User-Driven Requirements Engineering for Mobile Social Software

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Abstract: Social software is an important phenomenon which allows end-users to be socially connected whenever and wherever they want. The broad distribution of sophisticated mobile devices strengthens the importance of Mobile Social Software while the number of mobile social applications is increasing. Emerging paradigms such as mobile and service-oriented computing raise challenges for the design and development of social software. This paper discusses a novel approach for requirements engineering which is tailored to the needs of developing Mobile Social Software. We present a mobile requirements elicitation tool allowing social software users to document needs in situ. Furthermore, the tool automatically captures contextual information. We also discuss how the gathered requirements and contextual information can inform future social software development.

1 Introduction

Social software is an exciting and important phenomenon in today's software and business world [Tm03] and its weaving into the fabric of daily life is faster than expected. Social software enables its users to communicate, interact and share data with other individuals and gives them the possibility to increase their social interaction. The ongoing widespread use of social software triggers new research and application challenges and opportunities [HB08], [NS08], [Or06]. Based on a literature review, we identified following emerging trends within social software: (i) provision of social software for mobile devices, (ii) integration of location-based services and social software and, (iii) integration of social software and service-centric systems.

Mobile devices such as smartphones have advanced significantly over the last years. Today’s end-users are familiar with these sophisticated mobile devices and an increasing number of Mobile Social Software (MoSoSo) is available [At06]. Mobile Social Software allows end-users to be socially connected anytime, anywhere and often integrates information on location and time.
Traditional social software systems often provide a fixed, predefined functionality which is used by special-interest communities. Novel software engineering paradigms, such as service-oriented computing, drive the personalization of software systems [GTR06] and strengthen immediate system development and deployment. We foresee that service-centric Mobile Social Software services will provide just the right functionality at the right time to social software users.

Developing Mobile Social Software is challenging and little is known on software engineering methods and tools in this new field. Thus, research on social software engineering is needed to support the realization of customized and personalized Mobile Social Software for end-users and social communities. Disciplines such as requirements engineering (RE) [KS98] are important to gather an individual end-user’s needs and to address the design factors critical to the success of mobile social applications [Sm05]. Research in the field of RE is considered to be particularly crucial for social software engineering [CHS06] because state-of-the-art RE approaches provide neither specific method nor tool support.

The research presented focuses on user-led RE for Mobile Social Software. More specifically, our aim is to improve support for requirements discovery for such systems by identifying individual end-user’s needs and contextual information relevant to the early design process. Our goal is to address the needs of tomorrow’s Mobile Social Software engineering based on research strategies that address both social and technical issues. In Section 2 we highlight the research goal in more detail and describe research questions and objectives. Section 3 presents a novel mobile requirements blogging tool for end-users, which allows them to document needs themselves in situ. Furthermore, we describe how the tool uses context sensing technologies to automatically gather information about the end-users’ context and environment. Section 4 discusses how gathered individual end-user’s needs and contextual information can be communicated and visualized in order to inform software design. Section 5 reviews the research questions, gives a conclusion and highlights future work.

2 Research Goal and Questions

The goal of our research is to develop and evaluate a tool-supported requirements discovery method for Mobile Social Software. We are focusing on user-led requirements documentation and in situ capturing of individual stakeholders’ needs with the help of everyday mobile devices such as mobile phones. In addition to requirements discovery, the method is intended to support the on-site identification of contextual information relevant to inform system design. This tool-supported method is supposed to consider recent trends in social software including mobility, location-awareness, and service-centric system design.

Based on these goals, more specific research questions (RQ) can be identified; they define the focus of our research:
- RQ 1: How to discover the individual needs of Mobile Social Software end-users?

- RQ 2: How to identify contextual information relevant to Mobile Social Software engineering?

- RQ 3: How to distribute and communicate gathered end-users’ needs and contextual information to inform future system design activities?

By their nature, most requirements elicitation approaches focus on gathering requirements fulfilling the needs of the majority of stakeholders [SFS05]. We foresee, that requirements elicitation tools installed on mobile devices such as smartphones suggest the potential to support end-users in capturing individual needs in situ. Therefore, our first research objective is to develop a mobile tool for end-users allowing them to capture their needs wherever and whenever they want.

Mobile devices provide sophisticated context sensing capabilities. For example, this includes detecting the user’s position with the help of built-in GPS functionality. The second research objective is set to explore how this functionality can be used in order to automatically gather relevant contextual information for Mobile Social Software design.

