry window below at the bottom of the page for the detailed of sightseeing route. When a user submits a comment, the commenter's user ID, comment date/time, and comment are displayed. The user can confirm the sightseeing route for which the comment was submitted on the page for the management function of user information introduced later.

4.1.6. Management Function of User Information

Figure 10 shows the page for the management function of user information. Users can switch to this page by selecting "My Page" on the menu bar at the top of the main page of the system. On this page, the user can see their ID, the total distance they have covered, the number of steps they have taken, the total number



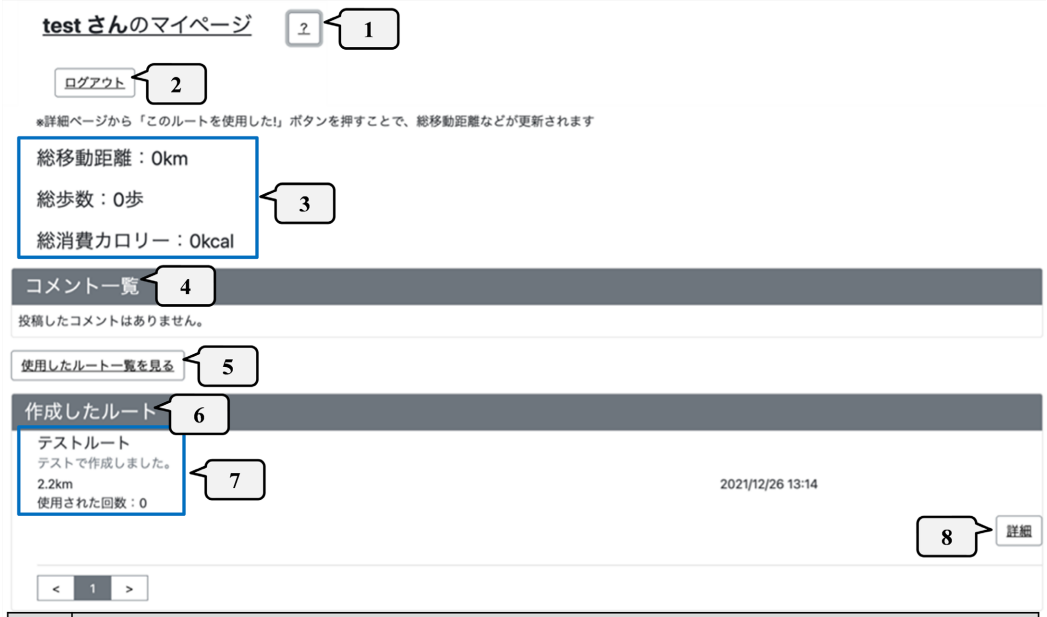
No.	Description
1	Menu bar (A: Top page, B: Create route, C: Add attraction, D: View sightseeing route, E: View tourist attractions, E: Ranking, F: My page)
2	Page for the viewing function of sightseeing route(on digital map)
3	Sightseeing route information (The date and time the route was created, the title, a description)
4	Sightseeing route on digital map
5	List of comments
6	Write and submit a comment related to sightseeing route
7	"I used this route!" button
8	Return to the page of the viewing function of tourist attraction information and sightseeing route

Figure 9. Page for the details of sightseeing route.

of calories they have consumed, the comments they have submitted, and the sightseeing routes they have selected or created. Pressing the "Log out" button on this page will log the user out of the system.

