A GIS-BASED TECHNOLOGICAL ASSIST FOR TRAVEL PLANS OF THE VISUALLY IMPAIRED

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Keywords: Visual impairment, e-AT, AHP, GIS, Factor Analysis

Various technologies have been developed for assisting the ability of the visually impaired to travel, e.g., long canes, textured paving blocks, infrared- and GPS-based speech output guidance systems, etc. In particular, the guidance systems using the infrared beams and the GPS can be defined as the electronic information technology based assistive technologies (or e-AT). In the guidance system using an infrared beam, such as the Talking Sign system of remote signage, the user obtains, locally, the name of a location in a public space. On the other hand, the GPS-based system [1]-[4] globally supplies the user with positional guidance, based on numeric data from satellites. These e-ATs are of help for the visually impaired in traveling to cities and towns. However, in a survey on lifestyles of about 300,000 visually impaired people, the Ministry of Health, Labor and Welfare in Japan, discovered that about 40 % do not travel very much, as indicated in Table 1. In Table 1, the gray region (a few days every month, or year, and staying at home) means that, in fact, the visually impaired do not go out. The question arises as to why do the visually impaired stay at home, or do not travel? What is inadequate regarding such assistive technologies?

Table 1: A questionnaire of 300,000 visually impaired people
(The Ministry of Health, Labor and Welfare in Japan, 2002)

Travel behavior	Almost everyday	30 %
	A few days every week	27 %
	A few days every month	20 %
	A few days every year	13 %
Staying at home		7 %
No answer		3 %

Gärling [5] proposed a behavioral process to illustrate the interrelation between information acquisition and travel. Gärling's proposal comprises three sequential steps; firstly: an action plan; secondly: formation of a travel plan (travel plan) and finally: execution of the travel plan (travel performance). The action plan stimulates people to travel. Secondly, the travel plan, rendering the action plan operational, is needed to achieve the travel performance. The travel performance entails not only direct observation of the environment but also maintenance of the traveler's orientation within it. Integration of this travel performance results in a navigation that involves the updating of the position and orientation, whilst traveling towards the destination. If sequential transformation from the travel plan to the travel performance is broken by some disability, it is difficult to achieve the necessary navigation. Under these circumstances, infrared- and GPS-based speech output guidance systems are helpful for the travel performance of the visually impaired. However, if the transformation from an action plan into a travel plan is broken, infrared- and

GPS-based speech output guidance systems are not so useful. In this case, the 40% visually impaired who are not inclined to go out need other types of assistive technology to construct their travel plans.

The main purpose of our research is to clarify a technological possibility for assisting the travel plans of the visually impaired. To this end, we have developed tentative software to assist travel plans of the visually impaired before commencing their travel. In particular, self-determination would play an important role in travel planning when selecting an appropriate travel route between the starting point and the destination. Therefore, we have applied an analytic hierarchy process (AHP) technique, which is a mathematical model of human decision-making, to our software as a self-determination assist for the visually impaired. It was difficult, however, to select a couple of preset travel routes automatically. We addressed this problem by applying a factor analysis of the road sections in the geographical information system (GIS) database. Figure 1 shows a schematic flow of our development. In Figure 2, we illustrate our software. Finally we show an example of the determination of a travel route in figure 3.

