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Abhimanyu Gupta
Ghent University, abhimanyu.gupta@ugent.be

Geert Poels
Ghent University, Geert.Poels@UGent.be

Palash Bera
St. Louis University, palash.bera@slu.edu

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Ghent University
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Geert Poels
Ghent University
Geert.Poels@UGent.be

Palash Bera
St. Louis University
palash.bera@slu.edu

ABSTRACT

Agile practitioners and researchers have identified many challenges related to the requirements in agile projects. Some of these challenges relate to documentation and more specifically the development, maintenance, and management of user stories. This research addresses some of the user stories challenges by proposing the use of conceptual models while developing user stories. Conceptual models are presentations used for domain understanding. The proposal considers development of such conceptual models automatically while user stories are developed. A detailed research plan has been developed to conduct this research.

Keywords

user stories, agile methodologies, conceptual models

INTRODUCTION

In Agile software development processes, the software requirements documentation is limited to the creation of user stories (Inayat, Salim, Marczak, Daneva, & Shamshirband, 2015). A user story is a simple description of a feature of the working software written from the user's perspective (Cohn, 2004). Because of the substantial number of user stories that are developed in an Agile software development project, Agile teams find difficulties in maintaining, tracing, and managing the user stories (Ramesh, Lan, & Baskerville, 2010). Also at a later stage the Agile team loses the high-level view of the various functions and their integrations (Trkman, Mendling, & Krisper, 2016). The problem gets magnified when the team changes and/or there are new members added to the team who fail to comprehend the high-level architecture of the software under development (Vithana, 2015).

To alleviate this problem, we suggest using conceptual models in the process of developing user stories. Conceptual models are visual representations that are commonly used for understanding the domain of business functions and communicating with the stakeholders (Wand & Weber, 2002). The conceptual model can link individual user stories and help the Agile team in creating an understanding of the domain. It is suggested that user stories should be linked and mapped with the conceptual model of the domain (e.g. Figure 1). The research question that we investigate is "*how conceptual models can help in creating, maintaining and managing user stories?*"
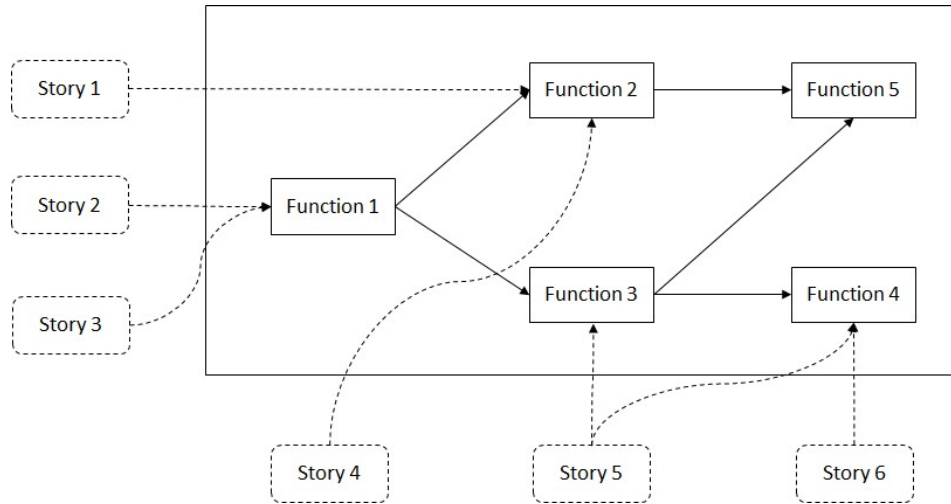
Figure 1. User stories mapped with conceptual models

Two working hypotheses are made in the conceptual model creation process. First, conceptual models (one or more) can be created from user stories. Second, these conceptual models can be created by a tool instantaneously as soon as the user stories are written or modified.

