

Interfaces Everywhere – Interacting with the Pervasive Computer

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ABSTRACT

Due to recent technological advances, it has become possible to integrate sensor and actuator technologies as well as wireless communication in everyday objects and environments. These developments open up a huge amount of innovative interaction scenarios, involving new forms of user interfaces. This half day tutorial gives an overview of the emerging field of everywhere interfaces, referring to computing devices that disappear within objects of everyday life and thus enable omnipresent physical interfaces to the digital world, describes the state of the art of sensor and actuator technologies and demonstrates the development of a smart artefact for controlling everyday environments.

Categories and Subject Descriptors: H.5.2 [Information Interfaces and Presentation]: User Interfaces – Haptic I/O, Input devices and strategies, Interaction styles, Prototyping.

General Terms: Design, Experimentation, Human Factors.

Keywords

Everywhere interfaces, tangible interaction, smart artefacts.

1. INTRODUCTION

Most recent advances in microprocessor-, wireless communication- and sensor/actuator-technologies envision a whole new era of computing, popularly referred to as “pervasive” or “ubiquitous” computing. Autonomous, ad-hoc networked, wirelessly communicating and spontaneously interacting computing devices appearing in great number, and embedded into environments, appliances and objects of everyday use will deliver services adapted to the person, the time, the place – or most generally: the context – of their use. The nature and appearance of computing devices will change to be hidden in the fabric of everyday life, invisibly networked, and will be augmenting everyday environments to form a pervasive computing landscape, in which the physical world becomes merged with a “digital world”. Computers are becoming invisible.

This tutorial explores the interaction paradigms, interface engineering issues, challenges and enabling technologies associated with the provision of context aware interaction styles within ad-hoc, highly dynamic and frequently changing computing environments, where computers are “invisible”, but

physical interfaces are “omnipresent”. Implicit and explicit interaction approaches are analysed at the frontiers of pervasive, integrated and thus “hidden” technology. Challenges in the interaction design space spawned by both the perceived invisibility and the invisibility of technology are presented, and strategies for embedding interaction into everyday objects and environments, into literally every “thing” are identified.

2. TUTORIAL STRUCTURE

The tutorial is structured into the following three parts:

- *Interaction Paradigms:* Starting with the historical foundations, the first part spans interaction modes and modalities, context awareness, the interaction design space, prototyping of everywhere interfaces and consequential social implications.
- *Design and Implementation Principles:* The second part of the tutorial covers the design process and design issues concerning the interaction with artefacts, provides a technological state-of-the-art (e.g. sensors, actuators and output technologies, recognition techniques, interconnection among artefacts and the environments, and software frameworks) as well as a prospect with challenges and visions.
- *Case Study:* The tutorial finally gives an insight in the development of smart artefacts. It is exemplified by a cube for controlling everyday environments, which contains an orientation sensor and optionally further sensors and actuators (e.g. a fingerprint reader for user authentication or vibration elements for haptic feedback). This part includes a presentation of aspects like design, hardware, and software of the cube, as well as a practical demonstration.

Further information is available online at the tutorial’s web site: www.pervasive.jku.at/Research/Conferences/_Tutorial_IUI_2006

3. INSTRUCTORS

All three instructors are affiliated to the Department of Pervasive Computing at the Johannes Kepler University Linz. Alois Ferscha is head of the department and was program chair of PERVASIVE2004. Clemens Holzmann and Michael Leitner are PhD students and work as research and teaching assistants.