

Touch Headphones: An Example of Ambient Intelligence

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ABSTRACT

The Touch Headphones are presented as an example of Ambient Intelligence, and aim to improve interaction with portable music players when on the move. Two capacitive touch sensors in each earpiece enable control via tapping on the earpieces, and an automatic control lock feature.

ACM Classification: H.5.2 [User Interfaces]: Interaction styles - Input devices and strategies - capacitive touch sensor. J.7 [Computers in Other Systems]: Consumer products - Portable music players - music playback.

General terms: Design, Human Factors

Keywords: Headphones, touch sensors, input techniques

INTRODUCTION

The Philips vision of the future is 'Ambient Intelligence': people living easily in digital environments in which the electronics are sensitive to *people's needs, personalized* to their requirements, *anticipatory* of their behavior and *responsive* to their presence [1].

USER NEED: EASY CONTROL ON THE MOVE

Control of portables when on the move is suboptimal. A remote control in the headphone wire is difficult to access under clothes, and requires visual attention. Controls on the (wireless) headset is better, but leaves some issues:

- Users cannot look at the ears: they can only use proprioceptive and tactile senses to find the right controls
- There is little space on headphones to place (multiple) controls, particularly on in-ear type headphones,
- The inner ear is sensitive to pressure [2]: conventional buttons are not well suited for in-ear type headphones.

The Touch Headphones provide a solution to these issues, using capacitive touch sensors on in-ear headphones. By tapping on the left and right earpieces the user can control playback and volume of the MP3 player, see Table 1.

Table 1: Mapping of controls

Tapping pattern	Left earpiece	Right earpiece
Single tap	Pause	Play
Double tap	Previous track	Next track
Hold	Volume down	Volume up

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ANTICIPATION AND RESPONSE TO USER PRESENCE

Touch controls can easily be triggered in unwanted situations, for example when the user holds the earpieces in the hand or carries them in the pocket. Using two sensors, for tapping and for in-ear detection, we invented a way to robustly detect when the earpieces have been inserted in the ears of the user, and when they have been taken out. Only when the earpieces have been inserted, the controls are automatically unlocked. In this way users do not have to remind to manually lock and unlock the controls.

IMPLEMENTATION

Two electrodes on each earpiece of in-ear type headphones function as capacitive touch sensors: the metal ring of the speaker and a small piece of copper tape, see Figure 1. The electrodes are connected to a separate box with four QT300 capacitive sensor chips (Quantum Research), some capacitors, and a USB bridge. This box sends the sensor readings to a PC for conversion into touch-, tapping- and in/out-the-ear events to control the playback of a software MP3 player, and arrange the automatic control locking.



Figure 1: The Touch Headphones prototype

FUTURE WORK

One aspect of Ambient Intelligence is not yet addressed in the Touch Headphones, but will be: personalization. We foresee implementation of custom tapping patterns, and adjustment for people that prefer fast versus slow tapping.

REFERENCES

1. Philips Research. What is Ambient Intelligence? (2006). http://www.research.philips.com/technologies/syst_softw/ami/index.html
2. Buil, V., Hollemans, G. Acceptable Operating Force for Buttons on In-Ear Type Headphones. In *Proceedings of the IEEE 9th International Symposium on Wearable Computers (ISWC2005)*, (2005), pp. 186-189.