Chapter 2

Walking Support System with Users' Circumstances

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Additional information is available at the end of the chapter

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Abstract

In Japan, the central government started the promotion of citizens' health by self-supervision in 2000, and walking is recently recognized as the most popular sport for many generations. Based on this background, the present study aimed to design, develop, operate, and evaluate a walking support system, which takes into account the users' circumstances (each user's health conditions, needs, and preferences). The system was developed by integrating Web-GIS (geographic information systems) as a base system and social networking services (SNS) as well as a registration system of walking information into a single system. Additionally, the system was operated for 5 weeks in Chofu City in Tokyo Metropolis, Japan, and the total number of users was 73. Based on the results of the Web questionnaire survey, the usefulness of the system when selecting a walking course was high, and the further use of each function can be expected by the continuous operation of the system. From the results of access analysis of users' log data, it is evident that the system has been used by two types of information terminals approximately in the same way, and that the entire system has been used according to the purpose of the present study, which is to effectively support the users' walking.

Keywords: walking, walkability, users' circumstances, Web-GIS, SNS, registration system of walking information

1. Introduction

In Japan, the central government declared "Healthy Japan 21" in 2000, put the Health Promotion Law into force in 2003, and spelled out the measures and policies for the promotion of citizens' health by self-supervision. It is pointed out that the increase of human body activities centering on walking should lead to suppress cardiovascular diseases and cancer and prolong human lifespan. Therefore, the main objective of the "Healthy Japan 21 first

(2000–2012)" was to increase the numbers of walking steps and those who continue some physical exercises (Ministry of Health, Labour, and Welfare [1]). In the "Healthy Japan 21 second (2013–2023)," the improvement of the environment to continue walking was added to the main objective (Ministry of Health, Labor, and Welfare [2]). Additionally, according to the public opinion survey conducted by the Ministry of Education, Culture, Sports, Science and Technology [3], it was evident that walking is the most popular sport among Japanese because it is easy for everyone to start it. In this way, regardless of age or sex, it is possible for everyone to easily work on walking in everyday life. Walking is the most suitable physical activity (PA) especially for elder people because it is possible for them to prevent the drop of physical strength and body ability by aging.

On the other hand, currently, Japan finds itself in the position of a "developed" country, facing many serious challenges to declining birth rate, aging population, and the environment and energy issues, that it must address head-on, challenges, which other countries will 1 day also be facing. Therefore, in most of the Japanese cities, it is essential to realize "compact town development" that puts homes and places of work in close proximity to each other appears to be one effective way of making it easier to face the above serious challenges. Walkability is a concept to comprehensively show the situations of the physical environment of the urban space to support and promote walking in everyday life. An environmental approach, which ameliorates the urban space to improve and promote residents' health, attracts attention all over the world, and walkability is placed as the important point. An increase in the number of steps, that is, an increase in walking time, is related to the walkability factors such as sidewalks, landscapes, and traffic safety, which influence on walking time (Inoue et al. [4]).

One of the methods to explicitly provide geospatial information related to the above walkability factors is geographic information systems (GIS). GIS is a powerful tool to overlay, analyze, maintain, and share various kinds of geospatial information on the digital map, referring to the longitude, latitude, and height. Therefore, it is possible to visually display geospatial information concerning the above walkability factors on the digital map of the Web-GIS to efficiently support walking.

Based on the background mentioned above, the present study aims to design, develop, operate, and evaluate a walking support system, which integrates a Web-GIS as a base system, an social networking services (SNS), and a registration system of walking information, while taking into account the users' needs, which can change according to the circumstances (each user's health conditions, needs, and preferences). The system efficiently provides various information related to walking to support many generations, and it is expected that it will enable users to control their health by themselves.

2. Related work

The system in the present study was developed by integrating plural systems such as Web-GIS, SNS as well as the registration system of walking information into a single system. Therefore, the present study is related to three study fields, namely, (A) studies regarding walkability, (B) studies regarding activity support system developed by GIS, and (C) studies regarding social media GIS.

In A studies regarding walkability, as this topic attracts attention just in recent years, there were few preceding studies until now. Cerin et al. [5] examined the factorial and criterion validity of the neighborhood environment walkability scale (NEWS) and developed an abbreviated version (NEWS-A). Kondo et al. [6] investigated the actual association between physical activity (PA) and neighborhood environments (NE) focused on either objectively measuring the NE or the residents' perception of NE in Japan. Inoue et al. [7] conducted a questionnaire survey to investigate the relationship between living environment and walking, just targeting Japanese.