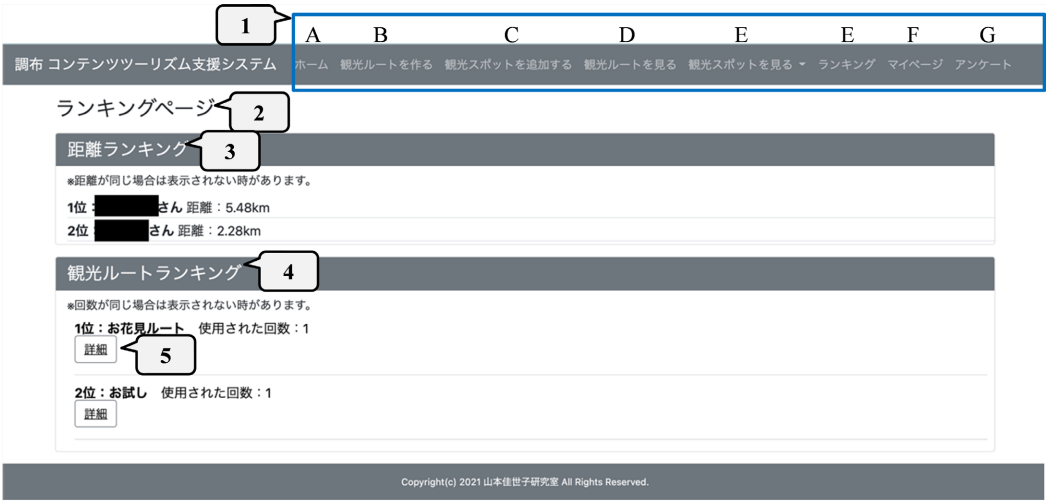
4.1.7. Ranking Function of User and Sightseeing Route

Figure 11 shows the page for the Ranking function of user and sightseeing route. Users can switch to this page by selecting "Ranking" on the menu bar at the top of the main page of the system. This page displays the top five users in terms of total distance covered and the top five most-used sightseeing routes. For users, the user ID and total distance covered are shown. For sightseeing routes, the title and number of times the route was selected are shown. Pressing the "Details" button on this page causes the system to switch to the page for the details of



No.	Description
1	Page for the management function of user information
2	Logout
3	ID, total distance, number of steps, total number of calories
4	List of comments
5	List of sightseeing routes used
6	Sightseeing routes selected or created
7	Sightseeing route information (The date and time the route was created, the title, a description, the amount of time required to walk the route, and the number of times the route has been selected)
8	"Details" button

Figure 10. Page for the management function of user information.



No.	Description
1	Menu bar (A: Top page, B: Create route, C: Add attraction, D: View sightseeing route, E: View tourist attractions, E: Ranking, F: My page)
2	Page for the ranking function of user and sightseeing route
3	Top five users in terms of total distance covered
4	Top five most-used sightseeing routes
5	"Details" button

Figure 11. Page for the Ranking function of user and sightseeing route.

sightseeing route.

4.2. The Backend of the System

In the backend of the system, the following 4 processes are conducted in response to the 5 functions in the frontend.

1) Processing related to the user information registration and login

This processing is related to the function of new user registration and login, and management function of user information. User information is stored in the database developed by heroku. The password is hashed to prevent it from being used maliciously by a third party. This system performs backend processing, when users log in to only allow users who enter matching IDs and passwords to log in. If they do not match, an error message is displayed.

2) Processing related to the update of tourist attraction information

This process is related to the submission function of new tourist attraction information. When a user submits new tourist attraction information, the system performs backend processing to store the data in the database.

3) Processing related to the creation of sightseeing route creation

This processing is related to the creation function of sightseeing route. The system performs backend processing on the information input using the creation function of sightseeing route to divide it into two tables and store it in the database. One of these tables contains the date/time that the sightseeing route was created, its title, its description, the amount of time it takes to walk, and the number of times it was selected. The other contains the coordinates of the center point of the digital map, its magnification rate, the name of the tourist attraction, its category and its related content.

4) Processing related to the evaluation of sightseeing route

This process is related to the viewing function of tourist attraction information and sightseeing route, and the evaluation function of sightseeing route. The system performs backend processing on the comments on sightseeing routes to divide it into two tables and store it in the database. One of these tables contains comments on sightseeing routes by the user that created them, while the other contains comments by other users.

5) Processing related to the selection of sightseeing route selection

This processing is related to the ranking function of user and sightseeing route. When a sightseeing route is selected, the system performs backend processing to calculate the total distance covered by the user, the total number of steps they took, and the total number of calories that they consumed. The system also performs backend processing to update the number of times the sightseeing route was selected and the content of the user information. The backend organizes data related to the number of times that each sightseeing route is selected and the total distance covered by each user, and it displays the top five users in terms total distance covered and top five most-often used sightseeing routes on the page for the ranking function of user and sightseeing route.

4.3. System Interface

The interface of the system was designed to be usable on both a PC and a mobile device. As the user's mobile device interface is developed using a responsive design, it is almost identical to the PC interface. The administrator's PC interface is developed utilizing Graphic User Interface (GUI). If malicious users and invalid submissions might be found, the administrator can delete them at one click.

