Chapter 22

Game Aspects in Collaborative Navigation of Blind Travelers

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ABSTRACT

This chapter shows how elements of gamification, i.e. game thinking and game mechanics, can be integrated into a collaborative navigation system for visually impaired persons in order encourage them to travel independently and thus improve their quality of life and self-confidence. The system supports independent navigation in unknown places by mediating help from another visually impaired person, who is familiar with the particular place. Our system utilizes a thermal user interface to introduce an additional communication channel and thus to increase the usability of the system. The system has been successfully enhanced by game elements and illustrates the potential of introducing game elements into these systems.

INTRODUCTION

The ability to live independently is crucial for the quality of life and the self-confidence of people with special needs. From the perspective of quality of life, the most important activity for visually impaired people is independent traveling. Unfortunately, visual impairment has negative effects especially on the navigation and orientation skills needed for efficient independent traveling (Golledge, 1993). The restricted mobility caused by visual impairment typically results in decreased involvement of visually impaired persons in activities that require traveling (Golledge, Klatzky, & Loomis, 1996). It has been observed (Wycherley & Nicklin, 1970) that visually impaired people experience a high level of stress whenever they try to travel independently. Although they undergo special training where they learn specific navigation and orientation techniques and use more and more sophisticated navigation aids, a study by White and Grand (2009) revealed that...
almost 30% of visually impaired people never leave their homes independently. Only a fraction of blind people travel independently to unknown places (Golledge, 1999). Restricted mobility typically results in loss of leisure time activities (according to LNS 2004, 38% of visually impaired people reported at least some interference with their leisure activities), loss of career and work opportunities, and loss of social contacts (Caroll, 1961). Independent movement plays an important role in the process of adjustment to blindness. According to the model defined by Tuttle and Tuttle (2004), the adjustment process consists of seven phases:

1. Trauma,
2. Shock and denial,
3. Mourning and withdrawal,
4. Succumbing and depression,
5. Reassessment and reaffirmation,
6. Coping and mobilization, and
7. Self-acceptance and self-esteem.

Independent movement and the ability to navigate in known and unknown spaces is important for the sixth phase, coping and mobilization, where it can help to develop key competences, such as the ability to work, to create social relations, to act independently, etc.

A tele-assistance center with a navigation instructor can help to tackle the problem of stress level and reluctance to travel to unknown places. The bottleneck in this solution is the limited availability of navigation instructor services and the limited number of routes known with the necessary level of detail. However, according to a study by Balata, Franc, Mikovec and Slavík (2014), visually impaired people memorize relatively long routes at a very high level of detail. This finding led us to base a tele-assistance service on visually impaired volunteers, and to build up a system in which one visually impaired person navigates another. To reach a satisfactory level of efficiency we need to solve two problems. First, we need to reach a critical mass of volunteers who will cover a significant number of routes and to ensure almost non-stop availability of the service. Second, a training methodology for navigation instruction needs to be created. We focus here on the problem of recruiting volunteers, which can be approached by introducing game aspects into the navigation system.

In this chapter we illustrate how game elements can be integrated into a navigation system based on a collaborative tele-assistance service. The introduction of game aspects is aimed at attracting a critical mass of volunteers, and at supporting the social activity of visually impaired people through cooperation within the framework of a game. In the section on Related Work, we describe the problem of navigation without visual cues, the role of nontraditional user interfaces in HCI, the problem of game development, and the potential of thermal interfaces in games. The navigation system is described in the section on Collaborative Navigation of Visually Impaired People. The sections on Game Aspects of Collaborative Navigation and on Game Aspects Supported by a Thermal Interface describe how gamification can be implemented in our navigation system. In the Discussion section, we discuss the potential of gamification and thermal interfaces for improving navigation systems. Future steps in our research are indicated in the section on Future Research Directions.

RELATED WORK

The problem of navigation for visually impaired people spans across several fields of research. The first problem area concerns navigation for visually impaired people who cannot use visual cues. We will describe some differences between visual and non-visual navigation, and we will discuss the consequences of these differences. The second problem area had arisen when visual impairment limits the communication channels, since vision is
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