Agent Oriented Design for Ambient Intelligence

Ao Dai

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Agent Oriented Design for Ambient Intelligence

overview
The Ao Dai Project:

· presented and demonstrated at the 5th NII-LIP6 Workshop, in June 2010.

· developed by Thi Thuy Nga Nguyen, Diego Salomone-Bruno and Andrei Olaru, under the supervision of prof. Amal El Fallah Seghrouchni.

· part of the ongoing collaboration between:

  ▶ LIP6/SMA team – University Politehnica of Bucharest
    Andrei Olaru is PhD student in co-supervision between UPB and UPMC (prof. Amal El Fallah Seghrouchni and prof. Adina Magda Florea).

  ▶ LIP6/SMA team – Institut de la Francophonie pour l’Informatique, Hanoi
    PhD thesis of Thi Thuy Nga Nguyen.

  ▶ LIP6/SMA tema – PUC-Rio
    Diego Salomone-Bruno, Project STIC-AmSud.
Ubiquitous electronic environment that supports people in their daily lives, in a proactive, but "invisible" and non-intrusive manner [Ramos et al., 2008, Weiser, 1993]

What is AmI?

Scenario

Context

Agents

CLAIM

Architecture

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Conclusion & Future Work
Ubiquitous electronic environment that supports people in their daily lives, in a proactive, but "invisible" and non-intrusive manner [Ramos et al., 2008, Weiser, 1993]
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People · Devices

Conclusion & Future Work
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People · Devices · Services

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Ubiquitous electronic environment that supports people in their daily lives, in a proactive, but "invisible" and non-intrusive manner [Ramos et al., 2008, Weiser, 1993]

People · Devices · Services · Communication
Two researchers arrive for the first time on the floor of the LIP6 laboratory – they both must attend a meeting in room 105.

Elements of an Ambient Intelligence environment:

- guiding people by means of light intensity or sound;
- appropriate adjustment of lights and other elements according to user preferences / aggregation of user preferences;
- appropriate choice of available screens for displaying useful information;
- choosing information to display depending on its estimated relevance to the present users;
- detection of incompatible contexts – e.g. unappropriate resources for the users’ activity.
Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves. [Dey and Abowd, 2000]
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In the Ao Dai project, we have so far considered:

- the spatial location of the user
- the user's preferences
- the available computing resources
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Aspects: [Chen and Kotz, 2000]

▶ physical aspect (location, conditions)
▶ user profile and preferences
▶ computing resources
▶ associations
  (e.g. time – place – activity)

▶ temporal aspect
▶ activity
▶ social aspect
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In the Ao Dai project, we have so far considered:
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Software agents are an appropriate implementation for AmI, considering they satisfy the needs of AmI in terms of:

- reactivity
- proactivity
- autonomy
- anticipation
- reasoning
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Agents also offer beliefs, goals, intentions and easier implementation of a human-inspired behaviour.
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For Ao Dai, we use CLAIM + Sympa as agent-oriented programming language and platform.
Agent-Oriented Design for Ambient Intelligence

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Why CLAIM?

- Agent-Oriented programming language created by Alexandru Suna, during his Thesis at LIP6 [Suna and El Fallah Seghrouchni, 2004]
- Eases the programming task involving a Multi-Agent System

CLAIM is based on explicit declaration of agent’s characteristics:

- Knowledge
- Goals
- Capabilities
- Procedures
  - Conditions
  - Triggers
  - ...

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  ➤ ...

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Idea: map contexts to agents:

- each agent represents a device, or a service, or a location, or a user;

- the agent sub-tree of every agent represents the context of the agent and moves together with it.
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Examples:
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Idea: map contexts to agents:

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- the agent sub-tree of every agent represents the context of the agent and moves together with it.

Examples:
Agent interacts only with its parent or its children

Example: Search

1. Search
2. Search/Not found
3. Search
4. Not found
Agent interacts only with its parent or its children

Example: Search

1. Search
2. Search/Not found
3. Search
4. Not found
5. Search
6. Search/Not found
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Example: Search

![Diagram of agent interactions]

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Example: Search

1. Search
2. Search/Not found
3. Search
4. Not found
5. Search
6. Search/Not found
7. Search
8. Search/Not found
9. Search
10. Found (Dev a)
11. Search
12. Not found
Agent interacts only with its parent or its children

Example: Search

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2. Search/Not found
3. Search
4. Not found
5. Search
6. Search/Not found
7. Search
8. Search/Not found
9. Search
10. Found (Dev a)
11. Search
12. Not found
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Agent interacts only with its parent or its children

Example: Search

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**Example: Search**

![Diagram of the search process involving multiple agents](image)

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Example: Search
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Concluding & Future Work

- The Ao Dai project means implementing the idea of linking the two concepts of context and agent in a hierarchy.

- The project was implemented in CLAIM, that offers to developers an easy way to work with agents and hierarchies of agents, at a higher level.

- The demonstration showed how a simple scenario can be implemented, supporting context-aware actions that support the user.

- Future work includes developing the features of agents, a better representation of context, and the extension of the types of context that are supported.
A survey of context-aware mobile computing research.

Towards a better understanding of context and context-awareness.

Ambient intelligence - the next step for artificial intelligence.
*IEEE Intelligent Systems*, 23(2):15–18.

Programming mobile intelligent agents: An operational semantics.

Some computer science issues in ubiquitous computing.
*Communications - ACM*, pages 74–87.
Thank you!

Any Questions?