PECO: 3D-BASED INTERACTION WITH A UPNP MEETING ROOM

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Abstract

Current paper presents the PECo system, a Personal Environment Controller. The aim of PECo is to provide an integrated and intuitive access to the user's personal environment and media repositories. Up to now, the human has to deal with complicated user interfaces. Existing user interfaces for intelligent environments enforce the user to intensively interact with the system and to have deep knowledge of the room's technical infrastructure organization, e.g. IP adresses, device IDs etc. Even if the user needs access both to virtual items (such as personal media) and physical devices at the same time, most of these control solutions do not offer an integrated and unified access. As a result of this user interface weaknesses, available infrastructure and technology become effectively useless.

With the PECo [1,2] system, we address mentioned challenges and provide a novel interaction metaphor to access and manage intelligent environments. PECo uses an automatically created 3D visualization of the environment. Entering a room, PECo discovers the infrastructure and available devices and constructs the integrated user interface. The 3D Visualization makes a direct link between physical devices and their virtual representations on the user's PDA. So the user can just identify a device within his environment based on its position, orientation and form. Then he can access identified devices through the 3D interface and directly manipulate them. For example he can just click on a 3D object to turn on a light. The 3D Interface allows the user to access the infrastructure without having knowledge about specific device names, IP-Numbers, URLs etc.

With the demonstration system described, a user with a PDA can remotely control appliances in a conferencing room, such as media visualisation infrastructure, complex lighting control, window shutters as well as the video conferencing system. Via a video streaming system, the user can observe the results of his interaction.

1. A Novel Interaction Concept

Ambient Intelligence (AmI) is the vision of a world where we are surround by a huge amount of intelligent and small things which are seamlessly embedded in the user‘s environment [3]. They pro-actively support the user by performing every-day activities. In such a world, one major question is how the user will be able to interact with all those devices?

PECo is a personal Environment controller which allows the user to access his physical environment. With the PECo system, we address mentioned challenges of AmI and provide a novel interaction metaphor to access and manage intelligent environments. *Figure 1* shows a complex meeting room and the PECo UI for that room.

One important feature of PECo is its Media Management functionality. It provides the user a single point of access to his distributed personal media. The user has always his media on his PDA

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regardless the physical storage location of the documents. PECo integrates the virtual media repository as well as the physical environment of the user into a personal environment. By interconnecting these two worlds the user can for example move a PowerPoint document -- which is stored on his notebook – to the beamer by just one drag&drop operation. PECo provides a unified interaction metaphor for both documents and devices the user can interact with beamers and lights in the same manner he also interacts with his files. By doing so, we extend the well-known metaphor of direct manipulation to the physical world.

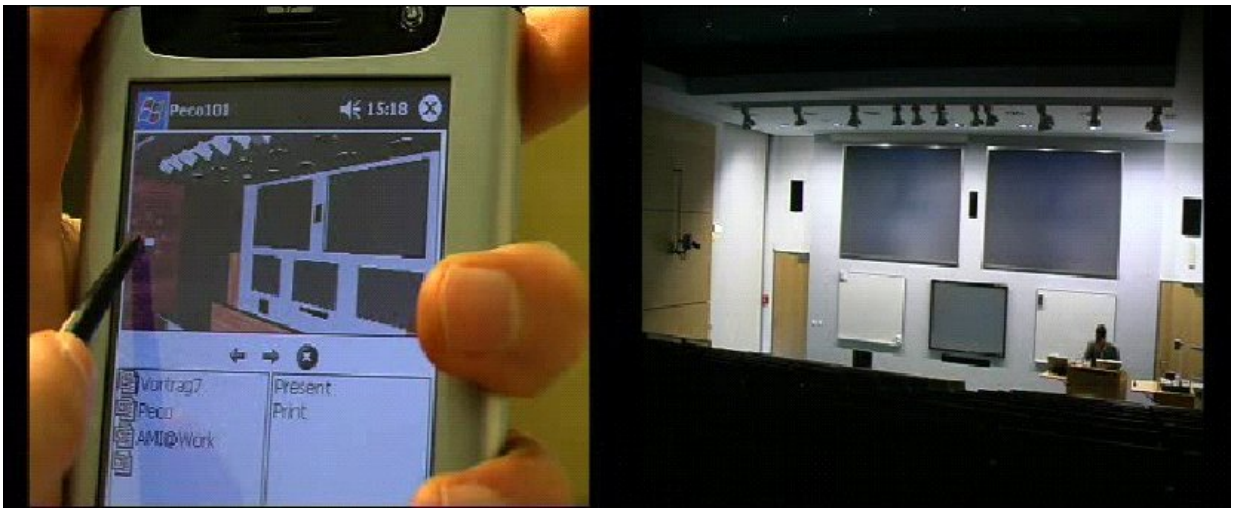

Figure 1 A User interacting with an intelligent conference room using PECo

The PECo UI, the interaction concept as well as the way how the 3D model is created dynamically for a new environment, is described in detail elsewhere [1,2].

2. PECo Interaction Example

In *Figure 2* we can see an example scenario where a researcher uses PECo to interact with a conference room:

1 The researcher has arrived to the room, and he wants to set it up according to his necessities for a conference. Instead of using the control panel, he uses PECo to interact with the room.

2, 3 First he wants to change the lighting settings of the room. The lighting system of the room is quite complex, as it implies different light groups that are controlled independently. With PECo, a simple click operation in the 3D model counterpart allows him to set them as he wants.

4, 5, 6 The user identifies a camera in the room. He wants to show its output to the top left display of the room. This is achieved by performing a simple drag&drop operation in the 3D model from the camera counterpart to the display counterpart.