5. Operation

5.1. Operation Target Area

Chofu City, Tokyo Metropolis, and its periphery is selected as the operation target area of this system. This is because the area contains many locations associated with anime and movies, etc., and because performing tourism on foot is recommended for this area. The system is envisioned to be used by the following three types of people. People who are very familiar with the operation target area and who are also knowledgeable about tourist attractions that are related to content can share information by submitting new tourist attractions and sightseeing routes. People who are very familiar with the operation target area but who are not knowledgeable about tourist attractions that are related to content can gather information shared by other users and can create sightseeing routes. People who are not familiar with the operation target area can view tourist attraction information and sightseeing routes created by others to efficiently design their sightseeing plans.

5.2. Gathering Data Related to Tourist Attraction

In order to make it possible to use the functions of the system immediately after it was launched, data related to tourist attractions needed to be gathered in advance. Sightseeing pamphlets from the Chofu City Tourist Association [32] and the Chofu Chamber of Commerce and Industry [33] are used to gather the data related to tourist attraction for 133 locations.

5.3. Operation Results

This system was put in operation for a period of one month, for use by people both inside and outside the operation target area. **Table 2** shows the overview of system users. Users aged 20 - 29 accounted for 43% of all users, followed by users aged 10 - 19 at 14%, and then users aged 30 to 39, 40 to 49, and 60 to 69 each accounted for 12%. **Table 3** shows the number of new sightseeing spots submitted by users by each category. 12 new sightseeing routes were created during the operation period, and 30 new tourist attractions information was submitted. These results indicate that there is great potential for a large amount of new tourist attraction information to be submitted and sightseeing routes to be created, if the system were put into long-term operation.

Table 2. Breakdown of system users and questionnaire survey respondents.

Age groups of Users	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60-	Total
Number of system users	6	18	5	5	3	5	42
Number of web questionnaire survey respondents	5	17	4	4	1	4	35
Valid Response Rate (%)	83.3	94.4	80.0	80.0	33.3	80.0	83.3

Table 3. Number of new sightseeing spots submitted by users by each category.

Category	Number of new sightseeing spots submitted by users
Famous places and historical sites	1
Park and garden	6
Public facilities	4
Eateries	11
Temples and shrines	2
Museums	1
Hot springs	0
Cherry blossom viewing	1
Festivals and events	0
Theme parks	0
Others	4
Total	30

6. Evaluation

In this section, first of all, the system developed in the present study was evaluated based on the results of a web questionnaire survey to users and an access analysis of users' log data. Next, based on the results, improvement strategies for the system will be submitted.

6.1. Evaluation Based on the Questionnaire Survey

6.1.1. Overview of the Questionnaire Survey

In accordance with the objectives of present study, a web questionnaire survey is conducted in order to evaluate (1) system usage and (2) the system functions. The questionnaire survey was conducted on a website one week after the system went into operation. Table 2 also shows an overview of the web questionnaire survey respondent. As Table 2 shows, questionnaire survey responses were received from 35 users, and the response rate was 83%. From the results of the questionnaire survey, it can be determined that the majority of users were residents of Chofu City, 71% were unfamiliar with content tourism, and 60% had never engaged in content tourism.

6.1.2. Evaluation of System Usage

30% of respondents gathered tourism information from websites, 22% from social media, and 20% from guidebooks and pamphlets (multiple answers were allowed). From this, it can be concluded that while some users gathered tourism information from printed media such as guidebooks and from word of mouth, many users gathered information via their internet using PCs or smartphones. It is also important to note that social media was used to gather tourism information. The above make it clear that the system, which gathers tourism information via the web from PCs and mobile devices, would be effective at providing tourism support.

6.1.3. Evaluation of System Functions

1) Evaluation of key functions

Figure 12 shows the evaluation results of the key functions. 80% of respondents indicated that they "Agreed" or "Somewhat agreed" that the submission function of tourist attraction information, and the viewing function of tourist attraction information and sightseeing route were easy to use. 75% of respondents indicated that they "Agreed" or "Somewhat agreed" that the creation function of sightseeing route was easy to use. 17% answered that they were "Undecided" and 8% answered that they "Disagreed". Users who evaluated the ease of operation of these functions unfavorably said that it was not intuitive. 86% of respondents indicated that they "Agreed" or "Somewhat agreed" that the management function of user information would be effective at promoting better health. This function was highly evaluated by users.