In B studies regarding activity support system developed by GIS, Ishizuka et al. [8] proposed a similarity search method for the movement tracking data of tourists obtained from their location data and its text information. Kurata [9] developed an automatic generation system for sightseeing courses using Web-GIS and genetic algorithm (GA). Kawamura [10] proposed the use of standard tags related to sightseeing on SNS and set up a Website to organize tourism information of Hokkaido on the Internet. Sasaki et al. [11] gathered information concerning local resources and developed a system that supports the sightseeing activities of each user. Fujitsuka et al. [12] used the pattern mining method, which lists and extracts the time series action when touring sightseeing spots, and developed an outing plan recommendation system. Ueda et al. [13] generated post-activity information from the sightseeing activities of the users and developed a tourism support system, which shares such information as prior information for other users. Okuzono et al. [14] took into consideration the preferences of several people using photos, and proposed a system that recommends sightseeing spots.

Fujita et al. [15] developed a navigation system using augmented reality (AR), Web-GIS, and social media, in order to support sightseeing activities during normal occasions and evacuation in case of a disaster. Zhou et al. [16] develop a sightseeing spot recommendation system using AR, Web-GIS, and SNS. Based on these results, Mizutani et al. [17] developed a sightseeing spot recommendation system taking into account the change in circumstances of users. Abe et al. [18] developed a tourism information system with language-barrier-free interfaces, mainly targeting foreign visitors. Mizushima et al. [19] proposed a service data model in design support system for sightseeing tours, based on tourists' three types of requests (geographical, time, and meaning information). Yamamoto [20] developed sightseeing navigation system, using 2D and 3D digital maps of the Web-GIS, and just targeting foreign visitors.

In C studies regarding social media GIS, Yanagisawa et al. [21] as well as Nakahara et al. [22] developed an information sharing GIS, using Web-GIS, SNS, and Wiki, with the purpose of storing and sharing information of the local community. Yamada et al. [23] and Okuma et al. [24] developed a social media GIS, which strengthened the social media function of the information sharing GIS mentioned above. Based on such systems developed from preceding studies, Murakoshi et al. [25] and Yamamoto et al. [26] developed a social media GIS supporting the continuous use of disaster information during normal occasions and in case of a disaster. In addition, based on these social media GIS, Ikeda et al. [27] developed a social recommendation GIS to accumulate sightseeing spot information and recommend sightseeing spot according to the preference of each user.

Among the preceding studies in related fields as listed above, B and C support the tour planning and accumulating and sharing of spot information for activity support. Additionally, the existing system developed in B and C is not suitable to support walking. Against the abovementioned preceding studies, the present study demonstrates the originality to develop a walking support system, by integrating Web-GIS as a base system, an SNS, and a registration system of walking information, and targeting many generations. Furthermore, referring to Inoue et al. [7] in A, the present study shows the usefulness to provide important geospatial information from the viewpoint of walkability to users, and support them to select their suitable walking courses in response to their preferences, aptitudes, and situations.

3. System design

3.1. System configuration

The system of the present study is developed by means of Web-GIS, an SNS, and a registration system of walking information, as shown in **Figure 1**. The system enables to visualize the information related to outlines, height, and sightseeing spot on the digital maps of the Web-GIS. Therefore, it is possible for users to efficiently obtain the necessary information related to walking. Since the system is connected with external SNS (Twitter), it is possible for users to share various information related to walking, and displaying the tweets with a specific hashtag submitted by others. Additionally, it is also possible for users to register their walking information such as the number and time of their steps. Users can freely confirm their registered information, which is maintained in the database of the system.