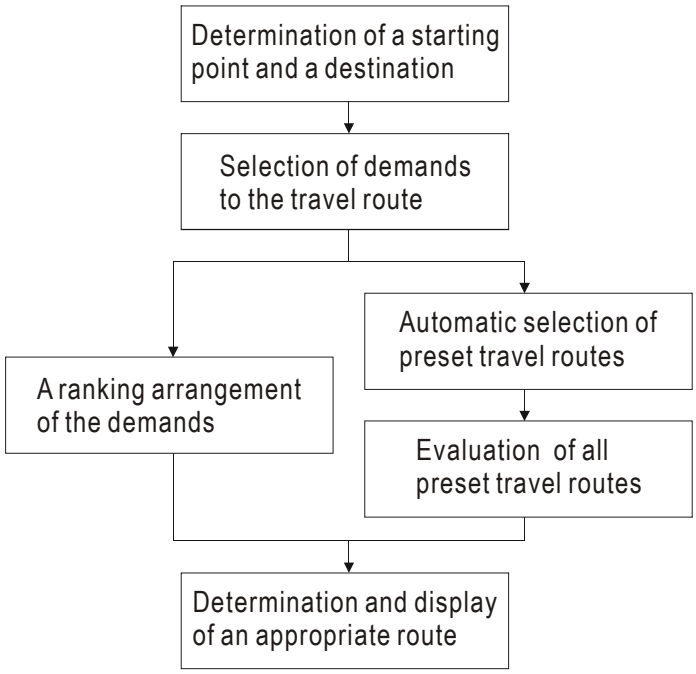
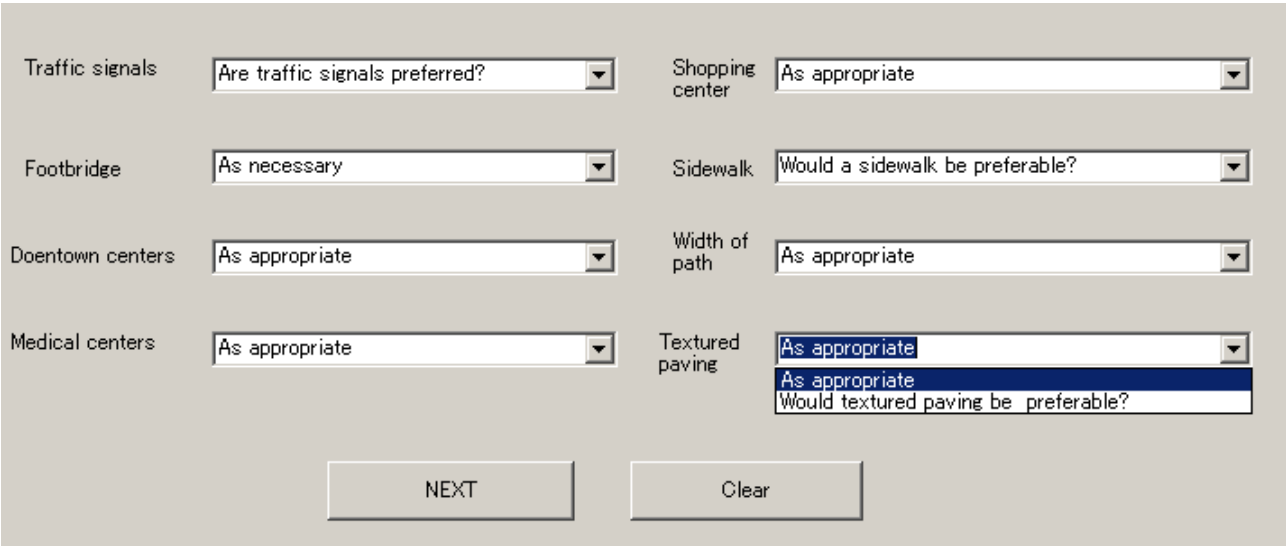


Figure 1: Schematic flow of the development of AHP-GIS-based decision-making software.

(a)



(b)

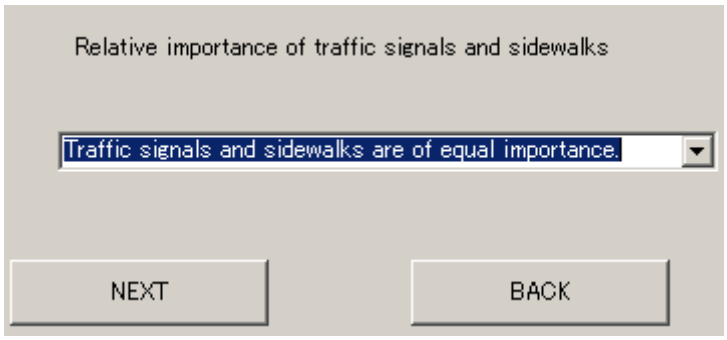


Figure 2: Images of our software displays in selecting demands for the travel routes.

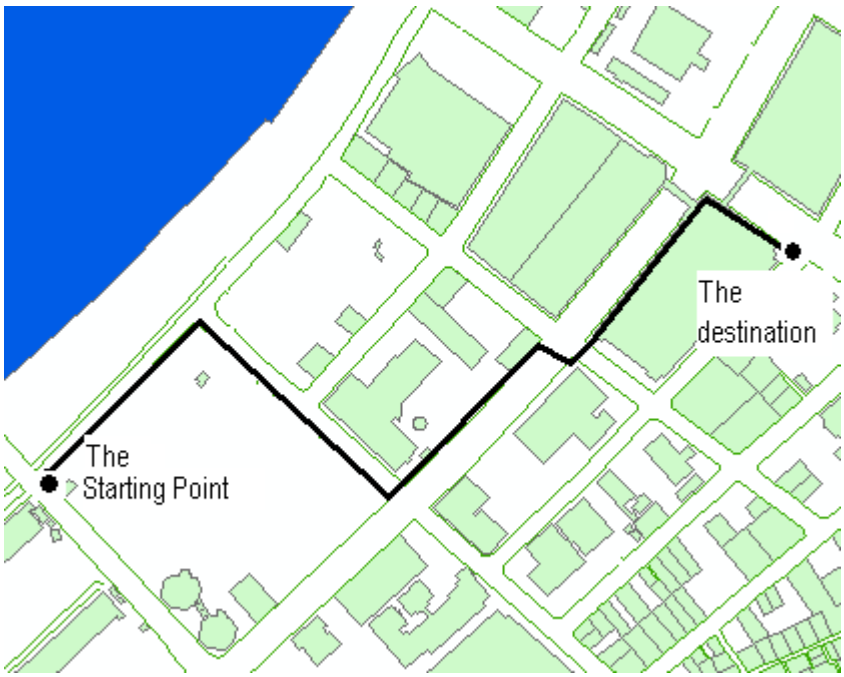


Figure 3: An example of the result.

Acknowledgement. This research was partially supported by Japan Society for the Promotion of Science (JSPS), Grant-in-Aid for Young Scientists (B), and Mitsubishi Foundation, the 36th Grants for Social Welfare Activities.

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