2) Evaluation of the system as a whole

Figure 13 shows the evaluation results of the system as a whole. 86% of respondents indicated that they "Agreed" or "Somewhat agreed" that the system promoted greater understanding of the operation target area (Chofu City). 86% and 82% of respondents indicated that they "Agreed" or "Somewhat agreed" that the system was effective in fostering greater interest in content tourism and that the system was effective in popularizing content tourism, respectively. The system

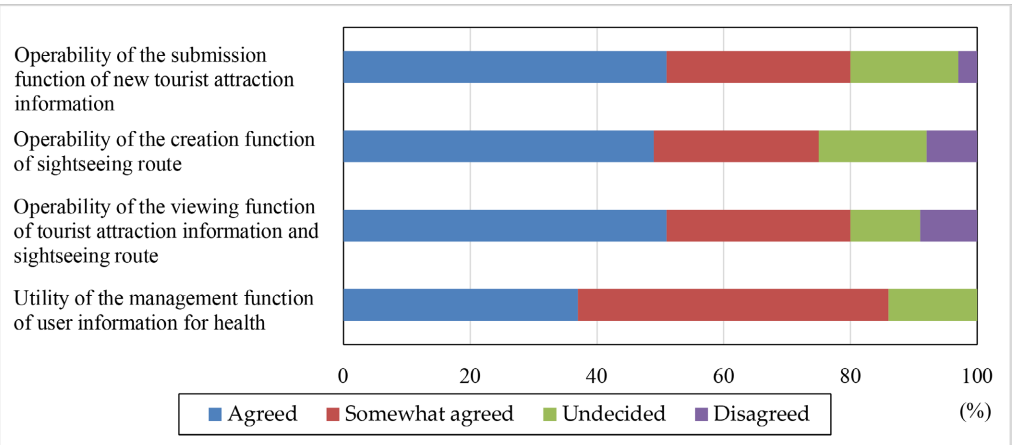


Figure 12. Evaluation results of key functions.

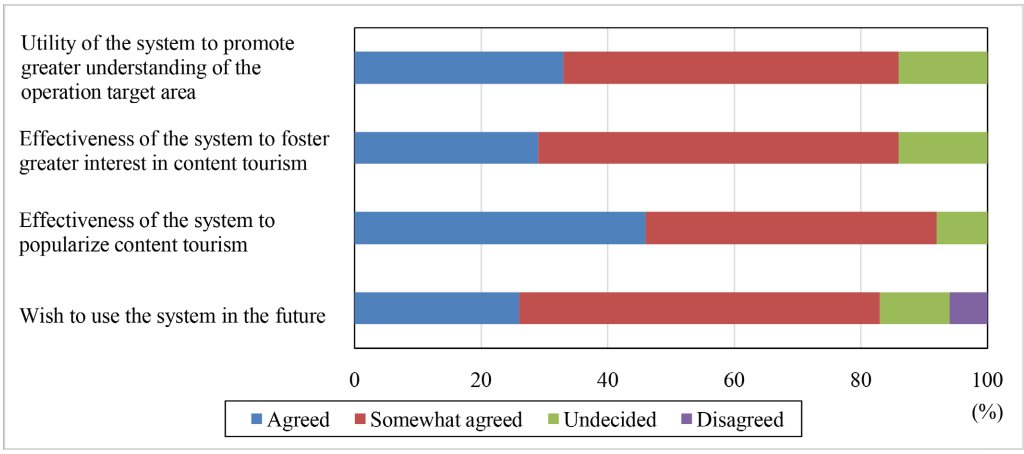


Figure 13. Evaluation results of the system as a whole.

therefore can not only provide users with a deeper understanding of the operation target area, but can also promote content tourism. 83% of respondents indicated that they "Agreed" or "Somewhat agreed" that they wished to use the system in the future. Ongoing operation of this system therefore has potential for multifaceted use by users.

6.2. Evaluation Based on the Access Analysis

In present study, Google Analytics is used to analyze user access logs from the operation period. Access logs is acquired by using html files loaded by each page of the website to be analyzed to call a PHP program that contained an access code created using Google Analytics.