Gathering individual end-user’s needs is a prerequisite to building customized software systems for end-users and social communities. However, these requirements need to be distributed in order to start system development and provide a solution. Therefore, the third research objective focuses on the exploration of suitable ways to distribute and communicate information gathered with a mobile requirements elicitation tool for end-users.

### 3 Gathering Individual End-User Needs and Contextual Information

Cultural, emotional, social and material aspects of life often trigger end-users’ requirements [SFS05]. Understanding these contextual triggers and upcoming requirements is particularly important for Mobile Social Software whose scope is the support of social interaction in a volatile mobile context [CHS06]. Kolko et al. [KJR07] highlight that understanding particular characteristics and patterns of life, and investigating new locations and situations, supports stakeholders in envisioning how mobile technology can facilitate social interactions.

Our research is more particularly motivated by the work of Blomberg et al. [BBG03] who suggest that people are better able to describe what they do when they actually perform these activities. Mobile requirements elicitation tools enable end-users of future social software to blog their needs in situ. For example, while enjoying a cup of coffee with a friend, an end-user could come up with the idea that it would be nice to invite all their other friends to the café by just pressing a button of an envisioned mobile social application. Our mobile requirements elicitation tool would enable the future system end-user to immediately document this need on-site.
We envision further benefits of mobile RE tools for end-users besides enabling anytime anywhere requirements documentation. State-of-the-art requirements elicitation approaches often rely on requirements analysts to document end-users’ needs [Ma04]. This is generally costly, time-consuming and it limits the number of end-users that can be involved [Se09]. Easy-to-use mobile RE tools could significantly strengthen end-user involvement in RE by providing adequate guidance and support capturing needs in a structured manner without the help of an analyst.

Following the first and second research objectives, we have developed the iRequire prototype which allows end-users’ requirements, blogging and capturing contextual information about the end-user’s environment.

3.1 iRequire: Mobile Social Software End-Users Document Needs

The development of iRequire was informed by earlier research on how mobile RE tools can help analysts document end-users’ requirements in the field [Se09], [Se09]. Furthermore, we explored on-site end-users’ requirements capturing in a study where end-users documented requirements with the help of standard mobile phone features (e.g. audio recording). In this study, we used Microsoft SenseCam [Ho06] to capture information on the end-users’ environment.

Our vision was to provide an easy-to-use mobile tool which can be installed on widespread mobile platforms and is available to a large number of end-users. By documenting individual needs end-users provide the basis for customized and personalized Mobile Social Software. The developed iRequire prototype is available for Windows Mobile smartphones and enables Mobile Social Software end-users to blog their upcoming needs while interacting with their social community. To simplify tool usage, iRequire provides a touch screen user interface. It was designed to be a self-explanatory tool which guides Mobile Social Software end-users via a wizard-like user interface. Following four steps, end-users can document needs in a structured way.

Taking a picture of the environment. After displaying the start screen, iRequire invites the future Mobile Social Software end-user to capture pictures of her surroundings or objects that are related to her need (see Figure 1). Our initial studies on using mobile phones and SenseCam equipment for end-user requirements elicitation revealed that such pictures can be used to refer to the (social) environment and provide a starting point for expressing a need. An example could be a user who takes a picture of friends sitting in a café and documents a need referring to this social information (see Figure 1).

Documenting a need. In the next step, iRequire invites the end-user to blog her needs and ideas regarding an envisioned Mobile Social Software system (see Figure 1). iRequire offers the functionality to record short text-based requirements descriptions (e.g. I would like to invite friends for a coffee at the push of a button). However, studies with mobile RE tools for analysts [NF09] have shown that using a mobile tool’s (virtual) keyboards for entering text is not always comfortable. Audio recording was often the preferred choice to capture a need. Therefore, iRequire provides a dictaphone-like feature to allow the quick documentation of upcoming ideas and requirements.
Describing the relevant task and providing a rationale. In the last elicitation step, iRequire asks the end-user to describe the task which she intends to support with her requirement and why the reported need is important to her. As for the description of her needs, the end-user can capture this information via audio recording or a short textual description. An example for a task supported by the requirement could be: “Inform my friends that I am here at the café having a cappuccino”. A rationale for this need could be: “I do not want to give all my friends a call because this takes too much time”. Gathering information on the task and the rationale clarifies the vision of the new system and helps social community members and requirements analysts understand the end-user’s individual needs.

