

Accessibility information gathered by a field assessment using a social platform to share accessibility information among people with disabilities

YABU Ken-ichiro^{1,2)}, MIURA Takahiro^{2,3,4)}, SAKAJIRI Masatsugu²⁾, UEDA Mari⁵⁾,
HIYAMA Atsushi³⁾, HIROSE Michitaka³⁾, IFUKUBE Tohru⁶⁾

¹⁾Research Center for Advanced Science and Technology, University of Tokyo,
Komaba4-6-1, Meguro-ku, Tokyo 153-8656, Japan

E-mail:yabu@human.iog.u-tokyo.ac.jp, Tel: +81-3-5841-1524, Fax: +81-3-5841-1523

²⁾Faculty of Health Science, Tsukuba University of Technology, Ibaraki, Japan

³⁾Graduate School of Information Science and Technology, University of Tokyo, Tokyo, Japan

⁴⁾National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki, Japan

⁵⁾Aviation Environment Research Center (AERC), Tokyo, Japan

⁶⁾Institute of Gerontology, University of Tokyo, Tokyo, Japan

Abstract: Accessibility information can allow disabled people to identify suitable pathways by which to reach their destinations, but it is difficult to obtain new accessible pathway information rapidly because of limited local information disclosure. Thus, it is necessary to develop a comprehensive system that acquires accessibility information from various sources and makes that information available in an intuitive form. In this study, we developed a social platform through which to obtain and present appropriate information based on users' situations, such as disability and location, and to share and then evaluate the barrier-free information provided by other users.

Keywords: Accessibility information, Barrier-free, People with disabilities

1. Introduction

Some developed countries, such as Japan, are faced with a rapidly aging society, and they need to cope effectively with the increasing numbers of sensory and physically disabled people [1,2]. It is predicted that the numbers of visually and physically impaired people will gradually increase; therefore, effective support schemes and systems will become necessary. Accordingly, medical technologies and welfare systems will mature, and barrier-free locations will gradually increase. Japan is also in this situation, particularly after the enactment of the Act on the Promotion of Smooth Transportation, etc. of Elderly Persons, Disabled Persons, etc. in 2006 [3].

However, visually and physically impaired people find it difficult to obtain information about both barrier-free and non-barrier-free areas and routes because of the limited local disclosure of this information. This inconvenient situation is detrimental to the quality of life of people with disabilities because it reduces their opportunities for social participation and limits their recreational opportunities. Thus, it is necessary to develop a system that helps these people to obtain this information easily.

In Japan, an increasing number of websites have been developed for the purpose of sharing barrier-free information to support disabled people [4]. Unfortunately, these websites only involve downtown areas. In addition, it is sometimes impossible for mobile phone users to read these maps because they are provided in PDF format. However, maps of multipurpose restrooms [5] and the *VizWiz* [6] have been successful for visually impaired people,

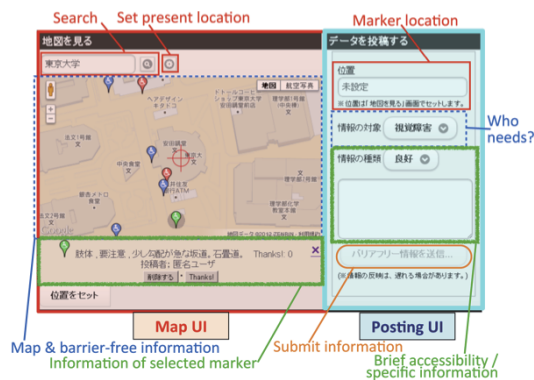


Figure 1. An example of user interfaces displayed on Google Chrome

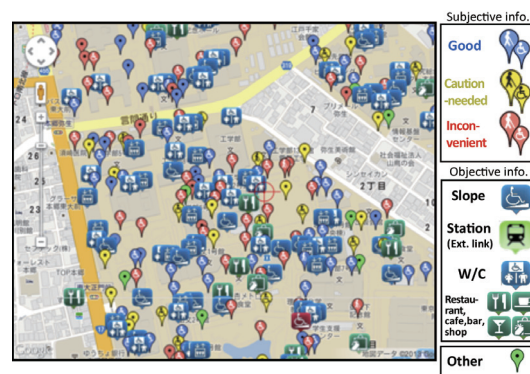


Figure 2. Map UI and the meanings of markers

as volunteers perform data collection and data sharing. Disabled people often have difficulty providing barrier-free information because there are few interfaces on which they can post such information. If a more effective information collection system could be developed, it would allow people with disabilities to share information amongst themselves, as well as with public administration officers and volunteers.

