

Requirements Engineering Tools Go Mobile

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1. Introduction

Software tools that support or automate software engineering tasks are typically available on traditional desktop-based workstations. In Requirements Engineering (RE), for example, many such tools are available for acquiring, communicating, modeling, and managing requirements throughout a product life-cycle [9].

In contrast, mobile tools for requirements engineers offer considerable potential. For example, analysts might be able to acquire more complete and realistic requirements for a new system by combining the observation of stakeholders in their work environment with structured tools for asking questions, recording requirements, and augmenting these requirements with audio notes or drawings. In short, mobile devices offer a mechanism for linking the ethnographic and contextual traditions in RE [1] with more structured and interventionist approaches from software engineering. Likewise, important stakeholders who are often difficult to involve in requirements processes could use mobile tools to contribute their goals, expectations, and preferences to the wider RE process.

This vision is rapidly nearing realization. In the last few years the capabilities of mobile devices such as Personal Digital Assistants (PDAs) have advanced considerably. These devices now provide faster processing, increased storage, and improved connectivity. Hence, Mobile Computing will become a dominant computing paradigm [8]. These developments let us envision novel mobile tools for RE that are sophisticated enough to be used in real-world projects.

2. Existing Requirements Tools

In our previous research we have been developing methods and tools supporting the acquisition and negotiation of requirements:

The *ART-SCENE Scenario Presenter* [7] is a web-based tool supporting a team of stakeholders and facilitators to effectively acquire requirements for a software system. The tool is based on CREWS-SAVRE [2, 10] and provides different functions for viewing scenarios and the requirements generated for them. It offers functions to add, edit or delete events, comments, and requirements.

For each scenario the normal course event sequence is available. It also describes generated alternative courses for each normal course event, presented in the form of 'what-if' questions. Facilitators walk through the scenario with stakeholders, guided by the Scenario Presenter, to consider each normal course event and each alternative course linked to that normal course event in turn;

ARENA (Anytime, Anywhere REquirements Negotiation Aids) [5] is a web-based tool supporting a team of stakeholders in eliciting and negotiating requirements in a distributed and asynchronous manner. It is based on the EasyWinWin process and the WinWin negotiation model [4]. ARENA provides negotiation techniques and collaborative tools that guide success-critical stakeholders in elaborating mutually satisfactory agreements.

3. Mobile RE Tools

Our first step in going mobile has been the design and implementation of new mobile RE tools that complement our existing web-based tools. Our aim was to utilize the frequently advertised benefits of PDAs including: anytime/anywhere computing; connectivity/browser support, for example, through Wi-Fi network access; or different input modes such as audio recording, drawing, handwriting, and typing. Furthermore, we had to overcome existing limitations such as screen size, performance, accumulator capacity, network bandwidth, or storage capability. We also tried to explore the scope of mobile RE tools from the users' perspective:

Mobile tools for analysts, that is people trained to acquire requirements then document and analyze these requirements using structured notation. Indeed, mobile tools offer the potential to unite different RE traditions: Whilst requirements documentation and analysis has borrowed from the structured analysis and systems engineering traditions, approaches from softer sciences such contextual inquiry [3] are increasingly important for acquiring requirements. Mobile devices offer the potential to bring structured techniques, for the first time, unobtrusively into the work place;

Mobile tools for stakeholders, typically users and developers who are participating in a requirements elicitation process. Requirements acquisition is increasingly carried out in a distributed and asynchronous environment

with little possibility for stakeholders to meet. By using mobile RE tools stakeholders could more easily participate in selected steps of a requirements engineering process.

The newly developed tools are PDA-based web applications which use a mobile browser and Wi-Fi to access server-side requirements databases:

The *Mobile Scenario Presenter (MSP)* is designed to support analysts to use structured scenarios to acquire requirements systematically and in situ. As such, the analyst can undertake future scenario walkthroughs and observe current system behaviour at the same time. Furthermore, the MSP's what-if capabilities – generating candidate alternative courses for each event – enable the analysts to follow up and ask questions about abnormal and unusual behaviour in different work contexts, thus leading to more complete and correct requirements. Besides capturing requirements as plain text, the tool also allows to attach audio notes and drawings to requirements. Some screenshots of the MSP are available at <http://www.sea.uni-linz.ac.at/Research/Projects/MSP>;

ARENA-M is based on the EasyWinWin process and allows mobile stakeholders to participate in requirements negotiations. Stakeholders have access to the same workspace as other ARENA users. They can express their goals and expectations by contributing statements about their vested interests in an electronic brainstorming tool. There is also a capability that allows stakeholders to define important terms of the project in a shared glossary. Electronic polling is used to prioritize requirements and to visualize situations where a team does not agree. The mobile tools supports the negotiation of mutual commitments by providing access to win conditions, issues, and options raised by other stakeholders and responding to them.

4. Lessons Learned and Future Research

Some lessons learned from designing our RE tools for mobile users include:

- *Understand usage of mobile device - Focus on simplicity:* Features that are made available to mobile users should be carefully selected. Not all features that are useful on a desktop computer will make sense on a mobile device and vice versa. For example, audio recording, navigation, drawing is well-supported on mobile devices. Modelling and detailed documentation of requirements works better on desktop-based computers;
- *Integrate desktop tools and mobile tools:* The previous lesson already indicates that mobile RE tools are only useful if they complement existing tools and environments. Integration is critical and mobile users as well as desktop users should have access to the same workspace;
- *Usability is a primary issue:* Designing the user interface and optimizing navigation and representation of information is challenging due to the limited screen

size [6] and different style of human computer interaction. Usability is also affected as sophisticated user interface concepts can often not be realized because the technology is still immature.

As part of ongoing research with Eurocontrol, we expect to evaluate the MSP. In parallel, the availability of such mobile devices is encouraging us to think more about the integration of contextual inquiry techniques [3] into structured scenario and requirements methods. Another research plan is thus to integrate scenario-based and negotiation-based RE methods and tools.

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