TalkingBadge Demo

John Paulin Hansen
IT University of Copenhagen
Rued Langgaards vej 7,
DK-2300 Copenhagen,
paulin@itu.dk

Wang Wusheng
School of Electronics
Engineering and Computer
Science, Peking University
wws@pku.edu.cn

Irina Shklovski
IT University of Copenhagen
Rued Langgaards vej 7,
DK-2300 Copenhagen,
irsh@itu.dk

ABSTRACT
TalkingBadge is a Bluetooth platform for indoor location-based audio messaging, supporting zone-specific information retrieval and one-way text-to-speech paging via smartphones or a TalkingBadge piece of hardware that the user might carry with them. When people walk through a zone covering a few to fifty meters they can listen to short audio messages sent to them. The platform provides zone-based tracking in a low-cost fashion, which makes large-scale in-door deployment feasible for a range of locations, including airports, shopping malls and hospitals.

Author Keywords
Location-based services, Bluetooth, tracking, tagging, badges, ubiquitous computing, voice interfaces, text-to-speech, privacy, disability, interactive.

ACM Classification Keywords
H.5 [INFORMATION INTERFACES AND PRESENTATION]:

H.5.2 User Interfaces - Evaluation/methodology, Prototyping, Voice I/O

INTRODUCTION
As is common with location-based services, privacy concerns are at the forefront of use considerations. The HCI community has seen scores of studies considering location-sharing and other such applications. The TalkingBadge deals with privacy concerns in an innovative way by introducing episodic rather than continuous location tracking in areas that are clearly marked as such. The empirical question remains whether this would alleviate privacy concerns and to what extent.

SYSTEM DESCRIPTION
TalkingBadge uses Bluetooth zone localization for several reasons: it is supported by most mobile phones, PCs and tablets; Bluetooth has been a standard for many years, built from inexpensive chips and supported by widespread software libraries; the read-range can be adjusted from just a few centimeters up to 50 meters; and antennas may be placed in stationary computers around a building, making the cost of the necessary infrastructure reasonable.

There will be two versions of the system: a smartphone (i.e., Android) application of the TalkingBadge and a physical badge with just a minimum set of features, in order to keep the price low (i.e., <20€) (Fig. 1). The platform is intended for use by people on the move in places such as airports, shopping malls or busy workplaces. It is also meant to support environments where smartphones are restricted, for instance at hospitals, and to support users who do not have a smartphone, or users who do not have the capabilities to operate a smartphone, for instance individuals with vision or cognitive impairments.

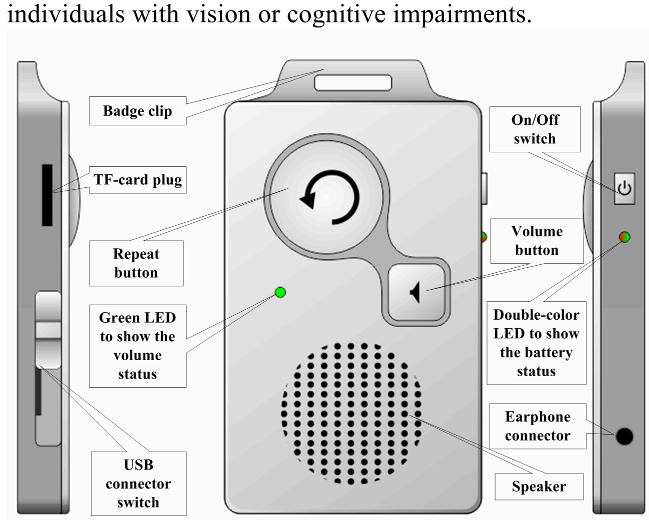

Figure 1: Interface components of the TalkingBadge (size 10 x 5 x 1 cm)

The TalkingBadge application can run on different Bluetooth Devices (BD), for instance a smartphone, tablet or a PC, or the TalkingBadge tag that we will be demonstrating at the conference. Bluetooth Nodes (BN) are fixed units inside or outside a building with a Bluetooth antenna constantly scanning for devices around it, thereby localizing them when detected.

BN are also used for communication with the detected BDs, sending a command or a sound file to it. The Bluetooth Server (BS) collects BD detection information from the BNs (i.e., time of day and the Bluetooth MAC address of detected devices) and they control the BNs to communicate with BDs. For instance the BS may adjust the detection signal threshold separately for each node, covering a range

NordiCHI'12, Oct 14-17 2012, Copenhagen, Denmark.
ACM 978-1-4503-1482-4/12/10..

from a few centimeters to 50 meters. Server Application (SA) runs on a computer, controlling which command or file is to be sent to a particular BD depending on where the BD is located, who owns it, what time of day it is, and whatever the purpose of the service might be.