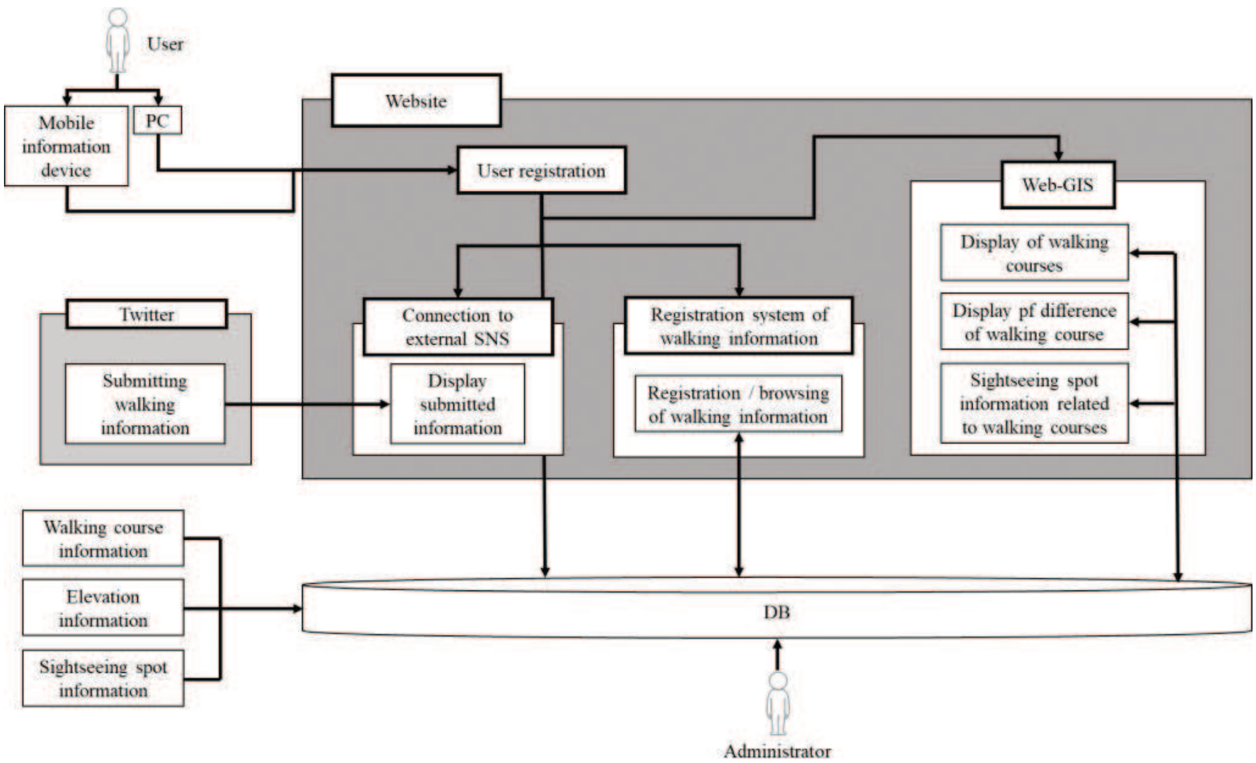

Figure 1. System design.

The usability of the system mentioned in the previous section can be summarized in the following three points, by means of the design described in detail as shown in **Figure 1**.

1. Reduction of the burden of information obtainment: Users can select their walking course, considering various information such as distance, height, and sightseeing spot. In general, it takes a long-time to gather such an information provided in multifarious formats. However, in the system, since the geospatial information related every walking course is displayed on the digital maps of the Web-GIS, users can reduce the time to obtain their necessary information, and receive the support of their selections.
2. Visual confirmation of geospatial information: It is difficult to grasp the geospatial information related to walking courses and sightseeing spots at a glance, just referring to guidebooks, and pamphlets. Since the above geospatial information is displayed using Web-GIS, the user can visually confirm it on the digital map at first glance.
3. Effective support for users' activities: Though it is possible to take the record of the number of walking steps using a pedometer, it is not easy to confirm the information related to walking courses, and comments. However, the system enables users to manually register their numbers and time of their steps, and their comments on the selected walking courses. Confirming these to grasp the present situation of walking at fixed interval, it is expected that users should control their health on their own initiative.

3.2. Target information terminals

Though the system is meant to be used from PCs or mobile devices, as there is no difference in functions on different information terminals, the same function can be used from any device. PCs are assumed to be used indoors for gathering and register walking information. On the other hand, mobile devices are assumed to be used both indoors and outdoors to gather information concerning sightseeing spots.

3.3. System operation environment

The system operates using the Web server, database server, and the GIS server. **Figure 2** shows the operating environment of the system. The Web server and database server both use the Heroku, which is a Platform as a Service (PaaS) provided by the Salesforce company. For the GIS server, the ArcGIS Online was used. The Web application developed with the system was implemented using PHP and JavaScript.

3.4. Design of each server

3.4.1. Web-GIS

As there are a variety of Web-GIS types, it is necessary to select the most suitable type according to the purpose of using the system. In terms of convenience, the system should be used without having to download any special software, which would be inconvenient for users, and it would be desirable if it could be used by accessing the Website on any PC or mobile device connected to the Internet. Therefore, a series of the GIS provided by Environmental Systems Research Institute, Inc. (ESRI) was selected to develop the Web-GIS in the present study. The detailed design of the Web-GIS is as follows:

1. Display of walking courses on the digital maps

   At first, the layers were created by plotting the geospatial information related to walking courses and sightseeing spots on the basic digital maps, and these were overlaid to create the Web maps, using the ArcGIS Online provided by ESRI. These Web maps were disclosed on the Website as the Web-GIS, using the ArcGIS application programming interface (API) for JavaScript provided by ESRI.

2. Display of elevation difference of walking course on the digital maps

   The elevation difference is related to exercise strength and influences on the selection of walking courses. Therefore, using the above Web maps and a Web application template included in the GitHub provided by ESRI, elevation difference of walking course was displayed on the digital maps, and was also disclosed on the Website as the Web-GIS, using the ArcGIS API for JavaScript.

3. Display of sightseeing spot information related to walking courses on the digital maps

   Inoue et al. [4] pointed out landscape is one of the most important walkability factors. Therefore, the system provides the sightseeing spot information related to walking courses to the users. For that, the detailed information and images related to walking courses in the operation target area in the present study were gathered, and they were displayed on the Web maps using the Web application template included in the GitHub. These Web maps were also disclosed on the Website as the Web-GIS, using the ArcGIS API for JavaScript.

3.4.2. Connection to external SNS

The system is connected to Twitter, and users can submit and search for the information related to walking courses and sightseeing spots. The system enables to obtain the tweets with a specific hashtag, and display them on the homepage.

