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What have they been up to in Lübeck recently?

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Abstract

This talk will give an overview over three related research prototypes for ambient interactive systems. We start by introducing NEMO, the Network Environment for Multimedia Objects. NEMO is a smart media environment for semantically rich, personalised, and device-specific access to and interaction with multimedia objects. Next, a shared electronic whiteboard called ShareBoard is decribed. The goal of ShareBoard is to deliver a natural user interface to working with electronic whiteboards. Integrated within ShareBoard are input devices to recognise the movement of users in the surrounding space and for sensing 3D-gesture. ShareBoard can make use of media objects in NEMO. Last, we introduce the Modular Awareness Construction Kit. MACK is a framework for developing context aware, ambient intelligent systems that blend seamlessly with the users' everyday route, enabling unobtrusive in-situ interaction and facilitating enhanced cooperation and communication. In the future, MACK is to deliver contextual information to both NEMO and ShareBoard.

Introduction

In his seminal paper "The Computer for the 21st Century", Mark Weiser (1991) states that "the most profound technologies are those that disappear". He also introduces tabs, pads and boards as differently sized computing devices to explore this disappearing computer. He later clarifies that such devices only constitute "Phase 1" of ubiquitous computing, since it is "unlikely to achieve optimal invisibility" with such devices (Weiser, 1993).

Today, 20 years later, the promises of ubiquitous or ambient computing have yet to fully manifest themselves. Therefore, it is necessary to look at ambient interactive systems not only as invisible systems, but as part of an ecosystem comprised of both disappearing components and pads, tabs and boards in Weiser's sense, as well as more "conventional" computer systems.

This technical argument is supplemented by a user centered perspective (e.g. Bellotti & Edwards, 2001). Ubiquitous systems in the strictest sense pose new human-computer interaction problems. For example, how can explanations about the system state be delivered to the user if the only available interfaces are embedded into everyday objects like lighting fixtures or other home automation actuators?

In our research, we have therefore explored a design space ranging from disappearing, ambient computing over mobile devices to stationary devices such as interactive boards or presentation systems.

NEMO

The Network Environment for Multimedia Objects NEMO (Lob et al., 2010) is a smart media environment for semantically rich, contextualized, and device-specific access to and interaction with multimedia objects. NEMO is a distributed system that gives users access to media objects like images, videos, audio or text on a wide variety of different devices and in a wide variety of different contexts. Single media objects are called NEMO Information Objects (NIO). NIOs can be bundled in collections called NEMO Multimedia Objects or NMO.

On a very basic level, semantic information is stored implicitly through the organization of multimedia objects in NMOs. In addition, metadata like author name, license information, or free tags can be stored. The metadata can also cover the context of use. For example, a NMO used in a particular meeting situation could be annotated with details of the meeting (time, location, users accessing the NMO). For an even richer representation, the collections can contain links to concepts in an ontology. We have chosen to cater for linking NMOs or NIOs with linked data objects (Heath & Bizer, 2011). The canonical solution here is to link NMOs and NIOs to dbpedia[1].

Access to NIOs can be handled in a device-specific manner. To this end, information about device capabilities (like the types of media that can be played back, screen size, etc.) can be stored inside NEMO. The goal is to provide means for automatic manipulation of objects to fit them to the device requesting the object. Videos can be transcoded to formats supported; images can be scaled according to screen size. In the future, NEMO will also support objects with different representations. Devices with 3D-displays can then, for example, show a 3D-model of an object, whereas devices capable of 2D-output only would show a 2D-rendering of the same object.

ShareBoard

ShareBoard is an electronic whiteboard for local and remote collaborative work. It supports both pen- or touch-based interaction and interaction with mouse and keyboard as well as any combination thereof. Experimental support for 3D-gesture recognition is also available.

A primary design goal for ShareBoard is to provide a “clean” user interface, presenting the user with a prominent working area with almost no menus shown. Important functions can be called using a gesture to open up a pie menu anywhere on the surface. Other interaction elements, e.g. to add images to the drawing area, are provided in drawers on the sides of the working area. ShareBoard can optionally be coupled with NEMO. Images can be downloaded from NEMO and placed on the drawing surface. Vice versa, images

1 http://dbpedia.org/

from local storage that are added to the drawing surface are automatically added to NEMO and annotated with metadata of the current meeting context. Support for other media types is under implementation.

MACK

The Modular Awareness Construction Kit MACK (Schmitt et al., 2011) is a framework for developing context aware, ambient intelligent systems that blend seamlessly with the users' everyday routine, enabling unobtrusive in-situ interaction and facilitating enhanced cooperation and communication. MACK features a central server, the so-called awareness hub. Sensors and actuators (i.e. devices that change the environment or present information) are connected to this central hub.

On the awareness hub, different reasoners can access the sensor data and process it. Their findings are then used as input for higher level reasoners or to drive actuators. MACK makes no assumptions on the inner working of the different reasoners other than that they have to express their input and output in terms of a common ontology. The advantage of this process is that MACK can make use of different reasoning paradigms. In one example application, both rule-based and case-based reasoners are employed.

While MACK is not yet integrated with either NEMO or ShareBoard, the goal is to use MACK to deliver contextual information to other applications. For example, a meeting room can be automatically opened in ShareBoard and media downloaded from NEMO if a meeting on a particular topic is scheduled and the required participants are present.

Conclusions

The frameworks described are used to build various research prototypes. Applications range from shared whiteboards over presentation systems coupling stationary and mobile devices to ambient awareness systems. While

first user studies are promising, MACK has to be integrated in more applications to explore the interplay of disappearing and visible systems.

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