In this study, we aimed to develop a social sharing platform to provide barrier-free/accessibility information for people with disabilities and volunteers. In the present study, we evaluated the effectiveness of this platform in sharing conditions assessed by disabled people and volunteers.

2. Interface for accessibility conditions input

The user interface (UI) for specific accessibility information is shown in Figure 1. The system can be accessed via web browsers because of the availability of many terminals. Figure 1 shows examples of the UIs, which are displayed on Google Chrome, operated in Windows Vista. This view of the system includes a map UI and a posting UI, which are the same regardless of the web browser.

The map UI manages information presentation. This UI includes a search area, a button for obtaining the user's current location, a map view comprising map and markers, and a view of comments on selected markers. The search area enables users to see maps and barrier-free/barrier information at an indicated location by inputting the particular location name in text form. When the button used to obtain a user's current location is selected, the user's current position can be acquired through the specific and coarse locations identified via GPS and Wi-Fi. The map view displays a map showing current positions; hovering markers representing barrier-free information.

A magnified image of the map UI is illustrated in Figure 2, with a legend displaying the meaning of the markers shown on the map. These markers summarize barrier-free/barrier information using three colors: red (dangerous/impassable), yellow (caution needed), and blue (safe/passable). These are classified into two categories—subjective and objective information—in order to facilitate easy information input for both sighted and visually impaired people. Sighted people can determine more easily what kinds of assistive systems are installed, while people with visual impairments have recognition difficulties and sometimes only have a vague impression of their surroundings. Other reasons for this include the fact that some volunteers may wish to post barrier-free information about a particular place for specific groups of people; for example, some slopes are installed not for wheelchair users, but for the conveyance of equipment.

The subjective information includes users' impressions of locations, which note the targets of accessibility situations using icons representing people with visual, hearing, and physical impairments. The objective information includes the existence of slopes, elevators, multipurpose toilets, and flat entrances to interior and exterior places. When users select markers, detailed information about those markers is displayed in the comment window at

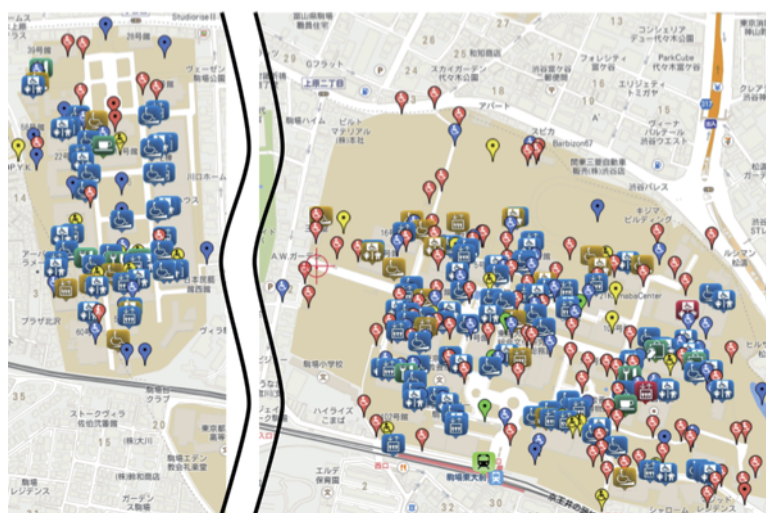


Figure 3. Accessibility information obtained during real-world assessment

the bottom of the map UI. In this window, users who found the displayed information useful can express their appreciation by pushing the *Thanks!* button. These markers represent not only the information stored in the system, but also the accessibility information openly available on the web. For example, a green marker with a train icon represents a link to the barrier-free conditions of all Japanese train stations, which opens the external website, *Station & Terminal Information Search* [4].

The posting UI allows users to submit barrier-free/barrier information. This UI comprises a box indicating a marker location, a pull-down menu containing information targets, a pull-down menu containing brief information on accessibility, and a text box for inputting specific information. When a user inputs or posts any barrier-free information from a location, the corresponding coordinate on the map is inputted to the marker location indicator box.

The target information pull-down menu lists the targets for the information provided, with tags people with vision, hearing, and physical impairments. Brief information on accessibility—including subjective information such as whether an area is passable and whether it is dangerous or safe, as well as objective information—can be selected from the appropriate pull-down menu. The text box for the inputting of specific information accepts information about particular situations.