The system had a total of 134 sessions. 64% of the devices used to access the system were PCs, 34% were smartphones, and 2% were tablet devices. This is because the system uses a digital map, which is easier to see on a PC with a large screen. A small number of users also accessed the system using a tablet device. In order to eliminate differences in the types of information that can be obtained depending on the type of device, the system was designed to provide identical functions regardless of the type of device used to access the system. The analysis results indicate that this approach was effective.

Table 4 shows the top ten most accessed pages. As Table 4 shows, the number of visitors was particularly high for the pages for the creation function of sightseeing route and the viewing function of tourist attraction information. It therefore appears that the system is being used as intended, with users creating sightseeing routes and viewing routes created by other users. However, the number of users that accessed the page for the creation function of sightseeing route and went on to create a sightseeing route was low, so the interface for the creation function of sightseeing route needs improvement.

6.3. Identifying Improvement Measures

Based on the results of the questionnaire survey and the access log analysis, after

Table 4. Number of visits per page (Top 10).

Rank	Page name	Number of visits by page	Percentage (%)
1	Page for the creation function of sightseeing route	557	25.5
2	Page for the viewing function of tourist attraction information	372	17.0
3	Page for the function of login	307	14.1
4	Top page	246	11.3
5	Page for the viewing function of sightseeing route	176	8.1
6	Page for the submission function of new tourist attraction information	134	6.1
7	Page for the management function of user information	117	5.4
8	Page for the questionnaire survey	109	5.0
9	Page for the ranking function of user and sightseeing route	85	3.8
10	Page for the function of new user registration	82	3.7

the issues Based on the results of the web questionnaire survey and the access log analysis to identify future improvements to the system. These are summarized below.

1) Enriching tourist attraction information

The tourist attraction information provided by the system should be expanded by gathering information on eateries and photographs of tourist attractions and registering them in the database of the system.

2) Changes to web page designs

Web pages should be changed to make them easier to understand and use by changing fonts, font sizes, and backgrounds for better visibility. The size of pop-ups on the digital map of Web-GIS should be changed to make the system easier to use on mobile devices.

3) Enriching the creation function of sightseeing route

A function should be added for searching for tourist attractions for individual content, when creating sightseeing routes. This would make it possible for users to learn about locations related to content that they enjoy. When there are locations related to content that users like but that is not registered in the system, this would also enable the users to submit the locations as new tourist attractions. There should also be a function for displaying detailed information related to each tourist attraction. This would make it easy for those unfamiliar with the area to create sightseeing routes using the system.

7. Conclusions

In present study, a system that integrated three subsidiary systems—Web-GIS, a tourism information system and SNS—was designed and developed in order to support walking-based content tourism. This made it possible even for users to create sightseeing routes and to submit, store, and view tourist attraction infor-

mation. Additionally, it also made it possible to strive to promote a greater understanding in the community and promote health by enabling both tourists and local residents to take part in content tourism on foot. The present study has these two elements of the originality, comparing the preceding studies in the related academic areas.

The operation target area of the system was Chofu City, Tokyo Metropolis, and it was put in operation for a period of one month, for use by people both inside and outside the operation target area. A total of 42 people used the system. The largest share of users was between age 20 and 29, and the majority lived in Chofu City. During the operation period, 12 new sightseeing routes were created and 30 new tourist attractions were submitted. These results indicate that there is great potential for a large amount of new tourist attraction information to be submitted and sightseeing routes to be created if the system were put into long-term operation.

A web questionnaire survey to users and analyzed access logs were administrated in order to evaluate the system developed in the present study. Based on the results of the questionnaire survey, users highly evaluated the key functions of the system and the overall system. Ongoing operation of this system therefore has potential for multifaceted use by users. However, of those key functions, evaluations were somewhat low for the ease of operation of the creation function of sightseeing route, so the improvements indicated in Section 6.3 must be made. Based on the results of the access log analysis, the system had a total of 134 sessions, and 64% of the devices used to access the system were PCs, 34% were smartphones, and 2% were tablet devices. Therefore, the approach of designing the system such that the same functions could be used regardless of the type of device one is using was an effective design approach.

Future research tasks include making improvements to the system based on the findings in Section 6.3 and using the system in other urban tourist destinations to expand the system usage track record and improve the usability of the system.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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