

# Discovery of Smart Objects in Ubiquitous Environments and the Need for Interaction Metaphors

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**Abstract:** In ubiquitous environments computers and smart devices, especially the technical view on them, disappear and users are supported to concentrate on the tasks they actually intend to perform without having to focus on *how* the required devices are to be operated. This vision on the one hand further encourages the miniaturization of devices and new design concepts, on the other hand it also implies disadvantages.

In such environments it is not really clear to the user *which* objects in a smart environment possess special capabilities. They also do not easily reveal their spectrum of functionalities.

## Ubiquitous Computing

In the vision of ubiquitous computing created by Mark Weiser, the standard metaphors of mouse and keyboard interaction should be overcome and the computer as interaction device itself disappears in an augmented environment [Wei91]. Users in ubiquitous environments should be able to concentrate on their tasks at hand and not have to care about the devices' usage.

Weiser compares ubiquitous interaction to the ancient way of writing; Nowadays, we just make use of a pen and concentrate on the task of writing itself. In former times, it was also necessary to know about the preparation of pinfeathers or the production of ink and papyrus.

## Problem Statement

The ubiquitous vision is a very good orientation point for emerging technologies and new ideas. However, my claim is that there is still a long way to go towards a ubiquitous environment that can *actively* be used.

From my point of view, one very problematic issue concerning ubiquitous computing is that the functionalities and capabilities of the environment and devices are hard to discover by the user. The meaning of certain devices' functions may also not be obvious and clear. In an embedded system like a car for example, hidden functionalities provide "outlets" or "markers" like panels with knobs or buttons. Examples are the radio or ventilation system.

Additionally, once a smart object has been discovered, interaction metaphors need to be found in order to establish an interaction. Not all objects in a ubicomp environment are capable of displaying information or provide input mechanisms for the extended, virtual functionality provided.

## Conceptual Approach

The assumption for my work is that every physical object is tagged as "ubiquitous device". Mechanisms to tag physical objects in order to be recognized by a computer system are for example described by Johnny Chung Lee<sup>1</sup>. This approach is based on the detection of infrared LEDs through camera vision. Henze et al. (cf. [HRL<sup>+</sup>08] and [HRR<sup>+</sup>08]) present solutions to recognize pictures taken by mobile phone cameras. Other approaches make use of RFID tags (cf. [KLO<sup>+</sup>04]).

In order to connect a physical device to a *virtual pendant* offering functionality and enabling the user to interact with it, a mediating instance is needed. As a starting point, a mobile device like a PDA or mobile phone can be used. The interaction metaphor resembles to classical point-and-click adventures in which the player had to explore the current screen with his mouse cursor. Objects of interest were highlighted and actions could be started by clicking at them. This approach lets the user explore a real environment with a mobile device. The camera picture is used to provide additional information on recognized objects by displaying it as video overlay.

The concept of a virtual pendant should provide a possibility to "take away" the services attached to objects. For example, a ticket vending machine could be augmented with a travel route recommendation service and a virtual timetable. Instead of having to remember a complicated URL to a website or download and install an application, a virtual copy of the machine is transferred to the device. So, users experience a real world mapping to virtual services; the ticket vending machine at the main station is still present on the mobile device and its services are still available.

## Summary

The problem stated deals with the difficulty of revealing functionalities of smart objects in ubiquitous environments. A mixture of smart objects and "standard" objects without any functionality even worsens the situation. Interaction metaphors need to be explored that provide users with information about smart objects and their capabilities. These metaphors are supported by mediating mobile devices. These could be mobile phones, PDAs, UMPCs or other hardware supporting the exploration of augmented environments. The metaphoric approach including virtual pendants of real world objects will also be explored in future work.

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<sup>1</sup><http://johnnylee.net/projects/wii/>

## Literatur

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