Chapter XXXVI
Designing Mobile Technologies for Individuals with Disabilities

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ABSTRACT

While mobile devices offer many innovative possibilities to help increase the standard of living for individuals with disabilities and other special needs, the process of developing assistive technology, such that it will be effective across a group of individuals with a particular disability, can be extremely challenging. This chapter discusses key issues and trends related to designing and evaluating mobile assistive technology for individuals with disabilities. Following an overview of general design process issues, we argue (based on current research trends) that individuals with disabilities and domain experts be involved throughout the development process. While this, in itself, presents its own set of challenges, many strategies have successfully been used to overcome the difficulties and maximize the contributions of users and experts alike. Guidelines based on these strategies are discussed and are illustrated with real examples from one of our active research projects.

INTRODUCTION

In an assistive capacity, computer technology can play an important role in helping to increase the standard of living for individuals with, for example, physical, cognitive, developmental, psychiatric, and learning disabilities. Technology can also benefit individuals with other special needs, for example, users with limited literacy skills and older users (age 65+). Technology in this genre (commonly known as assistive technology) can play a rehabilitative role to help individuals overcome a disability; it can also help individuals with a disability or special need to perform a particular
activity associated with daily living that they would otherwise be unable to do, thus providing a degree of independence. For the purpose of discussion in this chapter, we refer collectively to persons with disabilities and those with other special needs as individuals with disabilities.

Mobile computer technologies have many features that make them well suited to delivering assistive support. Being portable, they can be used to assist in various settings beyond the desktop. Recent mobile devices also have the capacity to exploit location and context information, and are thereby able to provide more advanced and/or intelligent assistance. Mobile devices are also becoming increasingly more powerful in terms of computing power, memory storage, and network capabilities. The cost of mainstream mobile computing is, however, relatively inexpensive compared to the cost of traditional desktop computers, which makes mobile devices more financially accessible.

Mobile devices can help individuals with disabilities in a number of ways (Bertini & Kimani, 2003) by, for example, acting as:

- An aid to carry out daily activities (e.g., individuals with a physical disability can use a device to remotely issue commands to operate PCs, elevators, doors, etc.)
- A means to communicate with others
- A guide or advisor that exploits contextual information to proactively help or warn the individuals

Despite the relative infancy of mobile technologies per se, many assistive applications have already been researched and developed based on commercial handheld devices and/or mobile phones. For example: Myers et al. (Myers, Wobbrock, Yang, Yeung, Nichols, & Miller, 2002) developed software to run on Palm OS and other mobile devices that assists individuals with neuromuscular disorders (e.g., Cerebral Palsy) to enter text into a computer; Fischer and Sullivan (2002) designed a proof-of-concept system for reminding users with cognitive disabilities through location-aware mobile phones about when to get on and off public transportation; Davies et al. (Davies, Stock, & Wehmeyer, 2002) have developed multimedia prompting software on a Windows CE mobile device to help users with mental retardation to complete work tasks; Wu et al. (Wu, Baecker, & Richards, 2005) created a software application to run on a Palm OS device that helps prevent users with amnesia from experiencing disorientation; and Moffatt et al. (Moffatt, McGranere, Purves, & Klawe, 2004) developed a sound- and image-enhanced schedule planner to run on a Windows CE device to help users with aphasia. To our knowledge, all of these applications, except the proof-of-concept prototype by Fischer and Sullivan (2002), have been implemented as fully functional prototypes that have been tested in the field by target users.

While mobile devices offer many possibilities for innovative assistive technologies, the process of developing an assistive technology, such that it will be effective across a group of individuals with a particular disability, can be extremely challenging. First, designing assistive mobile technology must consider whether inherent properties of a mobile device platform may make using mobile applications more difficult for certain users with disabilities (e.g., small screen size for people with visual impairments, small physical controls for people with neuromuscular disorders). Further, each user population has unique needs and abilities that heavily influence both the design and the design process; furthermore, individual user characteristics often vary considerably across the members of a user population and, if suffering from a degenerative disability, any one individual's needs may change on a day-to-day basis. In a group of persons with vision impairment, for example, individuals may differ greatly in terms of their level of impairment, as well as other usability-related factors such as age, experience with computers, and physical capabilities. Although the same might be said of any user population, given the very specific needs and abilities of individuals with disabilities, researchers and/or developers often find it hard to relate to and understand the requirements and/or constraints of such populations and their individual members; hence, the design process is often considerably more challenging than the norm.