This research agenda is executed through a PhD thesis and the various steps of the proposed methodology are the various stages of the PhD thesis. In the next section, the proposed methodology is discussed followed by initial results. The conclusion section suggests possible contributions.

RESEARCH METHODOLOGY

The methodology will be implemented in a series of sequential stages. These steps are mentioned in Figure 2 and elaborated further below.
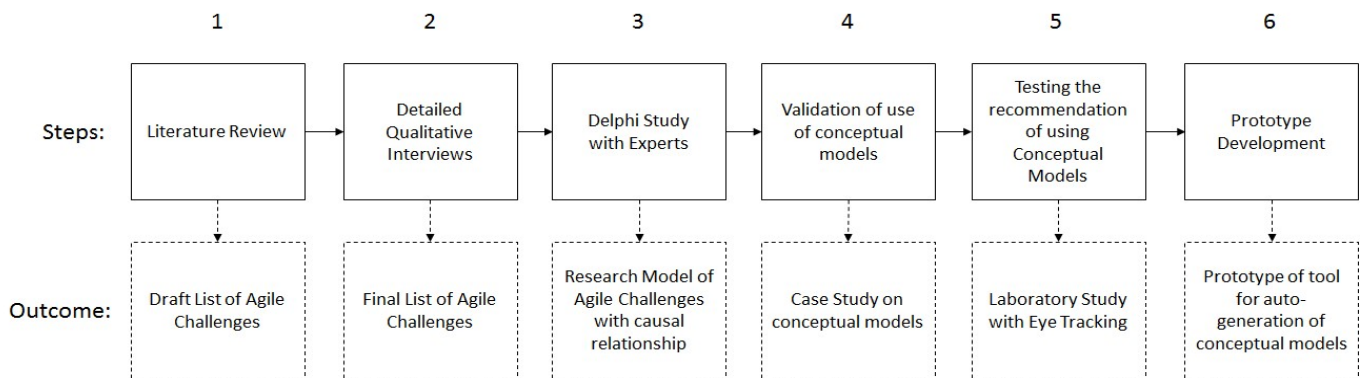

Figure 2. Research Methodology

Stage 1: Literature Review

Research papers exist (e.g. (Inayat et al., 2015; Ramesh et al., 2010)) that summarize the requirements elicitation challenges in agile projects. Although papers have reviewed the literature on challenges of Agile software requirements, it is important to review the literature again as Schön et al. (2017) mention that the Agile software development is a rapidly changing research area and it is important to identify whether the reported challenges are still relevant today. In addition, recent agile projects have become more complex involving multiple team members in multiple locations (e.g. offshore premises)

(Vithana, 2015). Thus, new challenges are expected in eliciting requirements in agile projects. A list of challenges related to requirements engineering in Agile projects will be identified from this systematic literature review.

Stage 2: Detailed Qualitative Interviews

Detailed qualitative interviews with experts in the use of agile methodologies are planned. The interviews serve two purposes- (1) validate the list of challenges already identified from the literature review and (2) identify additional challenges that are relevant in practice but not mentioned in the academic literature. Semi-structured qualitative interviews are planned as it enables examination of the phenomenon of interest from the team members' perspective. In depth interviews will be conducted with several of Agile team members from several organizations (approximately 5 members).

The initial guiding questions are: (1) what challenges do you face with requirements engineering (e.g., elicitation, specification, validation) in terms of Agile software development? and (2) what challenges do you face with the development and management of user stories in Agile software development? After stage two, the final list of agile challenges related to requirements engineering in Agile software development will be compiled.

Stage 3: Delphi Study with Experts

For ease of interpretation and further analysis, the finalized list of Agile requirements-related challenges determined from the literature review and qualitative interviews will be categorized into a smaller number of groups of similar challenges. Further, these groups will be analyzed for any cause-effect relationship among the categories. The cause-effect analysis will result into a framework of agile requirements challenges.

