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Allowing End-users to Actively Participate within the Elicitation of Pervasive System Requirements through Immediate Visualization

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Outline

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- A tool for Supporting the Immediate Visualization of Pervasive Systems
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Efficient requirements engineering activities are essential in order to develop software systems that properly satisfy user needs. These activities are even more important in the particular case of pervasive systems.

Changes in the requirements of a pervasive system once the development process has already started can require changes in the software and in the hardware infrastructure. These changes imply additional effort, time and money.

End-users do not understand the jargon of software developers and developers often do not understand the jargon of end-users. Problems of understanding.
Motivation

**Goal:** involve end-users in the requirements elicitation process in an active way

**Natural Requirements Elicitation technique**

Natural is a concept that is used in the field of end-user development, which is defined as “faithfully representing nature or life”; this implies that it works in accordance with the way people expect.
Contributions

Natural Requirements Elicitation technique

Immediate Natural Visualization

A tool for supporting the Immediate Visualization of Pervasive Systems

Requirements Elicitation Process
Information visualization is concerned with the visualization of a large amount of data and its representation in a comprehensive and natural way for end-users.

We define immediate visualization as offering end-users a natural visualization of the needs that they have just described on their own.

To select the appropriate representation of the visualization, we are inspired by well-accepted techniques and metaphors in the field of End-user Development: Natural Programming, Visual Programming, and Jigsaw metaphor.
A tool for Supporting the Immediate Visualization of Pervasive Systems

- In order to allow end-users to describe their needs within the development process of a pervasive system, we have developed a prototype of an elicitation tool.

- This tool allows end-users to describe their needs and visualize them in an immediate way.

Snapshot of our prototype specifying devices
A tool for Supporting the Immediate Visualization of Pervasive Systems

Architecture

Feature Model

- Smart Home
- Automated Illumination
- TV - Multimedia
- Presence Simulation
- In Home Detection
- Illumination
- Lamp
- Gradual Lamp
- Volumetric detector
- Infrared Detector
- Volumetric Detector
- Temperature Detection
- Window Detection
- Temperature Sensor
- Window Sensor

Initial features

Potential features
• This process determines the steps that end-users must follow to create a system description and how end-users and requirements engineers must interact with each other.

**Phases:**

1. Context scope
2. System specification
3. Advanced system
4. Validation
Phase 1. Context scope

Requirements engineer

Determine the characteristics of end-user context scope (domain and end-user profile) through traditional interviews

Prepares the end-user tool in order to allow end-users to interact with a natural interface adapted to their characteristics

Advanced end-user: Open-option interface

End-user: Closed-option interface
Phase 2. System specification

**Step 2.1:** end-users must describe the users who are allowed to use the system, their desired policies, and the links between user and policy.

**Visualization:**

[Diagram showing the process flow with steps and interactions]
**Phase 2. System specification**

**Step 2.2:** end-users must characterize the physical environment in which the system must be deployed.

**Visualization:**

[Diagram showing the process flow with steps and interactions.]
Phase 2. System specification

Step 2.3: end-users must specify the services needed in their physical environment and where they are located (e.g. Automated Illumination service in the living room).

Visualization:

List of services available

Visualization of the physical environment
Phase 2. System specification

Step 2.4: end-users must specify the **devices** that are available in each location

Visualization:

- **List of devices available**
- **Visualization of the physical environment**
Requirements Elicitation Process

Phase 2. System specification

**Step 2.4:** end-users must specify the *devices* that are available in each location

Visualization:

*Specification of a device*
**Phase 2. System specification**

**Step 2.5:** end-users are able to define the configuration of each specified service

**Visualization:**

**A) Default Configuration**

- Smart Home
- Illum.
- Lamp

**B) Customized Configuration**

- Smart Home
- Illumin.
- Light by presen
- Volum. detector

- Gradual Lamp
Phase 3. Advanced System configuration

- The information related to the description of new services is captured.
- End-users describe the information needed for a new service.

Visualization:

Information needed

Interaction with the requirements engineer
Interaction with the visual language
Extension of the predefined catalogue
Phase 4. Validation

- Requirements engineer validates with end-users the system described. To do this, traditional interview is used.

- If ambiguities or mistakes are detected, the end-users can repeat the different phases of the process in an iterative way.

- Otherwise, the obtained description constitutes a valuable product that allows the requirements engineer to obtain a formal requirement specification that can be used as a guide for the rest of the development process.
Example. An end-user description

A. The Living room

B. Service Configuration

C. Feature Model
Conclusions and Future work

- Our technique **involves end-users in the development process**. This improves the interaction with end-users and makes them more involved in the process.
- The use of a visualization based on the end-user environment allows requirements engineers to **mitigate the problem** that is typically known as “clients do not really know what they want” from early stages of the development process.
- It **avoids end-users having to extend or modify their requirements** once the development process has already started.
- By improving the understanding between end-users and software developers, the **true needs of the end-user system are addressed**.

**Future work:** we are working on tools that help requirements engineers automatically obtain a formal requirements specification from these descriptions.
Thanks!