3.4.3. Registration system of walking information

Users can register and confirm the date, selected walking course, number and time of steps, walkability, and comments on their personal pages. These are accumulated in the PostgreSQL connected with the Heroku application. The Web application developed with the system was implemented using PHP and JavaScript. Therefore, it is expected that users should reasonably continue walking and control their health by themselves.

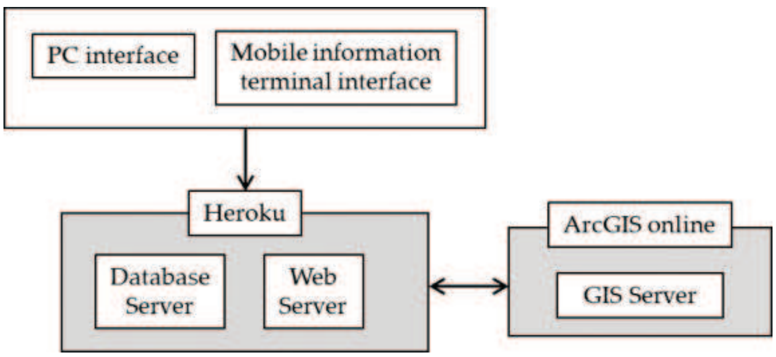

Figure 2. System operating environment.

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4. System development

The system will implement unique functions for users, which will be mentioned below, in response to the aim of the present study, as mention in Section 1. In order to implement these several unique functions, the system was developed by integrating plural systems into a single system, and is also connected with external SNS.

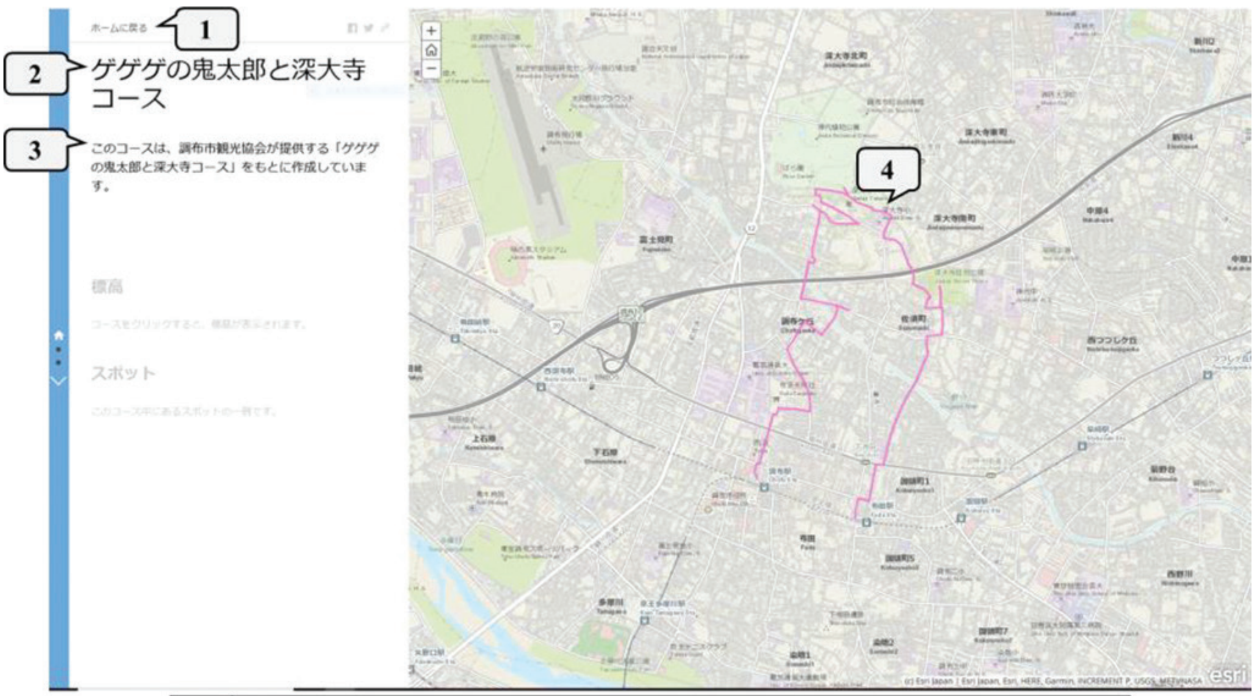
4.1. The frontend of the system

4.1.1. Login function

Users register when using the system for the first time. After moving from the login page to the registration page, users can register and submit the "ID," "password," "name," "age," "gender," and "email address." Next, after logging in to the system on the login page, users can move to the homepage.

4.1.2. Display function of walking course

After selecting a favorite course in the menu bar on the homepage, users can go the page for the display function of walking course (**Figure 3**) to confirm its outline on the digital map of the Web-GIS. The selected walking course is clearly displayed as a line on the digital map.



