Chapter 8.19
Voice–Enabled User Interfaces for Mobile Devices

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ABSTRACT

The use of a voice interface, along with textual, graphical, video, tactile, and audio interfaces, can improve the experience of the user of a mobile device. Many applications can benefit from voice input and output on a mobile device, including applications that provide travel directions, weather information, restaurant and hotel reservations, appointments and reminders, voice mail, and e-mail. We have developed a prototype system for a mobile device that supports client-side, voice-enabled applications. In fact, the prototype supports multimodal interactions but, here, we focus on voice interaction. The prototype includes six voice-enabled applications and a program manager that manages the applications. In this chapter we describe the prototype, including design issues that we faced, and evaluation methods that we employed in developing a voice-enabled user interface for a mobile device.

INTRODUCTION

Mobile devices, such as cell phones and personal digital assistants (PDAs), are inherently small, and lack an intuitive and natural user interface. The small keyboards and displays of mobile devices make it difficult for the user to use even the simplest of applications. Pen input is available on PDAs, but is difficult to use on handheld devices.

Voice input and output for mobile devices with small screens and keyboards, and for hands- and eyes-free operation, can make the user's interaction with a mobile device more user friendly. Voice input and output can also facilitate the use of Web Services (Booth, Hass, McCabe, Newcomer, Champion, Ferris, & Orchard, 2004) from a mobile device, making it possible to access the Web anytime and anywhere, whether at work, at home, or on the move. Global positioning system (GPS) technology (U.S. Census Bureau, 2006)

can provide location information automatically for location-aware services.

Many everyday applications can benefit from voice-enabled user interfaces for a mobile device. Voice input and voice output for a mobile device are particularly useful for:

- Booking theater and sports tickets, making restaurant and hotel reservations, and carrying out banking and other financial transactions
- Accessing airline arrival and departure information, weather and traffic conditions, maps and directions for theaters, restaurants, gas stations, banks, and hotels, and the latest news and sports scores
- Maintaining personal calendars; contact lists with names, addresses, and telephone numbers; to-do lists; and shopping lists
- Communicating with other people via voice mail, e-mail, short message service (SMS), and multimedia message service (MMS).

It is important to provide several modes of interaction, so that the user can use the most appropriate mode, depending on the application and the situation. The prototype system that we have developed supports client-side, voice-enabled applications on a mobile device. Even though the applications support multimodal input, allowing keyboard and pen input, we focus, in this chapter, on voice input and on multimodal output in the form of voice, text, and graphics. The prototype includes a program manager that manages the application programs, and six voice-enabled applications, namely, contacts, location, weather, shopping, stocks, and appointments and reminders.

BACKGROUND

A multimodal interface for a mobile device integrates textual, graphical, video, tactile, speech, and/or other audio interfaces in the mobile device (Hjelm, 2000; Oviatt & Cohen, 2000). With multiple ways for a user to interact with the applications, interactions with the device become more natural and the user experience is improved. Voice is becoming an increasingly important mode of interaction, because it allows eyes- and hands-free operation. It is essential for simplifying and expanding the use of handheld mobile devices. Voice has the ability to enable mobile communication, mobile collaboration, and mobile commerce (Sarker & Wells, 2003), and is becoming an important means of managing mobile devices (Grasso, Ebert, & Finin, 1998; Kondratova, 2005).

The increasing popularity of, and technological advancements in, mobile phones and PDAs, primarily mobile phones, is leading to the development of applications to fulfill expanding user needs. The short message service (SMS) is available on most mobile phones today, and some mobile phones provide support for the multimedia messaging service (MMS) to exchange photos and videos (Le Bodic, 2002). The mobile phone manufacturers are no longer focused on making a mobile phone but, rather, on producing a mobile device that combines phone capabilities with the power of a handheld PC. They recognize that the numeric keypad and the small screen, common to mobile phones of the past, do not carry over well to handheld PCs (Holtzblatt, 2005).

With the emergence of Web Services technology (Booth et al., 2004), the Web now provides services, rather than only data as it did in the past. Of the various Web Services available to mobile users today, the map application seems to be the most popular, with online map services available from Google (2006) and Yahoo! (2006b). Much progress has been made in creating the multimodal Web, which allows not only keyboard and mouse navigation but also voice input and output (Frost, 2005).

GPS technology (U.S. Census Bureau, 2006) already exists on many mobile devices, and can be used to provide location-aware services (Rao

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