3. Evaluation of the accessibility information system

In order to evaluate the system for real-world accessibility assessment, we cooperated with the Disability Service Office (DSO) of the University of Tokyo to gather information related to accessibility for people with disabilities. They assessed the accessibility conditions on campus in March 2013 with the objective of renewing the old accessibility map. Approval of the evaluation was obtained from the Office for Life Science Research Ethics and Safety at the University of Tokyo.

3.1. Participants and method

Five experts, including a wheelchair user and a person with total blindness, assessed barrier-free/barrier conditions. Ten volunteers also participated in the assessment, including three wheelchair users. The experts included DSO officers and employees of a company involved with accessibility consulting.

First, a briefing session and a trial session were held to provide information about the accessibility assessment method. Minimal check items and optional items were provided to the participants, who assessed these items. The

minimal items included the locations of barriers such as stairways, slopes, rough or narrow roads, and impassable places, assistive instruments such as elevators, slopes, multipurpose lavatories, and substitute accessible roads and entrances. Second, accessibility conditions were assessed by participants on campus over the course of one week. The assessed accessibility information was entered into the system using PCs and tablet computers, after which it was collated and the contents were analyzed through text analytics using the R.

3.2. Results and discussion

Figure 3 shows the barrier-free/barrier information obtained during the assessment. There were 353 entries in total, including 183 subjective and 157 objective information items. The remainder comprised information about facility locations that were not directly related to accessibility situations, such as ATMs, parking areas, and construction sites that could not be entered. The subjective information included entries for 67 passable and 97 impassable places for wheelchair users. The comments that corresponded to impassable places shared the following information: uneven roads, steep inclines, steps too high for wheelchair users, impassable or narrow entrances, roads and gates, and roads with bollards. Differences between the passable and impassable information were observed through their complementary information: the number of characters in the passable information (mean: 25.0 letters) was significantly less than in the impassable information (mean: 40.7 letters)(Tukey-Kramer's test: $p < .05$). The information about passable places tended to include the names of corresponding buildings and places, while the information about impassable places included not only the names, but also what kinds of barriers existed and how hard these barriers were to surpass.

The objective information included entries related to 122 convenient and 23 with-caution assistive instruments. The with-caution instruments included movable or steep slopes, elevators with narrow entrances, and multipurpose lavatories with heavy doors or narrow entrances. Similarly to the text length tendency of the subjective information, the number of characters in the convenient instruments (mean: 19.4 letters) was significantly fewer than in the with-caution instruments (mean: 66.3 letters)(Tukey-Kramer's test: $p < .001$). According to the results of a text analysis of the complementary information, the information about convenient instruments tended to include building and place names; this tendency was almost the same as that of subjective information about passable places. On the other hand, the information about with-caution assistive instruments included ways to use those instruments and types of existing barriers, as well as place names.

Based on participants' comments, the system was found to be effective for sharing up-to-date accessibility information and for inputting different types of barrier-free/barrier information, and it could also be easily modified. Some experts also commented that the web version of the accessibility map provided by the system could be a useful alternative to a paper version. The reason for this is that the final print version would not be updated frequently and could not therefore reflect updates such as short-term construction sites, whereas a web-based map could inform visitors of temporary accessibility changes. In addition, the system could be used to easily share assessment results, so the DSO also suggested that the map produced by our system would be useful in reporting to facilities administration offices and for health and safety management.

4. Conclusion

In this study, we presented a social platform through which to obtain and present accessibility information appropriate to users' situations, such as disability and location, and to share barrier-free information provided by other users. We also discussed the results of an evaluation of the system conducted via investigative fieldwork regarding barrier-free/barrier conditions on a university campus. The achievements reported in this paper can be summarized as follows:

- 1) The results of the system evaluations indicate that it can be useful for accumulating accessibility information: participants regarded our system as effective for sharing, modifying, and providing up-to-date information on accessibility conditions.
- 2) According to the results of a text analysis of complementary information regarding shared accessibility, the number of characters is significantly greater in barrier information than in barrier-free information.
- 3) The factors for users' continuous information entry include user-friendly interfaces, functions for motivation maintenance, use of existing information, quality control, and security management. These factors are complexly related with each other; for example, users' motivation can be secured by the appeal of the demand for accessibility information by people with disabilities, as well as the high-quality accessibility information obtained from users and external sources.

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