PRIOR WORK

TalkingBadge stems from a previous project SPOPOS [1] where we installed a zonebased localization system with more than 30 Bluetooth antennas in Copenhagen airport.

The idea of a "smart badge" locating people and objects has a long history within ubiquitous computing, starting with the Active Badge developed at the Olivetti Research Lab in the nineties [10]. Mobile phones were not common at that time, so one of the main applications considered was telephone call routing. The inventors also envisioned that staff and patients at hospitals could be found more easily with indoor tracking technology. Conferences are another apparent application area for smart badges. McCarthy [3] tracked RFID-tags worn by conference attendees to automatically announce speakers on displays and to encourage people to engage informally around proactive displays showing images of personal interest to those standing nearby. MIT Lab has done extensive research in wearable sensor networks and the social dynamics that they may facilitate [6].

We intend to use audio and vibration as the sole output from our TalkingBadge because it supports people on the move who might not have time to take the device out of their pocket, activate it, and then read a message. Nepper et al. [5] suggested using speech for proactive (i.e. not-requested) execution of location-based services, for instance a tourist guide. They outline how this can be implemented with tools like text-to-speech and VoiceXML, among others. Vadas et al. [9] compared a synthesized speech audio display to a head-down text display while participants were walking. Comprehension scores for the two displays were compatible but the participants walked faster and saw improvements in their ability to navigate when using the speech audio display. Sawhney and Schmandt [8] presented a wearable platform, Nomadic Radio, for managing voice and text-based messages. They argue that speech and audio interaction is particularly appropriate in mobile scenarios for several reasons: it fits into small devices without keyboard or monitor, it is hands- and eye-free, and it can be attended with peripheral awareness. Nass and Brave [4] have conducted extensive research in the expressiveness of synthetic speech and the design of voice interfaces. They pointed to the potentials in differentiated use of synthetic voices with varying gender, age and emotional tones. Finally, several papers have explored the possibility of using location-based guiding for people with special needs; [7] developed a system to assist people with low vision around buildings and [2] explored the design of a way finding system for individuals with cognitive impairments.

REFERENCES

1. Hansen, J., Alapetite, A., Andersen, H., Malmborg, L., and Thommesen, J. Location-based services and privacy in airports. *Human-Computer Interaction–INTERACT 2009* (2009), 168–181.
2. Liu, A., Hile, H., Kautz, H., Borriello, G., Brown, P., Harniss, M., and Johnson, K. Indoor wayfinding: Developing a functional interface for individuals with cognitive impairments. *Disability & Rehabilitation: Assistive Technology 3*, 1-2 (2008), 69–81.
3. McCarthy, J., McDonald, D., Soroczak, S., Nguyen, D., and Rashid, A. Augmenting the social space of an academic conference. In *Proceedings of the 2004 ACM conference on Computer supported cooperative work*, ACM (2004), 39–48.
4. Nass, C., and Brave, S. Wired for speech: How voice activates and enhances the human-computer relationship, Cambridge, MA: MIT Press, 2005.
5. Nepper, P., Treu, G., and Küpper, A. Adding speech to ocation-based services. *Wireless Personal Communications 44*, 3 (2008), 245–261.
6. Paradiso, J., Gips, J., Laibowitz, M., Sadi, S., Merrill, D., Aylward, R., Maes, P., and Pentland, A. Identifying and facilitating social interaction with a wearable wireless sensor network. *Personal and Ubiquitous Computing 14*, 2 (2010), 137–152.
7. Ross, D., and Lightman, A. Talking braille: a wireless ubiquitous computing network for orientation and wayfinding. In *Proceedings of the 7th international ACM SIGACCESS conference on Computers and accessibility*, ACM (2005), 98–105.
8. Sawhney, N., and Schmandt, C. Nomadic radio: speech and audio interaction for contextual messaging in nomadic environments. ACM Transactions on *Computer-Human Interaction (TOCHI) 7*, 3 (2000), 353–383.
9. Vadas, K., Patel, N., Lyons, K., Starner, T., and Jacko, J. Reading on-the-go: a comparison of audio and hand-held displays. In *Proceedings of the 8th conference on Human-computer interaction with mobile devices and services*, ACM (2006), 219–226.
10. Want, R., Hopper, A., Falcao, V., and Gibbons, J. The active badge location system. *ACM Transactions on Information Systems (TOIS) 10*, 1 (1992), 91–102.