No.	Description
1	Go to homepage
2	Name of selected walking course
3	Explanation of selected walking course
4	Display of selected walking course as a line on the digital map of the Web-GIS

Figure 3. Page for the display function of walking course.

4.1.3. Display function of the elevation difference of walking course

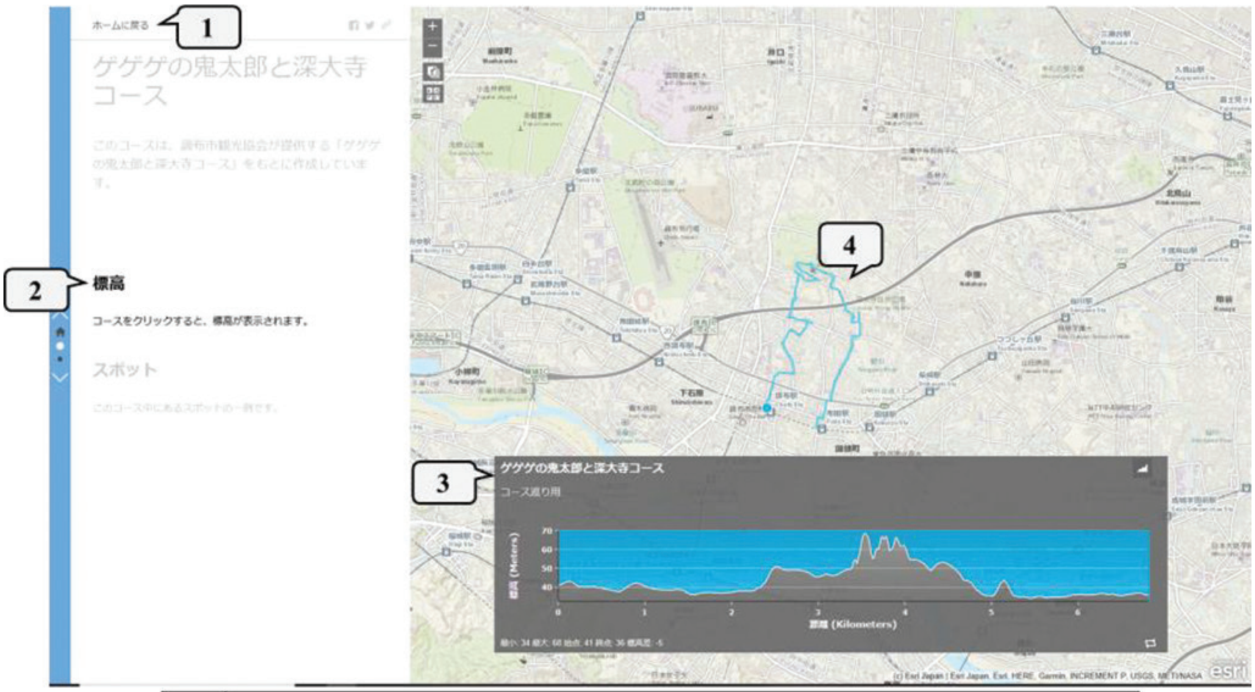
After confirming the outline of the selected walking course, by clicking its line on the digital map, users can go to the page for the display function of the elevation difference of walking course (**Figure 4**) to confirm the elevation difference. In the graph shown in **Figure 4**, the vertical axis indicates elevation (m), and the horizontal axis indicates the distance (km). By moving the cursor in the graph, the location corresponding to the walking course is displayed by a blue circle.

4.1.4. Viewing function of the sightseeing spot information related to walking courses

After confirming the elevation difference of walking course, by scrolling the menu bar on the left side of the screen downward, users can go to the page for the viewing function of sightseeing spot information related to walking courses (**Figure 5**) to view the sightseeing spot information around walking courses (location, explanation, and image).

4.1.5. Viewing function of the information submitted by twitter

After login to the system, on the left side of the home page, users can view the information related walking courses, and sightseeing spots submitted by Twitter. The information is updated in real time, and users can view others' tweets.



No.	Description
1	Go to homepage
2	Elevation difference of the selected walking course
3	Elevation difference of selected walking course displayed by a graph
4	Display of selected walking course as a line on the digital map of the Web-GIS

Figure 4. Page for the display function of the elevation difference of walking course.

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No.	Description
1	Go to homepage
2	Sightseeing spot information related to selected walking course
3	Images of sightseeing spot information related to selected walking course
4	Image and explanation of sightseeing spot information related to selected walking course

Figure 5. Page for the viewing function of the sightseeing spot information related to walking courses.

4.1.6. Registration function of walking information

After logging in to the system, by selecting "Registration of walking information" in the menu bar on the left side of the homepage, users can go to the page for the registration function of walking information (**Figure 6**) to register, and confirm the information related to their walking history.

4.2. The backend of the system

4.2.1. Process concerning the member registration and login

All of users' registered information is accumulated in the PostgreSQL connected with the Heroku application. Each user's password is, respectively, made a hash using the Hash function of PHP, and it is accumulated in the database. All of users' registered information and registration time are also accumulated in the database. At the time of login, each user's password is made a hash, and login process is conducted, if a password accords with an ID in the database.