Reviewing a summary. In a last step, iRequire displays a summary of the information captured. After a final confirmation, the system stores the captured information and, if requested, redirects the end-user to the start screen to capture another need.

We tried to minimize the time needed for capturing needs with iRequire. The current three elicitation steps are intended to balance out the end-user’s effort in documenting the ideas and information needed for future analysis. Time for documenting needs and ideas might be highly limited, especially during social interactions. Therefore, iRequire enables Mobile Social Software end-users to skip any of the above steps if, for example, they prefer to just provide a requirement description.

The iRequire tool enables end-users to document needs in everyday language since social software end-users are familiar with documenting information in this form (e.g. in a blog or a Wiki). However, iRequire is following the VOLERE Template [RR06] in documenting requirements identity, description, rationale and originator to support structured requirements documentation.
3.2 Capturing Contextual Information with iRequire

iRequire does not only enable future Mobile Social Software end-users to blog their needs, it also captures contextual information. For example, this includes taking a picture of the environment. However, there are situations where stakeholders might not be able to take a picture of the environment or where a captured picture is not self-explanatory. Therefore, iRequire encourages end-users to provide additional contextual information by describing the task, which will be supported by the captured need, as well as documenting a need’s rationale.

However, while designing iRequire, our goal was to go beyond end-user driven documentation of contextual information. Nowadays, context sensing technologies enable mobile devices to gather contextual information without end-user interaction. The current iRequire prototype provides initial capabilities for automated context sensing. Currently, iRequire can detect the end-user’s position (longitude, latitude) with the help of GPS. When blogging a need, this feature automatically detects the end-user’s position and stores this information in the local database. Furthermore, iRequire automatically captures the date and time when a need is documented by storing a timestamp together with the need. These features allow iRequire to gather contextual information on the end-user’s environment even if the end-user does not have time to take a picture.

The automatically gathered contextual information is only relevant for RE activities and system design if end-users document requirements in situ. However, we foresee that end-users will also document requirements using iRequire in situations which are not related to needs. For example an end-user might document an idea while she is having a break in a café although the need itself is related to commuting activities, which she performed before. This means that the automatically captured contextual information might not be useful. Therefore, iRequire encourages end-users to provide additional contextual information by describing the task which will be supported by the captured need, as well as documenting a need’s rationale.

4 Distributing End-User Needs and Contextual Information to Inform Mobile Social Software Design

Gathering and documenting individual end-users’ requirements and contextual information is seen as a first step towards the design and development of Mobile Social Software that is customized to the needs of a particular end-user or that of a social community. Following the third research objective, we have started to explore strategies on how to distribute and visualize the gathered information and how to enable members of a social community to discuss discovered needs in order to inform system design.
4.1 Distribution and Visualization of End-User Needs

The information captured with i Require is stored in a local database on the mobile device. Desktop PC equipment can be used to access this information. End-users themselves can then actively distribute this information. This could include emailing relevant needs to peers within a social community. However, we envision to provide more systematic approaches on how gathered end-users’ needs and contextual information can be distributed.

This includes introducing mechanisms which automatically distribute information, e.g., in order to present the end-user’s requirements to social community members. Traditionally, requirements are communicated and presented using text-based specifications [KS98]. However, web-based technologies provide new ways to communicate and visualize gathered information. We have prototyped a visualization solution which uses Google Maps [Go10] to present end-users’ needs. This solution specifically helps highlighting contextual information gathered with the help of the iRequire tool.

Figure 2 shows how the current prototype visualizes an end-user’s requirement and related contextual information. In particular, the balloon highlights the originator of the need and presents a description (e.g. I would like to invite friends for a coffee at the push of a button). Furthermore, social community members can access more detailed information on the need, which includes the rationale. Using Google Maps also allows the presentation of contextual information in an intuitive and well-known way. This includes displaying the gathered picture of the environment next to the needs description. Furthermore, using Google Map’s key feature allows the presentation of the captured location (e.g. the location of Lisa’s favourite café). The example also highlights how such an approach could be used to start requirements negotiation. As shown in Figure 2, social network users can rate the visualized need.

Figure 2: Requirements Visualization with Google Maps
4.2 How End-User Needs Can Inform RE Activities

Requirements elicitation typically begins with an informal and incomplete mission statement which can be represented by using high-level goals, functions and constraints for the planned software-intensive system [KS98]. These initial requirements are the basis for further refinements elaborated in an iterative and incremental manner. Individual end-users’ needs can be seen as a starting point for the development of Mobile Social Software. However, consecutive discussions and negotiations are needed to agree on fully specified requirements.