To create the above-mentioned framework, a Delphi study is planned. A Delphi study involves obtaining a collective view from individuals about issues where there is little definite evidence and where opinion is important (Thangaratinam & Redman, 2005). In this Delphi study, a group of experts in agile methodologies will interact anonymously in a web-based platform to create the framework.

Stage 4: Validation of use of conceptual models

In step 3, a research framework will be developed as an outcome. This framework will show the relationships among multiple categories (i.e., groups of challenges). It is expected that one or more of the links in this framework will be related to the use of conceptual models in developing user stories. This link of the research framework will be empirically tested and validated in this thesis.

Prior to continue with the rest of the steps of the thesis, it is important to validate that it is possible to develop conceptual models from user stories (as suggested in Figure 1). For this purpose, a case study approach will be taken. In this approach, an organization will be contacted who would share a set of user stories for a software development project. By analyzing the user stories and interviewing the Agile team who was involved in developing the user stories, conceptual models will be developed following a newly developed methodology. The user stories will then be mapped to the conceptual models and analyzed how the models can be useful. Feedback will be taken on the usefulness of these models in creating, maintaining, and managing the user stories.

Stage 5: Testing the recommendation of using conceptual models

To test the recommendation that conceptual models can be helpful for developing user stories, a laboratory study will be done with real users as subjects. Subjects will be asked to extend and develop a set of user stories from a specific set of existing user stories. A between group design study will be used where a group of subjects will have access to the conceptual models (related to the domain) and another group of subjects will not have any access to these models.

An eye tracking device will be used to identify: (1) whether the conceptual models that are provided to one set of users are indeed being used to develop the user stories. (2) if these models are used then which specific parts of the models are used, (3) between the two groups, whether there is a difference in the pattern of using the existing user stories. Eye tracking metrics such as fixation duration (Sharif & Maletic, 2010) can be used to identify which parts of the conceptual models' users are referring to while developing the user stories.

Stage 6: Prototype tool development

In agile development, where there is less focus on documentation, it will be unrealistic to expect that users will develop and maintain the conceptual models in the process of creating the user stories. Therefore, a prototype tool will be developed that

will automatically create and update conceptual models when user stories are fed to it. The objective of the prototype will be to demonstrate the feasibility of creation of such tool.

INITIAL RESULTS

Out of the above mentioned six steps, the first two steps have been completed so far.

From 80 IS journal papers a list of 50 challenges were identified. The top three challenges that were identified are: incomplete non-functional requirements, customer unavailability, and frequent changes in requirements.

It was identified that the words- domain knowledge, shared understanding, and communication occurred repeatedly in these challenges. Incidentally, two common uses of conceptual models are to: (1) facilitate communications between users and analysts and (2) support the analysts' understanding of the domain (Kung & Solvberg, 1986). Based on the definition and use of conceptual models, it seems that the cause of some agile requirements issues can be attributed due to lack of development of conceptual models.

Five Agile practitioners were interviewed in terms of what are the challenges they face working in Agile projects. The recruitment was based on convenient sampling and these practitioners had more than average 5 years of Agile experience. From the interviews, four new challenges were identified such as translation of features into user stories and unavailability of success criteria at feature level.

CONCLUSION

This research can have several contributions. First, the consolidated literature review and interviews can provide insights to the current requirements challenges in agile projects. Second, the Delphi study will help to develop a research framework on the agile requirements challenges. This framework will clearly relate challenges through cause-analysis relationship, such that the impact of proposed solutions can better be assessed. Third, an empirical study will be conducted to test the proposition that the use of various kinds of conceptual models is beneficial for the development, maintenance and management of user stories (which are used to document software requirements in Agile methodologies). The results of the study can provide insights on how users can use conceptual models in creating new user stories assuring their consistency and completeness. These insights can help the Agile teams in better managing user stories and better communicating with each other in the process of developing software. Finally, a key component of this research is to create a prototype to demonstrate that conceptual models can be created automatically when user stories are developed. This prototype can help practitioners to develop and use tools in practice.

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