4.2.2. Process concerning the connection with SNS

The tweets related to walking courses and sightseeing spots are obtained using the Twitter OAuth library. Specifically, the tweets with the hashtag "#chfgis" can be accumulated as new information in the system, and these are updated in real time.

No.	Description
1	Registration of walking information
2	Date of walking
3	Name of selected walking course
4	Number of walking steps
5	Walking time
6	Walkability
7	Comment

Figure 6. Page for the registration function of walking information.

No.	Description
1	Menu bar (Homepage, Walking course, Confirmation of walking history, Web questionnaire survey, Contact details for inquiries, Logout)
2	Display of Information submitted by Twitter
3	Explanation of the system
4	Explanation of walking courses
5	Explanation of the tweets with the hashtag "#chfgis"
6	Explanation of registration of walking information
7	Walking courses displayed on the digital map of the Web-GIS

Figure 7. User's PC screen and mobile device screen.

4.2.3. Process concerning registration of walking information

All of the users' registered information as well as ID and personal information is maintained in the PostgreSQL database server. Users can view and revise such information displayed on the users' personal pages.

4.3. System interface

The system has two types of interfaces: The PC screen and mobile device screen for users (**Figure 7**), and the PC screen for the administrator. In the latter, the "ID," "password," "name," "age," "gender," and "email address" of all users can be checked on a list. Additionally, due to the simplification of user management using graphic user interface (GUI), procedures such as the deletion of unauthorized users can be done without depending on the IT literacy of the administrator.

5. Operation

5.1. Operation overview

Regarding the operation target area, the Chofu City in Tokyo Metropolis, Japan, was selected. One reason for this selection is that it has popular walking courses and sightseeing spots in the city. The second is that the city consists of flat terrain and gentle slopes, and such a topography condition is suitable for walking.

The system was operated over a period of 5 weeks (from 12/15/2017 to 1/22/2018) with those inside and outside the operation target area. Whether inside or outside the operation target area, the operation of the system was advertised using the Website of the authors' lab as well as Twitter and Facebook.

5.2. Operation result

Users of the system are shown in **Table 1**. The system has a total of 73 users with 48 male and 25 female users. Regarding age groups, there are many male and female users in their 20s making up 56% of the total. Subsequently, those in their 50s were 15%; those in their 40s were 11%; those in their 30s were 7%; those in their 10s were 6%; and those in their 60s, and above were 6%. The number of people who used the registration function of walking information was only 5, about 7% of the total number of users, and the number of walking information registered was 21. However, by using the system over a long period, it is expected that further registration of walking information.

5.3. Management of submitted information by administrators during the operation

Every user's submissions of information and image files are all accumulated as data in the database of the system. Administrators manage users and check submitted information using a list screen designed especially for the purpose. Administrators can take the measure of suspending accounts of users who have made inappropriate transmissions or behaved

Age groups of users	10–19	20–29	30–39	40–49	50–59	60–69	70-	Total
Number of users	4	40	5	9	11	2	2	73
Number of Web questionnaire survey respondents	4	23	1	4	3	1	0	36
Valid response rate (%)	100.0	57.5	20.0	44.4	27.3	50.0	0.0	49.3

Table 1. Breakdown of system users and Web questionnaire survey respondents.

inappropriately, and if by any chance an inappropriate submission is made, administrators can delete the submission with just one click. Due to these features, there is no need for administrators to search to see whether or not inappropriate submissions of information have been made within the system; therefore, their burden can be lessened.

6. Evaluation

After the end of the operation, a Web questionnaire survey and access analysis of users' log data were conducted in order to evaluate the system developed in the present study.

6.1. Evaluation based on Web questionnaire survey

6.1.1. Overview of the Web questionnaire survey

Along with the purpose of the present study, a Web questionnaire survey was implemented in order to conduct an evaluation on the use of the system, an evaluation on system function, and an evaluation of the entire system. The Web questionnaire survey was conducted for 1 week after the start of the operation. **Table 1** also shows an overview of the Web questionnaire survey. As shown in **Table 1**, 36 out of 73 users submitted their Web questionnaire survey, and the valid response rate was 49.3%.

6.1.2. Evaluation on the use of the system

Regarding the viewing frequency of the Website, 75% viewed the Website every day, and 19% viewed the Website several times a week. Regarding the access methods to the system, 44% were PCs, and 56% were mobile information terminals. Therefore, it was made evident that the system developed using the Web-GIS as a base system is useful. Additionally, because the access method from the PC and the mobile information terminal was hardly different, it was effective to make the system available from both terminals.

6.1.3. Evaluation of system function

The evaluation results for the usefulness of the main functions to support walking are shown in **Figure 8**. Specifically, **Figure 8** shows the results that asked the users whether these items are useful.

