Survey on Crowd-based Requirements Engineering

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# 1. Introduction

In the success of a system development, Requirements Engineering (RE) plays a very critical and effective role. Workshops and interviews with the stakeholders are the most common activities in the RE process. Increase in the count of stakeholders will help to cover more breadth of requirements. Increase in the details of these workshops and interviews will help to cover more depth of the requirements. However, these are both time and budget consuming activities. On the other hand, too much breadth and depth can become hard to verify or realize. It is really important to keep RE activities in an optimum balance between its coverage (such as breadth and depth of requirements) and project constraints (such as time and cost). This is an important process because requirements must be complete but should not contain early decisions.

As seen, there is an ongoing tension between keeping depth in an effective level and remaining at a sufficient level of abstraction. In order to cover the breadth of requirements while remaining at a reasonable cost levels, one solution is to select smaller groups of stakeholders and this may cause non-verified or non-detailed requirements. To tackle these issues, this process can take advantage of automated approaches such as crowd-based RE. The most significant difference is that these techniques allow elicitation process to be performed remotely and reduce the necessity of the co-presence of stakeholders.

**The Concept**

Crowd-based requirements engineering (CrowdRE) is a generic term for automated or semiautomated approaches to gather and analyze information from a crowd to derive validated user requirements.[1] Based on this description the main concerns of a CrowdRE process are:

* Getting the feedback in a controlled process
* Analyzing the feedback in order to produce meaningful, refine outputs

Reasonably, a crowd is the initial component of any CrowdRE process. In terms of CrowdRE, a crowd is a group of people with a common interest in a product. The main idea behind CrowdRE is to collect usable information from this crowd and transform that feedback into a meaningful and refined requirement.

# 2. Eliciting & Analyzing Feedback

Once you have the crowd, next up, there must be a way for this crowd to give feedback for that particular product such as a feedback tool or a survey or the usage data that every individual in the crowd produces. App stores, product forums and social media platforms such as Twitter can be considered as a feedback channel.[1] Gamification is another approach in CrowdRE for gathering user feedbacks. In addition, some products have a built-in feedback module and/or they ask users' consents to monitor and collect their usage data. For example, in MS Office you may see the following dialog:

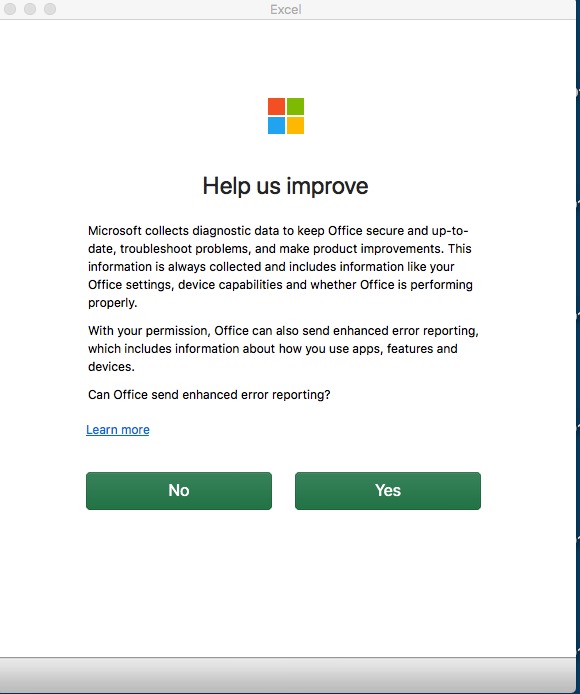


Figure 1 - MS Excel Help Us Improve Dialog

All of these feedbacks produce a message written in natural language. In order to analyze the feedback gathered from the channels mentioned above, the CrowdRE uses approaches such as linguistic analysis techniques like text-mining, sentiment analysis, irrelevant feedback filtering and structured techniques like bug reports and feature requests. [1]

### Classification

A feedback might be a bug request, a description of a problem, description of a bug or an error. Alternatively, a feedback might be a feature request or improvement suggestions on content or functionality.[2] Finally, a feedback can hold different sentences for both errors and feature requests.

In addition, it is also important to classify these feedbacks under related part of the system: functionality requirements, documentation requirements, design requirements etc.

To classify the feedback, NLP techniques are being used. These techniques can describe syntactic information (e.g., part-of-speech tagging, chunking, and parsing) or semantic information (e.g., word-sense disambiguation, semantic role labeling, named entity extraction, and anaphora resolution).[3] Studies shows that no single classifier works best for all review types and data sources.[4]

Furthermore, it is also important to identify the source of the feedback; which will bring us to the second issue about the classification and it is the classification of the stakeholders. For instance, Github may have many positive reviews by the software engineers, but it might not be the case for other professionals when they're try to use Github for version control. Classifying the stakeholders will help to identify use-patterns and common needs. Thus, prioritization of the requirements will be more focused and to-the-point.

### Challenge of Motivation

Motivating the crowd is a big challenge in CrowdRE process. One way to motivate users is to show them the benefit of their feedbacks. For instance, adding the most-wanted features to the product or fixing the bugs would be a preliminary motivation for users to keep giving feedback. This would be an indication of that feedbacks have been taken into consideration. Therefore, community management can be considered as an important tool for motivation.

Gamification is another incentive to be used as a motivational instrument. There are several reasons for people to participate in crowd related online work. For example, internal motivations that has been generated by tasks that allow the participant to be creative and experience autonomy, to develop skills and feel competent, to enjoy pastime or to achieve social recognition; or in some cases external motivations evoked by financial payoffs etc. [5]

*1. E. C. Groen et al., "The Crowd in Requirements Engineering: The Landscape and Challenges," in IEEE Software, vol. 34, no. 2*

*2. W. Maalej, M. Nayebi, T. Johann and G. Ruhe, "Toward Data-Driven Requirements Engineering," in IEEE Software, vol. 33, no. 1*

*3. R. Collobert, J. Weston, L. Bottou, M. Karlen, K. Kavukcuoglu, P. Kuksa, "Natural Language Processing (Almost) from Scratch" 12(Aug):2493−2537, 2011.*

*4. W. Maalej, H. Nabil, “Bug report, feature request, or simply praise? on automatically classifying app reviews,” in Proceedings of the 23th IEEE International Requirements Engineering Conference. IEEE, 2015, pp. 116–125.*

*5. Morschheuser, Benedikt & Hamari, Juho & Koivisto, Jonna. (2016). Gamification in Crowdsourcing: A Review. 10.1109/HICSS.2016.543.*