HCII-2003 - Summary

Thematic tracks: interaction design, computer augmented environment, architectures for interaction.

Title: End user programming tools in ubiquitous computing applications.
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Introduction:

Our future environments will consist of an increasing number of augmented artefacts; not only information appliances, but also ordinary objects enhanced with computing and communication capabilities. People may find themselves thrown into a world consisting of distinct, but interconnected via an invisible web of network services, artefacts.

The approach presented in this paper is to enable people make their own applications with 'augmented' artefacts, which are treated as reusable "components", by creating an appropriate infrastructure.

Scenario:

Lets assume a story involving the use of everyday artefacts: John, 21 is familiar with PC use, (text editing, web-searching). John has recently created his Study Application (a simple ubiquitous computing environment), with a new "extrovert-Gadgets" system he recently bought. He has set up his Study Environment to turn on the light automatically, when he is studying on his desk, since the desk light switch is at the back of the shelves and it is hard to reach it.

Basic concept:

The above story is one of the many possible examples that can be realized, by enabling people to shape their own environment. **Extrovert Gadgets**, a project of the E.U. Disappearing Computer initiative (IST/FET), transforms objects in people's everyday environment into autonomous artefacts (the **eGadgets**), by adapting the notion of component-based software systems to the world of tangible objects. The project develops GAS (Gadgetware Architectural Style), an architectural style for engineering eGadgets and Gadgetworlds. This involves GAS-OS, a (software and hardware) implementation of GAS as a distributed system, a set of concepts defined within GAS, and the tools, such as the Editor, to manipulate them.

The **eGadgets** are mostly common objects that range from simple (tags, lights, switches, cups) to complex ones (PDAs, stereos) and from small ones (sensors, pens, keys, books) to large ones (desks, chairs). Anybody can actively shape their environment by associating eGadgets into collaborating collections (the **Gadgetworlds**). With an Editor, people can purposefully create **Synapses**, that are invisible links between the capabability-Plugs of eGadgets. Synapses are the foundations of Gadgetworlds.

In contrast to the typical system-engineering process, there is no a priori system to be built. Creating a Gadgetworld is done by its "system architecture" by altering associations among participating eGadgets. The Gadgetworlds dynamic nature, needs to be understood by people. Nevertheless people should not need to be engaged in any type of formal "programming" in order to achieve the desired functions.

Example of Plugs and Synapses:

The simple story described above can be described as a Gadgetworld consisting of a Desk, a desk-lamp, a book, a chair. The overall Gadgetworld function can be described as:

When the particular CHAIR is NEAR the DESK

AND

ANY BOOK is ON the DESK,

AND

SOMEONE is sitting on the CHAIR

AND

The BOOK is OPEN

THEN

ADJUST the LAMP INTENSITY according to the book LUMINOCITY.

The set of Synapses for this Gadgetworld are (linked Plugs indicated in brackets):

·   Desk (weight=1) -> Lamp (on/off=on)

·   Chair (occupancy=1) -> Lamp (on/off=on)

·   Book (open/closed=open) -> Lamp (on/off=on)

·   Book (luminosity) -> Lamp (intensity)

Editing

A Gadgetworld Editor is a facilitator device that helps in formation of Gadgetworlds. It's main role is to enable people to create a set of Synapses. After someone defines the wished function, (s)he has to decide which eGadgets to use do as to achieve it. (S)he selects these eGadgets using the Editor and then, in a stepwise approach, indicates which plugs should be associated together; the rest is handled by the Editor via the services offered by the GAS-OS.

The purpose of the Editor is threefold: a) to indicate/make visible the available eGadgets and Gadgetworlds b) to form new Gadgetworlds c) to assist with debugging, editing, servicing, etc.

The editor identifies the eGadgets, as well as the current Gadgetworlds that are available and displays them for supervision. Plugs can also be viewed. Plugs have a direct relation to the sensors / actuators and the functions implemented in the eGadget by its manufacturer. Nevertheless, as Plugs are distinguished to lower or higher level, some of them (especially high-level ones) may not always be obvious to people, apart from via the editor. Synapses, the links between the compatible Plugs of eGadgets, are visualized and manipulated through an editing matrix of the Editor. People can form Synapses between certain Plugs, thus creating a Gadgetworld.

Conclusions

A novelty of this approach is that artifacts are treated as reusable "components". The component architecture is made directly visible and accessible to people, via an Editor, so that it enables them to act as programmers. This end user programming approach may be especially suitable for Ubiquitous computing applications. The possibility to reuse artefacts for several purposes, - not all accounted for-, opens possibilities for emergent uses of ubiquitous artifacts, whereby the emergence occurs from people's use.