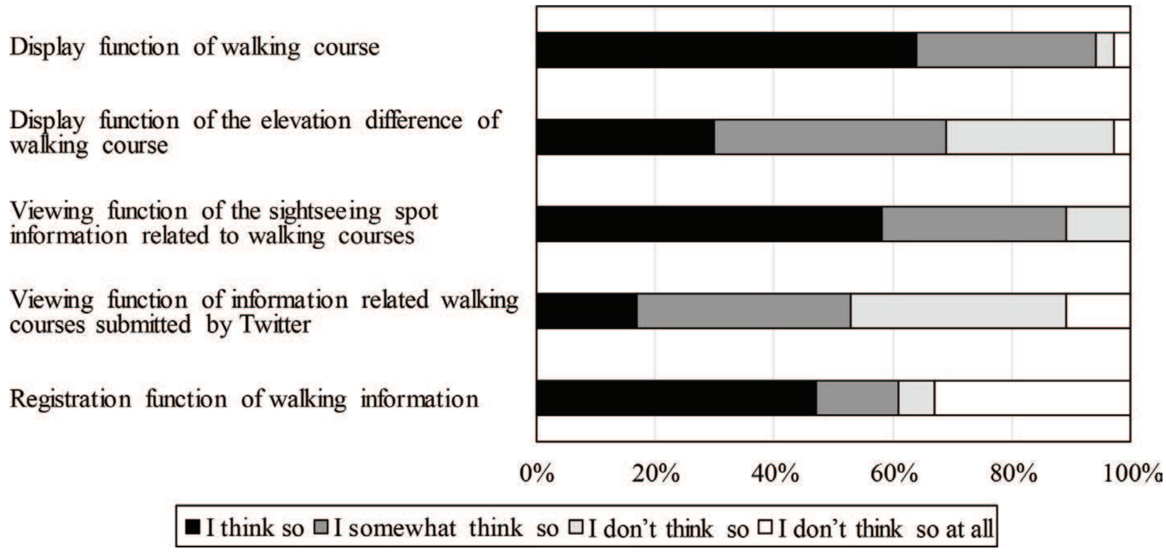

Figure 8. Evaluation of the usefulness of the main functions to support walking.

Regarding the display function of walking course, 94% answered "I think so" or "I somewhat think so," 3% answered "I don't think so," and 3% answered "I don't think so at all". Because it is important to select a suitable walking course, the usefulness of this function was highly evaluated. Regarding the display function of the elevation difference of walking course, 69% answered "I think so" or "I somewhat think so," 28% answered "I do not think so," and 3% answered "I do not think so at all". The reason for this result is that 56% of the users of the system were in their 20s, and they did not pay attention to the elevation difference of walking courses.

Regarding the viewing function of the sightseeing spot information related to walking courses, 89% answered "I think so" or "I somewhat think so," and 11% answered "I don't think so." Because most respondents tended to select the walking courses with a lot of sightseeing spots. Regarding the viewing function of information related walking courses submitted by Twitter, 53% answered "I think so" or "I somewhat think so," 36% answered "I don't think so," and 11% answered "I don't think so at all." Consequently, 47% of the users did not highly evaluate the usefulness of this function. Because these users did not have their Twitter accounts, and it was impossible for them to directly submit information to the system.

Regarding the registration function of walking information, 61% answered "I think so" or "I somewhat think so," 6% answered "I don't think so," and 33% answered "I don't think so at all." However, the function may be used more often by the continuous operation of the system, and this may advance the usefulness of the system when walking.

6.1.4. Evaluation of the entire system

The evaluation results for the usefulness of the entire system are shown in **Figure 9**. As with **Figures 8** and **9** shows the results that asked the users whether these items are useful.

Regarding the entire system when walking, 81% answered "I think so" or "I somewhat think so," and it was evident that the system was highly evaluated. Though it is necessary

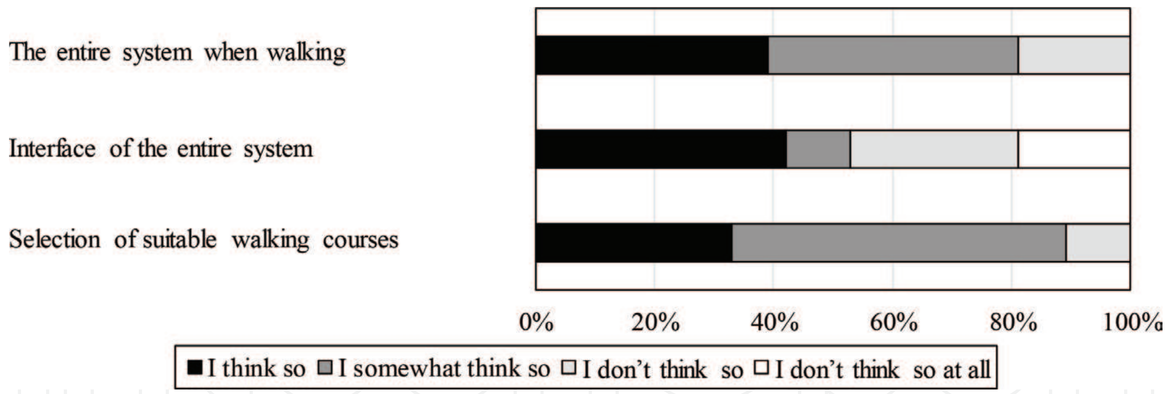

Figure 9. Evaluation on the usefulness of the entire system.

to improve some functions according to the users' evaluation results, it can be said that the system was useful to select a favorite walking course in responding to each user's preferences, aptitudes, and situations.

