A methodology for modeling Ambient Intelligence applications using i* framework

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The vision of Ambient Intelligence (AmI) is to create a “physical world that is richly and invisibly interwoven with **sensors**, **actuators**, **displays**, and **computational elements**, embedded seamlessly in the everyday objects of our lives and connected through a continuous network [J.C. Diane, 2005].
1.- Introduction

Also, there are new ways to communicate among human and technology.

In AmI there are different types of interactions:
✓ Human-Technology interaction
✓ Technology-Technology interaction
✓ Human-Human interaction.

Communication among technological elements (Technology-Technology interaction)
1.- Introduction

Problem Statement

The Ambient intelligence allows many areas in computer science that have a significant beneficial influence [J. Augusto, 2007].

However, currently there are no software methodologies that facilitate obtaining software requirements of Aml applications covering the basic components of these applications.

Relation between Aml and other areas in Computing Science [J. Augusto, 2007]
2.- Objectives of the research

Propose a software requirements methodology for Aml applications that helps analysts to understand the role of the key actors of a system of this kind.

i) The development of a modeling methodology that extends i* models.
ii) The development of a case study to provide an empirical validation of the proposed approach.
3.- Scientific Contributions

Develop a modeling methodology that extends i* models with elements specific for AmI systems.

a) The analysis of existing methodologies for requirements engineering
b) The discovery of new modeling elements
c) The proposal of a requirements engineering methodology based on i* framework
3. - Scientific Contributions

3.1 - Analyzing methodologies for modeling Aml applications

- Documentation of requirements approached to users (DoRCU) [G. Báez, 2001].
- Model requirements for embedded systems (ABS-Besoins-Sem) [L. González, 2008].
- Requirements engineering for intelligence environments (RE4IE) [C. Evans, 2014].
- Approach for incorporating technology to business models [A. Martinez, 2016].
3. Scientific Contributions

3.1 - Analyzing methodologies for modeling AmI applications

**Why i?**

- Allow us to generate modules
- Allow us to model graphically
- Allow us to incorporate technology
3. - Scientific Contributions

3.2 - Discovering **new elements of modeling**

- Ubiquity
- Intelligence
- Context sensitivity
- Natural interaction

3. Scientific Contributions

3.3 – Proposed **methodology and a case study**

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Overview of our approach for modeling AmI applications
3.3 – Proposed methodology and a case study

The validation of our approach was carried out in a real case study. This case study implements a software system for the detection of social isolation through AmI [V. Ortiz, 2016]. In this system software, the information is obtained in an automatic way using mobile phones and sensors (beacons).

The goal of this case study was validate our approach and identify the requirements of an Ambient Intelligence system.
3. Scientific Contributions

3.3 – Proposed methodology and a case study

**Business modeling phase.** In this phase, the organization has been modeled through of an i* service model [A. Martinez, 2016].

In this model, we try to capture the context sensitivity through the business context.
3. - Scientific Contributions

3.3 – Proposed methodology and a case study

**Technology modeling phase.** This phase represents all technological components of the software system to-be. It is composed of two models:

- Model of technology to development
- Model of technology to operate.

We take the *Agent* original notation of i* to represent the technological elements into the model.
3. - Scientific Contributions

3.3 – Proposed methodology and a case study

Model of technology to development

This model shows all the technology necessary for developing the application
3. - Scientific Contributions

3.3 – Proposed methodology and a case study

Model of technology to operate

This model shows the representation of the technological elements required for operation of the application.

In this model, we try to capture the **intelligence** defined by the main task and goals, and the **context sensitivity** defined by the environments.

Extension of protocol model [A. Martinez, 2016].
3. – Scientific Contributions

3.3 – Proposed methodology and a case study

**Interaction modeling phase.** In this phase we propose the *user-technology interaction* model. This model shows the interactions that exist in an Aml application. The model incorporates the technological elements defined in the previous phases. The goal of this model is to provide the analyst with the information about the **types of interactions** that exist within the application.
3.3 – Proposed methodology and a case study

Model of user and technology interaction

This model incorporates the technological elements defined in the previous phase.

In this model, we try to capture the *ubiquity* through the technological elements that allows the system runs anywhere, and the *natural interaction* through the specification of new ways to interact with the humans and technology.
General modeling phase. This phase provides information about organizational goals and the goals of the system to-be using a goal-refinement tree model [H. Estrada, 2003].
4.- Conclusions and future work

In this paper, a **methodology for modeling software requirements of Aml applications** is presented. This methodology consists of **five models**, the results on the validation of our approach with the case study showed better clarity in the specification of the **interaction between the user and the system**. In addition to a concrete definition of the objectives and goals of the analysts.

Currently, **we are working on refining our proposed methodology** for validating the identification of all elements of an Aml application. For to do this, we are working in several case studies reals of Aml applications.
Thank you

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