7, 8 In the two remaining displays, the researcher wants to show a presentation that is in his notebook. PECo's interface has a media server integrated where he can find the desired data. Using again a simple drag&drop operation he can show it in the required displays and control the way it is reproduced with PECo's interface.

9 Finally, the user has set up the environment by just a few simple interaction steps, that involved only clicks and drag&drop operations.

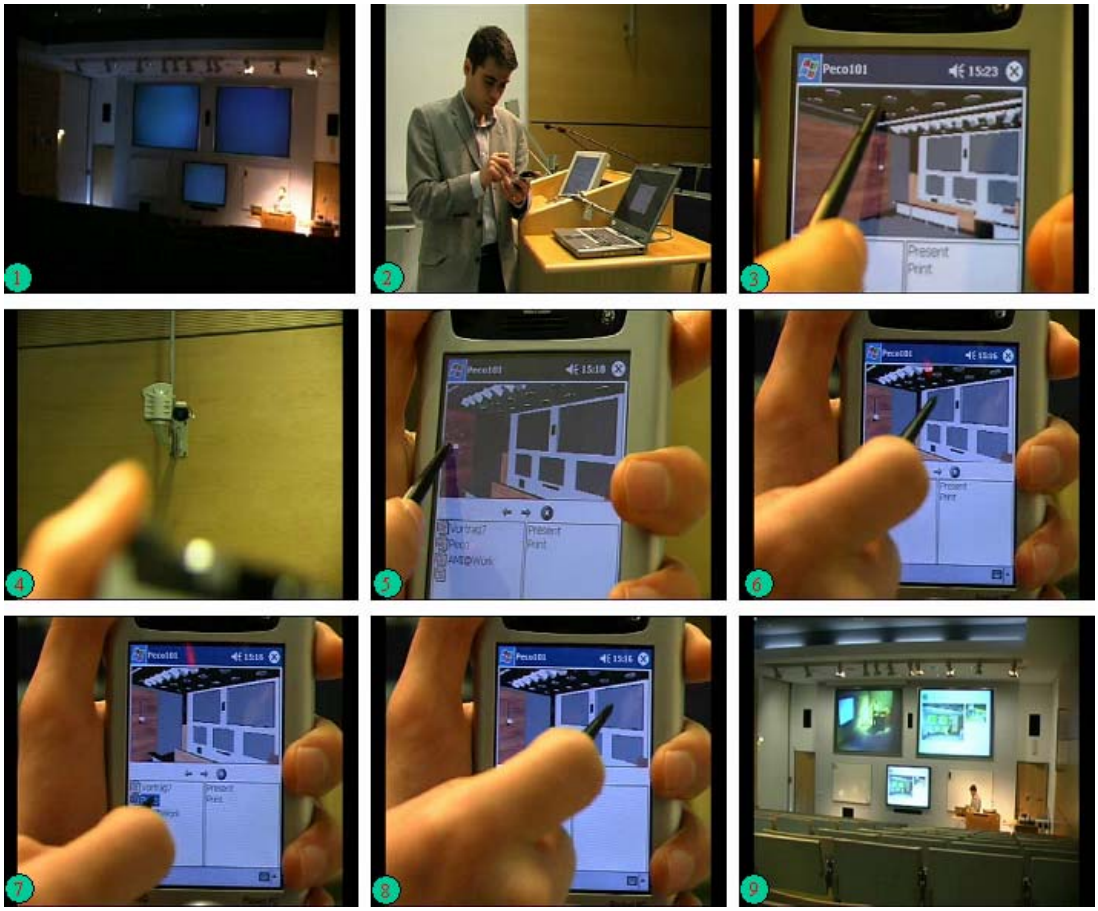

Figure 2 PECo interaction example

3. Room Description

The room we are going to demonstrate is a meeting room. Currently, they are two environments supported by PECo. One is a conference room as shown in *Figure 1*. However, this room is still based on non-UPnP technologies, e.g. EIB or proprietary bus systems. The current demonstration environment is a meeting room which we have wrapped as a UPnP [4] room. It is a meetings room for approximately eight persons. The available devices and commands are listed in *Table 1*:

Device	**Actions**
Light	on/off, brightness up/down
Blind	up/down/stop
Projector	on/off, source selection, shutter open/close
VCR	Play, stop, pause, rec, ffwd, rew, eject
Visualizer	on/off, light on/off, focus more/less, zoom more/less, paper size A4/A5/A6
Camera	PIP on/off/change, move up/down/left/right, zoom more/less
Video-Telephone	Volume up/down/mute, source selection
Mixer	Mic. volume up/down/mute, line in volume up/down/mute

Table 1 Devices available in the room and functions associated with them

4. Related Work

There exist several solutions for providing access to physical environment and to the user's personal media: The Personal Universal Controller (PUC) [5], The Universal Information Appliance (UIA) [6] and The Information Furnace [7] are examples. However, most of them have drawbacks for varying reasons.
In contrast, PECo provides the user new methods to access his physical world and its devices as well as his personal media regardless their storage location. Allowing the user to easily access virtual and physical objects surrounding him is the goal of PECo. It solve common problems of existing systems by allowing to intuitively access complex infrastructures of the physical world based on the 3D-visualization of the user's environment. Furthermore, PECo integrates the user's virtual environment and physical world to a ***personal environment***. The user can drag a presentation from his virtual media repository and drop it to a physical display of his real world by just one interaction step (drag&drop). PECo allows the user to access virtual and physical objects without intensively interacting with the system and interrupting the flow of his main activities.

7. References

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