Regarding the interface of the entire system, though 53% answered "I think so" or "I somewhat think so," 47% answered "I don't think so" or "I don't think so at all." The reason for this result is that the interface optimized for mobile information terminals was not developed. Regarding the selection of suitable walking courses, 89% answered "I think so" or "I somewhat think so." Therefore, the system is useful for almost users to select their suitable walking course.

6.2. Evaluation based on results of access analysis

In the present study, an access analysis was conducted using the users' log data during the operation period. This analysis was conducted using Google Analytics, which is a Web access analysis service provided by Google. A PHP program with the analysis code made using Google Analytics was created, and for the target Websites for the access analysis, the access log was obtained by scanning the PHP program made for the access analysis of the program in each page within that Website.

The access method to the system is shown in **Table 2**. There is hardly any difference in the use of PCs and mobile devices as an access method. This is because smartphones are now often used as an easy way to obtain information. Therefore, the system design, which was made to eliminate the differences in obtainable information depending on the type of device and to make the system available to all types of devices, can be considered effective.

The number of views of each walking course is shown in **Table 3**. As it is made clear in **Table 3**, the most popular walking courses were "Course of Gegege no Kitaro (a Japanese famous cartoon setting in Chofu City) and Jindai-ji Temple." Subsequently, walking courses of "City of the Movie, Chofu, and Tama River," and "Art and culture in Sengawa District" were popular. Because these walking courses are displayed on the top of the menu, it was easy for users to select them. Additionally, there are a lot of well-known sightseeing spots around these walking courses, and users tended to select them. Among the four courses of city walking, the short ones are more popular than the long ones.

Access method	Number of sessions	Percentage (%)
PC	154	56.2
Smartphone	230	37.7
Tablet	25	6.1

Table 2. Access methods.

Name of walking course	Number of views
Course of Gegege no Kitaro (a Japanese cartoon setting in Chofu City) and Jindai-ji Temple	121
Course of City of the Movie, Chofu and Tama River	39
Course of art and culture in Sengawa District	34
Course of Kondo Isami and green space	18
Course of city walking 2013 (Jindai-ji Temple and Kaniyama)	23
Course of city walking 2013 (Fuda and Gojuku Districts)	12
Short course of city walking 2014	40
Long course of city walking 2014	9
Short course of city walking 2014	27
Long course of city walking 2014	14

Table 3. Number of views of walking course.

6.3. Identification of measures to improve the system

Based on the results of the evaluation of the operation in this section, measures for using the system even more effectively were summarized into the two points below.

1. Thought the system mainly provided the existing information related to walking courses and sightseeing spots, it did not provide real-time information related to users' present location, weather and traffic conditions. Therefore, it is necessary to examine the contents and providing method of information.
2. Though the information submitted by Twitter is accumulated in the system, it was impossible for the users who did not have their Twitter accounts to submit any information. Therefore, it is desirable to add a new function to directly submit information to the system.

7. Conclusion

In the present study, after designing and developing the system (Sections 3 and 4), the operation (Section 5) as well as the evaluation, and extraction of improvement measures (Section 6) were conducted. The present study can be summarized into the following three points.

1. In order to support many generations for walking, while taking into account the users' needs, which can change according to the circumstances, a system which integrated Web-GIS as a base system, SNS as well as the registration system of walking information was designed and developed. By doing so, the reduction of the burden of information obtainment, the visual confirmation of geospatial information, and the effective support for users' activities were made possible. Chofu City in Tokyo Metropolis, Japan was selected as the operation target area, and the system operation and evaluation were conducted.
2. The operation of the system was conducted over a period of 5 weeks targeting those inside and outside the operation target area, and a Web questionnaire survey was conducted toward all users. Based on the results of the Web questionnaire survey, the usefulness of the system when selecting a walking course was high, and the further use of each function can be expected by continuous operation.
3. From the results of access analysis of users' log data, it is evident that the system has been used by different types of devices just as it was designed for, and that the system has been used according to the purpose of the present study, which is to support the walking activities of users. Therefore, on the next step of the present study, it is necessary to inspect this point by the even more long-term operation of the system.

As future study projects, the improvement of the system based on the results in the previous section as well as the enhancement of the significance of using the system by gaining more results in other urban areas can be raised.

Acknowledgements

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Conflict of interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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