End-users’ needs gathered with iRequire could, for example, be used to inform state-of-the-art requirements elicitation approaches such as EasyWinWin [GS05]. Traditionally, EasyWinWin uses brainstorming to gather initial users’ needs which are prioritized and negotiated in consecutive steps. A modified version of EasyWinWin could consider end-users’ needs gathered with iRequire in addition to or replacing brainstormed needs. Contextual information gathered with iRequire could inform requirements negotiation by supporting stakeholders in better understanding initial needs. For example, pictures taken with iRequire enable stakeholders to see the environment in which a need emerged. Furthermore, automatically captured contextual information such as location information could inform system design. For example, a system implementing Lisa’s requirement to invite her friends at the push of a button, needs to automatically detect Lisa’s current position. Assuming that Lisa documented her need in situ, the automatically gathered contextual information could inform developers about the availability of GPS positioning data. If iRequire was not able to document Lisa’s position while she was documenting her requirement, developers might need to consider other technologies than GPS to provide a system which is able to detect Lisa’s position.

We foresee that the information gathered with iRequire could be used in web-platforms for social software requirements engineering such as the system presented by Lohmann et al. [Lo09]. Furthermore, an integration of negotiation functionality in social networks (e.g. Facebook) and the use of requirements visualisation features (e.g. based on Google Maps) would enable existing social communities to discuss the data gathered with iRequire to design Mobile Social Software tailored to their particular needs.

5 Conclusion and Future Work

Paradigms such as mobile and service-oriented computing provide new opportunities for social software, but also require tailored software engineering methods and tools. In this paper we presented preliminary answers to research questions focusing on end-user driven requirements elicitation for Mobile Social Software. The main contribution of our work is the iRequire tool, which enables future end-users to blog their individual needs and expectations regarding a future mobile social application in situ. Presenting iRequire also gives preliminary answers to research question one and research question two. The tool allows end-users to document individual needs on-site and provides automatic context sensing capabilities (e.g. capturing of GPS location information).
Research question three focuses on the distribution of gathered end-user needs and contextual information in order to inform system design activities. We presented a novel way how to visualize documented information using Google Maps and discussed strategies how RE activities could benefit from the gathered requirements and contextual information. To the best of our knowledge iRequire is the first mobile RE tool enabling end-users to document their needs in situ. Initial studies suggest that end-users of Mobile Social Software are able to document their needs with iRequire. However, future research is needed to investigate the benefits and limitations of end-user driven requirements elicitation.

**Improving iRequire’s usability and utility.** We plan to conduct advanced usability and utility studies to explore end-user driven requirements elicitation in more detail. Based on the results of these studies we will enhance the iRequire prototype and provide guidance and support on how to use iRequire in mobile software engineering projects.

**Immediate distribution of needs.** The current iRequire prototype stores captured information locally on the mobile device. We plan to provide an advanced version of iRequire, enabling the distribution of upcoming needs via mobile networks. This feature will enable end-users to immediately inform interested parties (e.g. social community members and requirements engineers) about upcoming needs. However, this research also needs to address privacy issues that are raised by the distribution of needs.

**Improved capturing of contextual information.** iRequire’s automatic context capturing capabilities are currently limited to location and time. We will provide extended automated context sensing capabilities in the near future, which will allow iRequire to more precisely describe the environment in which a need was captured. For example, we intend to make the tool capable of sensing Bluetooth signals of other mobile devices in order to detect the proximity of nearby mobile social software users.

**Informing system design with contextual information.** In our current research we have shown that contextual information enables us to visualize requirements in a novel way. Furthermore, we argue that contextual information supports stakeholders in understanding end-user needs in which situation a need emerged. However, more sophisticated studies are needed to investigate the relation between end-user needs and context and the correlation between contextual information and future system design activities. We envision that contextual information could be in particular relevant for the design and development of context-aware and context-adaptive mobile social software.

**Investigating RE in social networks.** In this paper we have started to discuss how requirements and contextual information gathered with iRequire could inform RE activities. However, we envision that individual end-user needs could be reviewed and discussed in existing social networks (e.g. Facebook). The integration of RE features in social networks would enable social communities to discuss needs and expectation in a familiar environment. Our vision includes integrating requirements prioritization and requirements visualization (e.g. using Google Maps) in social networks. Using such features, social community members would be able to more easily contribute to the design of social software.
References


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