Eliciting User Requirements for Ambient Intelligent Systems: A Case Study

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1. Introduction

Ambient Intelligent (AmI) systems are electronic environments that are responsive and sensitive to the presence of people [1]. Eliciting requirements for AmI systems, like for any novel technology, is hard because of high uncertainties, such as:

1) both the users and use context are unknown;
2) there is no identified problem that needs to be solved (people cannot state in advance what they want);
3) there is no product idea;
4) it is unclear what future technology can do.

There is currently no requirements engineering method for novel AmI technologies. In this short note we present the current state of our research, which aims at defining a method for identifying requirements for AmI systems.

The basic idea of our proposed RE method is this:

1) Choose a representative sample of users.
2) Observe, identify and analyse problems. Cluster them in three levels: the infrastructure, social and individual level.
3) Propose a solution to these problems by introducing AmI technologies, using a scenario-based approach.
4) Observe how problems evolve on all three problem levels related to each other. This allows for high uncertainty problems and solutions to evolve together.

We perform our research by means of case studies and action research of various kinds. We observe how novel technology is introduced and evolves; we use our RE method to identify AmI requirements and reflect on our experience; we let others use our RE method and observe the results. This is done as a part of the Smart Surroundings (SmS) project [2].

2. Case studies

The first case in the SmS project, that we chose to analyze, was an office setting. Since there was no existing AmI system in use, we reflected and investigated a case of technology introduction where people act similarly to how they would act in an AmI environment. Our goal was to study the way how experienced problems and introduced technical solutions were evolving.

In order to choose a representative sample of users and the appropriate existing environment we stated two criteria:

1) There must be significant similarities between an AmI environment and the case. Just as in AmI environments, the case must provide a physical environment that offers ubiquitous services to users, wherever they are.
2) The case must contain new technology that was introduced in a more traditional environment. This is necessary as we want to observe the evolution of problems and solutions in introducing technology similar to AmI.

So, two flexible offices were chosen as cases and their employees as appropriate surrogate users for an analogous AmI office. The reason for this choice is that in a flexible office, a person can work everywhere with the help of appropriate technologies [3] that will satisfy our first criterion. The second criterion was also fulfilled, as there were innovation changes from static to the flexible office.

Our cases were flexible offices of two Dutch governmental advisory companies, each employing circa 500 people. The case study population was 20 employees in total. We used contextual inquiry [4] as an interview technique.
3. Lessons Learnt

The questions in the interviews were related to the changes introduced from static to the flexible working way. We wanted to capture current problems and see how they evolved from a past static office to a flexible office. The observations from the interviews are the following:

A problem was not solved; rather, the problem reappeared in a transformed way in the transition from a static office to a flexible office. Examples of such evolvement are:

- In the static office it was cumbersome to retrieve documents from archives. In the flexible office, the archiving problem transformed from a spatial to a time consuming problem.
- In the static office, people were separated by walls, which prevented relational coordination. Although in flexible offices people have easier face to face contact than in the open environment, the level of communication was not changed due to a lack of informal social knowledge.

A new set of problems appeared, that did not exist before. Examples of such evolvement are:

- In the flexible office, people experienced a violation of their privacy that did not exist before.
- If the roles of respecting the flexible way of working were stricter, defined by organization, there would be stronger need of the personalization of the working environment.
- Because every day employees could work at a different place in the office, they could not find each other easily.
- Due to open space, there was much background noise (people walking, phoning, discussing, etc.) and visual unrest that made people feel uncomfortable.

People (try to) continue their habits. Examples of such evolvement are:

- Implemented infrastructure is framed by the perception of users. Regardless of the introduced changes on the social and infrastructural level, their work process did not change on the content level.
- If violation of the new rules of working would not have an impact on the group, people would violate these rules.

4. Implications for RE

What we learnt was an initial step to identify implications for the RE method. We now transfer what we observed to a hypothetical situation in which AmI will be introduced, and define RE method for AmI environments. From the observation we learnt the following:

- Problem theories are implicit, often incomplete or wrong.
- The problem theories evolve; they must be refined due to new solutions and newly discovered (un)desirable side effects.
- Observed problems have to be clustered, understood, and traced with introduced solutions in order to identify requirements successfully.
- Each identified problem had various instantiations on: the infrastructure, social, and individual level and they were intertwined.
- In the majority of cases the solutions for the identified drawbacks were aiming at solving all problems (including individual and social ones) only on the infrastructure level.
- Solving problems only on infrastructure level brought new problems all over again or they reappeared in a transformed way.

In the future work, we will focus on proposing an AmI solution by introducing novel technologies through a scenario-based approach. Each scenario will present a new technological solution for a problem identified in the flexible offices. We will observe how problems evolve on all three problem levels: the infrastructure, social, and individual level and investigate how they relate to each other. The solution will be refined by observing possible problems on those three levels.

We will use our RE method to identify AmI requirements and reflect on our experience. To refine our method we will let others to use our RE method and observe the results.

5. References